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Guarantees of Origin (GOs) from Renewable Energy Sources: A tool for diffusion green electricity in the society

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This thesis was approved unanimously by the three-member Commission of Inquiry appointed by the Special General Assembly of the Department of International and European Studies, University of Piraeus in accordance with the Operating Regulations of the MSc in Energy.

The Committee members were:

- Athanasios Dagoumas (Supervisor)
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The total greenhouse gases emissions from the procedure of research, compilation and final writing of this MSc thesis are amounting to 2.364 tCO_2e and are offset by South Pole Carbon Asset Management Ltd. using following emission reduction credits:

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Summary

This MSc thesis attempts to illustrate the Guarantees of Origin (GOs) as a tool for diffusion of green electricity in society. Voluntarily purchased renewable electricity products like GOs have an impact on the environmental footprint of products, services and companies and thus may create an increase in the demand of renewable electricity by end-customers. The background of this study is the European Union and there is one chapter especially for the situation in Greece.

The aim of this study is the in-depth analysis and depiction of reality in the European Union and Greece about the operation of GOs from renewable energy sources (RES). It examines the benefits / limitations of use by providers/suppliers and end users of electricity, while referring to the problematic situation in Greece and in the end there are suggestions for the better functioning of the GO system.

An extensive literature review on Greece and the rest of the European Union has done and there were meetings with the responsible of GOs System in Greece (EMO, HEDNO, CRES). Furthermore there was communication with GO certificates agents/exchanges (e.g. European Energy Exchange-EEX, Grexel, EcoHz, CertiQ, Danske Commodities etc.) but also with the Greek company LANEL. Also, are given examples of operation of the GOs System and a case study for the use of GOs from the group OTE/COSMOTE.

Finally, the author has successfully entered several windfarms and photovoltaic plants in GO system of EMO (LAGIE) as works in the last sixteen years in the market for RES.

The thesis is constructed with seven chapters.

Chapter 1 has done a brief historical overview of the electricity market in the European Union, the objectives set for increasing the use of renewable energy and the need for disclosure of the mixture of electricity received by the final consumer.

In Chapter 2 presented in detail the disclosure mechanisms of the electricity mix and tracking tools that one of them are the GOs.

In chapter 3 presented the use of Guarantees of Origin and have given examples.

In Chapters 4 and 5 presented the current situation in European Union countries and Greece. Chapter 5 deals in depth with the situation in Greece through the statistics of the competent Bodies and extracted the problematic situation. It is given as a case study the use of GOs from OTE/COSMOTE Group of Companies as part of their environmental policy.

In the chapter 6 are provided suggestions for the future of GOs System in the European Union and specifically for Greece.

In the chapter 7 takes place a summary of the study and final conclusions are presented.

Περίληψη (Summary in Greek)

Η παρούσα εργασία αποτελεί την Διπλωματική Εργασία του φοιτητή Κων/νου Γκαράκη στα πλαίσια των σπουδών του στο ΠΜΣ Ενέργεια: Στρατηγική, Δίκαιο και Οικονομία στο Τμήμα Διεθνών και Ευρωπαϊκών Σπουδών του Πανεπιστημίου Πειραιά.

Το θέμα της διπλωματικής εργασίας είναι «Εγγυήσεις προέλευσης ΑΠΕ: Εργαλείο διάχυσης πράσινης ηλεκτρικής ενέργειας στη κοινωνία».

Σκοπός της διπλωματικής είναι η σε βάθος ανάλυση και η αποτύπωση της πραγματικότητας στην Ευρωπαϊκή Ένωση αλλά και την Ελλάδα της λειτουργίας των εγγυήσεων προέλευσης από ανανεώσιμες πηγές ενέργειας (ΑΠΕ). Εξετάζονται τα πλεονεκτήματα/περιορισμοί της χρήσης τους από παρόχους/προμηθευτές αλλά και τελικούς καταναλωτές ηλεκτρικής ενέργειας, ενώ γίνεται αναφορά στην προβληματική κατάσταση στην Ελλάδα και στο τέλος δίνονται προτάσεις για την καλύτερη λειτουργία του Συστήματος Εγγυήσεων Προέλευσης.

Πραγματοποιήθηκε εκτενής βιβλιογραφική ανασκόπηση για την Ελλάδα και την υπόλοιπη Ευρωπαϊκή Ένωση ενώ υπήρξαν συναντήσεις με τους υπευθύνους του Συστήματος Εγγυήσεων Προέλευσης στην Ελλάδα (ΛΑΓΗΕ, ΔΕΔΔΗΕ, ΚΑΠΕ). Επιπλέον πραγματοποιήθηκε επικοινωνία με φορείς εμπορίας πιστοποιητικών εγγύησης προέλευσης (πχ EEX, Grexel, EcoHz, CertiQ, Danske Commodities κα) αλλά και με την εταιρεία ΛΑΝΕΛ.

Συνάμα, δίνονται παραδείγματα λειτουργίας του Συστήματος Εγγυήσεων Προέλευσης αλλά και case study τη χρήση τους από τον όμιλο OTE/COSMOTE.

Τέλος, συγγραφέας έχει εγγράψει με επιτυχία αρκετές αιολικές και φωτοβολταϊκές μονάδες στο Σύστημα Εγγυήσεων Προέλευσης του ΛΑΓΗΕ εργαζόμενος τα τελευταία δεκαέξι έτη στην αγορά των ΑΠΕ.

Ακολουθεί μία σύντομη περιγραφή των θεμάτων που καλύπτονται σε κάθε κεφάλαιο.

Σαν εισαγωγή και θεωρητικό υπόβαθρο για τις βασικές έννοιες στις οποίες στηρίχθηκε η εργασία αυτή καταστρώθηκαν τα πρώτα δύο κεφάλαια (πέρα από το γλωσσάριο και τις συντομεύσεις).

Στο Κεφάλαιο 1 έγινε μια σύντομη επισκόπηση της πορείας της ηλεκτρικής αγοράς την Ευρωπαϊκή Ένωση, των στόχων που έχουν τεθεί για την αύξηση της χρήσης ΑΠΕ αλλά και της ανάγκης αποκάλυψης του μείγματος της ηλεκτρικής ενέργειας που λαμβάνει ο τελικός καταναλωτής.

Στο Κεφάλαιο 2 παρουσιάστηκαν αναλυτικά οι μηχανισμοί αποκάλυψης του μείγματος ηλεκτρικής ενέργειας αλλά και των εργαλείων ανίχνευσης αυτού εκ των οποίων ένα είναι και οι Εγγυήσεις Προέλευσης.

Στο Κεφάλαιο 3 παρουσιάστηκαν οι χρήσεις των Εγγυήσεων Προέλευσης και με παραδείγματα.

Στα Κεφάλαια 4 και 5 παρουσιάστηκε η ισχύουσα κατάσταση στις χώρες της Ευρωπαϊκής Ένωσης και την Ελλάδα. Το κεφάλαιο 5 ασχολείται σε βάθος με τη κατάσταση στην Ελλάδα μέσα από στατιστικά από τους αρμόδιους φορείς και εξάγεται η προβληματική κατάσταση που επικρατεί. Δίνεται ως case study η χρήση των εγγυήσεων προέλευσης από τον Όμιλο ΟΤΕ/COSMOTE ως τμήμα της Περιβαλλοντικής τους πολιτικής.

Στο 6^{ο} κεφάλαιο δίνονται οι προτάσεις για το μέλλον του Συστήματος Εγγυήσεων Προέλευσης στην Ευρωπαϊκή Ένωση αλλά και ειδικά για την Ελλάδα.

Στο 7^{ο} κεφάλαιο πραγματοποιείται μια σύνοψη της εργασίας και εξάγονται τα τελικά συμπεράσματα.

Acknowledgements

First of all, I would like to thank the University of Piraeus for the support and contribution to this thesis. I specially want to thank my supervisor Dr. Athanasios Dagoumas, for valuable advice, guidance during this process and also for editing and proofreading the text.

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Contents

Glossary

Additionality
Generally a term indicating that a certain measure would not occur without the additional incentive provided by a certain policy. The term is used e.g. in the context of the Clean Development Mechanism under the Kyoto Protocol. In the field of green power, additionality means that by purchasing a certain green product, consumers can actually contribute to a higher renewable energy production compared to a reference case without this purchase. This is difficult to achieve because of the general surplus of RES-E production in Europe compared to the specific demand for green energy and also due to the national targets for renewable energy under the 2009 RES Directive.

Association of Issuing Bodies
The European organization which governs the European Energy Certificate System (EECS). See http://www.aib-net.org.

(Electricity generation/Disclosure) Attributes
Information related to the generation of electricity, which is to be allocated through tracking. Details are specified by the respective tracking purposes. For example for disclosure, the following attributes are required: Fuel source and technology used for power generation, related CO_2 emissions and production of radioactive waste.

Cancellation
The realization of the value of a certificate (or a non-certificate GO). On its cancellation a certificate ceases to be transferable. Sometimes the term "redemption" is used instead of cancellation.

CDP
CDP is an international, non-profit organization that provides the only global system which allows companies and cities to measure, disclose, manage and share vital environmental information. These insights enable investors, companies and governments to mitigate risks related to the use of energy and natural resources while identifying opportunities for taking a responsible approach to the environment. CDP is an investor-led organization. Requests for disclosure come from the 822 signatories. These investors hold US$ 95 trillion in assets – a little less than half of global invested capital. The multi-purpose climate change questionnaire is used to update results related to the climate change and supply chain programs.

Certificate
An evidence which represents the attributes of an instance of electricity generation for one or more tracking purposes and which can be transferred between different owners. Certificates are usually held as electronic records in a database (registry) and their typical life cycle is issuing, transfer and cancellation. Guarantees of Origin can be implemented in the form of certificates. It is quite common to issue certificates in units related to 1 MWh of electricity.

Competent Body
A person or a body appointed by legislation to supervise a tracking system. Competent Bodies are supervising the issuance, transfer and cancellation of

Guarantees of Origin, or systems of support certificates, if applicable. The management of a Residual Mix calculation falls under the responsibility of a Competent Body for disclosure. There can be only one Competent Body per tracking system in a domain. In the specific case of voluntary RECS certificates the Competent Body is often not appointed by legislation but rather by members of the RECS system.

Contract-based tracking
An explicit tracking method where electricity attributes are allocated to consumers or their suppliers based on the bilateral contracts concluded in the physical electricity market. This excludes purely financial contracts which are not fulfilled physically. Contract-based tracking can be performed ex ante or ex post (in relation to the point in time when the electricity contract is concluded). Ex ante contract-based tracking means that the parties of a contract in the electricity market agree on the attributes of the related volume of electricity at the time when the contract is concluded. Ex-post contract-based tracking means that after the end of a disclosure period the generators determine their attribute mix and allocate this mix to consumers or their suppliers based on the net balances of the contracts in the electricity market during this period. Contract-based tracking can also be implemented by using certificates, which in this case would be allocated along the contract path.

Contractual instruments
Any type of contract between two parties for the sale and purchase of energy bundled with attributes about the energy generation, or for unbundled attribute claims. Markets differ as to what contractual instruments are commonly available or used by companies to purchase energy or claim specific attributes about it, but they can include energy attribute certificates (RECs, GOs, etc.), direct contracts (for both low-carbon, renewable, or fossil fuel generation), supplier-specific emission rates, and other default emission factors representing the untracked or unclaimed energy and emissions (termed the residual mix) if a company does not have other contractual information that meets the Scope 2 Quality Criteria.

De-linked tracking
An explicit tracking method where electricity attributes are allocated to consumers based on certificates. This allows for the allocation of the attributes from generators to consumers or their suppliers along a path which can be independent from the physical electricity market and thus has no negative impact on the liquidity of electricity markets. Guarantees of Origin which are implemented as electronic certificates enable de-linked tracking for purposes of disclosure.

(Electricity) Disclosure
Based on Directive 2003/54/EC and its successor Directive 2009/72/EC electricity suppliers are required to disclose to their customers certain average attributes of the electricity which they have supplied in the previous year. The disclosure attributes comprise the energy sources and the conversion technology used for electricity generation, the related CO2 emissions and the production of radioactive waste. In order to determine this information a tracking system for electricity is required. The two Directives require that the disclosure information given to consumers is reliable.

Disclosure certificate
A certificate which can be used for purposes of disclosure. The E-TRACK project uses the term Guarantees of Origin in its broader sense for this kind of certificates.

Disclosure period
The period of time this is used as the accounting period for energy consumption and the attributes which suppliers of electricity have acquired for disclosure purposes. Directive 2003/54/EC and Directive 2009/72/EC define that the disclosure period is one year. The E-TRACK recommendation is that this should be the calendar year.

Domain
A single geographic or geopolitical region in which the rules for a tracking system related to a certain tracking purpose are defined consistently and are supervised by a Competent Body. Usually each country in Europe forms one domain. However, there may be several domains in one country, like it is the case in Belgium, and in the future it might also be that several countries jointly form a single domain.

Double counting
The attributes from an instance of electricity generation should only be used once for the same purpose. If for example a MWh of RES-E is allocated to two or more different consumers or their suppliers for purposes of disclosure, then this denotes a case of double counting. Double counting mostly occurs due to improper design of tracking systems, but it might also be caused by errors or fraud.

Electricity from high-efficient cogeneration (HE-CHP-E)
Electricity from cogeneration plants which satisfies the criteria for high-efficiency cogeneration as defined in Directive 2004/8/EC and its annexes. Further details of how the share of HE-CHP-E in the production of a CHP plant should be calculated are laid down in the calculation guidelines and in the efficiency reference values which have been published by the Commission. The Association of Issuing Bodies has produced a calculation model for this purpose which proposes a fully harmonized methodology.

Electricity from renewable energy sources (RES-E)
Electricity from renewable energy sources as defined in Directive 2001/77/EC and its successor, Directive 2009/28/EC.

Environmental reporting
Environmental reporting is used as a general term, comprising various different types of environmental reporting schemes, such as GHG accountings, carbon footprints and environmental footprints. Thus, the term encompasses the general reporting form without focusing on the various types of emissions and impacts covered in the different environmental reporting schemes.

ENTSO-E
The European Network of Transmission System Operators for Electricity, which has been formed by the members of six organizations of transmission system operators: ATSOI (Ireland), BALTSO (Baltic region), NORDEL (Nordic region), UCTE (western continental Europe), UKTSOA (UK) and ETSO (http://www.entsoe.eu).

European Energy Certificate System (EECS)
A harmonized European system for the handling of certificates for electricity attributes, which is operated by the Association of Issuing Bodies. EECS is the only standardized tracking system for electricity in Europe. Each EECS certificate is uniquely identifiable, transferable and therefore tradable, and contains standard information on the source of the energy, and its method of production. The Principles and Rules of Operation of the European Energy Certificate System (the EECS Rules) defines a certificate as an electronic document which identifies the source and method of production of a unit of energy, and relates to a specific purpose – such as energy source disclosure or compliance with an obligation. It also prohibits certificate holders from separately claiming or conferring rights or title to any element of this benefit, and for this purpose. Certificates are created, change owners and are eventually made untransferable under a carefully developed and managed control infrastructure, the EEC Rules, as interpreted by each country or region according to its "Domain Protocol". The adequacy of this interpretation is assured by the other AIB members as a condition of membership. Summarizing EECS certificates are the RECS plus GOs.
Currently, EECS integrates Guarantees of Origin for RES-E and HE-CHP-E, RECS certificates and generic Guarantees of Origin in their broader sense (disclosure certificates).

Explicit tracking
A mechanism which allows the bilateral allocation of electricity attributes from a generator to a final consumer or its supplier. The allocation might also involve traders as intermediaries. Explicit tracking can be based on electricity contracts or can be delinked from these. Both types of explicit tracking can be implemented based on certificates.

Guarantees of Origin (GO)
GO in a narrow sense: A means of proving the origin of electricity, which was generated from renewable energy sources or from high-efficient cogeneration, which was introduced by Directive 2001/77/EC for RES-E and by Directive 2004/8/EC for HE-CHP-E. By December 2010 EU Member States have to adapt their GO for RES-E to the regulations of Directive 2009/28/EC, which includes a more precise definition of GO for RES-E and links them to electricity disclosure. The use of GO is optional for generators. However, some countries require the suppliers of green power to use and cancel GO for their green supplies. GO for RES-E are also abbreviated RES-GO and GO for HE-CHP-E are also abbreviated CHP-GO. GO in a broader sense: General term for proofs of the origin of electricity for purposes of electricity disclosure. GO in a broader sense encompass the RES-GO and CHP-GO and expand their concept to any type of electricity generation.

Implicit tracking
A mechanism which allows the allocation of electricity attributes from a group of generators to usually a large group of suppliers or final consumers for purposes of electricity disclosure. Implicit tracking is mostly used in the case that the origin of electricity is unknown. For this purpose most domains have defined a default set of attributes which can be used by suppliers. The simplest method of such implicit tracking is the use of (uncorrected) generation statistics. This inevitably leads to double counting of attributes in relation to GO and other tracking mechanisms. E-

TRACK recommends the use of a Residual Mix for implicit tracking which avoids double counting.

Issuing Body
In terms of tracking systems based on certificates, this term is often used as a synonym for the Competent Body. It might also denote the more technical role of accrediting production devices and managing the issuing, transfer and cancellation of certificates.

National target
A target for the share of a certain type of electricity production in e.g. the total consumption of electricity in a country, to which a country is legally bound e.g. by European legislation. Such targets currently exist only for RES-E for the year 2010 under Directive 2009/28/EC. National targets should not be confused with the support scheme of a quota obligation which can be placed on actors in the electricity market within a country.

Physical electricity market
Market transactions (long-term contracts, over-the-counter transfers, trades on power exchanges) which imply a physical delivery of energy into the balancing group of the buyer. Pure financial contracts can be disregarded for tracking purposes, as they do not allocate physical energy.

Tracking Purpose
Tracking is undertaken for different purposes. The typical purposes are disclosure, the management of support schemes and possibly also accounting for national targets.

Tradable certificate systems
Tradable certificate systems: these systems are better known in Europe as Tradeable Green Certificate (TCG) systems and in the US and Japan as renewable portfolio standards (RPS). In such systems, the generators (producers), wholesalers, distribution companies or retailers (depending on who is involved in the electricity supply chain) are obliged to supply or purchase a certain percentage of electricity from RES. At the date of settlement, they have to submit the required number of certificates to demonstrate compliance. Those involved may obtain certificates:
- From their own renewable electricity generation;
- By purchasing renewable electricity and associated certificates from another generator; and/or
- By purchasing certificates without purchasing the actual power from a generator or broker, that is to say purchasing certificates that have been traded independently of the power itself.

The price of the certificates is determined, in principle, according to the market for these certificates (for example, NordPool).

RECS International – RECS certificates
The European organisation of the market actors which are using the European Energy Certificate System (EECS). RECS International and the AIB have jointly developed the RECS system and subsequently expanded it into the EECS system. RECS started as an initiative of European companies to create a voluntary market for green energy, and become a huge success. To prove the concept, RECS International held a "Test

Phase", sponsored by the European Commission and lasting two years. During this period, in which close to 200 participants from across Europe participated in RECS certificate trading, 17 million certificates were issued, and one third of these were redeemed with voluntary schemes and certificate authorities as proof that the associated renewable source energy had been consumed. At the end of the Test Phase, RECS International was formed to represent the interests of market participants, and now has over 140 members drawn from electricity generators, suppliers and consumers.
The traded volumes of obligatory "guarantees of origin" (GoO) have now far overtaken voluntary RECS certificates, and are now issued across Europe. For this reason, RECS certificates ceased to be issued by members of the AIB from 1st January 2015; and will cease to be supported by the AIB from 1st January 2016.
More info could be found in the following link: http://www.aib-net.org/portal/page/portal/AIB_HOME/CERTIFICATION/Types_certificate/NGCs%20-%20Non-Governmental%20Certificates/IRECSI

Registry
An electronic database in which certificates such as electronic GO can be issued, transferred and cancelled. Typically there is one registry per domain. In order to allow transfers of certificates between domains, the registries must be connected and the definition of the certificates needs to be harmonised.

Renewable Energy Certificate System (RECS)
A voluntary certificate system which was developed in order to track electricity attributes from RES-E for purposes of green electricity supply or electricity disclosure. The RECS system can be regarded as a predecessor of Guarantees of Origin for RES-E.

(Other) Reliable Tracking Systems (RTS)
Explicit tracking systems other than Guarantees of Origin which are used for purposes of electricity disclosure and which fulfil the criteria of added value, reliability and transparency as defined in the E-TRACK recommendations. Typical examples of Reliable Tracking Systems are allocation mechanisms for electricity which has been supported under a feed-in support system or ex-post contract based tracking systems.

Residual Mix
A set of attributes for purposes of implicit tracking in electricity disclosure, which has been determined by a Competent Body based on the attributes of all electricity generation in one or several disclosure domains and corrected by all attributes which have been allocated by other tracking systems. Exports and imports of attributes, e.g. in the form of GO, also have an impact on the Residual Mix. The objective of the introduction of the Residual Mix is to avoid double counting in relation to other tracking systems.

Support certificate
A transferable certificate which is used for the implementation of support schemes. Support certificates are typically used in the context of quota obligation systems, where producers, retailers or consumers are obliged to cancel support certificates which represent a certain share of their production, sales to final consumers or

consumption. E-TRACK recommends that support certificates should be separated from GO and thus should have no relation to disclosure.

Support scheme
A policy by which a country promotes the generation of electricity from certain energy sources (e.g. renewable energies) or by certain conversion technologies (e.g. high efficient cogeneration) through financial incentives. Typical support schemes used are feed-in tariffs, bonus systems, quota obligations, investment support and tax exemptions.

Supplier's remaining mix
The difference between the individual supplier mix of a supplier and the attributes of all the products, which the supplier sells with claims regarding the origin of the electricity (e.g. "green" products). The volume of the remaining mix is equal to the electricity sales to final consumers under a "residual" or default product of the supplier, which is not advertised with ex-ante claims regarding the origin of the electricity.

Total supplier mix
The total volume of attributes disclosed in a domain, both explicitly tracked and those disclosed through the residual mix, expressed in fuel mix and environmental indicators as required for electricity disclosure.

Tracking
General term for the accounting of generation attributes. Tracking usually implies an allocation of attributes from generators of electricity to other actors in the electricity market, such as consumers or their suppliers. Tracking is undertaken for different purposes such as disclosure, the management of support schemes and possibly also the accounting for national targets.

Untracked consumption
Electricity consumption that is not disclosed by using explicit tracking mechanisms such as GOs. Untracked consumption should be disclosed based on the residual mix.

Voluntary market
The voluntary market is a market based on the trading of Guarantee of Origin certificates available through the European electricity tracking system. Guarantees of Origin have no inherent value but, because they are traded on an open supply and demand market, they are given a value based on the consumers' willingness to purchase them. Consumers, from private individuals to multi-national corporations, buy guarantees of origin to prove the originating location of their electricity consumption. This is proven via cancellation the term used to indicate the final consumption of the certificate

List of Abbreviations

2001 RES Directive
Directive 2001/77/EC of the European Parliament and of the Council on the promotion of electricity produced from renewable energy sources in the internal electricity market

2009 RES Directive
EU Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC

AIB
Association of Issuing Bodies (see http://www.aib-net.org)

CHP
Directive EU Directive 2004/8/EC of the European Parliament and of the Council on the promotion of cogeneration based on a useful heat demand in the internal energy market

CHP
Combined heat and power (cogeneration)

CHP-GO
Guarantee of Origin for high-efficient cogeneration, issued under the CHP Directive

Directive 2003/54/EC
Directive 2003/54/EC of the European Parliament and of the Council concerning common rules for the internal market in electricity and repealing Directive 96/92/EC

Directive 2009/72/EC
Directive 2009/72/EC of the European Parliament and of the Council concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC

EU
European Union

EU12
Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovenia, Slovakia, (which joined the EU in 2004), and Bulgaria and Romania (which joined in 2007), also referred to as New Member States

EU15
Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Ireland, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom

EU27
The total of current EU Member States (EU15 + EU12)

GO
Guarantee of Origin

HE-CHP-E
Electricity from high efficient cogeneration as defined by the CHP Directive

kWh
Kilowatt-hour (unit of (electric) energy)

MWh
Megawatt hour (unit of (electric) energy which equals 1.000 kWh)

RECS
Renewable Energy Certificate System

RES
Renewable energy sources

RES-E
Electricity from renewable energy sources

RES-GO
Guarantee of Origin for (electricity from) renewable energy sources

CHAPTER 1 - Introduction

The European Union perceived the consequences of the climate change, has taken immediate measures in order to control initially and reduce the pollution. The EU Member States and the European Commission signed the Kyoto Protocol in 1998 and in May 2002 the European Union ratified.

There were also other actions in this direction, the European register of emissions and reducing certain pollutants. By EU directive of 2003 set the foundations for emissions trading and in 2005 the first results showed the success of the measures. In January 2008 the European Union, compliant with the Kyoto Protocol, promotes the use of renewable energy by adopting the so-called "20-20-20" targets: For all the EU Member-States by 2020 provided the following binding legislative energy targets for 2020 [1a]:

•20% cut in greenhouse gas emissions (from 1990 levels)
•20% of EU energy from renewables
•20% improvement in energy efficiency

The targets were set by EU leaders in 2007 and enacted in legislation in 2009. They are also headline targets of the Europe 2020 strategy for smart, sustainable and inclusive growth. The EU is taking action in several areas to meet the targets.

The 2030 climate and energy framework sets three key targets for the year 2030 [1b]:
- At least 40% cuts in greenhouse gas emissions (from 1990 levels)
- At least 27% share for renewable energy
- At least 27% improvement in energy efficiency

The framework was adopted by EU leaders in October 2014. The framework contains a binding target to cut emissions in EU territory by at least 40% below 1990 levels by 2030.

The legislative framework sets national planning: each Member State sets a target for the share of energy from renewable sources in gross final consumption of 2020. More specifically, propose specific rates for each sector of electricity, heating and cooling in the residential sector but also in the use of biofuels in transport, such that total to meet the goal. Reported measures to reduce energy consumption and increase the use of RES. The proposal also sets milestones by country; if not achieved can be reviewed.

In each sector, Europe sets the bar at a different height, depending on the current situation. So, for example, in the transport sector, which depends almost exclusively on oil, the goal is to increase the share of renewable energy in total fuel consumption by 2020, but not as much as other sectors. Finally, the fuel consumption in the transport sector, Member States should increase the share of renewables to 10% at least until 2020. So to achieve this challenging goal the EU steps up its efforts in the field of power, facilitating the spread of RES with a friendly framework.

The attainment of the targets will contribute to energy security, the optimal use of resources and strengthen the competitiveness of key sectors of the economy.

However, measures taken and the use of renewable sources in electricity generation and heating. These measures depend on the results of other ecological actions in final energy consumption. The greater the reduction in energy consumption of other environmental measures, the more little is the use of renewable energy to achieve the targets. There is capability in the EU Member States to exchange amounts of energy from renewable sources using a statistical transfer and setting common processes relating to the production of electricity and heating from renewable sources (the Kyoto Protocol). Cooperation with third countries, as long as the electricity is produced by an installation built after June 2009, to be consumed within the EU, and not benefit from any other body. Finally, there is the obligation for each Member State to guarantee the origin of electricity, heating and cooling from renewable sources.

The information contained in the guarantees of origin is normalized and recognized by all Member States and transmitted electronically, and must specify in particular the source from which the energy was produced and the type of. Refusal to recognize a guarantee of origin issued by another Member State must be based on objective criteria. Please note that the road map drawn for RES, which means evaluating, sources in total energy consumption.

The road map shows the long-term strategy of the Commission in the field of renewable energy and is defined as a binding target of covering 20% of total energy consumption in the EU by 2020 and a minimum target of 10% for biofuels [1b]. Also included measures to promote the development of renewable energy in the electricity, heating and cooling. Also, a new legislative framework is proposed to enhance the promotion and use of renewable energy sources. With this strategy the EU has the dual objective of greater security of energy supply and the reduction of greenhouse gas emissions sought to achieve. This design, among other things, initiated procedures to redefine the studies, the pricing and access to electricity grids, promoting renewable energy sources.

The targets set by the EU encounter obstacles to their implementation, starting with the high cost of investment in RES. Of course they must be included the benefits in particular as regards long-term effects on health or the environment. Another obstacle is the bureaucratic establishment and decentralized nature of most renewable energy applications procedures. In this direction are done actions to simplify procedures and where possible eliminate bureaucracy.

In the last years, the Electricity Market under the European Directives released by the hitherto almost monopoly and state commitments. Consumers today, with the exception of an unfortunate period of liberalization effort electricity was almost always obliged to pay its energy consumption under a special invoice kilowatt hour, which was negotiated by the semi-monopoly electricity supplier and the respective Government and government policy.

The liberalization of the energy market, signifies to the consumer that could be choose the provider of electric energy, have options in the pricing cost of the offered kWh, compare the services of the provider, and choose the source and/or the mixture of electricity will consume.

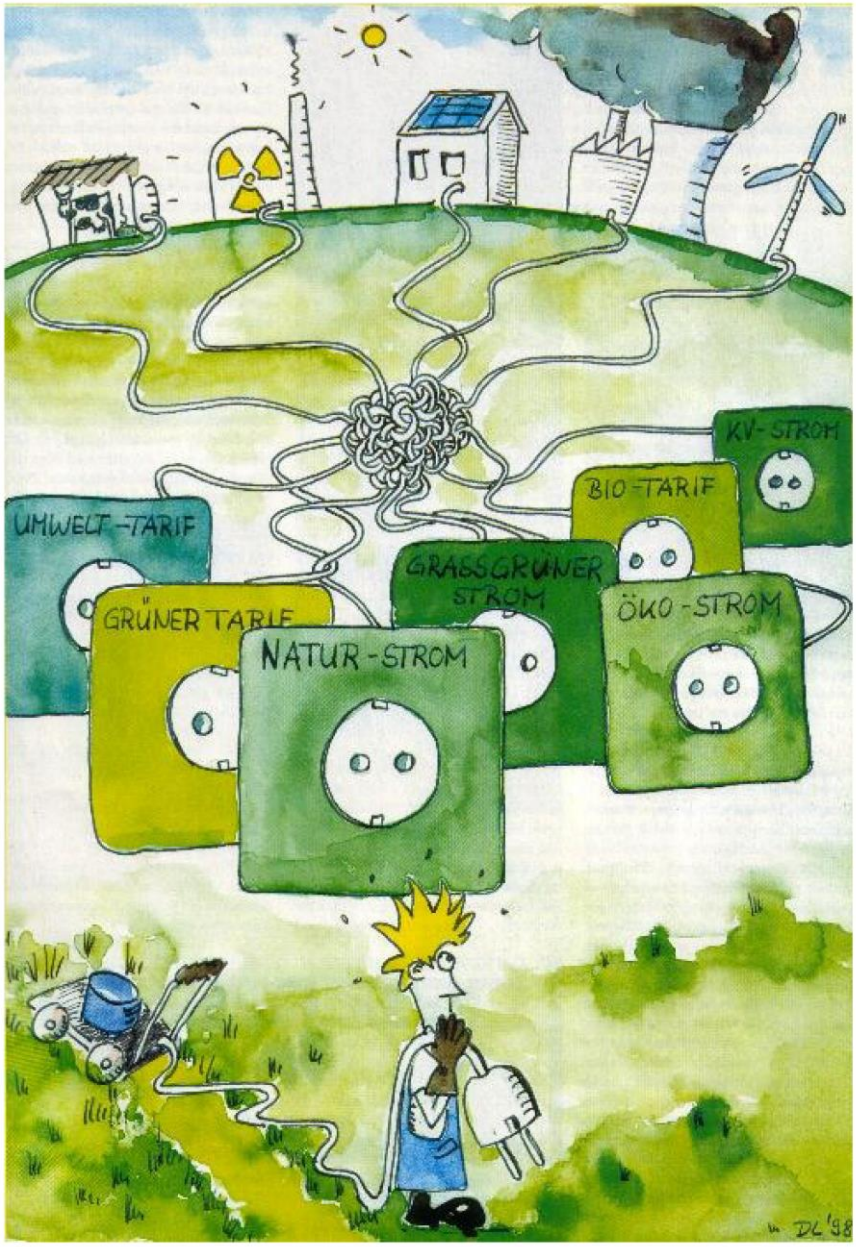

Figure 1.1. The consumer perspective of electricity disclosure.

This liberalization leads the electricity supply energy companies in a healthy competition, to offer a greatest possible "green" energy mix electricity to attract new environmentally sensitized consumers and industries, offering tariff rates that are in line with high offered services, environmental protection and sustainability.

It should be mentioned that according to the source of energy adopted various forms of Guarantees of Origin (GOs) or Energy Certificates. The most popular and commercial bankable energy certificate is the Guarantee of Origin from Renewable Energy Sources. In addition there are Guarantees of Origin from other energy sources like coal, nuclear energy etc.

Guarantees of Origin for Renewable Energy negotiate and redeemed in international energy exchanges and in secondary markets so that providers and energy suppliers to use as evidence to their customers about the origin and quality of supplied electricity.

Also, large industries and brands bought them in order to certify the use of renewable energy sources for the production of their products and to declare so, their active participation in the sustainability and environmental protection of the planet.

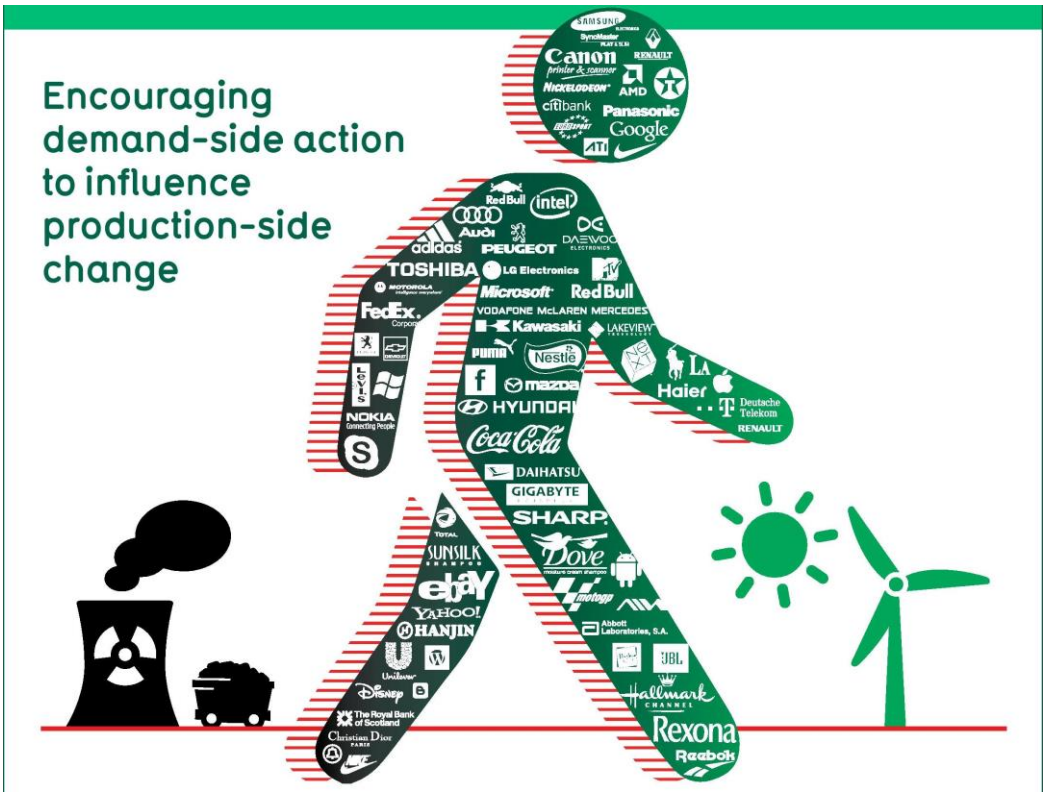

Figure 1.2. The cover from the RECS magazine - 4/2015 [1c].
The companies' transition to green energy sources through GOs.

Electricity has traditionally represented a product supplied through homogeneous markets as it is impossible to physically distinguish one unit of electricity taken from the grid from another. At the same time, these units of electric energy have been fed into the grid from production plants with very different environmental loads as well as different resource costs. This form the background for the discussions and debates regarding which electricity models should be assumed for one particular electricity customer in Life Cycle Assessment (LCA) and environmental reporting of products and services [2].

CHAPTER 2 - Electricity Disclosure and Tracking electricity systems

2.1. Electricity Disclosure and GOs

Electricity cannot be tracked along the electricity grid. Thus, consumers cannot have the guarantee that they really get power from a specific supplier/producer or from a specific power plant. If you live next to a thermal power plant, you will likely get the power produced by that plant. Electricity cannot be counted and separated like grains of rice: all the electricity produced from different sources is mixed in the same conductor or cable.

For consumer protection reasons, as well as for environmental reasons, it is useful to give people the opportunity to choose. So, "book and claim" systems have been developed. Through databases in which producers can register how much they have produced, when they have produced it and how they have produced it. Electricity suppliers and consumers could use the same databases to decide what "kind" of electricity they want.

When use "tracking of electricity" we mean all mechanisms which are being used in order to account for certain volumes of electricity generation and their generation attributes, such as the energy source and technology used for power production, related CO_2 emissions etc.

There are three main purposes for which tracking is currently being used [3], [4], [5]:

- The provision of information to final consumers for electricity disclosure as prescribed by Directive 2003/54/EC, its update in Directive 2009/72/EC and national regulations. Electricity disclosure means that all suppliers of electricity disclose to their consumers the origin of the electricity which they are supplying in terms of the energy sources used for power generation, related CO_2 emissions and radioactive waste produced. This regulation is in power in Europe since the year 2005 and it requires the tracking of all forms of electricity generation [6], [7], [8]. Figures 2.1 and 2.2 shows an example for a disclosure statement of the British supplier Ecotricity. Since 1 October 2005, UK electricity suppliers must provide customers with details of the mix of fuels used to produce the electricity supplied. They will also have to show the associated carbon dioxide emissions and high-level nuclear waste produced. Nuclear power also creates large quantities of medium and low-level waste which requires storage and/or controlled disposal, but the fuel mix disclosure regulations only relate to high-level waste. Due to the specific demand for green energy and the higher market prices in this sector, a certain focus is usually put on the tracking of electricity from renewable energy sources (RES-E).

Ecotricity

The fuel mix for the year 1 April 2014 to 31 March 2015 is shown below.

Fuel Mix

	Ecotricity	UK average
coal	0.0%	26.7%
natural gas	0.0%	29.7%
nuclear	0.0%	22.2%
renewable	100.0%	19.3%
other	0.0%	2.1%
CO_2 emissions (kg/kWh)	0.000	0.360
high-level nuclear waste (g/kWh)	0.00000	0.00160

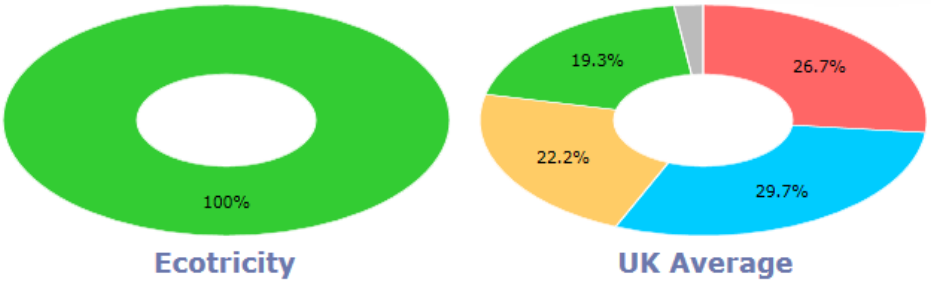

Figure 2.1. The fuel mix for one year (4/2014-3/2015) for supplier Ecotricity and UK average mix [9].

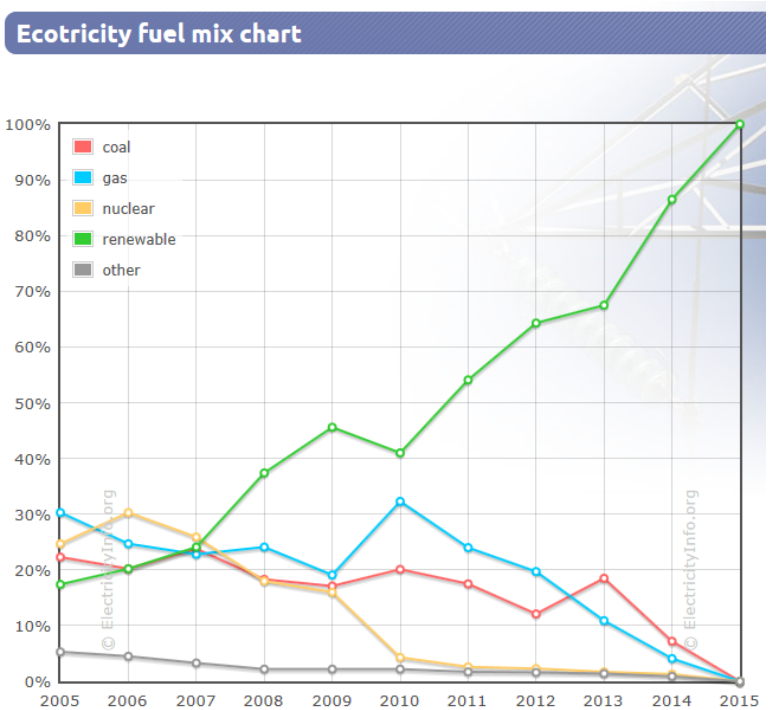

Figure 2.2. The ecotricity fuel mix for supplier Ecotricity for the period 2005-2015 [9].

- Some of the support mechanisms which European countries are using to promote the generation of RES-E or electricity from high-efficient cogeneration (HE-CHP-E) are based on quota obligations which use a transferable support certificate for their compliance mechanism. There are also other forms of support systems such as feed-in tariffs and market bonuses which usually do not require support certificates. Thus only part of the countries in Europe is using support certificates.

- European governments have committed themselves to fulfil quantitative national targets for the share of renewable energy in overall energy consumption. Such targets apply for RES-E in the year 2010 under the "old" RES Directive 2007/77/EC and more generally for renewable energy for the years 2011 to 2020 under the "new" RES Directive 2009/28/EC. The compliance with these targets is usually verified based on statistics on the renewable energy production in each country, but certain transfers of renewable energy between the countries are possible in order to add flexibility to the national targets. The 2009 RES Directive defines certain so-called Cooperation Mechanisms on the level of Member States which can be used in order to add flexibility to the targets up to 2020.

The electricity disclosure is possible to be done through the use of tracking systems for the electricity generation. In figure 2.3 is illustrated the basic types of transactions between a generator of electric energy and a final consumer [10].

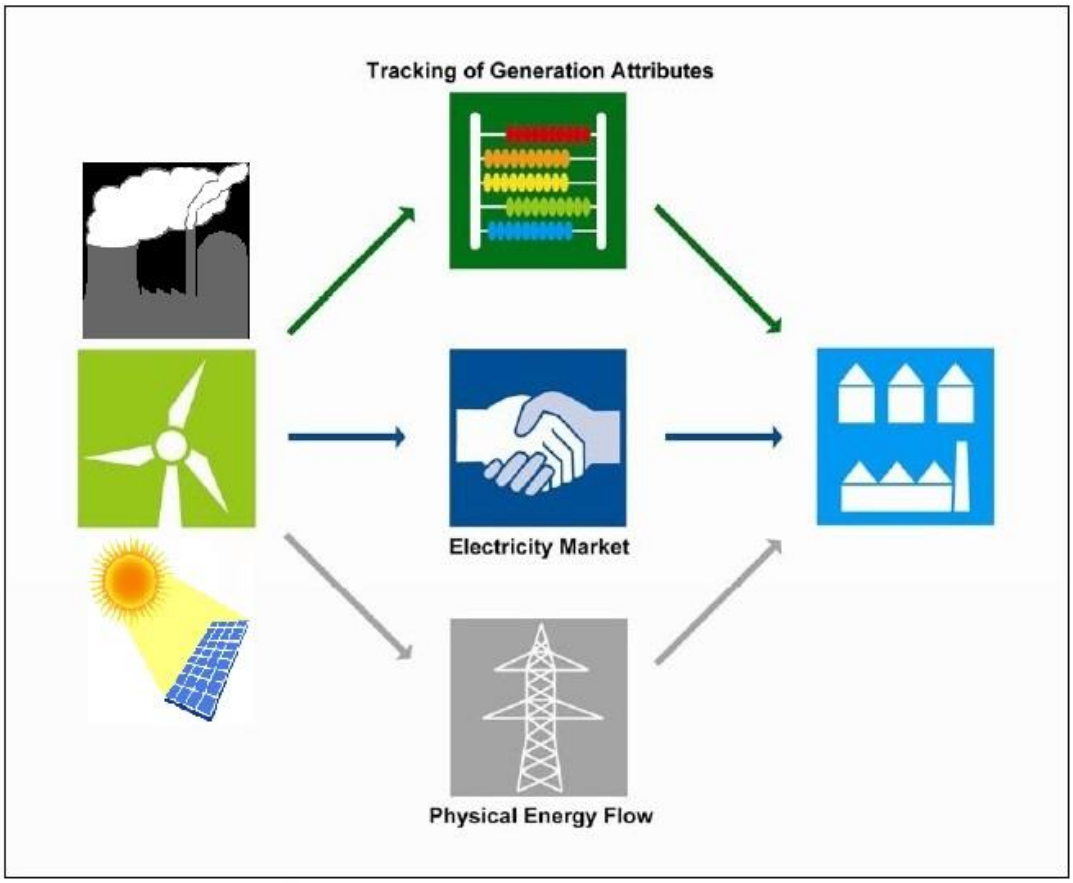

Figure 2.3. The basic types of energy transaction between producer and consumer.

a. Physical Energy Flow
Electricity is generated and flowing physically through the electricity grids to the consumers. This flow of electrons is governed by physical rules only. In most cases these rules mean that the consumers located next to a power plant are supplied physically from this power plant. This physical flow is not affected by the other two types of transactions, unless they have impact on the patterns of operation of power plants.

b. Electricity market (Trade in electricity)
The trading of electricity between generators and final consumers, which usually involves a final supplier of electricity to the consumer and possibly other trading intermediaries, a power exchange etc. Electricity contracts create a relation between electricity generation and consumers which is independent of the physical flows of electrons. Thus it is possible that a consumer which is located next to a power plant is purchasing electricity from another plant further away. So while this consumer is physically supplied from the power plant in his geographical vicinity, the contractual and financial relationship might be with a different generator.

c. *Tracking of electricity generation attributes*
The allocation of the generation attributes to consumers which is needed for purposes of electricity disclosure can follow either of the two paths described before or it can be based on another separate path. Thus it is possible that the tracking of generation attributes represents a third type of transaction.

The electricity disclosure requirement is put on suppliers and its intention is to enable consumers to make an informed choice between different suppliers and their electricity products. Thus an allocation of the attributes along the physical electricity flows, which can hardly be influenced by the suppliers, does not make much sense. We rather need an allocation of the generation attributes from the producers to the suppliers which can be influenced by market mechanisms. This allocation can be linked to the contracts in the electricity market ("contract based tracking") or it can use a separate tracking system ("de-linked tracking").

GOs and Electricity Disclosure, however, represent only two of several policy instruments relating to the generation and consumption of electricity. This is shown in Table 2.1.

Market based	Non-market based	Administrative	Informative
Emission Trading	Taxes	Environmental code	Labeling
Tradable Green Certificates	Subsidies and subventions	Municipal energy planning	Electricity Dislosure
Guarantees of Origin	Programmes for energy efficiency		Information campaigns
	Investments programmes		Research funding
	Technology procurement		

Table 2.1. Overview of the major relevant policy instruments [11] supplemented by GOs and electricity disclosure.

GOs is the most widespread and important tracking system in Europe, implemented in the form of transferable electronic certificates, de-linked from the electricity market.
When introducing Guarantee of Origin (GO) and Electricity Disclosure according to the European Renewable Energy Directive (2009/26/EC) and Electricity Market

Directive (2009/72/EC), respectively, the issue regarding which electricity models should be assumed for one particular electricity customer gets more complicated as these means allow the distinction between the physical electricity and the related environmental attributes.

Due to the Electricity Market Directive (2009/72/EC, Article 3(9)), suppliers of electricity are required to disclose their electricity portfolio with regard to energy source and environmental impact, specifying the emissions of CO_2 and the production of radioactive waste. The disclosed indicators are known as generated attributes and supply environmental information associated with the electricity generation processes. Electricity Disclosure aims at increasing the market transparency, complying with the consumers' right to information about purchased products, enabling consumers to make informed choices, educating consumers and stimulating electricity production contributing to a secure and sustainable electricity system. The information should be given to all customers regardless of whether the customer has made an active choice of product specific electricity or not. Thus, the selection of a supplier may not be based on electricity prices alone [12]. The regulatory authority has to ensure that the information provided by suppliers to their customers is reliable and is provided, at a national level, in a form which easily enables comparison.

It is important to be referred that while green power quality labelling is based on subjective quality criteria (which usually exclude a significant part of the electricity market from labelling), Electricity Disclosure is an objective information scheme for the whole electricity market, providing consumers with information which they can use following their individual preferences. Each labelling system has its own range of criteria. Thus, a label guarantees a specific quality based on self-defined criteria and is not necessarily comparable with other labels [13].

A GO is defined as a means of proving the origin of electricity, while the objective of the Electricity Disclosure is to provide consumers with relevant information about power generation and to allow for informed consumer choice, not only based on electricity prices. The suppliers of electricity are required to disclose their electricity portfolio with regards to energy source and environmental impacts, specifying the emissions of CO_2 and the amount of radioactive waste. The disclosed information is often referred to as the environmental attributes [2]. So, it is possible to involve market forces within a regulated system by creating a customer-driven demand for renewable electricity. The system also opens up an opportunity for creating a competition arena among electricity producers, suppliers and customers for achieving the best environmental electricity profile (e.g.CO_2) This may further promote improvement, innovation and investment in new renewable electricity capacity.

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Thus, the selection of electricity supplier may not be based on electricity prices alone. Also, the information should be given to all customers regardless of whether the customer has made an active choice of product specific electricity or not. The regulatory authority has to ensure that the information provided by suppliers to their customers is reliable and is provided, at a national level, in a form which easily enables comparison.

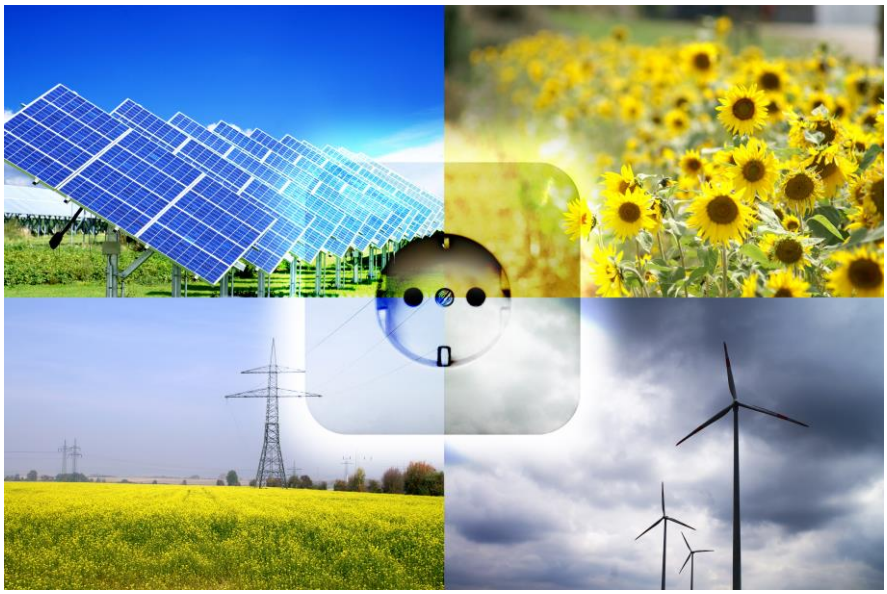


Figure 2.4. The selection of energy supplier and the energy source.

As a result of the voluntary GO system, the disclosed electricity for a customer who buys electricity as a commodity without any special requirements will be represented by the "remaining" Residual Mix where the amount of purchased GOs related country/region are excluded. This Residual Mix equals the consumption mix representing the consumption volume for all customers who do not voluntarily purchase GOs. The objective of the introduction of the Residual Mix is to avoid double counting of attributes related to the renewable electricity products. Thus, when calculating the Residual Mix it is necessary to take into consideration the voluntary trading of GOs, as well as national and international statistics for electricity generation, adjusted in accordance with import and export figures.

When calculating the Residual Mix it is necessary to take into consideration the voluntary trading of GOs, as well as national and international statistics for electricity generation, adjusted in accordance with import and export figures. The related attributes for the amount of electricity that have been traded explicitly (e.g. by GOs) have to be excluded from the calculation of the Residual Mix in order to avoid double counting. The principle for the system is illustrated in Figure 2.5.

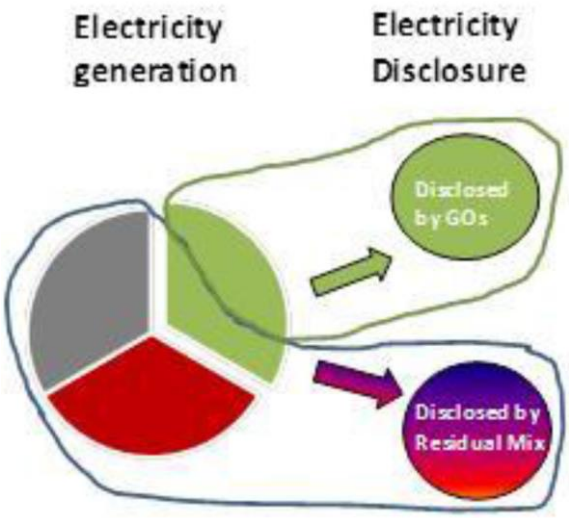


Figure 2.5. Principle for the electricity disclosure system.

Suppliers of electricity can use GOs to account for the correct amount of electricity in order to achieve a satisfactory disclosure of the electricity mix. Thus an electricity supplier can disclose the relevant attributes of the GOs purchased by the consumer. For a customer who buys electricity as a commodity, without any special requirements, the disclosed electricity will represent a mix of electricity generated from different energy sources which are not covered by GOs. This electricity mix is known as the Residual Mix and represents the consumption mix for all customers who do not purchase GOs in the related country/region. When calculating the Residual Mix it is necessary to take into consideration the trading of GOs, as well as national and international statistics for electricity generation, adjusted in accordance with import and export figures. The related attributes for the amount of electricity that have been traded explicitly (by GOs) have to be excluded from the calculation of the Residual Mix in order to avoid double counting [14].

GOs can be voluntarily purchased by any customer with the scope to claim the related attributes (origin, emissions etc.) of the generated electricity, thus improving the Electricity Disclosure. The remaining electricity customers have to use the Residual Mix for disclosure (as figure 2.6 shows).

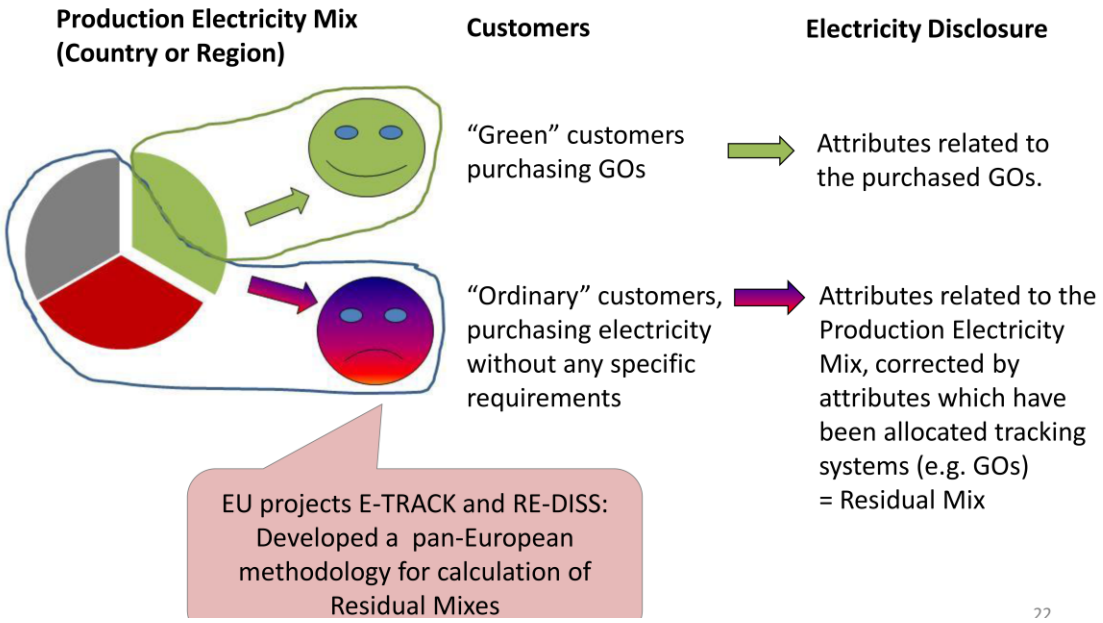


Figure 2.6. Connection GOs and electricity disclosure.

The EU financed E-TRACK project [13] aimed to provide detailed insight into the tracking of electricity in order to set a European-wide standard for such tracking systems. Two collaborating European projects have been established as a follow-up to the E-TRACK project: Reliable Disclosure Systems for Europe [15] and European Platform for Electricity Disclosure [16]. The follow-up projects have, based on the E-TRACK methodology, calculated national Residual Mixes for 27 European countries for 2009 and 2010 [17], [18].

As an example of GOs operation (exporting GOs) in a country Residual Mix is illustrated in the figure 2.7.

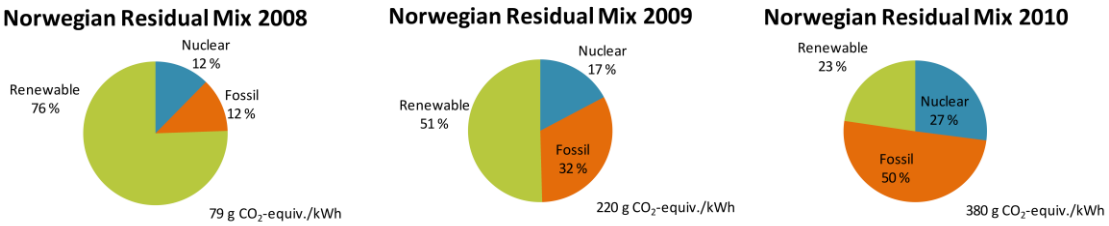


Figure 2.7. The Norwegian Electricity Disclosure 2008 – 2010, calculated on the basis of the European harmonised E-TRACK methodology [17], [18].

The renewable share in the Residual Mix has decreased from 76% in 2008 to 23% in 2010. The corresponding (scope 2) CO2-emissions for the 2010 Residual Mix is about 380 g/kWh, which is significantly higher than zero (scope 2) CO_2-emissions from e.g. hydro and wind power (of which customers typically buy GOs).

This reduction of renewable share and the CO2 emissions in the residual mix from 2008 to 2010 (not in reality of course) is due to the large export of GOs in other countries. This fact drives to an increase of income from GOs and to a "dirtier" with more fossil fuel share residual mix. So, the increased electricity demand, the

environmental education of the end consumers and the income from GOs helps the funding of new RES plants and the energy producers are invited to turn their activities from fossil fuel plants to RES.

The GOs system is a tool which helps the diffusion of green electricity to society and contributes to the green energy transition.

The European Attribute Mix is filled from the preliminary Residual Mixes of the Domains which have a surplus in attributes. The European Attribute Mix is used to fill up the Residual Mixes of the Domains which have a deficit in attributes.

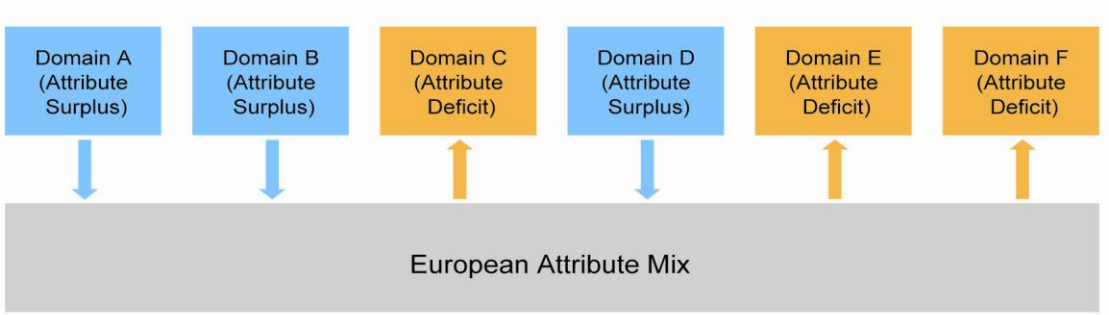


Figure 2.8. The operation of attributes surplus/deficits in the total European Attribute mix [3].

The reasons that a European Attribute Mix is needed are the following:

a) EU Directives and consumer rights require GO and disclosure information to be reliable.
b) Due to cross-border transfers of GO and physical energy, a fully reliable system cannot be ensured on a national basis alone. (Massive growth in international trade of electricity attributes and domestic calculations lead to double counting of green attributes).
c) Uncoordinated residual mixes are currently the most relevant reason for double counting of green attributes. This puts the reliability of GO, disclosure information and of green products at risk.
d) The calculation and use of the European Attribute Mix eliminates this error and significantly increases the reliability of attribute information in Europe.

Tracking of electricity is regulated consistently in geographical domains, which could be defined as the territory of a country or of regions within a country. In principle, a tracking domain could in the future also encompass several countries with a fully homogenous framework for tracking of electricity [10].

The recommended set-up for a tracking system for purposes of electricity disclosure consists of up to three elements (as illustrated in figure 2.9):
- Guarantees of Origin
- A Domain Residual Mix (adjusted by attributes from a European Attribute Mix)
- Other Reliable Tracking Systems (if required in a domain)

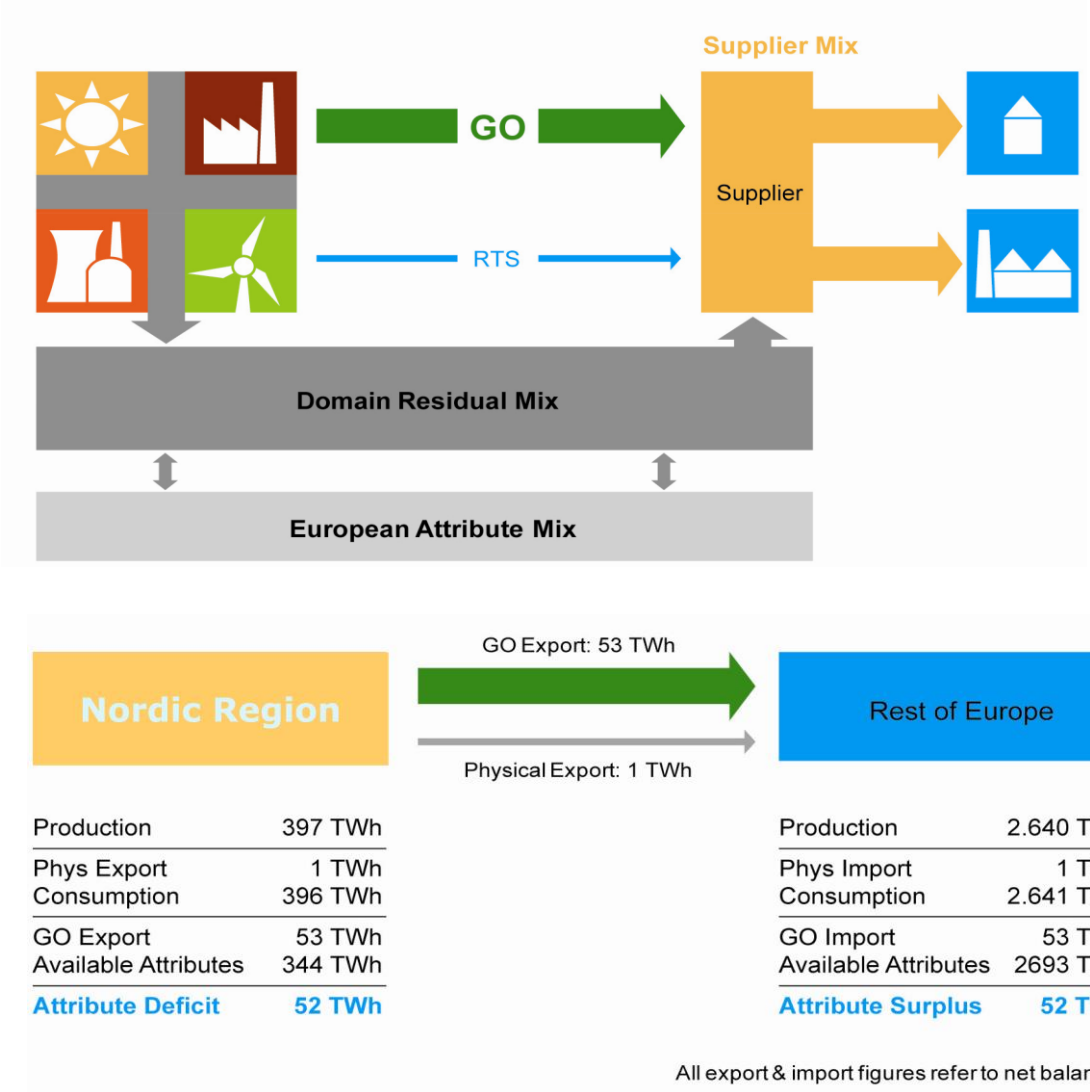


Figure 2.9. Elements of tracking system for electricity disclosure [10], [19].

It should be noted that the more GOs that are voluntarily purchased, the more "dirty" the Residual Mix becomes, which, by itself, may become a motivation for increased demand for voluntary purchased GOs by other customers. This may, in a long-term perspective, increase the prices and influence the decisions of renewable energy investors [20]. This shows that the system may have a potential for contributing to additional renewable electricity generation.

It is valuable to be noted that many end customers have difficulty in understanding the differentiation between trade in electricity and in electricity generation attributes and physical flows of energy. As an example, inhabitants of countries with high share of wind power generation might find it difficult to understand that part of this generation has been exported to other countries and thus the share of renewable energy in disclosure statements is significant lower than in production statistics.

2.2. Tracking electricity systems and GOs

Renewable energy is at the forefront of European energy policy using variable support schemes which are caused financial pressures due to rapid development and maturation of used technology. The way is to be part of the market-based market and Guarantees of Origin system is an important tool for making this happens. The concept of a GOs market could also be used to help the investment problem, so to have a transition from support schemes towards a more market-based solution. Coupled electricity spot-markets and the progressive development of intra-day markets will allow this integration to occur. The mechanism of GOs is a tool for a market-based solution to RES support dilemmas and consumer empowerment.

The implementation of Guarantees of Origin (GOs), representing a tracking instrument for proving the origin of electricity, opens up the possibilities of separating the produced electricity which is covered by GOs from the rest of the electricity production. Additionally to the tracking mechanism, a GO also provides contractual obligations between the supplier and customer regarding the relevant electricity plant, energy source, production period etc. This means that the consumers are given the opportunity of demanding and choosing (by voluntarily purchasing GOs) a specific volume and electricity generation technology in order to cover their electricity consumption volume [2].

During the 90's there were large changes regarding the electricity market regulations in several countries. In 1996, a common Norwegian-Swedish power market was established to become the first intercountry integrated power market in the world. Nord Pool took responsibility for power exchange for the common market in Norway and Sweden. Finland and Denmark integrated the system later and, since 2002, there has been a common Nordic integrated electric power market (excluding only Iceland) [21]. The re-regulation has implied that the electricity market has turned from a monopoly situation to competitive markets [22]. This means that the market competition between electricity producers has increased as a result of increased geographical area (from a national to a Scandinavian base) and by letting consumers easily choose and switch among electricity suppliers on the basis on prices.

The directive 2009/28/EC set national targets for RES development so to have an increase of use of renewable energy sources. This increase has come at a cost. Support schemes for RES were introduced in order to make competitive RES technologies with conventional energy caused increase of consumers' electricity prices. Also, another factor adding to the financial pressure of support systems is the difficulty of administering subsidies efficiently, particularly when costs are changing rapidly. Measures like challenging support systems, open legal proceedings, new Guidelines on environmental and energy aid and drastic changes in support systems in the EU have already happened. One of these measures could be a more pronounced role for the GOs system.

Since electricity is a commodity, it used to be impossible to claim any specific quality for a particular quantity of electricity. However the use of Guarantees of Origin (GOs) is changing this. The European Union is currently implementing a scheme which allows specific attributes to be assigned to particular quantities of electricity.

The primary role of GO is to serve as a basis or a tool for disclosure, i.e. informing consumers about what kind of electricity they are using. So, the disclosure of electricity's origin would be simpler and more transparent. Due to the provided information of GOs offer a solid basis for serving other purposes, as well as labels and support systems, driven by customer choice.

A Guarantee of Origin is similar to a label on a bottle: it carries information telling the consumer facts about the product. Controlling the information and the accuracy of the guarantee of origin is therefore of critical importance. A unique body (e.g. an electricity regulator or a transmission system operator) is usually granted this authority for a given domain.

In their most accomplished form, Guarantees of Origin are issued electronically for a controlled quantity of electricity generation (usually 1 GO per MWh), traded and redeemed (i.e. used) by suppliers as evidence to their customers of the quality of the delivered electricity. Generation from renewable energy sources is the most sought-after attribute. A new development concerns guarantees of origin for cogeneration heat plants (or CHP). Some countries already have guarantees of origin issued for all types of electricity generation (nuclear, coal, solar, biomass). Possible extensions also include fair-trade, CO_2 statistics etc.

Guarantees of origin should not be confused with the Eugene Green Energy Standard or EKOenergy labelling scheme. Both provide consumers with more information about their power (transparency). However, Eugene and EKOenergy go further by requiring additionality. Besides, Eugene and EKOenergy are private initiatives whereas guarantees of origin arise from European regulations.

GO is an electricity tracking device which is used for electricity disclosure. It is important not to be confused with other tools or certificates. So:

- It is not a green label
- It is not a support mechanism
- It is not a vehicle for flexibility mechanisms of the directive
- It is not a carrier of CO_2 reductions
- It is not a statistics collection ticket

The GO system is a book and claim system which enables the consumer to voluntarily purchase GOs to claim the specific energy source of the consumed electricity [1]. It can be used as an information carrier for further information according to specific green power labels.

An important effect of the implementation of the GO system is that the traditional electricity product has been divided into two separate products: (i) the environmental attributes related to the generation of the electricity, and (ii) the physical electricity being delivered. The implementation of this voluntary and regulated trading system thus means that the GOs are sold in a market which is separated from the physical electricity market.

The principle for this system is illustrated in figures 2.10 and 2.11.

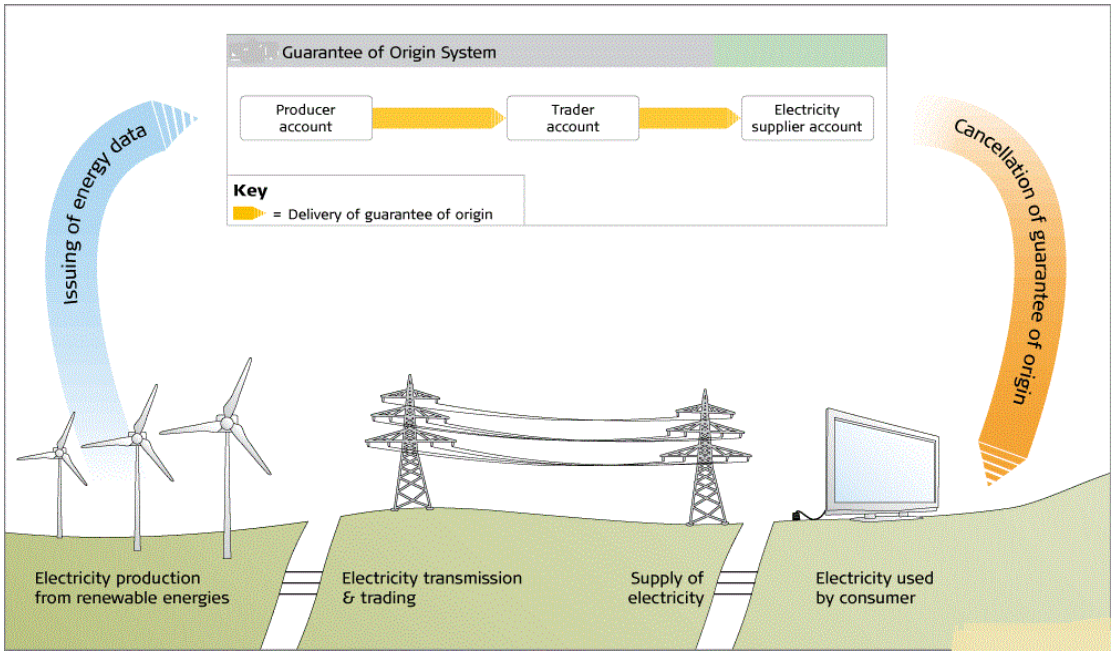
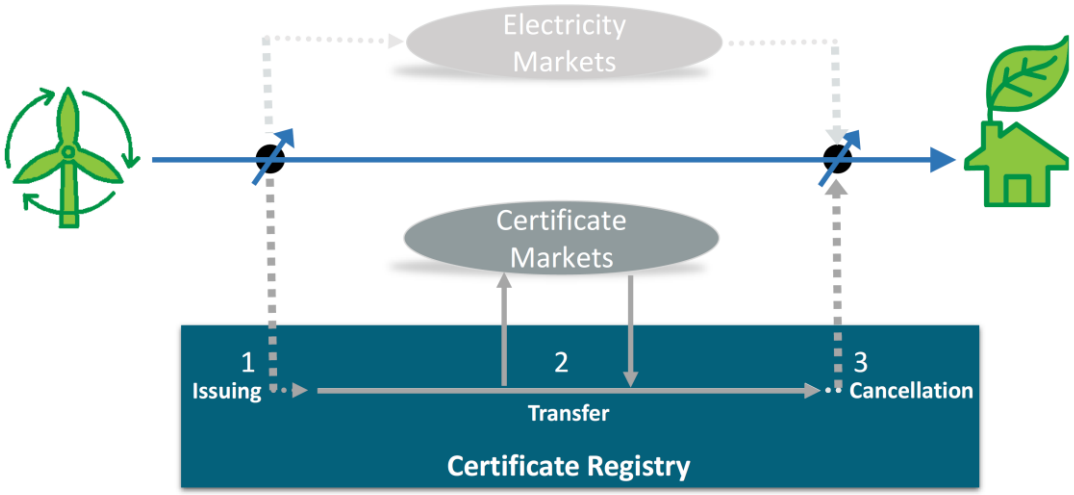


Figure 2.10. The principle of GOs system operation.



1. The Issuing Body issues 1 energy certificate for each MWh of electricity production from a verified production plant and deposits the certificate into the account of the plant owner in the electronic registry.
2. Energy certificate, representing the generation attributes of the produced MWh can be traded in the certificate markets separately from the trade of electricity.
3. Electricity consumers or suppliers on their behalf purchase energy certificates and cancel them to comply with a set quota and/or to prove that consumed or sold electricity is renewable.

Figure 2.11. Principle of the separated systems for electricity trading: The GO market represents trading with the environmental attributes of electricity while the electricity market represents trading with the physical electricity (Source: Grexel).

CHAPTER 3 - GOs and their usage

3.1. In General

Guarantees of origin in the meaning of Directive 2009/28/EC are the only precisely defined instruments evidencing the origin of electricity generated from renewable energy sources.

All EU member States are required to establish and maintain a GOs scheme. The purpose of this scheme is to promote and increase the contribution of RES to electricity production across the EU, providing a common platform to facilitate the trade of renewable electricity between member States. Also this scheme sets out increased transparency to consumers, allowing to choice to purchase renewable or non-renewable electricity.

A guarantee of origin (GO) regime was created by Directive 2001/77/EC in order to facilitate domestic or international trade in renewable electricity (i.e. proof of the green nature of the electricity) and to increase transparency in consumers' choice between renewable and non-renewable electricity.

Article 5 of the Directive introduces a minimum set of requirements for the GO. The GO must specify the source, date and place of production in a reliable manner; it should be mutually recognised by all Member States exclusively as proof of renewably sourced electricity, and it should be reliable and accurate. The GO can be used for a number of purposes, including claiming subsidy (a feed in tariff or green certificate payment), supporting electricity bill energy mix "disclosure" (In accordance with Article 3(6) of Directive 2003/54/EC, Member States are required to implement a scheme for the disclose of the fuel mix.), and proving compliance with national renewable energy obligations. However, these applications are voluntary. Under the Directive, producers of renewable electricity may request certification that the electricity they produce is from renewable energy sources. Furthermore, whilst the Directive allows the GOs traded together with underlying electricity (physical trade) to count towards the indicative national renewable electricity targets. Guarantees of origin are tradable across EU member states.

The operation of GOs in electricity consumption is presented in the next example.

A corporation has had 120-MWh of electricity consumption in 2011, from several plants located around the world, including Sweden, Germany, Iceland and Spain. After implementing an electricity savings plan they saw a drop in their electricity consumption to 100-MWh in 2012. Their goal was to have 80% renewable electricity for their remaining consumption. This corporation, based in Sweden, wanted 50% of their electricity to come from Swedish hydropower stations, 30% from wind sources in Europe and 10% from Icelandic geothermal production. To prove this they bought 50 GO certificates originating from Hydropower stations in Sweden, 30 GO certificates from wind power stations anywhere in Europe, and 10 GO certificates from Icelandic geothermal power. Once these GOs were cancelled on their behalf the company can claim electricity consumption of 50% hydroelectricity, 30% wind, 10% geothermal and 10% grid-mix [24].

3.2. GOs in EU directives (2001/77/EC, 2003/54/EC, 2009/28/EC and 2009/72/EC)

Due to the fact that potential for exploitation of renewable energy sources is underused in the EU in the start of 2000, the need for promotion of renewable energy sources was set as a priority measure, given contribution to environmental protection and sustainable development. Moreover, this exploitation could create local employment, have a positive impact on social cohesion and to contribute to security of supply and allow faster achievement of the Kyoto objectives. Therefore, it was necessary to ensure that this potential is better exploited within the the internal electricity market. "The promotion of electricity energy produced from renewable energy sources is high EU priority as outlined in the White Paper on renewable energy sources, for reasons of security and diversification of energy supply, for reasons of environmental protection and for reasons social and economic cohesion".

Following the above established by Directive 2001/77/EC on the production of electricity from renewable energy sources in the internal electricity market energy, which is the first European legislative initiative to regulate the field of renewable energy. The main target of that Directive aimed to promote and increase electricity produced from renewable energy sources in the internal electricity market, creating the basis for a single European framework for that purpose (Article 1).

The Directive recognized that financial support in renewable energy investments is necessary because the produced energy is often more expensive than that produced from conventional sources. Also, this directive provided for choice and setting of financial support schemes for RES from Member States to achieve the targets. The selection of a single framework was rejected because of the limited experience with national schemes and even the relatively small share in the Union of electricity produced from RES, which is subsidized.

Moreover, the Directive obliges Member States to create appropriate mechanisms and to establish Bodies responsible for issuing Guarantee of Origin for energy derived from renewable sources according to objective, transparent and non-discriminatory criteria laid down by each Member State and specified the content of those guarantees. A guarantee of origin of such electricity is necessary to facilitate energy trade produced from renewable sources and to increase transparency in the consumer choice between electricity produced from non-renewable and electricity produced from renewable sources. Guarantees of origin should cover all forms electricity produced from RES. Furthermore, Directive requires Member States to recognize guarantees of origin from other EU Member States, and adopts a relevant competence of the Commission in case of refusal to recognize a guarantee origin, can compel the refusing party to recognize it (Article 5). Finally, it is noted that it is important to clearly distinguish between guarantees of origin and exchangeable green certificates.
For the purposes of proving to final customers the share or quantity of energy from renewable sources in an energy supplier's energy mix Member States shall ensure that the origin of electricity produced from renewable energy sources can be guaranteed as such within the meaning of this Directive, in accordance with objective, transparent and non-discriminatory criteria. GOs are exclusively issued for disclosure and transparency purposes.

Member States shall ensure that a guarantee of origin is issued in response to a request from a producer of electricity from renewable energy sources. Member States may arrange for guarantees of origin to be issued in response to a request from producers of heating and cooling from renewable energy sources. Such an arrangement may be made subject to a minimum capacity limit. A guarantee of origin is the standard size of 1 MWh. No more than one guarantee of origin shall be issued in respect of each unit of energy produced.

Member States shall ensure that the same unit of energy from renewable sources is taken into account only once.

Also, Member States may provide that no support be granted to a producer when that producer receives a guarantee of origin for the same production of energy from renewable sources.

The guarantee of origin shall have no function in terms of a Member State's compliance with the 20% share of energy from renewable sources in the Community's gross final consumption of energy in 2020. Transfers of guarantees of origin, separately or together with the physical transfer of energy, shall have no effect on the decision of Member States to use statistical transfers, joint projects or joint support schemes for target compliance or on the calculation of the gross final consumption of energy from renewable sources. Any use of a guarantee of origin shall take place within 12 months of production of the corresponding energy unit. A guarantee of origin shall be cancelled once it has been used.

Member States or designated competent bodies shall supervise the issuance, transfer and cancellation of guarantees of origin. The designated competent bodies shall have non-overlapping geographical responsibilities, and be independent of production, trade and supply activities.

Member States or the designated competent bodies shall put in place appropriate mechanisms to ensure that guarantees of origin shall be issued, transferred and cancelled electronically and are accurate, reliable and fraud-resistant.

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 extent the installation has benefited from investment support, whether and to what extent 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.

Where an electricity supplier is required to prove the share or quantity of energy from renewable sources in its energy mix for, it may do so by using its guarantees of origin. The Member State could decide if an energy producer will receive GOs depending has received financial support (FiT or subsidy) or not for his project.

With respect to electricity obtained via an electricity exchange or imported from an undertaking situated outside the Community, aggregate figures provided by the exchange or the undertaking in question over the preceding year may be used.

Member States shall take the necessary steps to ensure that the information provided by suppliers to their customers is reliable.

The amount of energy from renewable sources corresponding to guarantees of origin transferred by an electricity supplier to a third party shall be deducted from the share of energy from renewable sources in its energy mix.

Member States shall recognise guarantees of origin issued by other Member States in accordance with this Directive. A Member State may refuse to recognise a guarantee of origin only when it has well-founded doubts about its accuracy, reliability or veracity. The Member State shall notify the Commission of such a refusal and its justification. If the Commission finds that a refusal to recognise a guarantee of origin is unfounded, the Commission may adopt a decision requiring the Member State in question to recognise it.

A Member State may introduce, in conformity with Community law, objective, transparent and non-discriminatory criteria for the use of guarantees of origin.

Where energy suppliers market energy from renewable sources to consumers with a reference to environmental or other benefits of energy from renewable sources, Member States may require those energy suppliers to make available, in summary form, information on the amount or share of energy from renewable sources that comes from installations or increased capacity that became operational after 25 June 2009.

At the end, in directive 2009/72/EC is referred that 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 in a comprehensible and, at a national level, clearly comparable manner;

(b) at least the reference to existing reference sources, such as web pages, where information on the environmental impact, in terms of at least CO_2 emissions and the radioactive waste resulting from the electricity produced by the overall fuel mix of the supplier over the preceding year is publicly available.

3.3. GOs – a capability for electricity consumers to demand renewable energy

GO is not just one more “paper”, is actually a main tracking instrument for proving the origin of electricity in Europe, in accordance with two central EU Directives (the Renewable Energy Directive (2009/28/EC and the Electricity Market Directive (2009/72/EC)). GOs be allowed in use in LCAs or carbon footprints calculations. Each GO represents proof that 1 MWh of renewable energy has been produced and embodies the environmental benefits of that amount of renewable energy generated.

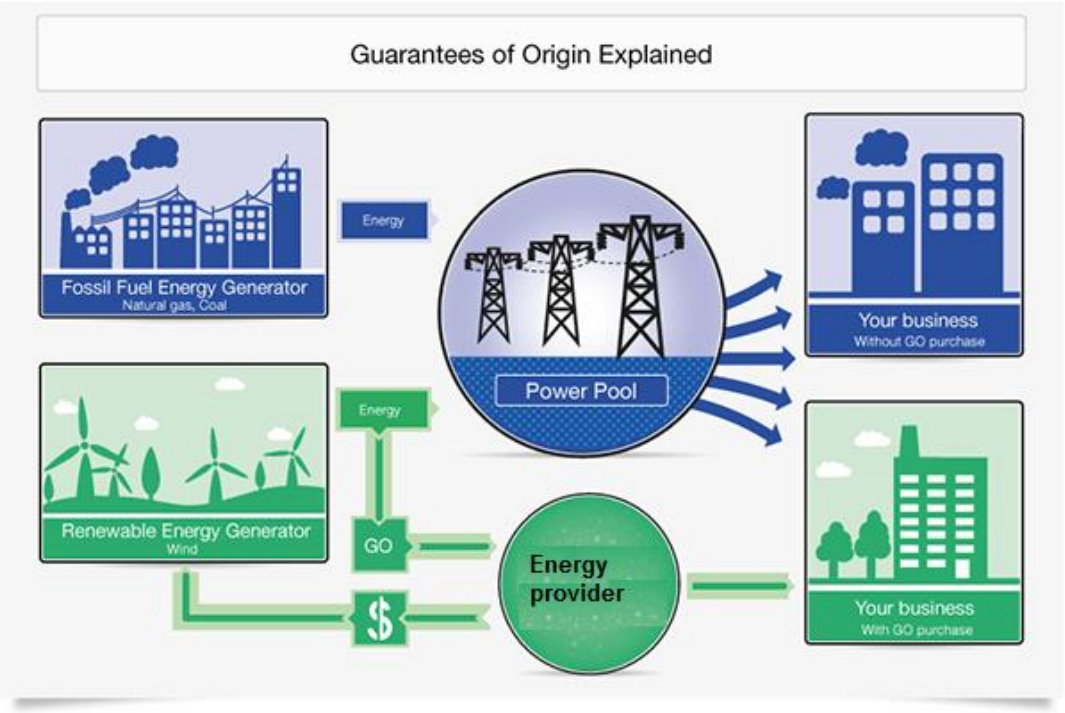


Figure 3.1. The basic operation of GOs.

An energy provider could provide energy products (e.g. a green electricity program) which incorporate GOs, so could offer the following [25]:

- Demonstrate environmental leadership in industry
- Differentiate from competitors by supporting investments in renewable energy
- Engage shareholders, employees and customers with an engaging narrative surrounding business's approach to sustainability
- Partially or completely mitigate the GHG emissions associated with your electricity consumption in Europe
- Comply with existing or approaching legislation surrounding electricity consumption in Europe
- Include GOs within Scope 2 GHG accounting under the World Resources Institute's (WRI) GHG Protocol and CDP reporting
- Channel funds into renewable energy projects, moderating the environmental impact of the energy use

In addition, the selections of GOs address the business's specific areas of interest, for instance renewable energy projects which are only from wind power projects or that are provided by producers that do not supply nuclear power.

It should be stated that there is a general agreement for applying the attributional approach for environmental documentation, e.g. Carbon footprint calculations [26], [27] and LCAs.

EU has developed a final draft for a new Product Environmental Footprint (PEF) Guide which accepts the use of Guarantees of Origin for carbon footprint calculations. It is proposed that when accounting for use of electricity, supplier specific data shall

be used if available [28]. That means that consumers who use renewable electricity documented with Guarantees of Origin, can claim almost zero emissions of CO_2 related to the electricity usage.

Also, the relevant consumption electricity mix related to the product/services under study should be based on either average or specific data. In accordance with this, the electricity mix should thus be either the average grid mix or a supplier-specific electricity mix. This means that electricity will, in general, be treated in the same way as other products when performing attributional LCAs.

However, a particular issue for electricity is the need for a tracking instrument in order to be specifically identified (as electrons are indistinguishable). A GO actually represents such a tracking instrument (legally based in EU Directives and national regulations).

In order to avoid double counting of the environmental attributes related to the purchased GOs, it important that the purchased GOs are separated (by the use of the tracking mechanism) from the average consumption mix. This has been the aim of a pan-European methodology for Residual Mix calculations which has been developed over several years through the EU-financed projects E-Track [13], RE-DISS [15], in addition to the EPED platform [16]. This methodology makes GOs and Residual Mixes applicable for environmental reporting based on reliable and trustworthy systems, thus avoiding double counting of attributes.

GOs represent a mechanism which gives customers the opportunity to select an electricity product based on environmental requirements. The system thus creates a mechanism for a customer driven demand for renewable electricity which, in the long-term, may influence the decisions of renewable energy investors [20]. Such a system fits well into the logic of a liberalised market where communication between suppliers and customers becomes a key element [29]. The GO system has shown that there is an existing and increasing market which is willing to pay the extra costs for renewable electricity, thus generating extra income for the energy companies, which can be invested in new power plants.

GOs represent a mechanism that gives customers the opportunity to select an electricity product based on environmental requirements, in addition to price. By purchasing GOs, customers are given a proof of the origin of the electricity, thus being able to use emission factors related to the specifically purchased electricity generation technology.

The system thus creates a mechanism for a customer driven demand for renewable electricity without the danger of double counting or duplication. However, as GOs are included in carbon footprints and LCAs the effect of this mechanism has strengthened. The GOs system is a reliable and regulated way which provides to customers the possibility of demanding renewable electricity and helps the funding of new renewable energy power plants.

3.4. GOs and TGCs

The EU Emission Trading Scheme (ETS) aims to reduce greenhouse gas (GHG) emissions, the Tradable Green Certificate or Green Certificates (TGC) system's objective is to increase the generation of renewable energy, while the goal of Electricity Disclosure and GOs is to provide consumers with relevant information about the generated electricity [30].

Their interaction may be significant and it is therefore important to analyze and define potential synergies and conflicts between different instruments with regard to policy development. The interaction between emissions trading and renewable support electricity schemes has been investigated by González (2007) [31], while Midttun & Koefoed (2003) [32] have explored the commercial and political implications of the greening of electricity in Europe. Analyses of the interactions between the TGC and electricity markets have been discussed thoroughly by Jensen & Skytte (2002) [33], Marchenko (2008) [34] and Nilsson & Sundqvist (2007) [35].

It is important to emphasise that the GO system represents a voluntary, but regulated market, while the TGC system represents a mandatory market. This is illustrated in Table 3.1.

	Voluntary Demand	**Mandatory Demand**
Policy goal	Inform consumers	Create new renewable electricity
Policy	Electricity Disclosure	Quota System
Mechanism	GO	TGC (based on a quota system)

Table 3.1. GO and TGC mechanisms which, respectively, create voluntary and mandatory electricity demands [2].

The Quota Support System uses Tradable Green Certificates (TGC) and was established in few EU countries (Belgium, Italy, Poland, Romania, Sweden and UK) as a support mechanism. Quota support schemes based on TGSs involve RES electricity set by the State. This quota is generally assigned to retail electricity providers who must show that they have obtained the mandated share of their electricity from RES. They could demonstrate this by buying RES electricity or green certificates (GCs). A GC is a document that certifies the generation of one unit of RES electricity in turn displaces the carbon equivalent of the marginal unit of conventional electricity generations [36] As RES electricity is indistinguishable from conventional electricity, GC proves the former's "greenness". A GC becomes a TGC when the mechanism allows trading of GCs as a means of meeting the RES electricity quota [37].

The respective objectives of the TGC system and Electricity Disclosure/GOs are to increase the generation of renewable energy and to provide consumers with relevant information about the generated electricity. Another factor, which should be born in mind when discussing the effects of the TGC and Electricity Disclosure/GO systems, is that the TGC system relates to the production of electricity while Electricity Disclosure and GOs relate to the consumption of electricity. This is illustrated in Figure 3.2, which presents the connection between the TGC system and the Electricity Disclosure/GO system.

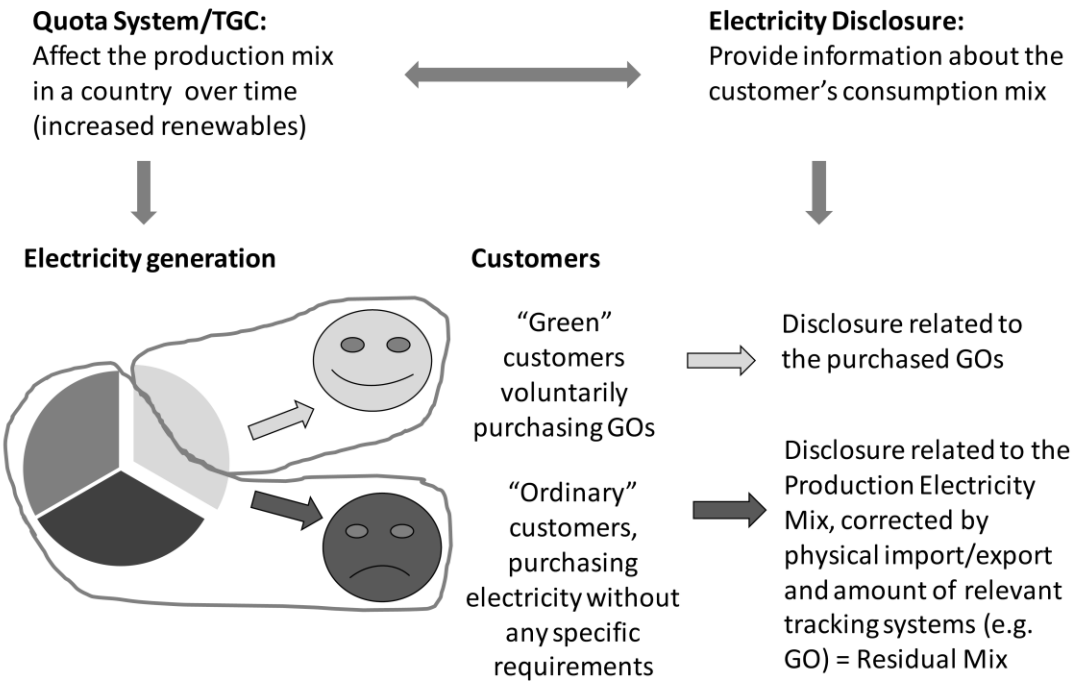


Figure 3.2. The connection between the mandatory Quota system/TGC plus voluntarily purchase of GOs and electricity disclosure [30].

The mandatorily purchased of TGCs affect national production mix and voluntarily purchased GOs affect individual consumption mix.

Price setting for electricity and TGC is driven by the demand for energy and, in the case of TGC, is also affected by the predetermined quota levels. The GOs market is linked to other needs, such as the customer's willingness to document the environmental performance of products and services. The fact that GO prices are set in a market which is separated from the TGC and power market may not therefore reduce the long-term incomes from the sale of TGC and power, in spite of increased income from the sale of GOs [30].

On the basis of this assumption, the GO income may result in an increased total income for electricity generators in the long-term. This opens up possibilities for investment in projects with higher long-term marginal costs, such as offshore windfarms or solar-thermal power plants, which can lead to an increase in renewable electricity generation. Important prerequisites for this would be significantly increased GOs prices and investors being willing to include GOs income in their investment calculations.

In summary, the GOs and electricity disclosure system may increase the total production of electricity from RES by leading to increase TGC targets. Thus changes in RES electricity generation might be helped by mandatory and voluntary markets working in parallel. On the basis of this, the GO, Electricity Disclosure and TGC mechanisms represent discrete elements of an overall package of policy instruments, which together may lead to increased renewable electricity generation at the expense of fossil generation.

3.5. GOs and LCA

Life Cycle Assessment (LCA) represents a structured, comprehensive and internationally standardised [38] method for quantifying environmental and health impacts, resources consumed and resource depletion associated with any goods or services ("products"). By applying the LCA method, the potential environmental impacts throughout the life cycle of a product or a service can be analysed and assessed. The potential contribution of a substance to climate change is expressed as its Global Warming Potential (GWP), which represents one environmental impact category within the LCA methodology. Characterisation of greenhouse gases (GHGs) is based on the extent to which they enhance the radioactive forcing in the atmosphere, i.e. their capacity to absorb infrared radiation and thereby heat the atmosphere. The GWP of a substance is defined as the ratio between the increased absorption it causes and the increased infrared absorption caused by 1 kg of CO_2 [39].

Life Cycle Assessment (LCA) of electricity generation enables assessment of both the investment and the operating impacts relating to the generation process, and requires that the entire life cycle of the investigated power generation, including upstream and downstream processes, be taken into consideration.

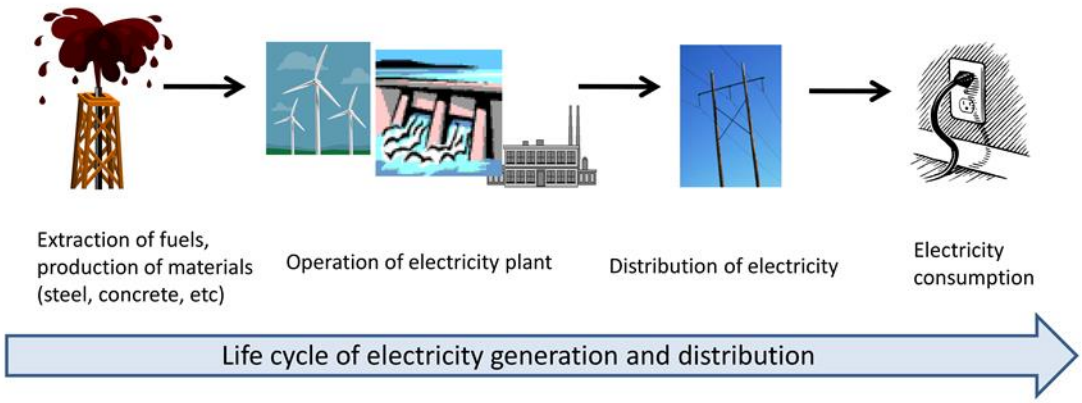


Figure 3.3. Life cycle of electricity generation and distribution.

Upstream processes include, for example, mining and transport activities relating to the extraction of fuel, as well as extracting and processing activities relating to the materials used for building the power plant. Typical downstream processes include activities relating to building and operating the grid, as well as the management of waste from the power generation processes. For most renewable electricity technologies and nuclear power, upstream and downstream GHG emissions account for over 90% of the cumulative GHG emissions [40]. Thus, when taking this life cycle perspective, GHG emissions from renewable electricity generation may vary considerably, depending on the renewable energy source and technology in question. Assumptions with regard to life time and operational conditions also play their part. For conventional fossil fuel technology, however, the upstream GHG emissions also impact on the total picture, as they can represent up to 25% of the direct emissions from the power generation [40].

Table 3.2 shows the main similarities and differences between claiming electricity traditionally using average electricity grid mixes and specifically using GOs.

	Average electricity grid mix	Specific contracted electricity mix (GOs)
Principle of calculating electricity mix	Electricity mix based on average annual electricity production mix of a geographical limited grid, corrected for import/export of electricity to/from that grid.	Electricity mix according to the customers' choice with regard to purchased electricity: • specific purchased GOs, or • average geographical Residual Mix based on production mixes, corrected for import/export of electricity and GOs.
Connection between physical delivered electricity and environmental attributes	Physical electricity generation and related environmental attributes are connected within a geographical area, based on average data for the regional or national grid electricity mixes.	Physical electricity generation and relating environmental attributes are decoupled based on economical contractual relations. Calculation of a Residual Mix is required in order to determine the electricity delivery to customers not purchasing GOs.
Effects on customers decisions	No possibility of affecting own electricity consumption mix of purchased electricity delivered by the grid.	Possible to demand and purchase specific electricity generation technologies, thus affecting own electricity consumption mix.
Incentives for changes	Induced by government (e.g. mandatory markets).	Induced by government and voluntary markets.

Table 3.2. Similarities and differences between claiming electricity traditionally using average electricity grid mixes and specifically using GOs [30].

GOs give end-consumers the possibility of demanding and purchasing specific electricity technologies, thus affecting their own electricity consumption. This electricity is allocated to an individual consumer on the basis of an economic and contractual agreement. The more traditional use of average grid mixes, on the other hand, gives no possibility for choosing specific electricity, as the electricity market's relationship with consumers is based on "fixed" average grid mixes determined by geographical locations and grid connections [30].

Table 3.3 shows different principles for determining electricity mixes when using the attributional modeling approach on GOs are allowed to be claimed.

Purpose of the analysis using the attributional modelling approach:	**GOs allowed to be claimed**	
	Customers purchasing GOs	**Customers not purchasing GOs**
1. Accounting and decision support (based on analyses describing an existing situation)	The electricity mix representing the contractual purchased GOs	The electricity mix representing the Residual Mix for the country/region
2. Decision support (analysing a future situation)	The electricity mix representing the contractual (future) purchased GOs	The electricity mix representing the future Residual Mix in the country/region, adjusted for future GO contracts, modelled based on future goals, predictions, etc.

Table 3.3. Different principles for determining electricity mixes when using the attributional modeling approach when GOs are allowed to be claimed [30].

Table 3.4 shows that the different electricity mixes represent a large variety of CO_2-emissions, varying from 2 to 518 g CO_2-equivalents/kWh. If GOs are allowed to be claimed in the environmental report, the purchase of GOs will lead to an improvement in the inventory of the product in question, since the CO_2-emissions are significantly lower when compared with the Residual Mix' emissions. This improvement will

occur to the detriment of the "ordinary" electricity customers (not purchasing GOs), as it makes the Residual Mix more "dirty".

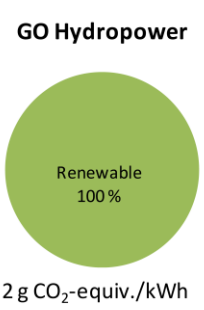
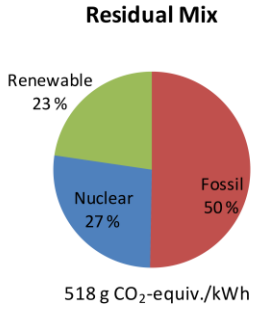
GOs allowed to be claimed	
Customers purchasing GOs	**Customers not purchasing GOs**
Contractual purchased electricity	Residual Mix for the country/region
 2 g CO_2-equiv./kWh	 518 g CO_2-equiv./kWh

Table 3.4. Different electricity mixes for customers who purchase GOs or not.

3.6. GOs and environmental reporting

GOs are useful for different environmental reporting purposes. According to the Greenhouse Gas (GHG) Protocol's Corporate Standard (The GHG Protocol 2004) these value chain perspectives are defined as different scopes, referring to direct and indirect GHG emissions. "Direct GHG emissions" comprise emissions from sources that are owned or controlled by the reporting entity, while "indirect emissions" encompass emissions produced as a consequence of the activities of the reporting entity, but occurring at sources owned or controlled by another entity. Scope 1 includes all direct GHG emissions while scope 2 also incorporates indirect GHG emissions from the consumption of purchased electricity, heat or steam, occurring physically at the generating facility. Scope 3 includes all indirect emissions (and not only those from purchased energy). Examples of these would be emissions from the extraction and production of purchased materials, outsourced activities and waste disposal. Thus, the calculated GHG emissions from electricity generation depend to a large extent on the scope under consideration as they include varying system boundaries relating to power generation [30].

The electricity consumption is an input in almost all environmental reports, most of them are and will, to a greater or lesser degree, be affected by the composition of the electricity mix. Different principles for electricity mix calculations may therefore cause large variations in the resulting environmental profile of the electricity. The issue of modelling electricity mixes on the basis of GOs and similar instruments being decoupled from physical electricity flows for environmental reporting purposes, has so far, not been covered by life cycle thinking standards [41].

In GHG Protocol Corporate standard the use of the energy-specific tracking instruments such as GOs means to claim a specific emission factor for Scope 2 calculations.

For the attributional accounting of Scope 2 emissions, companies will generally use one single and simple calculation method or expression:

*Emissions [tCO2e] = Activity data [MWh] * Emission Factor [tCO2e/MWh]*

Where:

- Activity data is for example the amount of electricity purchased and consumed in megawatt-hours (MWh). This value will generally be measured (by a physical device) or estimated;
- Emission factor, which represents some type of average, for a given period of time, of emissions per MWh, for either a specific grid, supplier or electricity source.

The GHG Protocol Corporate Standard recognizes and recommends that source and supplier specific information are preferable for the purpose of calculating Scope 2 [1, pp. 42, 87] and provides examples of how energy purchasing instruments such as certificates [1, pp. 61], green power markets and contracts [1, pp.12, 27] can be used as part of "purchase switching" to change the GHG-profile of the energy companies purchase and report on. These have been grouped in the category of "contractual instruments" in the GHG Protocol draft Scope 2 Guidance [24].

Companies which do not purchase electricity from specified sources through contractual or tracking instruments (like GOs), they usually using grid average emission factor. So the use of GOs is very important for the emission factor due to the capability of setting the desirable emission factor.

To be more specific follows an example of carbon accounting with a residual mix.

A company based in Norway is interested in calculating their emissions inventory for the year 2012. In 2011 they instituted an electricity savings program that cut their electricity consumption to 1000-MWh per annum. The company purchased Guarantees of Origin (GOs) to account for 50% of their consumption. These GO came from Norwegian hydroelectricity and the company has chosen to account Norwegian hydroelectricity as 0 (zero) gCO_2/kWh. The remaining 50% of consumption needs to be accounted for with the grid emission factor. The company follows best practice and has decided to use the residual mix emission factor. After reviewing the NVE website they saw that after import, export and electricity trading the Norwegian grid-mix in 2011 was responsible for 353.0 grams of CO_2 per kWh. 500 MWh of electricity with an emission factor of 353 gCO_2/kWh results in emissions for the grid consumed electricity of 176.5 tCO_2. The combination of 500 MWh originating from a hydroelectric plant and 500 MWh originating from the grid-mix resulted in total Scope 2 emission of 176.5 tCO_2 [24].

The GOs have been accepted in environmental reporting, but it is crucial to have separation of physical electricity delivery and environmental attributes, avoidance of double counting and availability of reliable data.

3.7. GOs and green labels

The green labels give companies the ability to communicate their commitment to renewable energy – just as other credible labels effectively communicate to consumers. Many brands have already made strong statements about their commitment to renewable energy, either as part of a wider Corporate Social Responsibility (CRS) strategy, or as an integral part of their business case. However, until now, they did not have the ability of credible, independent certification of their claims.

There are many green labels (like Ecolabel, WindMade etc.) for Products and Services will allow companies to communicate the amount of renewable electricity used in the production of a product or service, around the world. These Standards for Products and Services describes the qualification requirements for products and services in the Labeling Program. More specifically, the standard outlines the criteria that must be met to qualify for use of the Product Label. Furthermore, the standard describes the mandatory process for third party verification of the claims made through the label. In order to qualify for using the green Label a company or organization shall cover a high percentage of the product's or service's electricity consumption with RES energy This consumption refers to the electricity usage of the production process of the product or service from raw material to factory gate (i.e. 'cradle to- gate' scope).

A company or organization shall use the label on all units of a product or service that leave the factory gate or are being put in stock in a certain manufacturing site or plant during the annual reporting period.

The right to use the Product Label is based on the verified calculation of the electricity used for the production of one unit of the product or service and estimation of the amount of functional units that will be labeled during the 12 months label usage period (i.e. the annual reporting period), together with a clear approved sourcing plan for eligible renewable electricity.

The verified electricity consumption covered by the end of the annual reporting period, shall be based on all labeled functional units of the products or services during the annual reporting period.

A company or organization is eligible to use the Product Label if RES energy purchased via one or more of the below sourcing methods. Green credentials issued for the sourced renewable electricity shall be retired to prevent double claims.

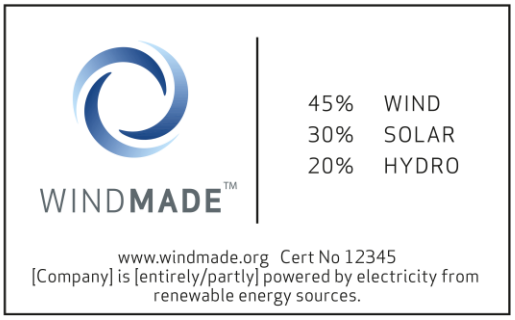
i. Own power generation facility. The ownership should be acquired less than 2 years after the commission date of the facility.
ii. Power purchase agreement for the purchase of electricity from a renewable power generation facility. The contract should be signed for an appropriate period of years.
iii. Procurement of green credentials (Certificates of Origin, etc) from a renewable electricity certification program approved by the Technical Committee of the green Label. As example, approved programs currently include Green-e (USA & Canada), OK Power (Germany), Green Power

(Australia), Naturemade Star (Switzerland), Green Power Certification System (Japan) and GoldPower (Global). The programs currently approved are all WWF endorsed programs with strict requirements to impact and/or sustainability requirements. The list of eligible programs is known.

Defining the electricity footprint of one functional unit of the product or service shall be done following one of the leading standards in life cycle analysis (Greenhouse Gas Protocol, ISO 14044, PAS 2050, LCD, BPX 30-323).

In figure 3.4 is illustrated informative material about WindMade Label and its application to companies and products.

Label type 1: Wind energy only (25-100%)



Label type 2: Mix of renewable energy sources, with wind power at least 25%

Figure 3.4. Informative material about Windmade label [42].

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3.8. An example of use GOs and their consequences

There is a Cypriot hotel owner who wants to improves the hotel's carbon footprint by using GOs, claiming the hotel owner does this in order to "buy himself a green image", so to have increased number of tourists from Scandinavian countries.

If the hotel guests choose to keep the AC on all night long, more oil will be burnt in the local thermal power plant, thus causing more CO_2 emissions. According to the E-TRACK methodology [13], these surplus emissions (balancing the amount of purchased GOs) from the Cypriot thermal power plant will be allocated to customers who do not purchase GOs (through the European Attribute Mix and Residual Mixes), thus making their electricity mix (and related carbon footprint) "dirtier". This is an effect of the system which, by itself, may become an incentive for increased demand for renewable electricity by purchasing GOs.

Following the above example there is a thought that GOs will lead to wrong decisions, exemplified by the Cypriot hotel owner choosing to heat the swimming pool by the use of electricity (covered by GOs) instead of e.g. solar heat. The kind of decisions dependent absolutely on several factors where different environmental issues (e.g. energy efficiency) may play a role, in addition to costs related to the alternatives. Thus, a complete technical-economical evaluation will give the optimal solution, than just a carbon footprint results. However, it should be noted that the price of GOs is in addition to the electricity price – the electricity is not free.

Summarizing the use of GOs is:

a) To prove the share or quantity of energy from renewable sources in the energy mix to the final customer (2003/54/EC art.3 (6)).

b) GOs issued in other Member States shall be recognized.

c) GOs can be traded without connection to physical energy.

d) GOs can be used as a proof that renewable energy has been sold or consumed.

CHAPTER 4 - GOs in Europe

4.1. European Energy Certificate System (EECS-GO)

The existence of a recognized European body which can specify, monitor and control with transparency and credibility of the system the transfer of guarantees of origin from renewable sources and their final cancellation in favor of an end consumer, it is vital for the value of the certificates, avoidance of duplicate entries and for statistical monitoring the reduction from polluting energy sources.

The European Union, through a body AIB (Association of Issuing Bodies) develops and promotes a standardized system of guarantees of origin, the called "European Energy Certificate System" (EECS-GO), so that there are structures and processes that ensure reliable operation of European System of Guarantees of Origin. To further facilitate international exchange and trading of energy certificates, the AIB operates an electronic registry (Hub) where electronic cancelled (cancellation) directly guarantees of origin for the final owner.

The European Energy Certification System (EECS) is a harmonised system for international trade of renewable energy certificates, such as GOs. EECS has been developed by the Association of Issuing Bodies (AIB), which is the leading enabler of international energy certificate schemes. Currently AIB has 21 members, representing 19 European countries (as each of the 3 Belgian regions has it owns issuing bodies) [43].

For a product to be accepted as an EECS Product it must be either a type of Guarantee of Origin or Support Certificate under a Legislative Certification Scheme established by the laws of a European state, or a Product established under an Independent Certification Scheme (ICS). Current registered ICSs include EKOenergy, Naturemade and RECS (AIB, 2011a). The product must be compliant with the relevant requirements described in the EECS Principles and Rules of Operation of the European Energy Certificate System (the EECS® Rules) [44].

The life cycle of an EECS Certificate is issuance, transfer and cancellation [44]. The way in which a certificate transits between these three major states is shown in Figure 4.1 In addition, the figure illustrates two other states: “Withdrawn” (for certificates that have been issued in error), and “Expired” (for certificates that have not been cancelled within the 1 year deadline and have thus been automatically cancelled).

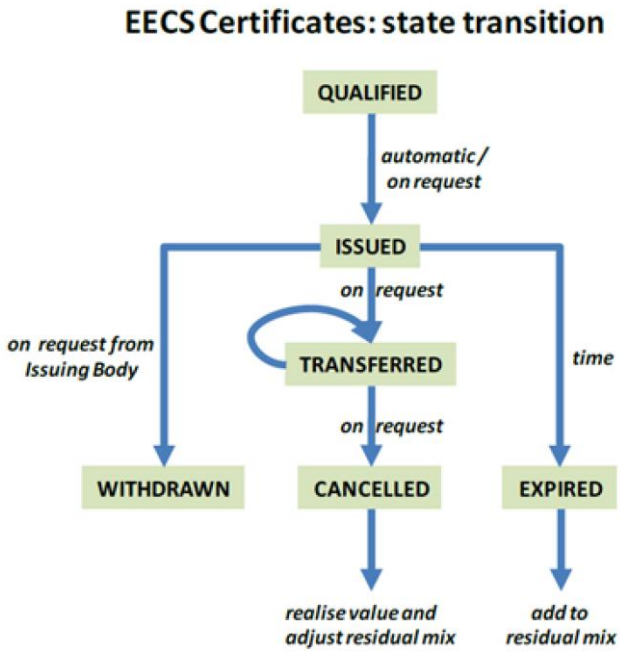

Figure 4.1. The life cycle of an EECS Certificate [45].

The Issuing Body, in order to maintain a transparent and stable market, in any domain has a duty to publish activity reports on the number of GOs which have been issued, transferred and cancelled. The Issuing Bodies are in most countries represented by the TSOs (Transmission System Operator). One of the major responsibilities of the Issuing Bodies is to ensure that the issued and cancelled volume of GOs do not exceed the actual corresponding electricity generation volume.

4.2. European Energy Certificate System EECS market statistics [46[, [47]

4.2.1. Overview of activity

EECS market activity continues to increase the last few years, with a large increase in the quantity of certificates that used by the suppliers to prove the source of the consumed electricity. This leads to continued increase in internal transfer, international trade and cancelations of the issued certifications. Over the years, more and more certificates find a value, growing the market.

Cause of this grow, statistical analysis by the competent is necessary to be done in order to be determined the appropriate activities from the involved organizations to meet their goals.

Statistics in monthly and yearly base are available for the certificates standardized under EECS, including EECS Guarantees of Origin and GOs Certificates. These statistics are closed related with the produced electricity in the same periods of times. So it is possible to analyze the quantity of certificates which are issued, transferred, cancelled or expired in a month or in a year, as well as those which were issued, cancelled or expired for the electricity produced in this period. This makes it possible to see how many of each “vintage” certificates are still available on the market; and to review seasonal certificate activity.

The following graphs show:

1. The annual quantity of certificates issued, cancelled and expired for production during that year; and
2. Those that have been issued, transferred within a country, transferred internationally, expired and cancelled during that year.

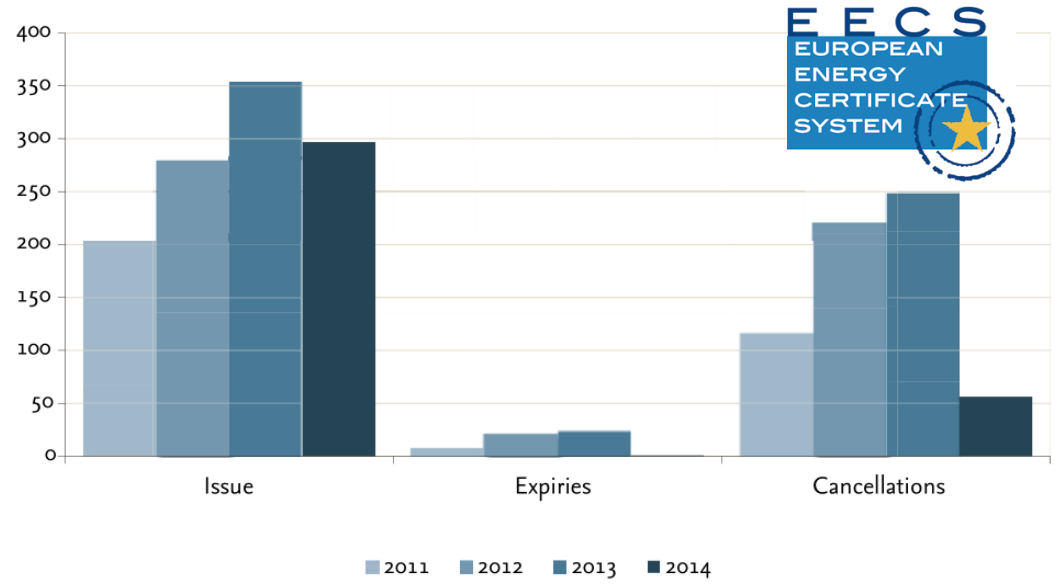

Figure 4.2. Annual EECS transaction by production date (TWh).

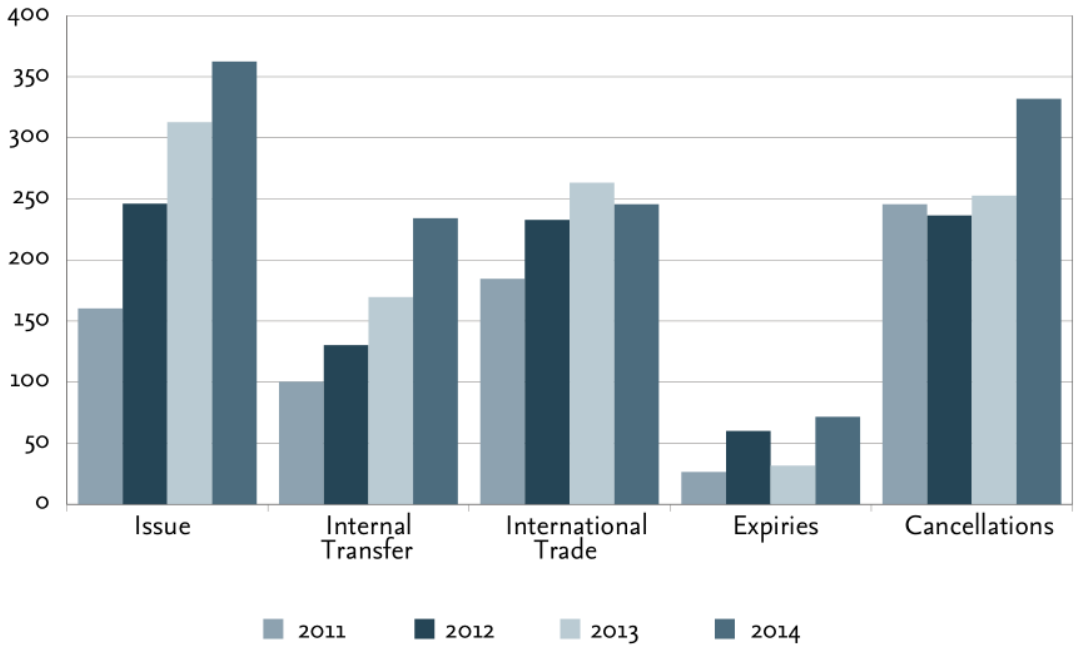

Figure 4.3. Annual EECS transactions by transaction date (TWh).

As it can be seen from the graph 1, by the end of 2014, 79% of certificates issued for electric produced during 2012 were reported as having been cancelled, and 70% of certificates issued for electric produced during 2013 were cancelled. The equivalent

percentage of the certificates issued for electricity produced in 2014 is 19% but this proportion expected to be increased the next few months. This low percentage is expected because the certificates can be stocked for 12 months, so a percentage of them were cancelled during 2015.

4.2.2. Source of certificates-technology / energy sources

The majority of the certificates that are issued and cancelled derived from hydro power sources, although the proportion has dropped from 80,6% in 2013 to 74,6% in 2014. On the other hand the proportion of certificates that derived from other sources is broadly the same in the same period of time. More precisely the proportion for nuclear is 7,5%, for geothermal is 1,5%, for solar is 0,6%. However, the amount of issued certificates from wind power has been doubled from 4% in 2013 to 8,4% in 2014. The same happened for biomass certificates where the proportion was doubled from 3,7% in 2013 to 6,4% in 2014.

On the other hand the use of fossil certificates has diminished from 1,9% to 0,7%.

At the same time, the cancellation of hydropower which fell from 84,8% to 77,5%, has been balanced by growth in geothermal, biomass and wind energy sources (about 16%) and nuclear (about 6%).

The following graphs show the annual quantity of certificates issued for a production period (2014); along with those that have been cancelled during that period.

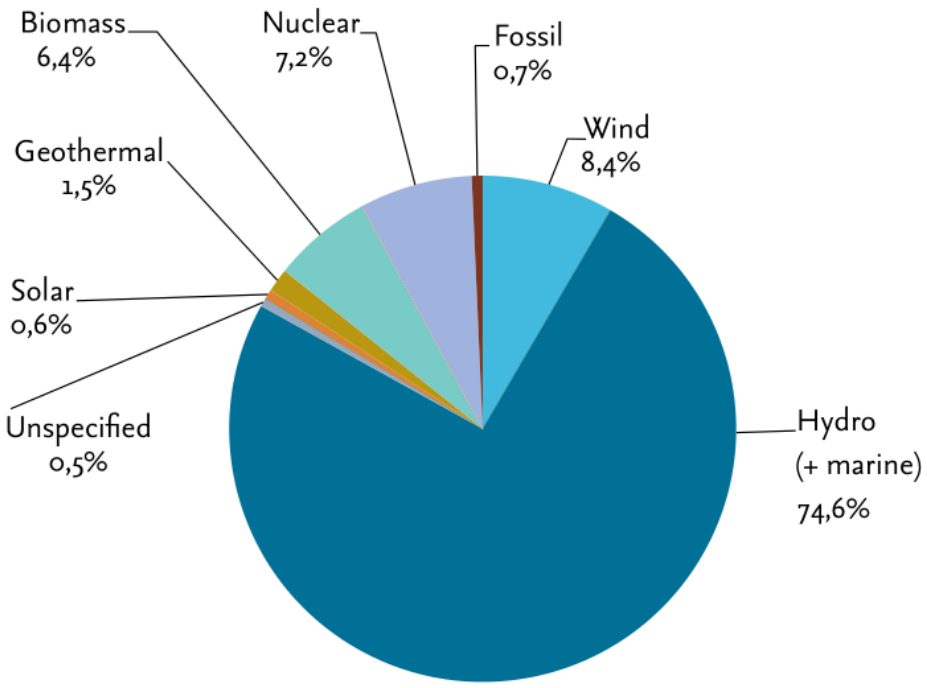

Figure 4.3. EECS certificates issued per technology (2014).

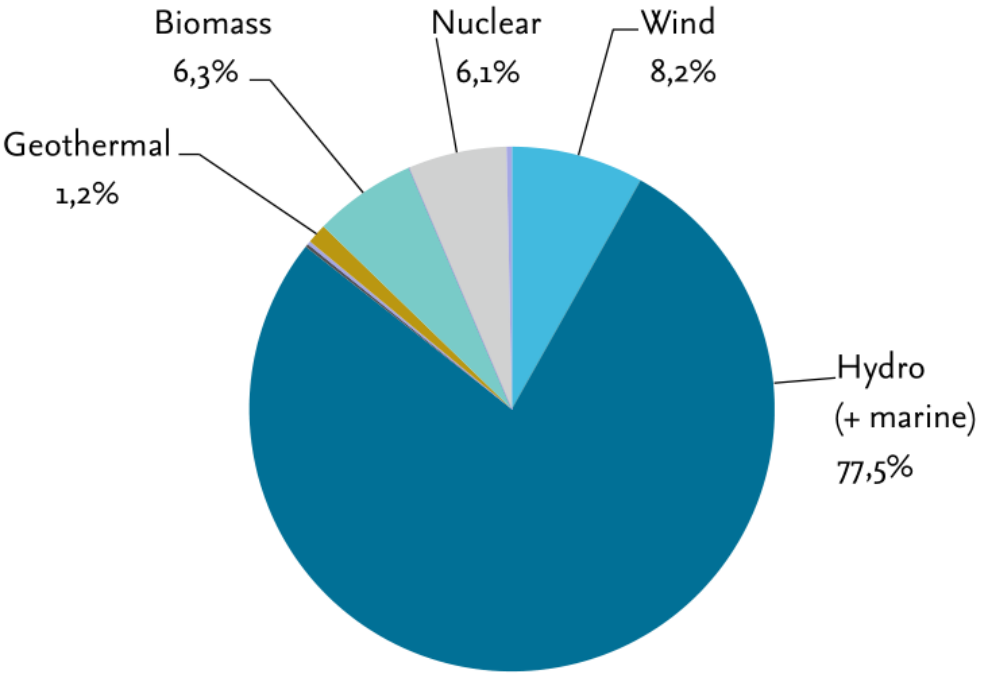

Figure 4.4. EECS certificates cancelled per technology (2014).

4.2.3. Source of certificates – country

Regarding national activity, Norway and Switzerland are by far the main suppliers of certificates. More precisely, 44.5% of the issued certificates derived from Norway, and 21.4% of issued certificates derived from Switzerland. The rest 44% of all certificates issued shared between Sweden, Denmark, Finland, France and other countries with smaller proportions.

As certificates consumers the proportions strongly change. It can be seen that Germany, the Netherlands and Switzerland are the major consumers of certificates, cancelling 52% of the total amount; while Norway which is the major supplier cancels only 9% of the total issued certificates.

The following graphs show the annual quantity of certificates issued for a production period (2014); along with those that have been cancelled during that period.

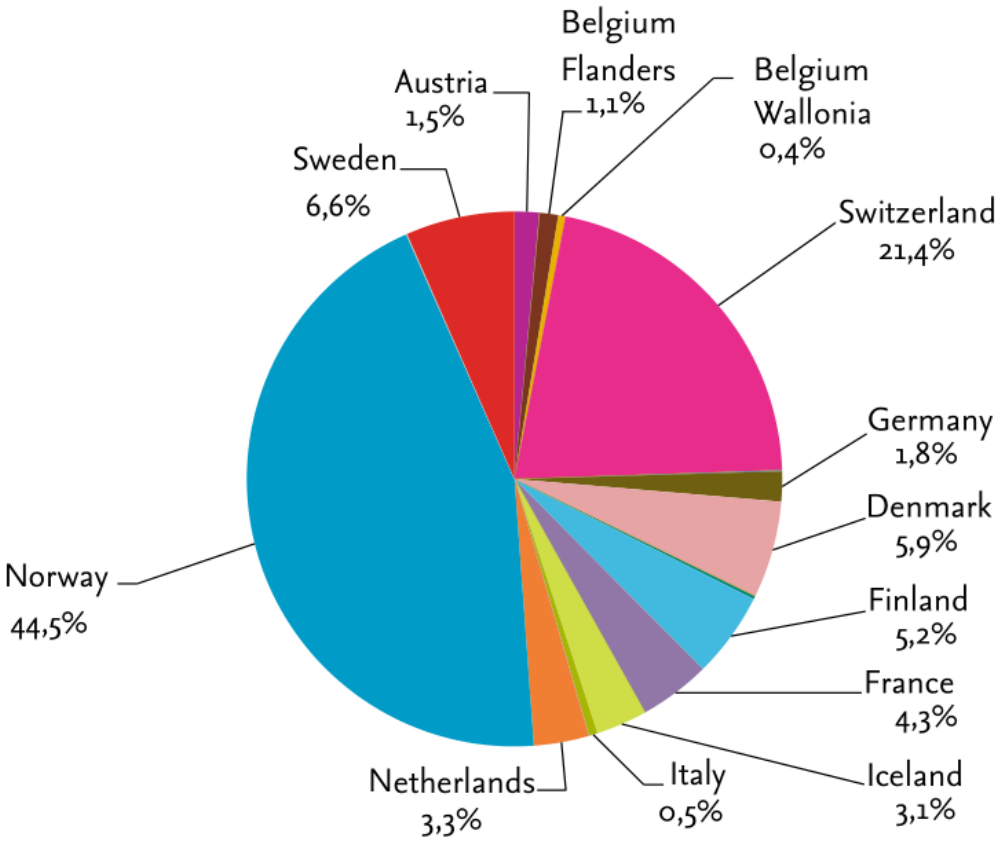

Figure 4.5. EECS certificates issued per country (2014).

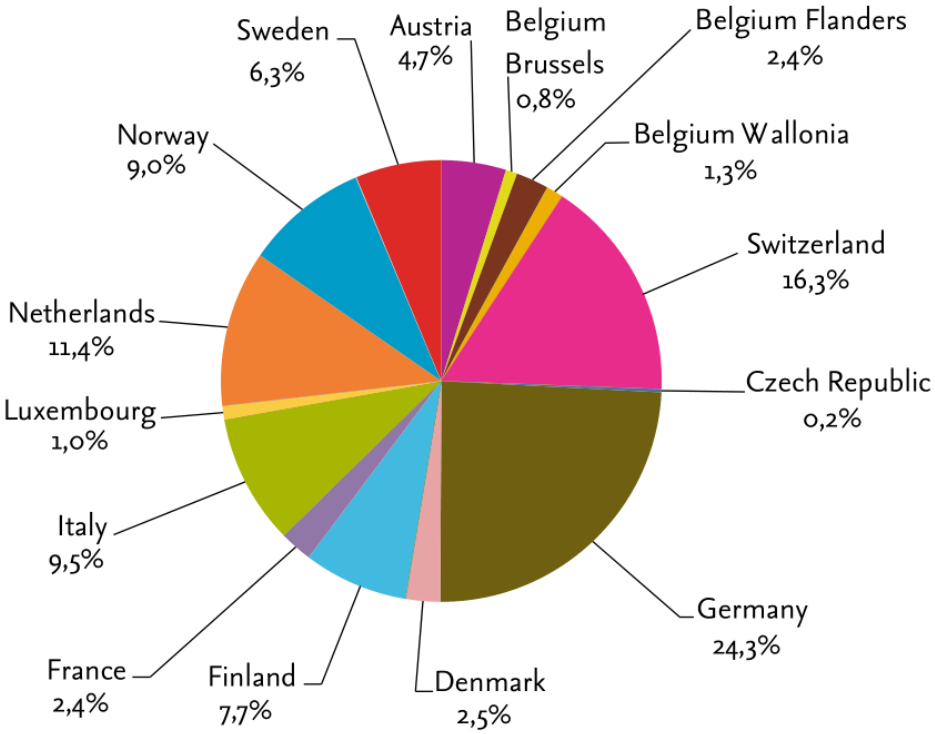

Figure 4.6. EECS certificates cancelled per country (2014).

4.2.4. Cumulative activity – national

The growth in issuing continues over the years. The following graphs show the annual quantity of certificates issued for production in each of the last 9 years per country and per technology. Norway is still the leading country supplying Guarantees of Origin; providing the market with approximately 130 TWh in 2014 and hydro is still the major source. These data can be seen more precisely in the following graphs.

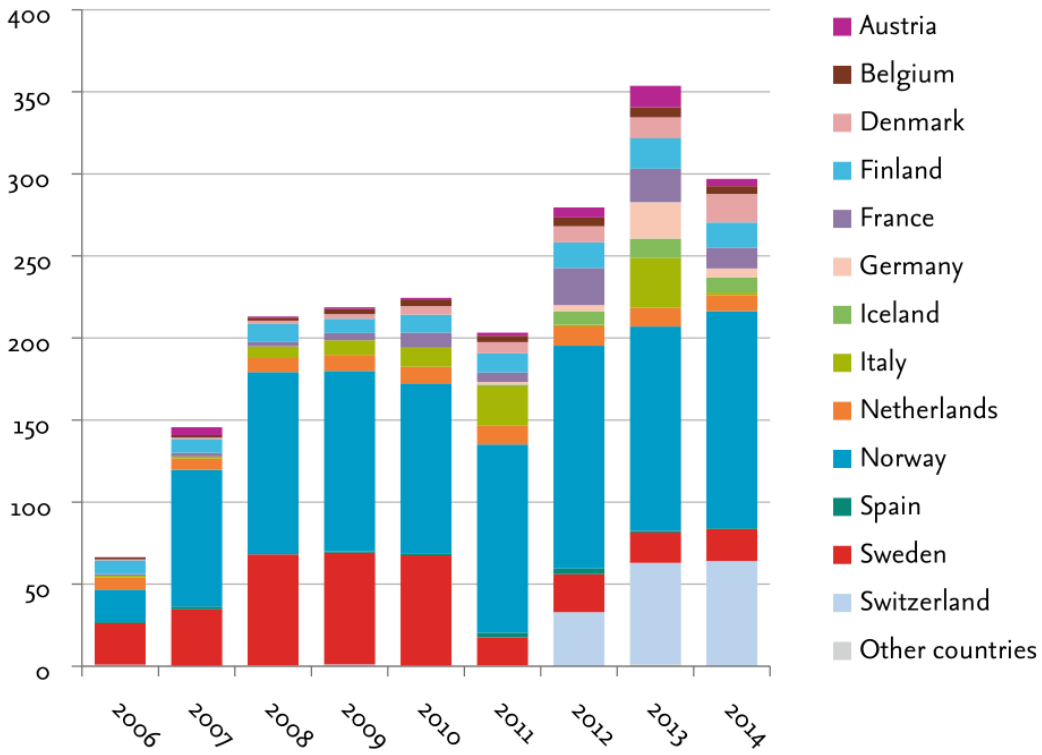

Figure 4.7. Issued GOs per year of production

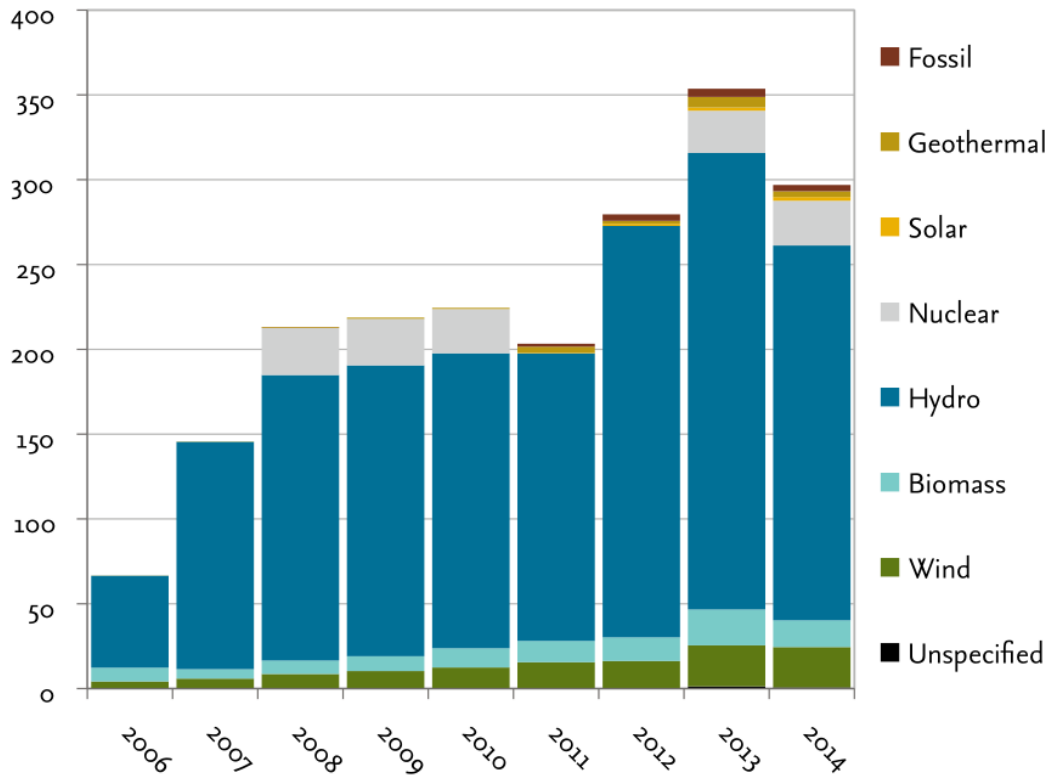

Figure 4.8. Issued GOs per technology.

Cancellation of the issued certificates continues to grow, reflecting growing consumption in a number of countries during 2014. The following graphs show the annuall quantity of certificates that have been cancelled for production during each of the last nine years; along with the certificates that have been cancelled in each year for all production periods.

In reviewing these graphs, please note that-in line with the provisions of the RES Directive 2009/28/EC-certificates are increasingly expired one year after the date of production. However, this had not been cancelled remained in registries for an unlimited time. Also, until relatively recently, registry operators recorded the quantities of certificates issued for each production period and those transferred and cancelled during a year of production during any year-increasingly, registry operators now record both.

Each of the above issues impact the statistics: for example, certificates are normally cancelled late in their life, which explains why most certificates for 2014 hadn't cancelled until the end of 2014.Also, the slight dip in certificates for all years that were cancelled during 2012 and 2013 may have been due to energy suppliers using up old stocks of certificates before they expired; plus the impact of change of issuing body in Germany and France. It is less easy to explain why cancellations seem to have risen sharply during 2014.

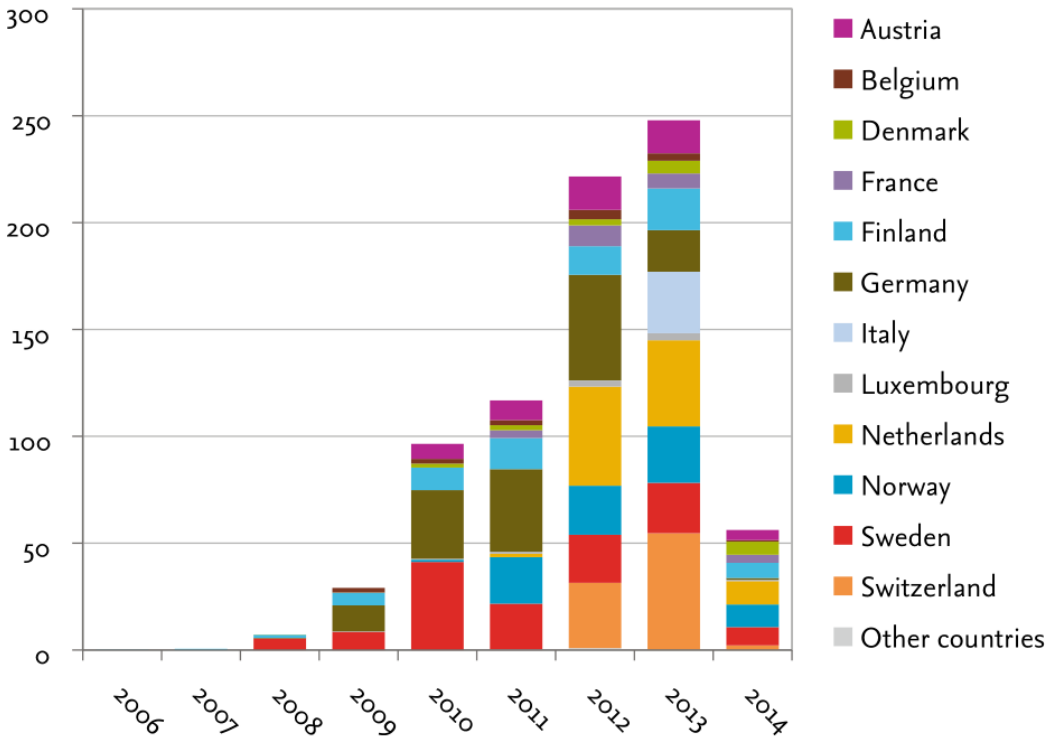

Figure 4.9. Cancelled per year of production (TWh)

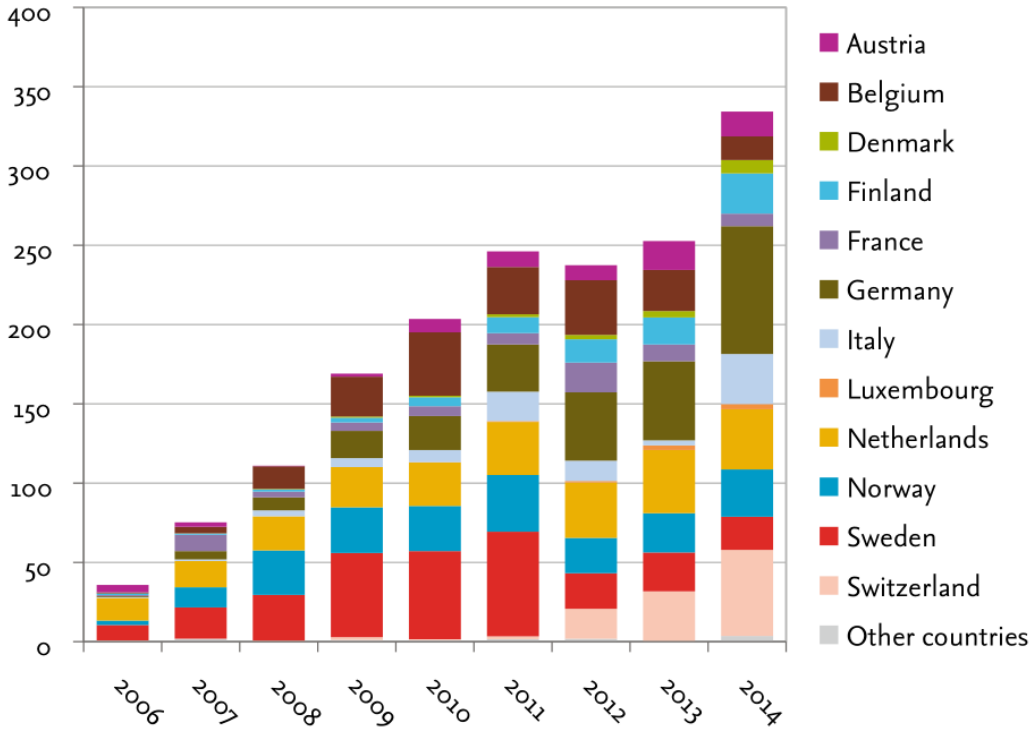

Figure 4.10. Cancelled per year of transaction (TWh).

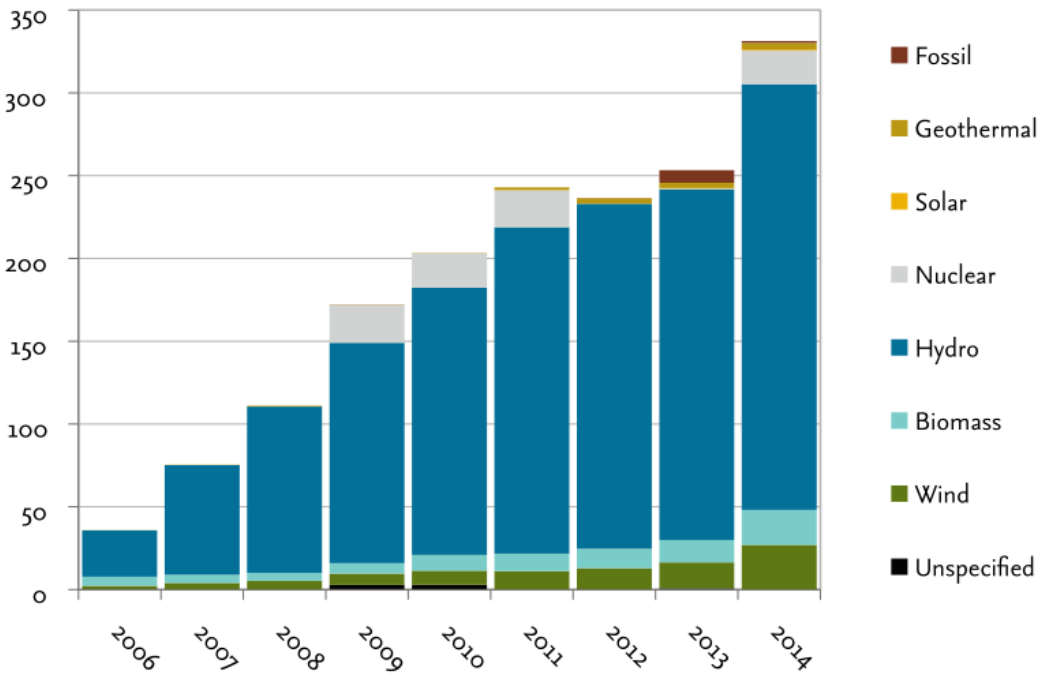

Figure 4.11. Cancelled per technology.

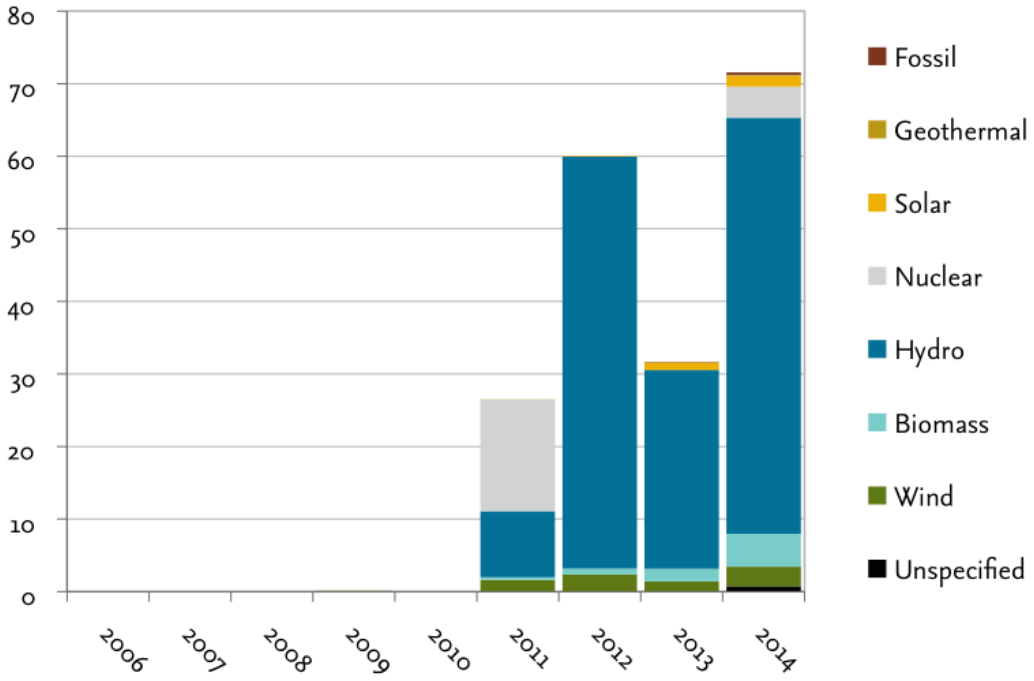

Figure 4.12. Expired per technology.

Considerable market activity in Slovenia, Spain and Sweden is currently unreported, as are the non-member countries. When this is eventually added, we expect to see further rise in reported market demand-perhaps by a third.

As it can be seen from graph 10, the rise 31% cancelled per year of transaction in 2014 compared to 2013 has led to a deficit of GOs on the market for the first time since 2011, when prices rose sharply, but it is less clear whether this will be repeated. Households, organizations and businesses all contribute to this impressive market growth; although it is clear that the corporate sector is the main driver. Global reporting initiatives like CDP (Carbon Disclosure Project) and the Greenhouse Gas Protocol, as well as EU's recently approved CSR Directive, emphasize that renewable energy is an important part of a broad corporate sustainability agenda. The Guarantee of Origin is the primary European tool for documenting the purchase of renewable energy.

4.2.5. Internal Transfers

Internal use of certificates continues to rise, with Norway, Germany, Italy and Belgium making a marked contribution. See the following graph.

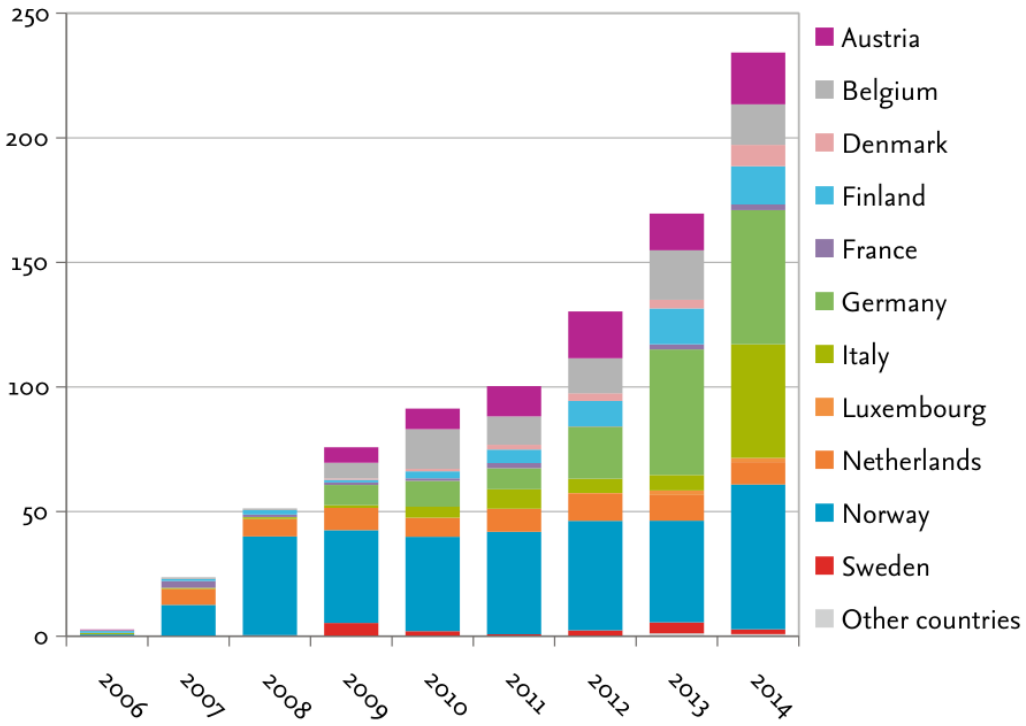

Figure 4.13. Transferred per year (TWh).

Externally, the exporting countries are predominantly Nordic plus Switzerland and Austria. The contribution of individual importers continues to show Germany as the major importer, followed by the Nordic countries and Austria.

The following graphs show the annual quantity of certificates traded internationally during a period.

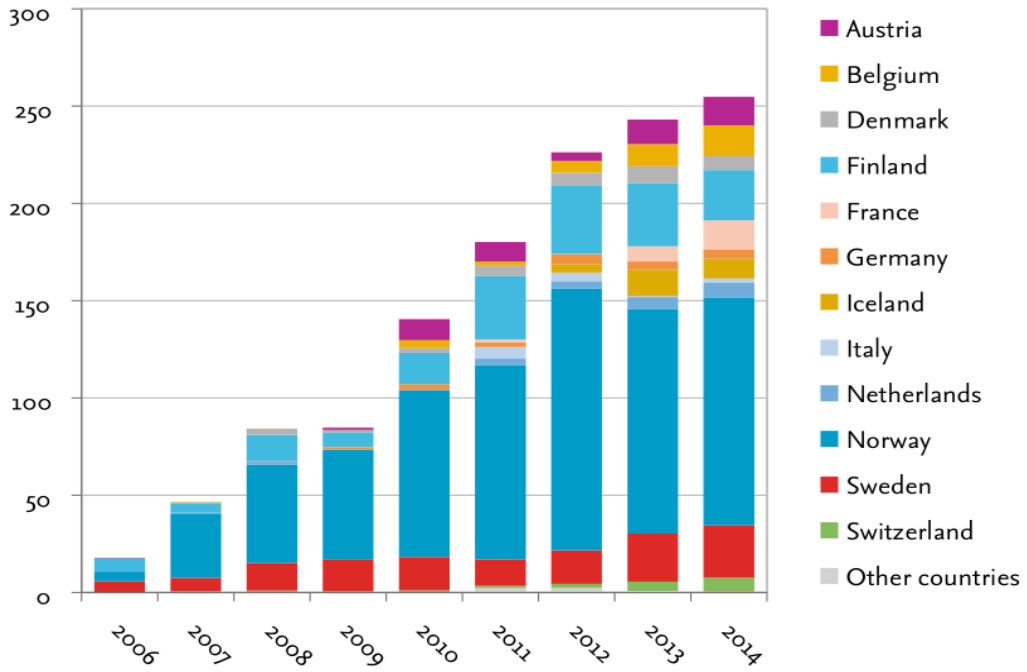

Figure 4.14. Exported per year (TWh).

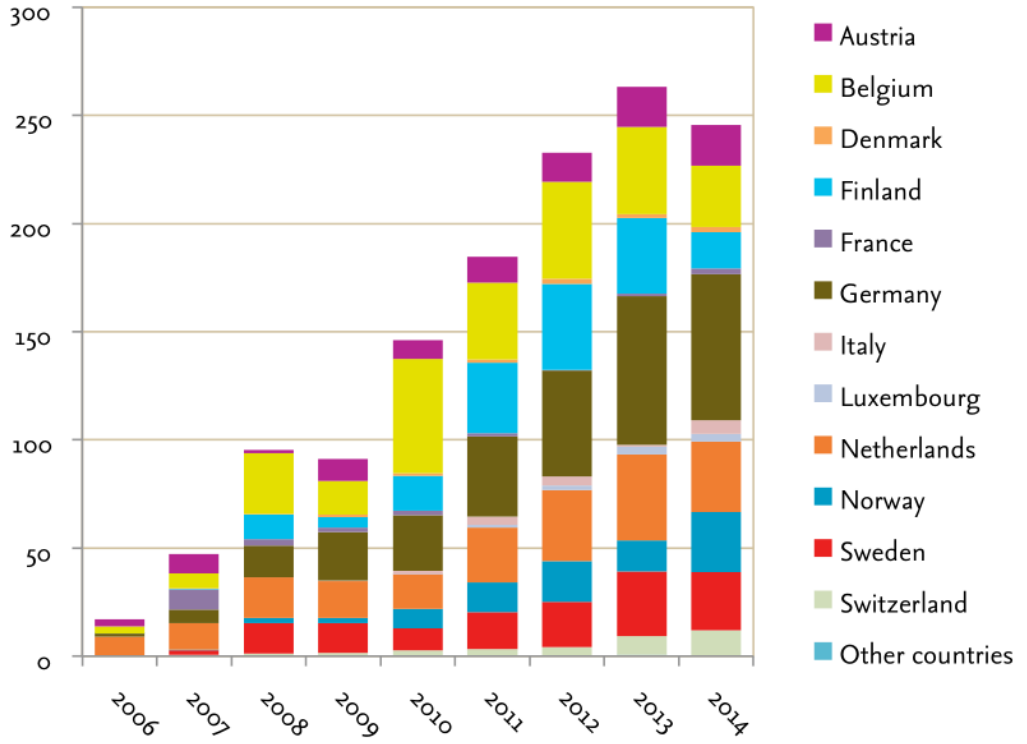

Figure 4.15. Imported per year (TWh).

4.2.6. EECS market penetration

An interesting factor that could be searched is the comparison of the amount of renewable electricity production in member countries and the number of EECS certificates issued.

The following graphs relate the energy production and the quantity of certificates issued, Based on the 2014 data of ENTSOe statistics.

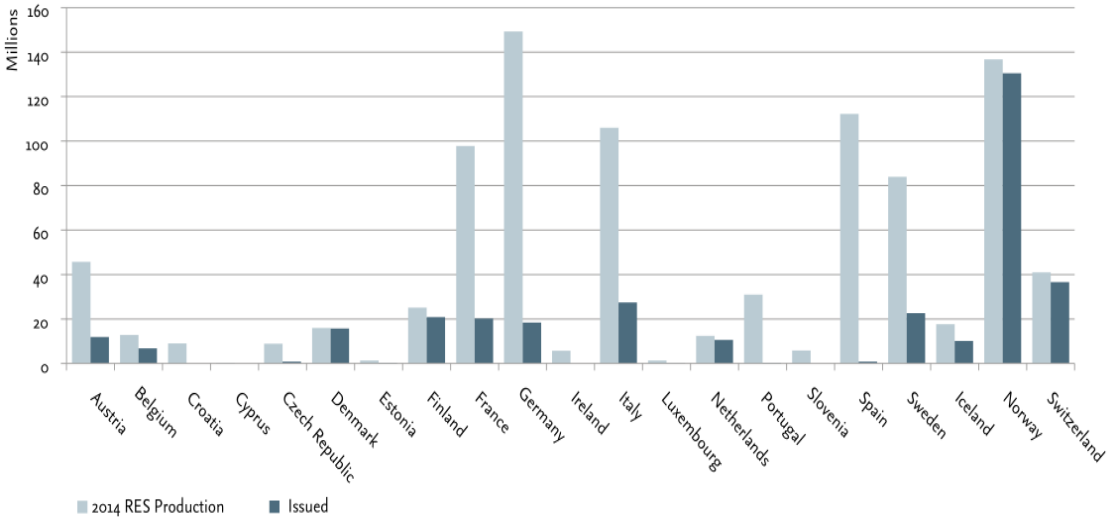

Figure 4.16. EECS market penetration (Millions).

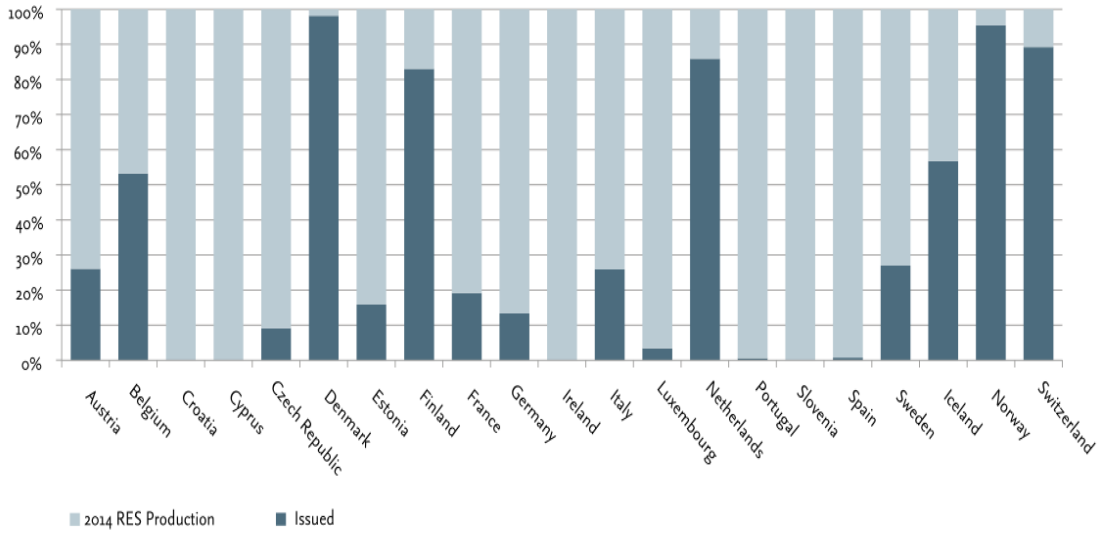

Figure 4.17. EECS market penetration (%).

As it can be seen, Norway, the Netherlands, Denmark, Finland, and Switzerland issue the majority of their energy production in EECS GOs in order to provide evidence of the source of energy to consumers; and there are gains in a number of other countries.

4.3. AIB members GOs

The legal framework of AIB was enhanced to improve and adapt to recent developments, perceptions and needs. The contract between the AIB and its members has been modified and the Hub Participant agreement (HPA) was approved. In EECS development, several steps were undertaken to strengthening the EECS GO system.

The scope of national participation in EECS shows the degree to which EECS is implemented in that country, according to the best available statistics.

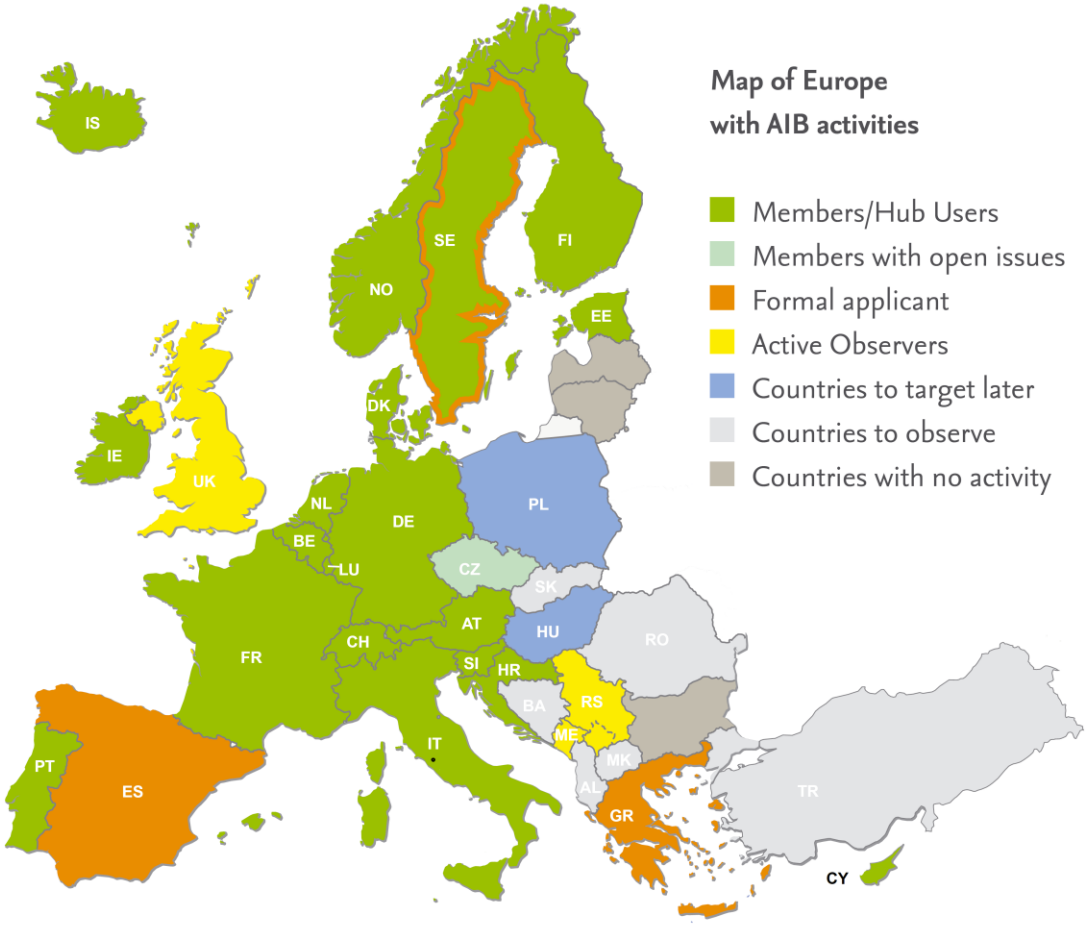

Figure 4.18. Map of Europe with AIB activities.

The figure 4.18, shows AIB activities, demonstrates that the countries have different status - if it is a member, a formal applicant for membership or a country which has shown an interest in the AIB work, or a country to which the AIB has made a first step of approach.

The following pages give details of each of the members of the AIB.

4.3.1. Austria

Austria was the first member state introducing an electricity disclosure system. The Austrian energy regulator is the E-Control (Energie-Control Austria) and is member of the AIB since 2001 and E-Control has actively contributed to the development of AIB association.

The regulator E-Control is by law responsible for the issuance of GOs, however, for GOs to be transferred to other member states. As in other member states, there is a distinction between national GOs and GOs to be transferred to other member states. The latter are not issued for free and the EECS rules apply, so that for those GOs one may consider the requirements that certain measures to avoid fraud are in place to be met. The EECS rules do contain certain verification mechanisms and there are

contractual sanctions e.g. on providing wrong information. For those GOs, the criticism mentioned above does in principle thus not apply.

In 2014, the Austrian database was adapted based on the legal requirements for pumping hydro which makes the process in the database even more transparent and traceable. Further, several small adaptations were made to facilitate the work with the database for users and administrators.

The Elektrizitätswirtschafts- und -organisationsgesetz (ElWOG 2010) was amended in 2013. As a result of this amendment, full disclosure was in force for the year 2014.
In the Austrian domain, GOs from renewable sources and fossil sources are issued, transferred and cancelled electronically. GOs issued in other countries and imported to the Austrian database are automatically checked once they are going to be used for disclosure purpose. If they are not in line with the criteria 6 SK-VO 2011, amended in 2013, cancellation of these GOs is not allowed in the system. This mechanism is a quality check for the supplier to use only valid GOs for national disclosure purposes.

The amount of suppliers and traders acting internationally by using the AIB Hub rose as an immediate response to this new requirement. During the transition period many suppliers had already started displaying full disclosure statements and cancelling higher amounts of GOs to fulfil that requirement. E-Control, as Competent Authority for disclosure, does not expect problems in the implementation of the full disclosure requirement in 2014.

Furthermore it is important to mention that 27% of the GOs used for Austrian disclosure purposes were imported from other countries, mainly issued in Norway.

Four potential observers could be considered as promising AIB members in 2016, and these are Energimyndigheten of Sweden, CNMC of Spain, LAGIE of Greece, Ofgem of UK, and also very likely EMS of Serbia. The Ministry of Energy and Natural Resources from Turkey became a new active observer during the Bruges GM in September 2015.

4.3.2. Belgium

In Belgium the regulation of renewable energy production is separated in three different areas, so there is three companies which regulate the total amount of energy production. These are: the BRUGEL which operates in Brussels-Capital Region, the VREG which operates in Flanders, and the CWAPE which operates in Wallonia.

Brussels regulator BRUGEL is the competent issuing body for the region member of the AIB and applies the EECS rules. It is AIB member since 2008. Relevant legislation on GOs dates from 2011 and since then no changes have been reported. The AIB Domain protocol in this regard states that by the end of 2013 the requirement of 1 GOs representing 1 MWh and the time limit for expiry of 12 months should have been officially introduced into the Brussels regulations but despite this not having happened so far, Brugel never accepted any GOs that did not meet those requirements and applied the EECS standards having the same requirements itself, so that in practice the requirement of the Directive is met.

During summer 2014, BRUGEL and its new Domain Protocol for Brussels, which was approved during the Geneva General Meeting of September 2013, were audited by the AIB.

This audit brought some issues to light, from which the major part have been solved by the Split General Meeting of September 2014. Only one issue remains, because more time is needed for implementation, and it will be solved by the Paris General Meeting in March 2015.

At the end, the outcome of the audit and the resulting actions allowed BRUGEL to reach a higher degree of consistency with the EECS Rules, as well as a higher degree of 'waterproofness' of its procedures. 2014 has also been the year, during which and for the first time, a producer – a 51 MW waste incineration plant - has finalized its application process for issuing of GO. This means that for the first time, transferable GOs have been issued for local renewable production, in this case for the biodegradable fraction of municipal waste.

Concerning legislation, the Decree implementing the legal framework for certification of production devices, issuing of GOs and disclosure, is currently at the end of the review process. As the first reading of the Decree by the Government, and the following formal advice of BRUGEL were accomplished at the beginning of 2014, it was expected that this new legislation would come into force at the end of spring 2014; however, with elections in May 2014, the whole process was delayed. With the new Minister of Energy into place, the aim is now to adopt the new Decree during 2015. BRUGEL has seized the opportunity to adapt the text in order to fully comply and be totally consistent with the RES Directive, the EECS Rules and the Brussels Domain Protocol. The Brussels database will be adapted accordingly.

GOs are entirely separate from the green certificates and are issued and cancelled separately, although they are administrated both by Brugel and in the same register.
Concerning disclosure, BRUGEL is finalizing an IT-project which will allow electricity consumers to check online which part of their electricity supply has been declared as green by their supplier, and which part of this declaration has been formally approved by BRUGEL. The formal approval will only rely on the cancellation of the amount of GOs concerned.

Flanders regulator VREG has last amended its GOs legislation in 2013 and nowadays, since 2013, GOs and green certificates are clearly separate instruments.

The Flemish regulator VREG is a member of the AIB and applies the EECS rules.
In 2014 the task of Production Registrar was transferred from the regulator VREG to VEA, the Flemish Energy Agency. The role of Production Registrar for solar photovoltaics remained with VREG in 2014, but by the end of 2015 this task will be taken over by the grid operators. VREG remains the Issuing Body for GOs and responsible for transfers and cancelations of certificates. By the end of 2015 a new database is implemented.

In the Walloon Region the regulator named CWAPE. GOs are issued in accordance with the EECS rules and the issuing body is member of the AIB. Outside the AIB hub

no transfers of GOs are recorded. There are no law changes the last few years, so the introduction of the Directive 2009/28/EC remains the same.

CWAPE has been granted formal approval of distribution grid tariffs and monitoring of renewable technology costs.

CWAPE has successfully fully upgraded its database; it has sped up its internal processes and this major upgrade has caused very few glitches. Each day, it now handles up to 2 000 photovoltaic meter readings and issues accordingly. Processes and database are being continuously improved.

CWAPE has been considering whether to transform local CHP GO into EECS CHP GO. The legal framework for issuing biogas GOs is in place, although no project is running yet (adding a modicum of support would be appreciated).

− Context: The support system based on green certificates (i.e. specific support certificates) has demonstrated its efficiency in developing affordable renewable and CHP by tripling the generation in 10 years. This support is based on the extra costs (when compared to conventional plants) of the technology (banding) and the measured environmental performance of the individual plant (avoided CO_2 emissions).

Supplementary certificates were generously granted to solar plants, which eventually received about half of all support; this led to a sharp fall in the market price of green certificates and impacted all pathways.

Although the quota system remains formally in place, for all matters practical, it behaves like a feed-in tariff system where CWAPE needs to regularly update technology costs and grant green certificates accordingly for new power plants.

− Quota: Quota is set to 37.9 % in 2020 with steadily increasing steps until then.

− Market price of support certificate: The current oversupply of support certificates means most generators are making use of the guaranteed price (65 € / certificate) and price recovery should take a long while.

− Joint schemes within Belgium: It is still unclear whether the scope of discussions between regions would include extending the mutual recognition of green certificates already applied between Wallonia and Brussels to Flanders. This is unlikely for federal offshore wind.

− Review of support level: Usually every year, the support level granted to generators by way of green certificates is assessed for each technology. The number of green certificates issued for each MWh will be adapted accordingly for new plants set up for the next period. New PVs below 10 kW now make use of another support scheme paid directly by network operators on the electricity invoice.

− New installations: About 1,800 new small (< 10kW) photovoltaic plants were installed in 2014 (for both old and new support regimes). Nevertheless, a sharp increase in non-domestic solar plants took place, equaling almost 35 MW. Few new

larger non-solar plants (biomass, wind, etc.) were commissioned due to uncertainties in financial support and planning permissions, but some were expanded for about another 45 MW.

− Sustainability criteria: Wallonia has been actively applying demand- ing sustainability criteria since 2002, especially for solid and liquid biomass. Transposition of Directive for bio liquids did not change this. Progress is also slowly being made towards harmonisation of sustainability criteria for wood. CWAPE also follows the development of the Sustainable Biomass Partnership (SBP) closely.

4.3.3. Bulgaria

In Bulgaria, the Sustainable energy agency (AUER) is responsible for the issuance of GOs. With the beginning of 2012 the new system entered into force as promised by the Progress Report 2011. GOs are now issued for 1MWh, over the time period of one month as production period and last 12 months before they expire. As many other Member States Bulgaria allows to take over surplus production from one month (thus excess of 1MWh but not reaching another full 1MWH to be taken over into the next production period of one month.

For the issuance of GOs it requires registration in an electronic register, where AUER gets the chance to verify the information provided. Similarly, AUER can carry out checks of the declared or submitted data, circumstances and documents and on-site inspections later on and out of own initiative. No sanctions or correction possibilities are mentioned though.

GOs are issued to the producers and they give them to suppliers when selling the electricity. With that, GOs serve as a double proof: on the one hand they are proof for suppliers that they sell renewable energy in their energy mix, on the other hand they serve as proof for producers of renewable energy that they are entitled to the fixed price support to be paid by the suppliers. Bulgaria is not connected to the AIB hub, but in principle both transfer to other Member States and import from other Member States seems to be possible as in accordance with the Directive 2009/28/EC.

4.3.4. Croatia

HROTE was established in 2005 as the state-owned company which performs the activities necessary to organise the electricity and gas markets as a public service under the supervision of the Croatian Energy Regulatory Agency.

HROTE controls the system of financial incentives for renewable energy sources, high efficient cogeneration and biofuels under the supervision of the Ministry of Economy.

The Regulation establishing the system of Guarantees of Origin of electricity was passed in July 2013. The Regulation determines the rules of electricity Guarantees of Origin for the purpose of certification of electricity produced from plants in the Republic of Croatia, as stipulated in the Energy Act. In accordance with the Regulation

HROTE performs the role of the Issuing Body for the Domain.

HROTE became member of the AIB with conditional status in May 2014. In the meantime all terms regarding the disclosure rule have been fulfilled, and the unconditional membership status was therefore approved and changed to ordinary membership status in November 2014.

Until 2012, no legislation was in place regarding a system of GOs. However, since then the Croatian government has been working on the development of such a system of electricity disclosure. The consultant Grexel, which has helped setting up an electronic GOs system in many Member States, has assisted the Croatian Energy Market Operator Hrote who will become the issuing body in Croatia is drafting a domain protocol according to EECS standards and in designing certificate registry software based on CMO. The new legislation already published and in force is in line with art. 15 Directive 2009/28/EC, however there is still one implementing directive expected for summer 2014.

The competent body for disclosure is the Croatian Energy Regulatory Agency. The disclosure rule and the methodology applied for calculating the residual mix are under the supervision of the Croatian Energy Regulatory Agency.

According to the regulation cancelled EECS-GO certificates will be the sole proof of the source of energy that will be eligible for disclosure approval from January 2016. Furthermore, the supplier claims the electricity purchased from the feed-in system to its customers.

HROTE has the obligation to calculate and publish the Residual Mix. The calculation is to be performed "in coordination" with other issuing disclosure competent bodies (EAM is to be used for this purpose). The residual mix for Croatia will be calculated according to the methodology presented in the RE-DISS Best Practice Recommendations. Since Croatia has electricity imports/exports with third countries, ENTSO-edata will be used for determining net imports from certain countries.

4.3.5. Cyprus

The TSO-Cyprus was established in 2004 as an independent legal entity for the public benefit. It operates, maintains and develops Cyprus' electricity transmission system; and it maintains security of supply, integrates renewable energy sources and issues the conditions for connections to be applied by new independent power producers. Under its duties and responsibilities is the operation of the Cyprus electricity market.

TSO-Cy is responsible for issuing, transferring, cancelling and revoking Guarantees of Origin both for RES and High Efficiency CHP installations in Cyprus.

The formulations in the Progress Report 2013 for Cyprus are almost the same as the ones used in the progress report 2011, though the reference to the law promoting and encouraging the use of Renewable Energy Sources and Energy Saving of 2013 has been updated. The Progress Report 2011 already stated that the Directive 2009/28/EC was fully transposed by then, though the legislation referenced pre-dated the entry into force of the Directive.

However, with the introduction of the new law in 2013 one may assume that Cyprus has brought its legislations in line as regards at least the clearly formulated requirements of the Directive (1 GOs for 1Mwh, minimum information, recognition of GOs from other Member States) should be met. This is even more so as Cyprus is applying for membership within the AIB, so that the national laws on GOs should have been aligned with the EECS rules which in this context set the same requirements as the Directive 2009/28/EC.

On measures to avoid fraud, Cyprus reports that GOs are issued based on actual measurements from remote metering, with certified, checked and sealed meters. Regular inspections are foreseen as well. However, there is nothing in the Progress report on sanctions or other consequences of wrong of misleading information. In particular, it is not clear whether wrongly issued GOs can somehow be corrected, though is seems that at least for cases of fraud, Cypriot criminal law would provide some sanctions.

The Electronic Registry for issuing, transferring and cancelling of GOs has been fully operational since 2011 when the first GO was issued. Since then, the Registry has been functionally improved, and it is continually being upgraded to harmonise with AIB's rules and the AIB Hub. The registry is expected to become fully compatible with EECS Rules and the AIB Hub during 2015, thus allowing the international transfer of Cyprus EECS GOs.

Harmonisation of the national law with Directive 2009/72/EC regarding the internal market of electricity has already been completed. The new law includes provisions for disclosure of the energy mix as well as provisions for joint projects. TSO-Cy has submitted a Fuel Mix Disclosure Regulation, based solely on Guarantees of Origin, to the Cyprus Energy Regulating Authority, and the regulation is expected to be enforced via a regulatory decision during 2015.

Harmonisation of the national law with the RES Directive 2009/28/EC is completed and the law has been implemented since the summer of 2013.

4.3.6. Czech Republic

OTE, a.s., the Czech electricity and gas market operator, is a joint stock company established in 2001. OTE provides comprehensive services to individual electricity and gas market players. OTE commenced organising trading in the day-ahead electricity market in 2002 and the intra-day and block electricity markets later on. OTE has been the market operator of the gas market since 2010, including operation of the day-ahead gas market and the intra-day gas market. Continuous data processing and exchange required for the accounting and settlement of the imbalance between the contractual and actual volumes of electricity and gas supplied and received are among the services offered by the OTE to players in the Czech electricity and gas markets, as well as the administrative procedures associated with change of supplier.

OTE is responsible for payments of a green bonus and feed-in tariff for electricity from renewable energy sources, secondary sources and combined heat and power, and support for decentralized electricity generation to producers. OTE also administers the

National Registry of Greenhouse Gas Emissions. OTE is the holder of the license for the market operator's activities, which includes activities in the electricity and gas markets in the Czech Republic.

In the Czech Republic, significant progress has been made as regards the system of GOs. Both the rules on electricity disclosure and the provisions of Art. 15 Directive 2009/28/EC are nowadays, and in contrast to the situation described under the last Progress Report 2011, implemented. GOs for energy from renewable sources are being issued only for electricity. GOs for heating and cooling are not being issued.

GOs are used for disclosure purposes towards the end consumer and a system of electricity disclosure following Directive 2009/72/EC has been introduced in 2011 and the system of GOs has been reformed in 2012. In addition to the use for disclosure purposes by the energy supplier towards the energy consumer, GOs are used as proof to entitlement to financial support in the support a scheme and can be used to claim exemption from the electricity tax introduced by Directive 2003/96/EC as they provide evidence that the electricity delivered and consumed stems from renewable energy sources.

The market operator OTE is responsible for issuing of GOs. The producer of electricity from renewable sources may request GOs no later than 12 months from realized production of electricity. The data provided by the electricity producer are collected by the market operator in a secure system. The validity of the information is verified. GOs are registered in an electronic register maintained by the market operator.

GOs are not being issued for free. The price for the issue of a guarantee of origin contains both fixed (for each month in which at least on GOs is issued) and variable (per each GOs issued) elements. GOs are issued per 1MWh and comply with the EECS rules, which accord to the requirements of the Directive 2009/28/EC.

GOs issued in other Member State can be recognized upon the condition of electronic transfer from the register of GOs of that member State to the register managed by the Czech Republic.

Czech Republic is connected to the AIB HUB and it is not known that GOs from the Czech Republic are refused recognition in other Member States.

Until December 2015, OTE (Issuing Body from Czech Republic) - had an open issue, because of the delay implementing appropriate disclosure legislation. The Czech registry was connected to the AIB's HUB on 25th April 2015; but while GOs were permitted to be imported from other EU registries into the Czech Republic registry, Czech GOs could not be exported to other EU registries due to the possibility of double-counting.

At the General Meeting of AIB in Arnhem on 4th December 2015, it was decided to allow OTE to remain a member of the AIB, but to suspend its membership of the EECS Electricity Scheme and to disconnect it from the HUB. This decision will be re-evaluated by the first General Meeting of 2018.

4.3.7. Denmark

In Denmark, the transmission grid operator Energinet.dk is the responsible issuing body, appointed by law. The electronic register for GOs for renewable electricity is run by Grexel.

The issuance is not for free, but Energinet.dk is empowered by law to get reimbursement for the costs.

Energinet.dk is an independent public enterprise owned by the Danish State as represented by the Ministry of Climate, Energy and Building. It has its own Supervisory Board.

As the entity responsible for the electricity and natural gas systems, Energinet.dk owns the overall energy infrastructure, ensuring reliable Energy supply and creates the framework for well-functioning energy markets and effective integration of renewable energy.

Energinet.dk is appointed by Executive orders in accordance with the Danish Electricity Law to issue Guarantees of Origin, to prepare general declaration for the default set of disclosure information, and to lay down conditions and guidelines for individual declarations on specific electricity supply.

GOs expire within twelve months after the end of the production period, which normally is the calendar month within which the electricity was produced. However, if the electricity production in one month is less than 1MWh, the GOs will be issued in the following month, when the production reaches 1MWh. The data based on which GOs are issued comes from the Danish distribution grid operators who read out the meters.

Prior to any new registration in the system, Energinet.dk sends an information request to the Danish Tax Payer and Customs Administration which investigates whether there are any incidents of tax fraud relating to the applicant. Once registered, users of the registry are contractually obliged for example to refrain from using GOs twice. Competences are foreseen for Energinet.dk to monitor and verify the GOs, in particular through requesting information and comparing it with different data sets. Notably, the GOs data is compared with the data collected for the purposes of the support scheme, to again avoid that producers try to benefit from both options. Contractual sanctions are in place and the law foreseen fines in case of misinformation as well as potential criminal sanctions.

GOs do not play a role in the support scheme and for renewable electricity receiving support no GOs are issued. However, the two sets of data are being compared so as to check whether producers act fraudulently or not.

A centralised DataHub, an energy market communication platform, went Live in March 2013 in Denmark. The DataHub is a scalable IT platform responsible for handling all market processes between market actors, and settlement of energy based on measures of approximately 3.5mio consumption and production meters down to

the hour in the energy market. The platform is based on the market philosophy and legislation driven by EU-Directives. The platform is owned by Energinet.dk - for further information go to the website www.energinet.dk/datahub.

The next version of the DataHub is designed with a functionality facilitating hourly settlement of electric energy and it is planned to go live in Pilot 2015, rolling out over the following years.

Denmark is connected to the AIB hub. GOs from other member states will normally be accepted, unless there is reason to doubt their accuracy, reliability or correctness, in which case the European Commision has to be informed.

It is known that GOs from Denmark are being refused in other Member States.

4.3.8. Estonia

Elering is an independent electricity system operator in Estonia whose main duty is to guarantee high-quality electricity supply to Estonian consumers at all times. Elering is also the appointed issuing body for renewable electricity and efficient co-generation guarantees of origin in Estonia.

Compared to the previous Progress Report 2011, Estonia has made significant progress as regards the implementation of Art. 15 Directive 2009/28/EC.

In cooperation with associated market parties, Elering AS is further developing and improving the Estonian registry system which facilitates the issuing, transfer and cancelling of guarantees of origin. As of November 2014 the Estonian registry has been connected to the AIB Hub to enable international transfers as well.

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4.3.9. Finland

Grexel is a privately owned company. Grexel enables energy certification by providing market infrastructure solutions and services. Ourmain service includes central registry system provision for guarantees of origin and other energy certificates as well as market design and regulatory engineering. We help Competent Bodies and legislators to develop the entire energy certification scheme from registry systems to definition of key processes as well as implementation of reliable electricity disclosure and residual mixes.

Finland has fully implemented Art. 15 Directive 2009/28/EC by 2013, as it is reported in the Progress Report 2013.

The grid operator Fingrid is the responsible issuing body and GOs are issued based on the metering data. Here, Finland is transitioning to hourly metering, allowing for more accurate data. By 2015, it is said, 100% of the meters in Finland shall be read out

automatically. The electronic register is maintained by Grexel. GOs are not issued for free but different fees apply to the plants registered. In Finland, GOs will in the future be the only method to proof the renewable energy origin of electricity produced, while in the past other instruments could be used as well. The Finish Energy Authority will calculate a residual mix, properly taking account of canceled or expired GOs, for 2013 the first time.

To avoid fraud, hourly metering by the grid operator Fingrid itself has been introduced. Further, all installations have to be registered, at which occasion there will be an audit. Every five years a re-audit is foreseen. In the course of the audits, which can also occur on site, available data from different sets, including e.g. the national support scheme, is compared and checked for coherence, with corrections being possible in case of errors or fraud.

Finland is connected to the AIB Hub and it is known that Finnish GOs are being refused in other Member States based on Art. 15(9) Directive 2009/28/EC at the time being.

4.3.10. France

Compared to the situation under the last Progress Report, France now seems to have a functioning GOs system.

Powernext, as the energy stock exchange, is the responsible issuing body in France since May 2013 (appointed by law in December 2012). The registration in the system and the issuance of the GOs is not for free, but the fees are published on the website.
Powernext has been appointed as the French national registry for guarantees of origin as of 1 May 2013, by a decree issued on 15 January 2013 by the French Ministry for Ecology, Sustainable Development and Energy. Powernext has succeeded RTE in this role, and has taken over all of the records of GOs issued by RTE since 2006. Powernext developed inhouse a completely new electronic registry for GOs, and became member of the AIB in June 2013.

On 20 January 2012, the existing legislation on guarantees of origin for electricity produced from renewable sources or cogeneration (decree #2006-1118 of 5 September 2006) was modified by the decree #2012-62 . Also, the decree #2004-388 of 30th April 2004 was modified. This introduces new characteristics of French GOs, making them fully compliant with Directive 2009/28/EC. In particular, GOs can only be cancelled in France provided their production start date occurred within the 12 previous months. Only GOs can certify the origin of the electricity produced from renewable sources serving to prove to final consumers the quantity of energy produced from renewable sources that contains the commercial offer contracted with their energy suppli- ers. From 20 January 2012, RECS certificates could no longer be used in France to prove the renewable character of electricity. The Energy and Climate Authority (Direction Générale de l'Energie et du Climat or DGEC) formally required Powernext to publish the French residual mix from 2013 onwards.

GOs expire twelve months after the beginning of the production period, which is not against the wording of the Directive 2009/28/EC, but still a peculiarity of the French system: In fact, it leads to a shorter lifetime of the GOs compared to those in other

countries where GOs generally expire twelve months after the end of production period. The data on the basis of which the GOs are issued is collected by the grid operators. Further, the holders of an account in the register have to renew registration every three years and are contractually obliged to submit complete data and correct it in case of changes. Exclusion from the system may be applied as a sanction, and it may be assumed that the crime of fraud (or similar) according to French criminal law might apply in certain cases as well.

France is now connected to the AIB hub and does recognize GOs from other Member States. For the moment, it seems no GOs from France are being refused by other Member States.

4.3.11. Germany

The UBA is a public authority competent for operating the German registry and issuing GOs; and the UBA has regulatory competencies with regard to the detailed provisions on GOs and the registry, laid down in the GO Implementing Ordinance, as well as fees. Besides running the GO system, the UBA is the scientific environment authority that comes within the remit of the Federal Ministry of the Environment, Nature Conservation, Building and Reactor Safety (BMUB) and it deals with a wide and varied range of environmental subjects.

The UBA is the competent authority and issuing body for Guarantees of Origin according to the EU Directive 2009/28/EC (RES Directive). The special section is the "Register of Guarantees of Origin for Electricity from Renewable Energy Sources" (German abbreviation "HKNR").
Germany adopted legislation to implement Directive (2009/28/EC in 2011, and implementing legislation followed in 2012. The electronic GOs system is now fully operational and the Federal Agency for the Environment (UBA) is responsible for the issuance, transfer and cancellation as well as recognition of GOs. No GOs are issued in case the electricity produced receives support through the national renewable energy support scheme (neither the feed-in tariff nor the market premium) and there are information obligations on all parties involved as well as provisions allowing audits and even on-site inspections to avoid fraud. It is also provided for specific sanctions in case of misinformation or lack of information.

The UBA has used the AIB Communication Hub as a non-member since the summer of 2013. It has gathered a lot of experience with operating its electronic system and in 2015 it will check and approve the disclosure for the share of "other renewable electricity" (which means RES without support) deriving from the delivery year 2013 for the first time with GOs. The latest development is the collection of fees, which started at the end of 2014.

Germany is connected to the AIB hub, although the German UBA is not a member of the AIB itself. It is known that German GOs are not being recognized in other Member States. The UBA is currently investigating into whether a certain number of countries with which (potentially) Germany would frequently transfer GOs have implemented the Directive 2009/28/EC correctly in order to find out whether recognition under Art. 15 (9) should generally be possible.

4.3.12. Greece

The Greek Progress Report 2013 simply mentions that the progress on GOs was reported already in the first Progress Report 2011. Instead the number of issued, cancelled and transferred GOs and the number of market entrants are presented. Those show that by the end of 2012 255 plants were registered and between the end of 2011 and 2012 3.357.982 GOs were issued. What surprises here is that in the first quarter of 2012 2.344.262 GOs where issued for hydro power whiles in all other quarters the numbers average 7.500 GOs, and that in the third quarter 2012 not a single GO was issued for hydro power.

Based on the Progress Report 2011, the Greek system may be described as follows: there are three issuing bodies, each of them maintaining an electronic register. The regulator has access to and thus an overview over all registers, while each issuing body is responsible for ensuring the correctness of the data submitted by the applicants and can for example perform inspections.

In the submissions by the Greek government, there is no information on the interaction between GOs and the Greek support scheme, nor whether GOs from other Member States can be recognized or what fees are applicable if at all.

While transfers of GOs are possible according to the numbers presented in the Progress Report 2013, Greece in not connected to the AIB hub. It is known that Greek GOs are not being accepted in other Member States, though.

4.3.13. Hungary

The existing Hungarian system of GOs described in previous reports was replaced by a new one as of August 2013. However, there still seem to be open questions as regards compliance with the requirements of the Directive 2009/28/EC which are at least not clearly dealt with in the law.

The regulator now maintains an electronic register in which everyone who wants to obtain either through first issuance (producers) or through purchase (vendors) GOs needs to register. Power plants can be approved for the issuance of GOs for five years, and only approved power plants can apply for the issuance of GOs.
One GOs is issued per MWh and there cannot be issued more than one for the same electricity produced, according to the progress Report. The application for issuance of GOs has to be submitted by the last day of the sixth calendar month following the generation of the given quantity of renewable electricity and has to be submitted for the quantity of electricity generated in at least a calendar month, i.e. the production period considered is a month.

GOs are now the only means of proof of the renewable origin of electricity to be used towards the consumer. Purchasers under the purchase obligation used in Hungary to support renewable electricity thus get the GOs from producers in exchange for paying them the fixed prices, it seems, and use them towards the electricity consumers to which they sell. This submission to the consumer is considered “use” and the purchaser has to notify of such use within 5 days so that the GOs get cancelled. GOs provided that they are still valid can be transferred freely. However, there is no

information in the law whether or not GOs expire 12 months after the production, neither about minimum information content or the like.

The regulator can verify the information submitted e.g. in the course of inspections and penalties apply in case of wrong information provided by the applicant, it seems. Absent any information on that point one may assume that the legislation allowing inspections and comparisons by the regulator has not been amended, so that the GOs system is continuously monitored and there is the possibility to correct mistakes in the system.

Hungary is not connected to the AIB hub, but principally allows for the recognition of GOs from other Member States and cooperates with other countries on the acceptance abroad of GOs issued in Hungary according to the Progress Report. It is not known whether or not other Member States refuge recognition of Hungarian GOs.

4.3.14. Latvia

Latvia reports to have implemented art. 15 Directive 2009/28/EC in 2011 by Cabinet Regulation No 900 which was already mentioned in the previous Progress Report 2011.

However, although it was mentioned that Latvia intends to join the EECS system, this has so far not occurred and as there had been no changes to the legislation in force in 2011, there are still points where Latvian legislation is not in line with the requirements of the Directive 2009/28/EC (and/or the EECS rules). In particular, the amount of electricity covered by one GOs is expressed in MWh but the requirement that one GO stands for 1MWH seems – while there is a formulation to that end in the Latvian law – in practice not implemented. While legislation provides that GOs have to be used within a year, it is not clear whether the year starts to count from production or for example from the date of issuance or what the respective production period shall be.

The Progress Report does not specify which measures have been or can be taken to avoid fraud or suggest how the GOs interact with the support scheme in place in Latvia.

Latvia is not connected to the AIB hub and there is no information on the recognition or non-recognition of Latvian GOs.

4.3.15. Lithuania

The amendments to the Lithuanian GOs system had already been reported under the previous Progress Report 2011. The Progress Report 2013 only adds that there was a draft order approving some more detailed rules on GOs submitted in 2012 but does not specify what has happened to it. The link to the document unfortunately does not work and there is no name provided under which one could search for it.

The draft was supposed to set out in further detail the “rules on the provision of guarantees of origin for electricity generated from renewable energy sources lay down the criteria, conditions and requirements for the issue, transfer and cancellation of

guarantees of origin for electricity generated from renewable energy sources and arrangements for monitoring and controlling the use of guarantees of origin". As nothing seems to have changed, one may thus refer to the information about the GOs system from the previous years.

So far, the only information on the fraud protection is that the transmission system operator monitors the operation of the system. The information provided is checked by the state Energy Inspectorate under the Ministry of Energy in the course of scheduled checks as well as at the request transmission system operator. However, whether there are correction possibilities or sanctions in place is not clear.

GOs are only issued to electricity production not supported in the course of the Lithuanian renewable energy support scheme.

Lithuania is not connected to the AIB hub. There is no information that GOs are being refused in other Member States and while Lithuanian law provides that GOs from other Member States shall be recognized there have been questions as to whether the system of import and export functions.

4.3.16. Luxembourg

The Institut Luxembourgeois de Régulation (ILR) is an independent authority in charge of regulation of electricity and natural gas markets, as well as of telecommunications, railways, airport taxes, postal services, and radio spectrum. In addition to the above, the ILR is also designated as the national competent authority for issuing guarantees of origin for electricity generated from renewable energy sources.

The legislation referred to in the Progress Report which introduced the GOs system in Luxemburg predated the entry into force of the Directive 2009/28/EC and indeed there has not been a full implementation of the provisions of the latter yet. In particular, GOs do not expire twelve months after production of the electricity they refer to, but no expiry is legally defined. For the rest, the Progress Report hardly contains any information.

In July 2010, disclosure regulations entered into force and define a unique form of electricity labels to be used by all suppliers in their disclosure information on the final bill for the end consumer. Cancellations of EECS certificates represent an easy and straightforward tool for electricity suppliers to prove the renewable origin of their electricity supply. In 2013, 2.8 million GOs (2.8 TWh) were cancelled in the registry, representing more than 40 % of the total electricity consumed in Luxembourg.

However, Luxemburg is connected to the AIB hub and the EECS rules are applied. For that reason, there are mechanisms in place to verify the information submitted with the application for GO's, a certain monitoring takes place and sanctions are possible. The regulator ILR is the issuing body in Luxemburg and the electronic register is run by Grexel.

Renewable energy projects benefiting from the feed-in tariff support will not be issued any GOs, but instead ILR will auction the renewable energy quality, i.e. the

GOs. GOs contain information on whether investment and/or operational support was received by the electricity in question.

There is no information on GOs from Luxemburg being refused in other Member States, but Luxemburg imports more GOs from other Member States than it exports.

4.3.17. Ireland

The Single Electricity Market (SEM) is the wholesale electricity market operating in Ireland and Northern Ireland. The Single Electricity Market Operator (SEMO) facilitates the continuous operation and administration of the Single Electricity Market. SEMO is a contractual joint venture between EirGrid Plc., the transmission system operator for Ireland, and the SONI Limited, the System Operator for Northern Ireland. SEMO is licensed and regulated cooperatively by the Commission for Energy Regulation (CER) in Ireland and the Utility Regulator in Northern Ireland (UREG).

SEMO is also the calculating body for Fuel Mix Disclosure for Ireland and Northern Ireland.

In Ireland, SEMO (the single Electricity Market Operator) is the body responsible for the administration of the GOs scheme and the latest reform took place in 2011. This had already been announced in the previous Progress Report 2011.

Now the system is in force and running and while SEMO is not a member of the EECS and the EECS rules do not apply, the Irish legislation seems to correspond to the requirements of the Directive. GOs are issued only for renewable electricity, not for heating and cooling, and only in case the electricity has not been supported in the course of the Irish renewable energy support scheme. Their purpose is electricity. Interestingly, though, it seems that transfer and use are possible even after twelve months of the production of the respective electricity.

GOs in Ireland are currently issued for free, and the costs are covered over the system charges, but there is an option that later on – in case of cost increases – there might be feed introduced.

Ireland is connected to the AIB hub, although the issuing body itself is not a member of the EECS. However, Ireland applies similar rules as regards recognition of GOs and imports over the AIB hub are possible and have occurred from Norway and Northern Ireland so far. There is no information that Irish GOs have been exported to other Member States and thus there is no information that they are refused recognition.

4.3.18. Italy

The UBA has used the AIB Communication Hub as a non-member since the summer of 2013. It has gathered a lot of experience with operating its electronic system and in 2015 it will check and approve the disclosure for the share of “other renewable electricity” (which means RES without support) deriving from the delivery year 2013 for the first time with GOs. The latest development is the collection of fees, which started at the end of 2014.

The provisions on GOs of Art 15 Directive 2009/28/EC had been implemented by Legislative Decree No 28/2011 already, but in 2012 a Ministerial Decree was issued introducing changes to the national renewable energy support schemes which again impacted the provisions on GOs.

GSE, the market operator and responsible body for the issuing and administration of the GOs system in Italy, transfers all GOs that received support under the Simplified Sale and Purchase Arrangement, the Net-Metering scheme and the All-Inclusive Incentives to itself. Producers do not get reimbursed extra for that, but the GOs function as a sort of proof to the entitlement of support. GSE then auctions off the GOs to energy suppliers who can use them for electricity disclosure purposes, which is the main function of GOs in Italy.

Another peculiarity, also introduced by the Decree in 2012, is the Abolishment of the link between imported GOs and physical import of electricity: From disclosure year 2012 imported GOs may be used to calculate the renewable energy share in the energy mixes, even when no physical electricity has actually been imported. Foreign GOs can thus "green wash" electricity produced in Italy. This may be problematic, though, as is appears that Italy does not (sufficiently) control whether GOs have already been used for disclosure in other Member States. While under the EECS rules for example, and in Member States with a proper implementation of the Directive 2009/28/EC used GOs should not be transferable anymore, there is the danger of double-counting in case a Member State has not implemented such rules and exports GOs to Italy. However, the double-counting would not relate to renewable electricity generated and receiving GOs in Italy, but to the production from the other Member State in which the rules are not properly implemented.

During 2014 the Italian Government issued two decrees aimed at reducing the electricity and gas bills. With regard to support schemes for electricity produced by renewable energy sources, they provided a reduction of the current amount of incentives by increasing the total incentive length. They also provided promoting measures for realization of the so called "end users efficiency systems" (SEU); these consist in configurations where a production unit, installed in an area owned or used by the end users, is managed by a sole producer, who is not the end user, which is directly connected, through a private connection, to the consumption unit. The economic advantage for the customer is that the energy produced and consumed within the SEU is free from grid and system fees, with lower rates compared to energy withdrawn from the public grid, while for the producer, the benefit lies in the sale of the energy at an above-market price. Furthermore, on December 2014, the Italian Regulator issued a deliberation providing a completed regulatory framework regarding the installation and use of storage systems which will impact on the ways of granting incentives and the issuing of Guarantees of Origin to accredited Production Devices.

Italy is connected to the AIB hub and GSE applies the EECS rules. It is not currently known that Italian GOs are being refused recognition in other Member States.

4.3.19. Malta

While Malta mentions that the applicable regulations have been amended, such amendment took place already in 2011. Since then nothing seems to have changed and for example the requirement of the Directive 2009/28/EC that one GO be issued for 1MWh has not been introduced so far.

However, no GOs have been issued in Malta, as none have been requested. Small producers, according to the Progress Report prefer participation in the feed-in tariff support scheme instead: GOs do not play a role in the Maltese support scheme and there is no obligation by the energy producers to request them. As there is no local demand for GOs no one has request them.

Malta is not connected to the AIB hub. Recognition of GOs from other Member States is however made possible by the relevant regulations.

4.3.20. Norway

Statnett SF is the system operator of the Norwegian electricity system. This means operating about 11 000 km of high-voltage power lines and 150 grid stations all over Norway. Operations are monitored by one national control centre and three regional centres. Statnett is also responsible for the connections to Sweden, Finland, Russia, Denmark and the Netherlands.

Statnett is a state enterprise, established under the Act relating to state-owned enterprises and owned by the Norwegian state through the Ministry of Petroleum and Energy.

Apart from being owner of the national grid, Statnett has a 28.2 per cent ownership of Nord Pool Spot which Statnett owns together with the other Nordic and Baltic TSOs.
Statnett has been member of the AIB since 1 January 2002. It has issued RECS certificates since 2001, and Statnett-issued certificates have been compliant with both GO RES-E and RECS standards since 1 January 2007.

Based on input from our customers, we continue to improve our registry NECS in cooperation with our supplier Grexel. One of the major changes implemented this year was to enable NECS to issue GOs with and without support to the same production device. More and more hydro plants receive support for part of their production (elcertificates) following a renovation project leading to higher production. From April 2016 the company eSett Oy will take over the balancing settlement in Finland, Sweden and Norway. Hence, the metering data on which issuance is based will come from a new source. Getting a smooth transition from the national to the Nordic balancing settlement is a key task for 2015.

Changes to the common system for elcertificates in Norway and Sweden will be implemented next year as well, and enters into force on 1 January 2016. In Norway, some more production devices will receive support, but there are few implications for guarantees of origin within the Norwegian domain.

4.3.21. The Netherlands

CertiQ B.V. performs the role of national issuing body for guarantees of origin, a task for which TenneT is legally appointed by the Dutch Ministry of Economic Affairs.

CertiQ issues guarantees of origin for renewable electricity, for electricity from high-efficient cogeneration and for renewable heat. In addition, CertiQ also issues disclosure certificates for electricity derived from other sources.
The Netherlands intend to introduce a renewable gas and a renewable heat GOs system in 2014. For renewable gas a stator certification system administered by Vertogas is supposed to be started, for renewable heat the voluntary system in operation since 2012 will be made statutory as well and the certificates will be issued by CertiQ, which is also in charge of the renewable electricity GOs system, and which is monitored in fulfilling its statutory tasks by the Authority for Consumers and Markets and the Ministry of Economic Affairs.

GOs are used for electricity disclosure but also play a certain role in the support system as issuing of GOs is also used a proof of eligibility for the Dutch premium support scheme. They cannot be cancelled for disclosure purposes later than 12 months after the end of the production period. However, it is possible to e.g. export them afterwards, as they only expire 12 months after the issuing date. The production period, as in most Member Stats, is limited to one month.

The Dutch issuing body is a member of and connected to the AIB hub and applies the EECS rules. GOs are imported and exported to other Member States and there is no information that Dutch GOs would be refused recognition anywhere.

4.3.22. Poland

In Poland, the rules on GOs apparently were changed in 2013. Today, according to the Progress Report, 1 GOs is issued for 1MWh, while in the past this was done for 1 KWh (One may note that under the rules issued and published by the Polish Power Exchange maintaining the register, at least the property rights represented by certificates are still granted per 1 kWh). The register rules also include provisions asking the users to regularly update information and inform e.g. about changes. However, no specific sanctions are foreseen, though likely general criminal law would apply in case of fraud.

The GOs seem to be used in the course of the national quota obligation system, as at least the Polish Power Exchange does not distinguish between the certificates (for support) and the GOs, neither does the law.

Poland is not connected to the AIB hub and there is no information that such is planned. However, neither is there any information that Polish GOs are being refused recognition in other Member States.

4.3.23. Portugal

TSO-REN is engaged in two principal lines of business: electricity transmission and natural gas. REN owns and operates the National Transmission Grid, the only

electricity transmission network in mainland Portugal. REN is also engaged in the reception and storage of natural gas and regasification of LNG, the operation of the national high-pressure gas transmission network, which it owns and operates under concessions, and the underground storage of natural gas.

The Portuguese system operator REN was one of the founding Members of the AIB and is as issuing body for EECS certificates connected to the AIB hub. While the EECS certificates issued by REN meet the requirements of the Directive, this is not based on legislation, but on REN's obligations within the AIB.

Portugal introduced legislation to implement Art 15 Directive 2009/28/EC in December 2010 and created and appointed EEGO as responsible body. As described already in the previous Progress Report 2011, under this system supported electricity was not supposed to receive GOs. A system was supposed to be implemented for GOs for heating and cooling. However, both systems are not operation yet and no electronic (or other) registries have been created. The Progress Report 2013 only speaks of a handbook being drawn currently and ahead of the legislation entering into force.

As regards the EECS certificates, issued by REN, it is not known that they are refused by other Member States. Rather they are exported to other Member States quite regularly.

REN has been disconnected from the HUB at the end of 2015, which is no longer the Portuguese competent body for guarantees of origin: this role has been inherited by the Directorate-General for Energy and Geology (recent Portuguese Decree-Law 65-A/2015, from 30th April 2015). The AIB Secretariat has already made contact with DGEG to discuss membership.

4.3.24. Romania

As reported already under the previous Progress Report 2011, Romania amended the GOs system in 2012 in order for it to conform to the requirements of the Directive 2009/28/EC.

The system runs parallel to the support scheme, and it is said that electricity supported in the course of the support scheme needs to be – when being sold and the final consumer requests it – accompanied by a GOs, and the GOs must provide information on whether the electricity was supported or not. In other circumstances, it appears, issuance is voluntary and disclosure can also occur based on contract-based tracking. Transfer of GOs is not linked to the physical transfer of energy, and GOs serve for energy disclosure purposes. Still, in 2011 and 2012 no GOs were requested or issued.
The Romanian regulator in principle would recognize imported GOs. However, Romania is not connected to the AIB hub for the moment and does not apply the EECS rules, as there currently seems to be no market for any imports or exports of GOs.

4.3.25. Slovakia

Slovakia does not report any changes to the GOs system since the last Progress Report 2011. The responsible body for issuing GOs for electricity is still the regulator, i.e. the Office for the Regulation of Network Industries. The regulator maintains an electronic registry. GOs for heating and cooling are not being issued.
GOs can only be used within 12 months from the date of the production of the respective electricity. There is no fee for issuing GOs. GOs are issued upon request and based on the information submitted to the regulator, which the regulator can verify. Initial registration is required for the issuance of GOs. Although there is no concrete information on what the regulator can do to verify the information, it appears, in particular as the GOs are linked also to the support scheme, that there will be measures to avoid fraud. Also, there are sanctions upon the submission of wrong information (even if only by mistake) and penalties apply.

GOs are linked to the support scheme, as they are used to demonstrate a right to financial support from the regional distribution system operator. The GOs can after support was received still be transferred, but can after such transfer no longer be used to claim support. The support received is mentioned on the GOs. GOs are cancelled after their regular use as proof to the consumer of generation of electricity from renewable energy sources by the respective energy supplier (or user). Slovakia is not connected to the AIB Hub.

GOs which were issued in a different Member State under a mechanism ensuring accuracy and reliability in the issuance of guarantees of origin are recognized. In case of doubt, the regulator will contact the respective other Member State and only if the doubts cannot be solved, recognition will be refused.

4.3.26. Slovenia

The Slovenian regulator AGEN-RS is the competent issuing body, appointed by law, in charge of GOs. There is an electronic register for renewable electricity which is administered by the market operator Borzen.

National GOs are issued for free, however, for national GOs to be transferred into EECS GOs, the EECS rules and respective fees apply. Notably, in Slovenia national GOs, EECS GOs and RECS GOs currently still exist, but the RECS GOs are supposed to be phased out. GOs expire twelve months after the end of the production period, which is generally one calendar month as in most Member States (exceptionally an extension up to a year is possible).

The grid operators collect the metering data on the basis of which GOs are issued. AGEN-RS can verify the information on the production site provided by the electricity producers when they initially apply to get an account in the register. Application has to be renewed every five years, to ensure regular verification. The law gives AGEN-RS competences to take measures such as (on-site) inspections to ensure that no fraud occurs. It also provides for specific sanctions for misinformation or non-information, in the form of financial penalties which are adapted to the size and capacity of the installation to which they refer.

Slovenia maintains a feed-in system for the support of renewable electricity, in which GOs can be used as proof of the production for which support is requested. However, GOs are taken in and cancelled for all electricity which receives support, so as to avoid that the producer generates income from the GOs and the support system at the same time.

The Energy Agency plays an important role in the national support scheme, since it issues production declarations, which are necessary for all producers who wish to enter the support scheme or receive GOs. Furthermore, the Energy Agency decides on eligibility of each producer to enter the support scheme and determines the actual prices for each producer in the scheme, taking into account previously received investment support. The Energy Agency also prepares yearly input for the calculation of feed-in tariffs and premiums in the form of forecasts of average electricity prices and fuel costs. In March 2014 a new Slovenian Energy Act was adopted. While it did not bring any changes to the national GO system, it brought some minor changes to the national disclosure system and an important change to the national support scheme for RES and HE CHP.

Slovenia is connected to the AIB hub, and GOs from other Member States can be recognized unless there are well-founded doubts. Refusal must be based on objective, transparent and non- discriminatory criteria, and according to the Progress Report, the refusal shall be taken back and the GOs recognized.

It is not known that GOs from Slovenia are being refused in any country.

4.3.27. Spain

The Spanish system for GOs has been last amended in 2011, whereby it has been brought roughly in line with Directive 2009/28/EC. In 2012, a circulation followed according to which Spain submits that the requirements of the Directive 2009/28/EC are now all met. However, GOs are not issued for 1 MWh, but representing electricity measured in MWh with three decimals. Thus this requirement of the Directive is not met.

Issuance of GO itself is free, however, there are annual charges for usage of the account in the electronic register. GO are used for electricity disclosure and they are issued independent of the financial support available to renewable energy producers. However, a producer receiving support under the national support scheme and getting GOs for the same production must invest the additional benefit from the sales of the "supported" GOs for environmental protection purposes (non- supported renewable energy projects, R&D or the like).

On the competences of the regulator to control the correctness of the data and to – if necessary – make corrections in the system, Spain had already reported in the previous Progress Report. The National Energy Commission as the responsible issuing body can make for example on-site inspections and can get access to the accounting of the producers. The electronic system of book entries allows verification of the data submitted by the producers together with their request for GOs as well. Under the EECS rules, which are generally applied in Spain, there are certain safeguards and correction possibilities allowing for error handling and sanctions.

Spain is connected to the AIB hub and imports of GOs are principally possible, though it appears none have happened yet. It is not known that Spanish GOs are refused recognition in any other Member State.

4.3.28. Sweden

In Sweden, Affärsverket Svenska Kraftnät is the issuing body for GOs, while the electronic register is run by Grexel, and the Swedish Energy Agency functions as regulator. For the purpose of fraud protection, the Swedish Energy Agency has relatively broad competences, from requests for information up to on-site inspection, and including the possibility to revoke the decisions on the issuance of GOs in case of error or fraud.

Grexel is a privately owned company. Grexel enables energy certification by providing market infrastructure solutions and services. Our main service includes central registry system provision for guarantees of origin and other energy certificates, as well as market design and regulatory engineering. We help Competent Bodies and legislators to develop the entire energy certification scheme from registry systems to definition of key processes as well as implementation of reliable electricity disclosure and residual mixes.

Swedish GOs are used for tracking the origin of electricity only, to which end Sweden maintains a system in which also electricity from other sources can obtain GOs. In principle, all sources may and should be tracked through GOs. The residual mix thus only contains (renewable) electricity for which the GOs have expired (i.e. cancelled after 12 months) or for which no GOs have been issued. GOs do not play a role in the course of the support scheme and are distinguished from the green certificates based on which Sweden supports renewable energy.

In 2014, a decision was made to transfer the responsibility of issuing Swedish national guarantees of origin from the TSO Svenska Kraftnät to the NRA Energimyndigheten. The transfer will be finalized in 2015. Grexel as the registry provider of Swedish national GOs is involved in the project and continues as the Issuing Body of EECS guarantees of origin in Sweden.

Issuing volumes remained very high in Sweden in 2013 as 141 TWh, which reflects some 95 % of the production according to Entsoe statistics. In Sweden, all energy sources are eligible for GOs. 18.1 TWh of the national GOs issued for the 2013 production have been converted into EECS-GOs. Current statistics for 2014 show no major changes. In Sweden, GOs are the only method to sell electricity products and deviate from the residual mix in relation to any energy source.

Sweden is connected to the AIB Hub and it is not known the GOs from Sweden are being refused recognition in other Member States. As in many other Member States, there is a distinction between purely national GOs and GOs for export, the latter of which issued in accordance with the EECS rules.

4.3.29. Switzerland

Swissgrid is the sole competent Issuing Body for Guarantees of Origin in Switzerland. Swissgrid has been accredited with this task by the Swiss Accreditation Service SAS. The Swiss Federal Office of Energy is the official authority for the supervision of issuing Guarantees of Origin for electricity as well as for the supervision of electricity disclosure in Switzerland. The legal basis is given in article 5a of the Federal Law on Energy as well as in the Ordinance on Energy and the Ordinance on Guarantees of Origin.

Switzerland has been an AIB member since 2002.Since 2013 plant operators are legally obliged to register the whole electricity production of plants with an installed capacity higher than 30kW (all technol ogies) in the Swiss Guarantee of Origin system. Therefore, almost 100% of the Swiss electricity production is registered in the Swissgrid database. On the supply side, all available national and international Guarantees of Origin have to be cancelled for disclosure purposes in order to give maximum transparency to the end consumers. In addition, suppliers are obliged to publish their disclosure mixes on a common website once a year (www.strom kennzeichnung.ch). With this regulation, Switzerland has implemented almost all recommendations proposed by the EU-supported RE-DISS project (Reliable disclosure system for Europe). As an improvement of the disclosure system, the Swiss parliament is currently discussing a potential introduction of a Guarantee of Origin obligation for imported electricity. With this measure, disclosure could be done in Switzerland based on Guarantees of Origin only, no matter whether it refers to domestic or foreign electricity.

While still negotiating with the European Union on an energy agreement, Switzerland is about to implement its Energy Strategy 2050. The aim of the Swiss Energy Strategy 2050 includes replacing nuclear electricity production by means of renewable energy and efficiency gains. In an early stage, the new strategy will be focused on the exploitation of existing energy efficiency potentials and on new renewable energy sources. Even though the revision of the Swiss energy legislation is still in progress, first measures have already been implemented in 2014. On the one hand, the feed-in tariff system has been extended and on the other hand, an investment support program for small photovoltaic plants has been introduced. In the long term, there is a strong tendency towards replacing the existing support system by an incentive program after 2020.

4.3.30. United Kingdom

In the United Kingdom, Ofgem is the competent body to issue GOs. An electronic register is being maintained, and while no heating and cooling GOs are issued in the United Kingdom itself such can be recognized from other Member States. Little progress on the scheme was reported and the latest reforms already date back from 2010, so that they were already reported under the previous Progress Report 2011. GOs issued from 5 December 2010 have a shelf life of 16 months (19 months for GOs from Northern Ireland) from the month of generation before they are cancelled, which is thus not in line with Directive 2009/28/EC as there it says they shall expire after 12 months. However, they nowadays are issued for 1MWh (instead of 1 kWh as previously).

Issuance of GOs requires registration, in the course of which Ofgem can verify the information provided. Ofgem maintains central registers for the various instruments relating to renewable energy in the United Kingdom and it should thus be possible to check the data provided against the information in other contexts. Further, it is possible to apply for registration for different purposes at the same time and using one form. Regular audits are foreseen as well and Ofgem can revoke GOs which had been issued based on wrong information, so as to correct the register, while no other specific sanctions are foreseen by the legislation (however, presumably, the law does sanction cases of fraud).

GOs are first and foremost used for fuel mix disclosure and stand alongside other instruments, such as certificates in the context of the Renewables Obligation. The relation is not entirely clear, it seems.

The UK is no longer connected to the AIB. However, according to the Progress Report, GOs from other Member States can be recognized unless any reasons are found why this should not be done. There is no evidence of GOs from the UK not being recognized in other Member States.

4.4. GOs in EEX

The European Energy Exchange (EEX) trades GO's products of European market platform for Guarantees of Origin (GOs).

The following derivative products are currently available for trading [48]:

- Nordic Hydro (NO, SE, FI, DK) – GOs from non-supported power plants
- Alpine Hydro (CH, AT, DE) – GOs from non-supported power plants
- Central Northern European Wind (DE, DK, NL, BE) – GOs from supported power plants

In figure 4.18 are illustrated the GO's products of EEX.

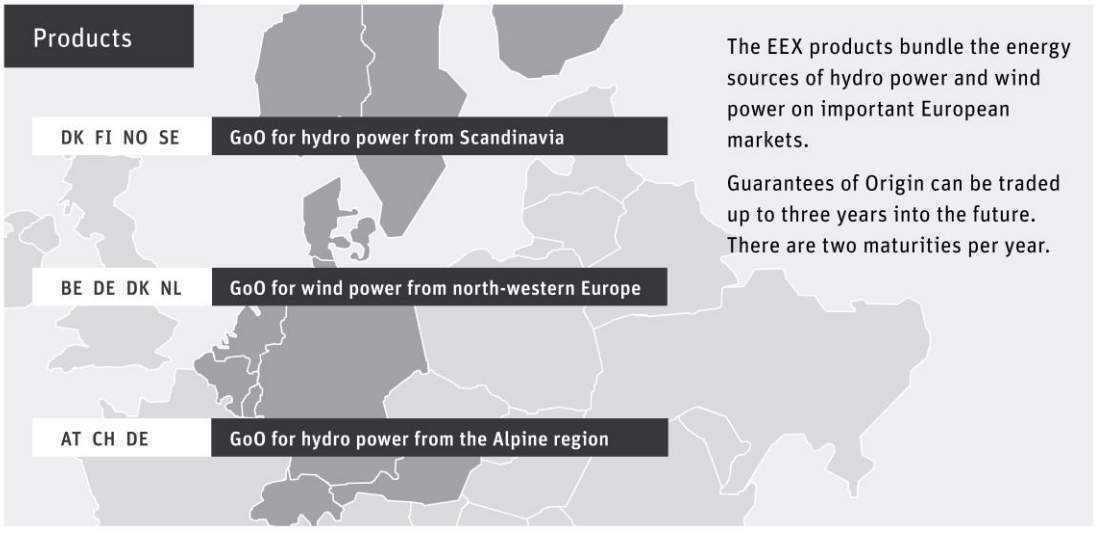


Figure 4.18. The GO's products of EEX [48].

In figure 4.19 are illustrated the tradable GO products at EEX and in figure 4.20 the price development of GOs until April 2014.

Tradable GO Products at EEX

	GO Futures on Nordic Hydro Power	GO Futures Alpine Hydro Power	GO Futures on Continental Europe Wind Power
ISIN/WKN/Eurex Code	DE000A1RRV24 / A1RRV2 / FECN	DE000A1RRV32 / A1RRV3 / FECA	DE000A1RRV40 / A1RRV4 / FECW
Tradable maturities	December (up to 3 years ahead) March (up to 3 years ahead)		
Valid production period	December expiry: January – December of current calendar year March expiry: April – December of previous calendar year		
Public Support	Code 0 – no support	Code 0 – no support	Code 0, 1, 2, 3 or 4
Contract Volume	1.000 GO's		
Tick Size	Three decimal digits after the point; this corresponds to € 0.001 per GO.		
Minimum Price Change	1,00 € per contract		
Trading model	Continuous trading with shortened trading hours (currently every Thursday 1:00pm – 4:00pm)		
Fulfilment	Delivery of GO's via ECC account at Grexel Finland upon expiry		

EEX is setting a new market standard for GO trading by grouping countries, production periods and expiries to standardized products.

Figure 4.19. Tradable GO products at EEX [48].

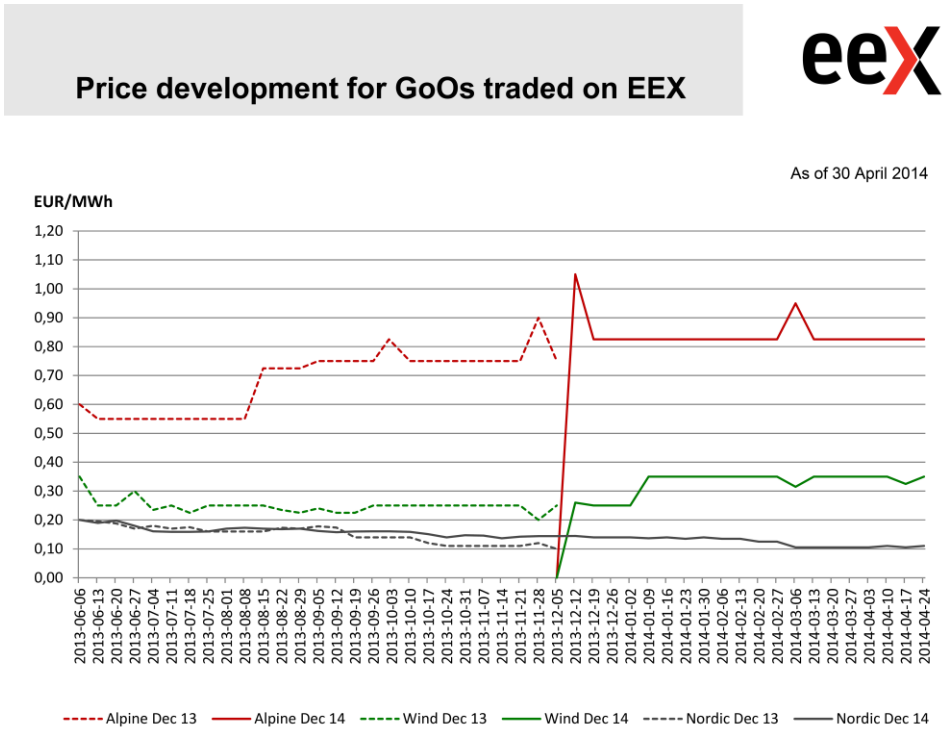


Figure 4.20. The price development for GOs on EEX [48].

CHAPTER 5 - GOs in Greece

5.1. Legislative status

The guarantees of origin are essential to identify the producer of origin of electricity produced from RES plants. These guarantees specify the sources from which the electricity was produced, giving info the dates and places of production. The Body that oversees the system of guarantees of origin in Greece and cooperates with the authorities of other EU Member States or third world is the Regulatory Authority for Energy (RAE) as a control body. Bodies issue guarantees of origin is Operator of Electricity Market (LAGIE) for the interconnected system (mainland and islands connected to mainland grid), the Hellenic Electricity Distribution Network Operator (DEDDIE) for non-interconnected system (islands not connected to mainland grid) and Centre of Renewable Energy Sources (CRES) for autonomous units.

There is a unique registry regrouping RES-GO and CHP-GO, which is in operation since October 2010. LAGIE is responsible for the operation, maintenance and upgrading of the registry. RAE the regulator has the responsibility to control.

For the issuance of the GO certificate owner shall submit the application in accordance with the ministerial decision Δ6/Φ1/οικ.8786. These guarantees are based on sufficient information and exact details provided by the energy produced to certify the origin of electricity.

European Provisions concerning Guarantees of Origin of electricity produced from renewable energy transferred by Law no. 3468/2006 as in force (Articles 15-18), which sets generally the manner, procedure and issuers of Guarantees of Origin for the control bodies of the National Guarantee of Origin system, as well as the safeguard mechanism of this system. Under the authority of this law was issued ministerial decision on "Implementation of the Energy Guarantees of Origin System from RES and CHP and Assurance Mechanism", which detail provides the necessary measures to implement the Guarantees of Origin system, in particular the creation of an electronic registry, issuers, the control and the process of issuing such guarantees.

Regarding the Guarantee of Origin procedure each interested RES producer must proceed Statement of data plant to be registered in the Register of Installations and to be recognized as an installation (Article 4 MD).

After the relevant control, the Body Issue decides for the inclusion or not of the Installation in the Registry Installation and in case of a positive decision rendered Unique ID of Installation (MAE) and the plant is considered as an installation for issuing Guarantees of Origin and the Single Number Share of Guarantee of Origin (ΜΑΜΕΠ) is conveyed to the energy producer. Subsequently, the interested energy producer shall submit electronic application for guarantees of origin to the issuing Body for a specified period of production of electricity, which varies between 30 days to 1 year. Since the conditions for the issuance are fulfilled, the competent Body shall record the relevant Register kept, namely Share of Guarantee of Origin, data for the requested guarantees, giving to each of them and a Unique Identification Number (ΜΑΕΠ). The issuance concludes with the electronic information of the holder of the Share (Article 6 MD).

The purpose of the GOs, is a proof to a final electricity consumer of the percentage or amount of electricity produced from renewable energy sources is included in the energy mix of the electricity supplier (Article 2 MD), it is particularly important to ensure the reliability and transparency the established formal system. All the above are guaranteed by RAE which is responsible as competent authority for that purpose (Control Body). The aim of this mechanism is to inspire consumer confidence, particularly to certify the specific percentage of electricity from renewables in the energy mix supplied.

Following principles apply for GO issuing:

• GO is issued based on actual meter readings

• GO is only issued for RES-E which is then used by end-consumers (i.e. no pumped hydro)

• There are mechanisms for periodic and random control of registered installations. To that end LAGIE keeps a registry of Certifying Bodies

• RES share of combustion plants is ensured by adequate measures

• Technical changes to plants are registered in the short term

• GO specifies the energy source, as one of: solar, wind, biogas, biofuel, biomass, hydro.

• Each GO specifies the nature of the support scheme.

• Metered production period on high and medium voltage is the calendar month, whereas for low voltage it is 4 calendar months.

• All GO data are kept for 10 years after the GO is cancelled or expired.

5.2. The current status

Based on "Report on status of implementation of proposed recognition criteria in European countries EU28+CH+NO+IS" of August 2015 [49] the status of Greece is described in the following tables.

3.13.1 Criterion No 1: Implementation of Art. 3 (9) of the Directive 2009/72/EC (on electricity disclosure) by Greece

Criterion No.	Criterion	Status	Explanation
1	**Implementation of Art. 3 (9) of the Directive 2009/72/EC (on electricity disclosure) by the Member State;** This can be considered fulfilled based on compliance with the following criteria:		
1.1	**National legislative implementation of disclosure system according to Art. 3 (9) of the IEM Directive 2009/72/EC, also including the following:**		
1.1.1	Disclosure is mandatory at least for company's mix of all suppliers.	not fulfilled	Although the disclosure of the energy mix is provisioned by the Supply Code, there is no legal provision yet for the methodology of the calculation of the energy mix. RAE has already consulted the methodology with the Market Operator (LAGIE), and intents to include it in the relevant Codes in the coming months.
1.1.2	Annual disclosure statement provided with or on bills and promotional material to customers.	no information available	
1.2	**No double counting with other explicit tracking mechanisms** by fulfilling one of the following criteria**:**		
1.2.1	No further tracking mechanism for RES besides GO and residual mix allowed for disclosure	fulfilled	
1.2.2	If further tracking mechanisms for RES besides GO and residual mix are allowed for disclosure, there should be transparent and reliable mechanisms to exclude double counting of RES production for which a GO is issued	not applicable	
1.3	**No double counting between GO and any implicit default mix (like e.g. an uncorrected production mix).** This can be checked through implementation of one of the following options:		
1.3.1	No statistical default mix possible	not fulfilled	
1.3.2	Statistical default mix contains no RES at all	not fulfilled	
1.3.3	Use of a robust residual mix according to RE-DISS	not fulfilled	

Table 5.1. Implementation of Art. 3 (9) of the directive 2009/72/EC by Greece.

3.13.2 Criterion No 2: Greece, as the issuing Member State has implemented Art. 15 of the Directive 2009/28/EC

Criterion No.	Criterion	Status	Explanation
2	**The issuing member state has implemented Art. 15 of the Directive 2009/28/EC;** This can be considered fulfilled based on compliance with the following criteria:		
2.1	**Standard size of GO is 1 MWh.**	fulfilled	
2.2	**GO has to be used within (maximum) 12 months after the end of the production period.**	fulfilled	
2.3	**GO has to be issued by a Competent Authority which is officially appointed, independent from production, trade and supply, and whose responsibilities have no geo-graphical overlap.**	fulfilled	

Table 5.2. Implementation of Art. 15 of the directive 2009/28/EC by Greece.

3.13.3 Criterion No 3: Greece, as the issuing Member State ensures that: 1) no more than one GO is issued in respect of each unit of energy produced and 2) the same unit of energy from renewable sources is taken into account only once (Art. 15 (2) 2009/28/EC)

Criterion No.	Criterion	Status	Explanation
3	**The issuing member state ensures that: 1) no more than one GO is issued in respect of each unit of energy pro-duced and 2) the same unit of energy from renewable sources is taken into account only once (Art. 15 (2) 2009/28/EC);** This can be considered fulfilled based on compliance with the following criteria:		
3.1	**No more than one GO is issued in respect of each unit of energy produced** by fulfilling the following criteria		
3.1.1	There should be no issuing of more than one GO for the same unit of electricity.	fulfilled	
3.1.2	This also applies to cogeneration plants which are using RES as the energy source: only one GO should be issued per unit of electricity.	fulfilled	one GO com-bines both information
3.2	**GO to be used only once,** also including the following criteria		
3.2.1	GO is cancelled when being used.	fulfilled	
3.2.2	GO can't be used or transferred after expiry, cancellation, export.	fulfilled	
3.2.3	Exported GO are marked as removed from the exporting registry.	fulfilled	
3.2.4	Processes in the registry exclude duplication of GOs.	fulfilled	
3.2.5	If suppliers disclose the specific product mix for some of their consumers they should be required to give product-related disclosure information, including environmental impacts, to all customers, including default products.	not applicable	

Table 5.3. Implementation of Art. 15 (2) of the directive 2009/28/EC by Greece.

3.13.4 Criterion No 4: Greece, as the issuing Member State ensures the function of a GO (Art. 15 (2) 2009/28/EC)

Criterion No.	Criterion	Status	Explanation
4	**The issuing member state ensures the function of a GO (Art. 15 (2) 2009/28/EC);** This can be considered fulfilled based on compliance with the following criteria:		
4.1	**The only purpose for GOs is disclosure, and no other (conflicting) purposes are existing for a GO in your country; particularly no accounting on EU RES targets.**	fulfilled	

Table 5.4. Implementation of Art. 15 (2) of the directive 2009/28/EC about function of GO by Greece.

3.13.5 Criterion No 5: The Registry system in Greece is electronic, accurate, reliable and fraud resistant (Art. 15 (5) 2009/28/EC)

Criterion No.	Criterion	Status	Explanation
5	**The Registry system is electronic, accurate, reliable and fraud resistant (Art. 15 (5) 2009/28/EC);** This can be considered fulfilled based on compliance with the following criteria:		
5.1	**An electronic registry is implemented. (GO is an entry in an IT database system)**	fulfilled	
5.2	**GOs are accurate, reliable and fraud-resistant** by fulfilling the following criteria		
5.2.1	Issuing of a GO is based on actual meter readings.	fulfilled	
5.2.2	GO is only issued for RES-E which is then used by end-consumers (i.e. no pumped hydro).	fulfilled	
5.2.3	There are mechanisms implemented for ongoing control of registered data (e.g. re-audits, random checks, etc.).	fulfilled	
5.2.4	Sufficient measures are taken to ensure correct accounting of RES share of combustion plants.		**
5.2.5	Competent Body can correct errors in issued GOs, before they are exported, and is the only one with this competence.	fulfilled	
5.2.6	Technical changes to plants are registered as soon as practically reasonable.		**
5.2.7	Issuing, handling, transfer and cancellation of GO in a secured registry with automated and auditable processes;	fulfilled	
5.2.8	One comprehensive registry per domain	fulfilled	Several IB using the same registry
5.2.9	GO is imported via AIB Hub or another reliable interface from the other respective national registries.	not fulfilled	ex domain redemptions are used

**This is subject to own evaluation.

Table 5.5. Implementation of Art. 15 (2) of the directive 2009/28/EC about GO registry system by Greece.

3.13.6 Criterion No 6: Issued GOs in Greece include the minimum content (Art. 15 (6) 2009/28/EC)

Criterion No.	Criterion	Status	Explanation
6	**Issued GOs include the minimum content (Art. 15 (6) 2009/28/EC);** This can be considered fulfilled based on compliance with the following criteria:		
6.1	**Energy source**	fulfilled	
6.2	**Start and end date of production**	fulfilled	
6.3	**Electricity, heating or cooling**	not applicable	
6.4	**Identification number, location, type and capacity of the installation**	fulfilled	
6.5	**Investment support**	fulfilled	
6.6	**Funding by any support scheme**	fulfilled	
6.7	**Date when installation became operational**	fulfilled	
6.8	**Date of issue**	fulfilled	
6.9	**Issuing Country**	fulfilled	
6.10	**Unique Identification number of GO**	fulfilled	

Table 5.6. Implementation of Art. 15 (6) of the directive 2009/28/EC about the minimum content of GO by Greece.

The disclosure of the energy mix is provisioned by the Supply Code, there is no legal provision yet for the methodology of the calculation of the energy mix. RAE, the regulator, has already consulted the methodology with the Market Operator (LAGIE), and intends to include it in the relevant Codes in the coming months but there is delay. At the moment, the supplier mix is calculated by LAGIE according to the actual national production of electricity. The intention is that LAGIE will calculate a Residual Mix that will be used for electricity for which no GOs will be available.

The legislation for the electricity disclosure is Law 3426/2005, article 17 (Official Government Gazette A'309/25-12-2005) and the Supply Regulation, article 13 (Official Government Gazette B'832/9-4-2013).

		Production Mix	Final Residual Mix	Total Supplier Mix
Renewables	Total	**26,96%**	**23,08%**	**24,42%**
	Unspecified	0,00%	0,02%	0,02%
	Solar	8,57%	7,12%	6,99%
	Wind	7,25%	6,17%	6,06%
	Hydro&Marine	10,65%	9,34%	10,92%
	Geothermal	0,00%	0,00%	0,00%
	Biomass	0,50%	0,44%	0,43%
Nuclear		**0,00%**	**3,95%**	**3,88%**
Fossil	Total	**73,04%**	**72,97%**	**71,70%**
	Unspecified	0,00%	0,74%	0,73%
	Lignite	54,70%	51,63%	50,73%
	Hard coal	0,00%	2,68%	2,63%
	Gas	18,34%	17,85%	17,54%
	Oil	0,00%	0,07%	0,07%
CO2 emissions (gCO_2/kWh)		**760,22**	**749,65**	**736,59**

Source: RE-DISS 2015

Table 5.7. Compared composition of national mixes as calculated by RE-DISS for 2014

The disclosure of environmental information is not complete.

Greece, although has been harmonized with the European Renewable Instructions (Official Gazette 646/14.05.2010) and the Implementation of the Energy Guarantees of Origin System RES and CHP (EECS system) and Mechanism of Assurance is simple "Observer" and not "Member" of AIB (an application have done in June 2015), due to software fails to connect to the electronic register (Hub) of AIB, making virtually all Greek Guarantees of Origin from RES and CHP non traded in Europe.

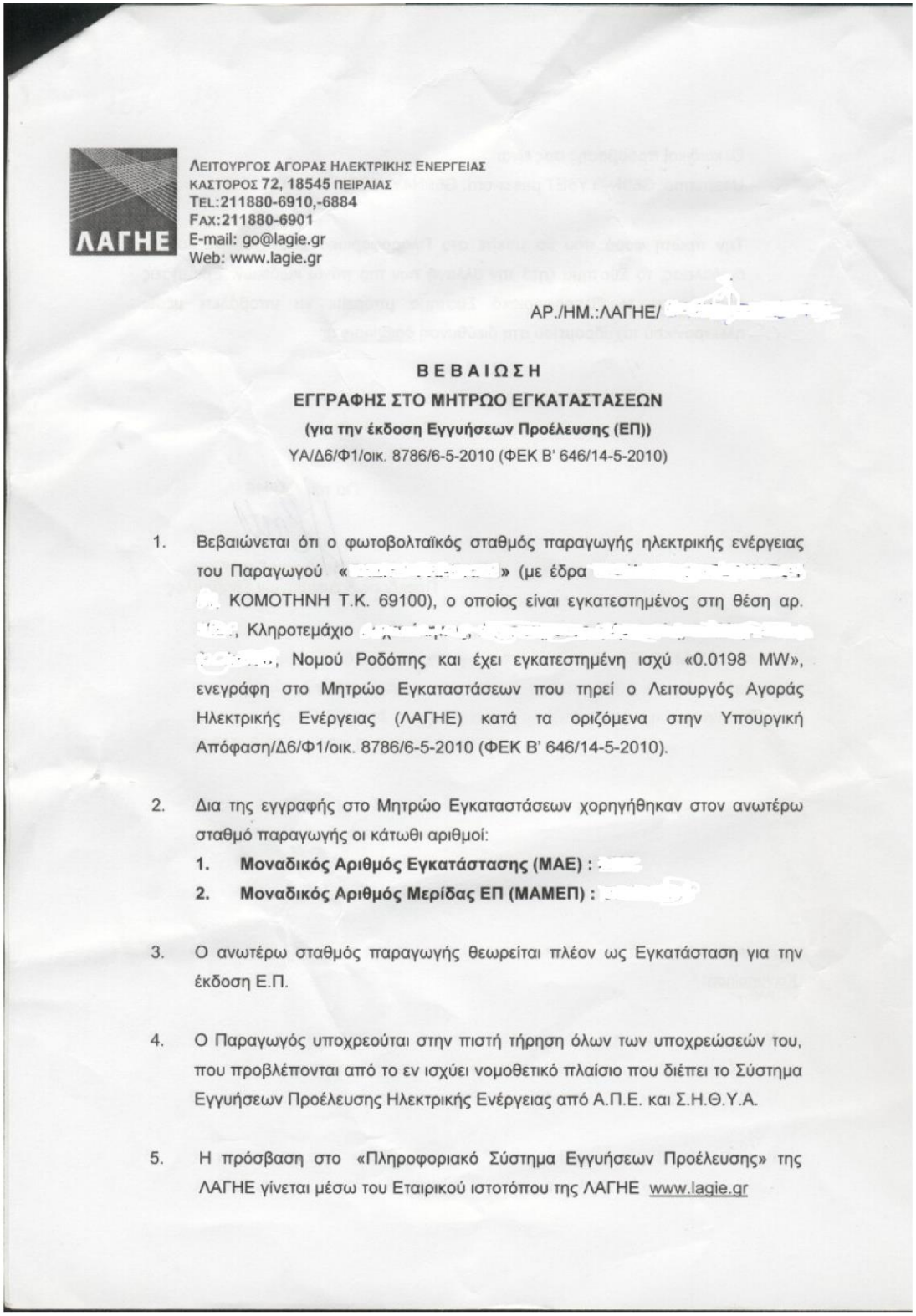
GOs are granted independently from the support scheme.

In Greece there is a supplier of GOs and service provider, LANEL SA, which is member of RECS and EKOENERGY. The activities are limited on Greek GOs from wind and solar energy. The lack of secondary legislation and connection to AIB hub makes the activities of this company very limited.

The author had communications with many companies which are active in GOs transaction and energy exchanges (EcoHz, CertiQ, EEX, Bergen Solutions, Grexel, Ekoenergy, Carbon Neutral) about possible sale of Greek GOs. The response from all of them was that it isn't possible to buy Greek GOs, due to the fact that there isn't connection to AIB hub. Any other ex-domain cancellation is not acceptable.

In contrast, the Turkish energy body, which doesn't follow the EECS-GO standards, offers to the Turkish hoteliers the capability to advertise their customers that electrifies through renewable energy and possibly be able to sell its rooms more easily to European environmental sensitized tourists while we in Greece we follow the EECS-GO standards, not finding utility for Greek Guarantees of Origin from RES,

either domestically but neither in the European market due to lack of interface software.
In figures 5.1 and 5.2 is illustrated the registration certificate of a 19,8 kW PV plant from LAGIE.



ΛΑΓΗΕ

ΛΕΙΤΟΥΡΓΟΣ ΑΓΟΡΑΣ ΗΛΕΚΤΡΙΚΗΣ ΕΝΕΡΓΕΙΑΣ
ΚΑΣΤΟΡΟΣ 72, 18545 ΠΕΙΡΑΙΑΣ
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E-mail: go@lagie.gr
Web: www.lagie.gr

ΑΡ./ΗΜ.:ΛΑΓΗΕ/

ΒΕΒΑΙΩΣΗ
ΕΓΓΡΑΦΗΣ ΣΤΟ ΜΗΤΡΩΟ ΕΓΚΑΤΑΣΤΑΣΕΩΝ
(για την έκδοση Εγγυήσεων Προέλευσης (ΕΠ))
ΥΑ/Δ6/Φ1/οικ. 8786/6-5-2010 (ΦΕΚ Β' 646/14-5-2010)

1. Βεβαιώνεται ότι ο φωτοβολταϊκός σταθμός παραγωγής ηλεκτρικής ενέργειας του Παραγωγού « » (με έδρα ΚΟΜΟΤΗΝΗ Τ.Κ. 69100), ο οποίος είναι εγκατεστημένος στη θέση αρ. , Κληροτεμάχιο , Νομού Ροδόπης και έχει εγκατεστημένη ισχύ «0.0198 MW», ενεγράφη στο Μητρώο Εγκαταστάσεων που τηρεί ο Λειτουργός Αγοράς Ηλεκτρικής Ενέργειας (ΛΑΓΗΕ) κατά τα οριζόμενα στην Υπουργική Απόφαση/Δ6/Φ1/οικ. 8786/6-5-2010 (ΦΕΚ Β' 646/14-5-2010).

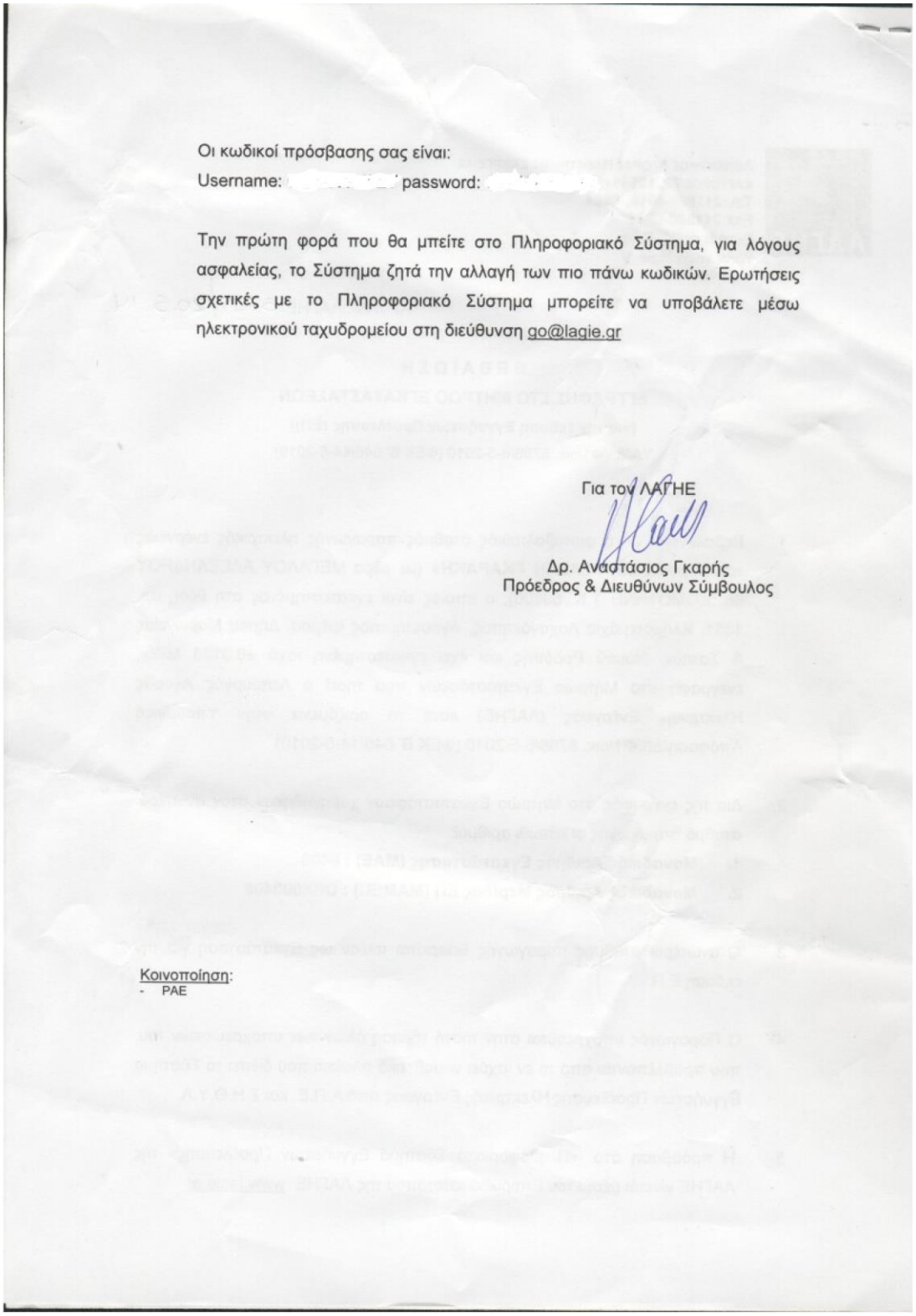
2. Δια της εγγραφής στο Μητρώο Εγκαταστάσεων χορηγήθηκαν στον ανωτέρω σταθμό παραγωγής οι κάτωθι αριθμοί:
   1. **Μοναδικός Αριθμός Εγκατάστασης (ΜΑΕ) :**
   2. **Μοναδικός Αριθμός Μερίδας ΕΠ (ΜΑΜΕΠ) :**

3. Ο ανωτέρω σταθμός παραγωγής θεωρείται πλέον ως Εγκατάσταση για την έκδοση Ε.Π.

4. Ο Παραγωγός υποχρεούται στην πιστή τήρηση όλων των υποχρεώσεών του, που προβλέπονται από το εν ισχύει νομοθετικό πλαίσιο που διέπει το Σύστημα Εγγυήσεων Προέλευσης Ηλεκτρικής Ενέργειας από Α.Π.Ε. και Σ.Η.Θ.Υ.Α.

5. Η πρόσβαση στο «Πληροφοριακό Σύστημα Εγγυήσεων Προέλευσης» της ΛΑΓΗΕ γίνεται μέσω του Εταιρικού ιστοτόπου της ΛΑΓΗΕ www.lagie.gr

Figure 5.1. The first page of a registration certificate of a PV plant in Greek GO system.



Οι κωδικοί πρόσβασης σας είναι:
Username: password:

Την πρώτη φορά που θα μπείτε στο Πληροφοριακό Σύστημα, για λόγους ασφαλείας, το Σύστημα ζητά την αλλαγή των πιο πάνω κωδικών. Ερωτήσεις σχετικές με το Πληροφοριακό Σύστημα μπορείτε να υποβάλετε μέσω ηλεκτρονικού ταχυδρομείου στη διεύθυνση go@lagie.gr

Για τον ΛΑΓΗΕ

Δρ. Αναστάσιος Γκαρής
Πρόεδρος & Διευθύνων Σύμβουλος

Κοινοποίηση:
- ΡΑΕ

Figure 5.2. The second page of a registration certificate of a PV plant in Greek GO system.

5.3. GOs statistics from EMO (LAGIE) - (2010-4) [50]

Operator of Electricity Market (LAGIE) is the Body which issue and manage GOs for the interconnected system. In the website of LAGIE there are statistics about the trading of GOs for the start of GOs implementation in Greece until the end of 2014. The next figures show the evolution of issuance, cancellation of GOs and the shares of RES technologies.

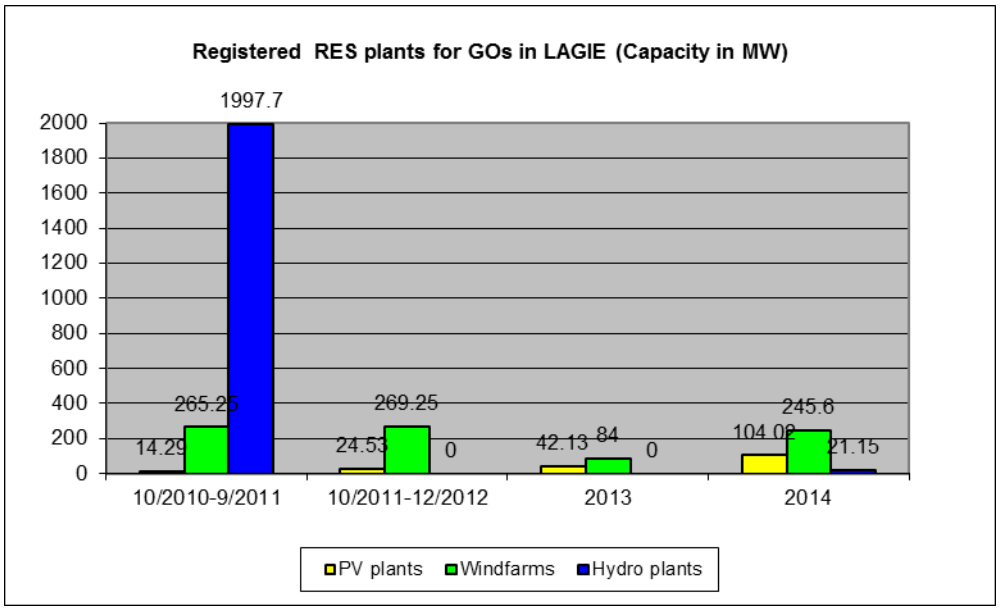


Figure 5.3. The registered RES plants for GOs in LAGIE.

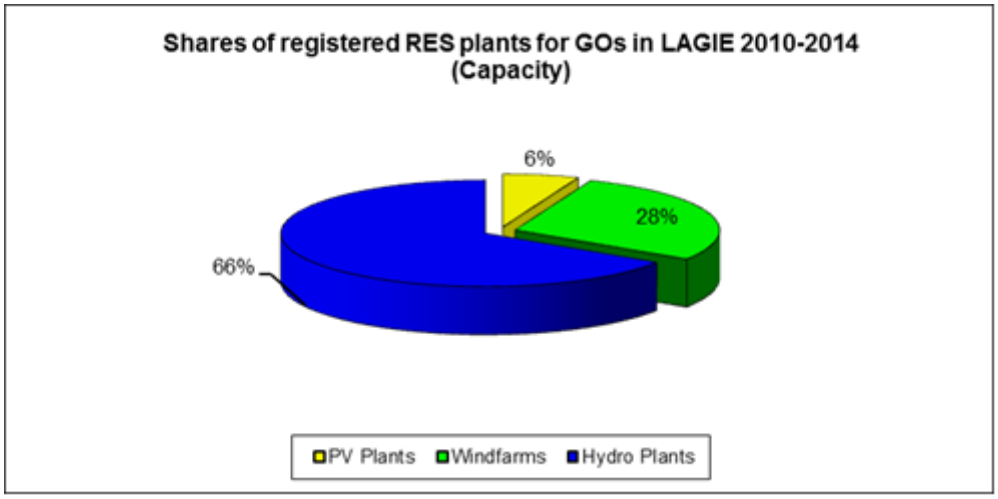


Figure 5.4. The shares of registered RES plants in LAGIE for 2010-4.

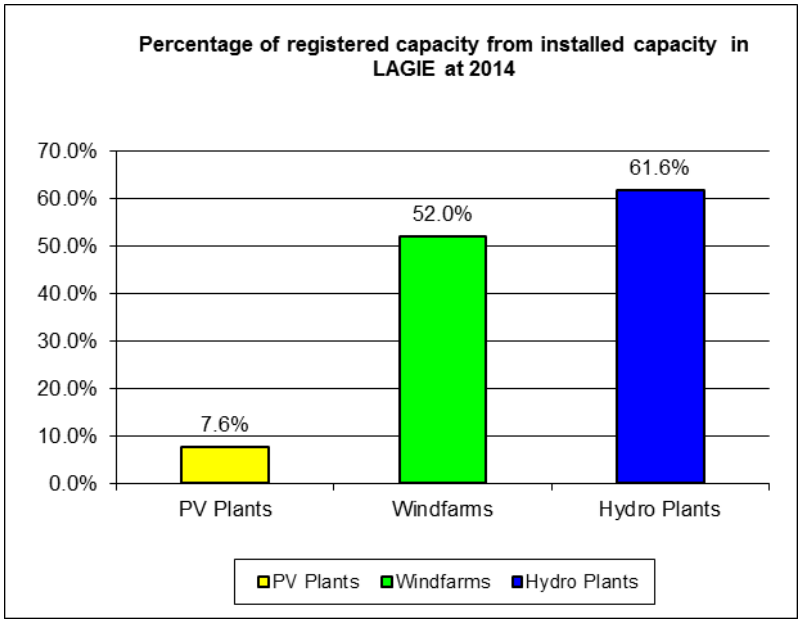


Figure 5.5. The percentage of registered capacity from installed capacity in LAGIE at the end of 2014.

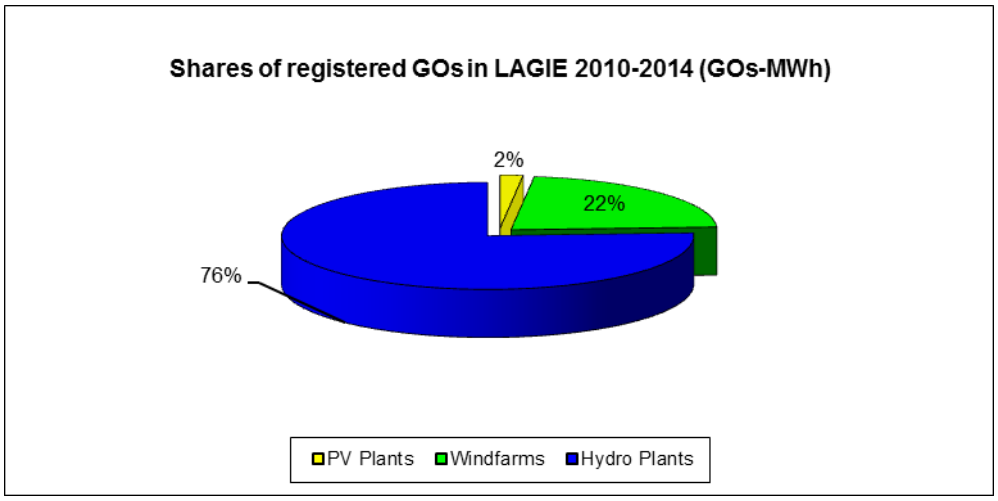


Figure 5.6. The shares of registered GOs in LAGIE (2010-4).

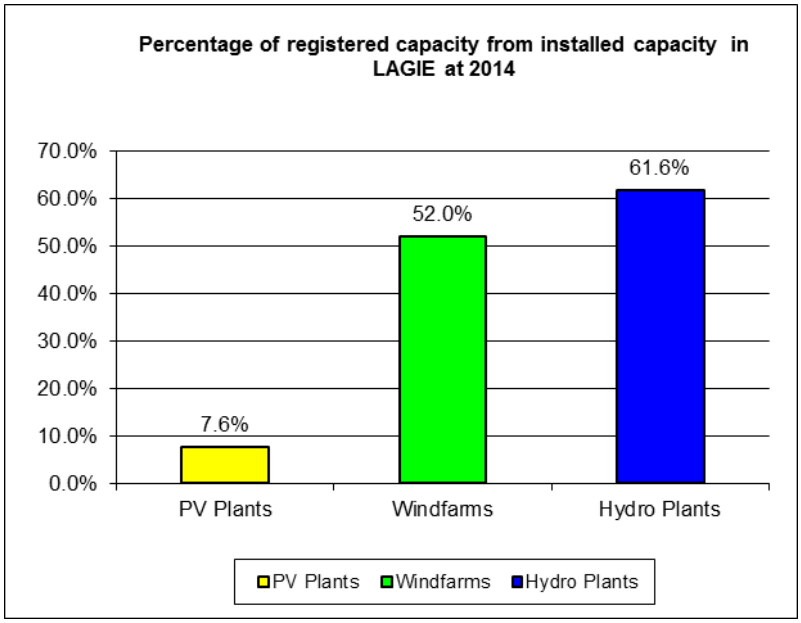


Figure 5.7. The percentage of registered capacity from installed capacity (in the mainland grid) in LAGIE (2010-4).

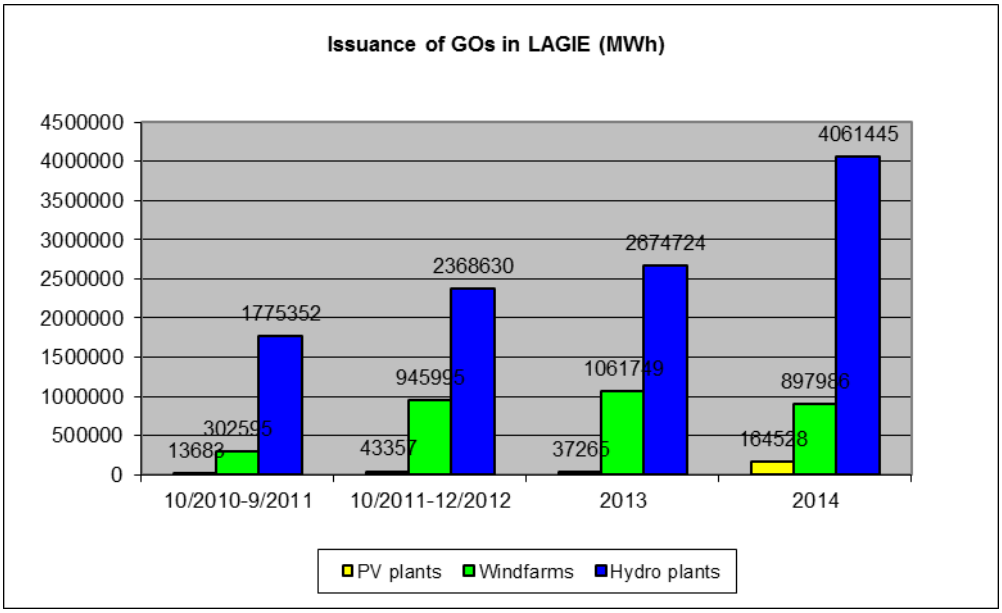


Figure 5.8. The issued GOs in LAGIE (2010-4).

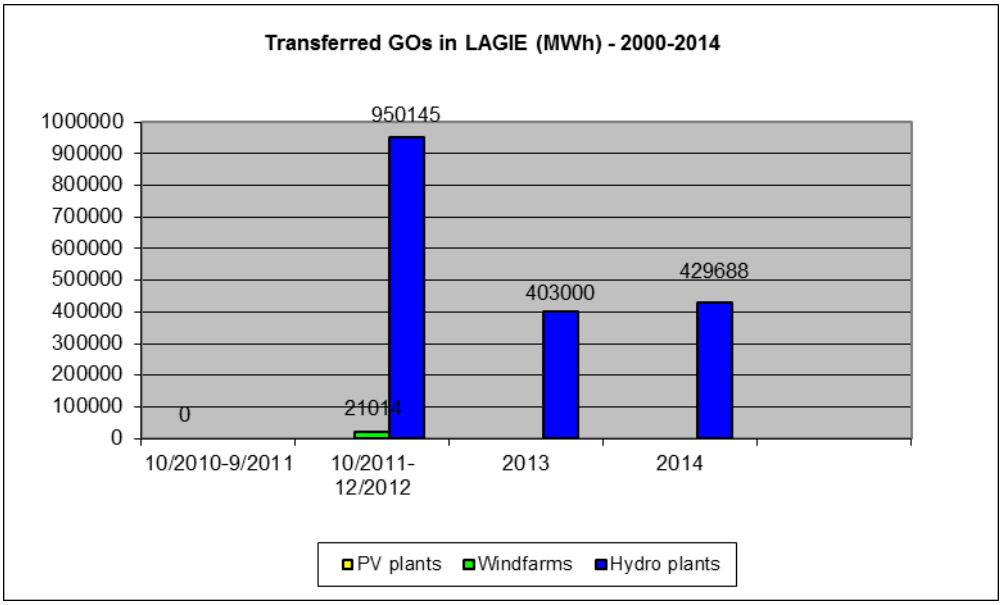


Figure 5.9. The transferred GOs in LAGIE (2010-4).

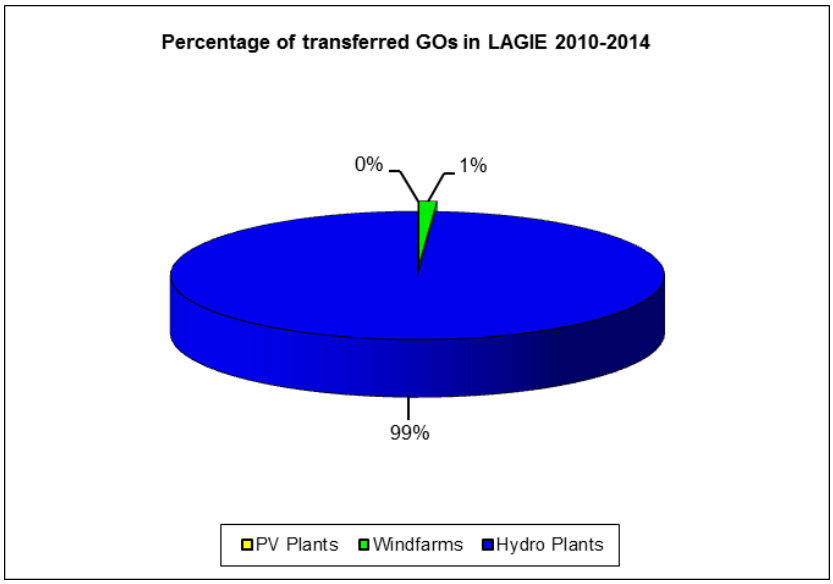


Figure 5.10. The percentage of transferred GOs by energy source in LAGIE (2010-4).

From LAGIE statistics is easy to extract the following conclusions:

i. The great majority (66%) of the registered RES plants in installed capacity has the Hydro plants and especially the Large Hydro Plants of PPC which has been registered in 2010-11. The second place has with 28% wind power projects and 6% the PV plants.

ii. Taking into account the installed capacity in the end of 2014 of the Greek interconnected electrical system, the registered Hydro plants are 62% of the total installed capacity; the registered windfarms are 52% and only 7% PV plants. The percentages of registrations in the GOs system of LAGIE shows that the producers are not familiar with the procedures of GOs and even more

the current status doesn't offer a chance to trade their GOs. The percentages of PV plants are extremely low.

iii. The transfers of GOs refer in vast majority at Hydro Plants (Large Hydro plants) and only one percent in windfarms. The last four years OTE and COSMOTE secure by PPC as electricity supplier, GOs Guarantees certify that all the electrical consumption of OTE and COSMOTE's, equal energy produced from RES by PPC. There is any transfer in GOs from PV plants.

5.4. GOs statistics from HEDNO (DEDDIE) [51]

Hellenic Electricity Distribution Network Operator (DEDDIE) is the Body which issue and manage GOs for the non-interconnected system. After a communication with the responsible of GO system, I have received are statistics about the trading of GOs for the start of GOs implementation in Greece until the end of 2014. The next figures show the evolution of issuance, cancellation of GOs and the shares of RES technologies for the non-interconnected electric system.

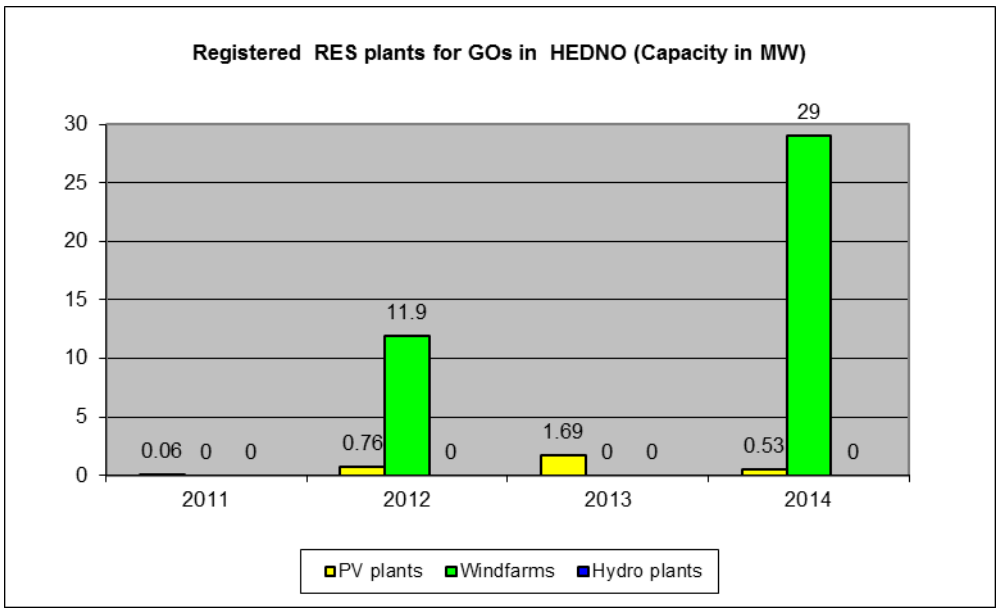


Figure 5.11. The registered RES plants for GOs in HEDNO.

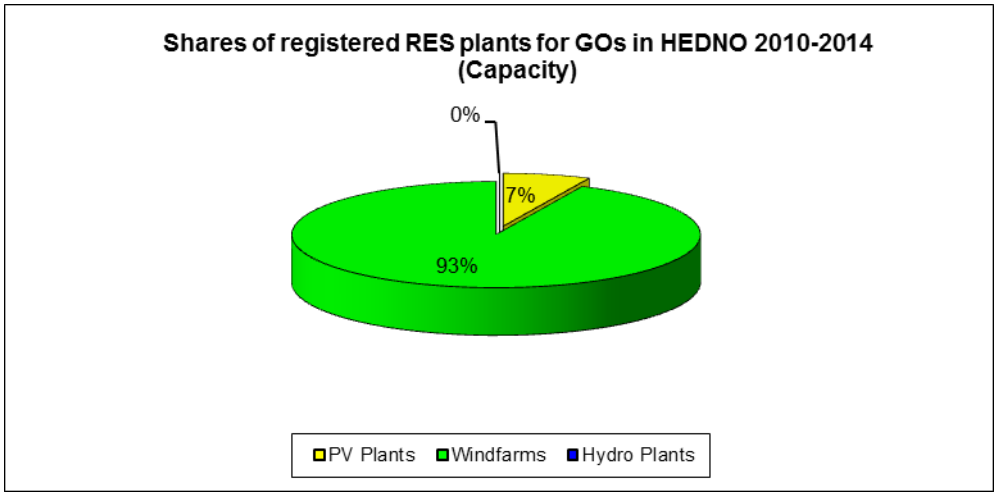


Figure 5.12. The shares of registered RES plants in LAGIE for 2010-4.

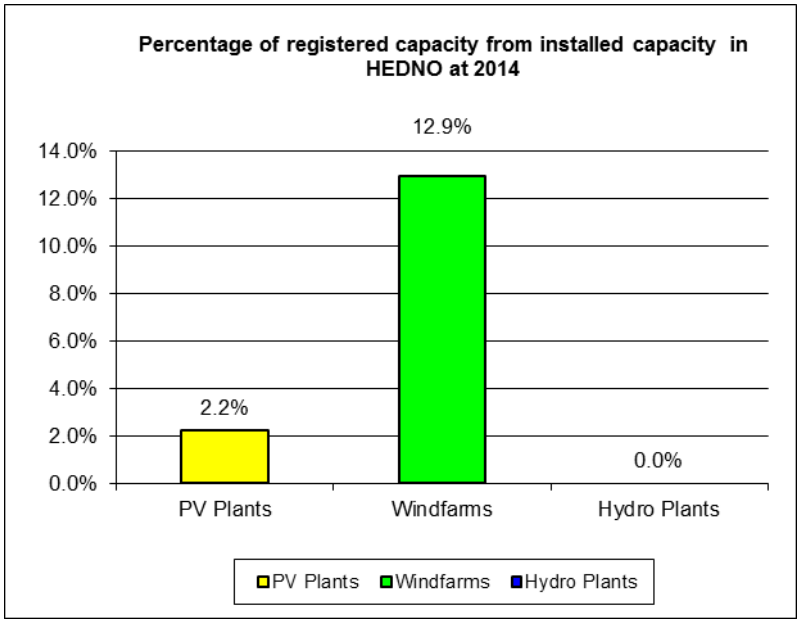


Figure 5.13. The percentage of registered capacity from installed capacity in HEDNO at the end of 2014.

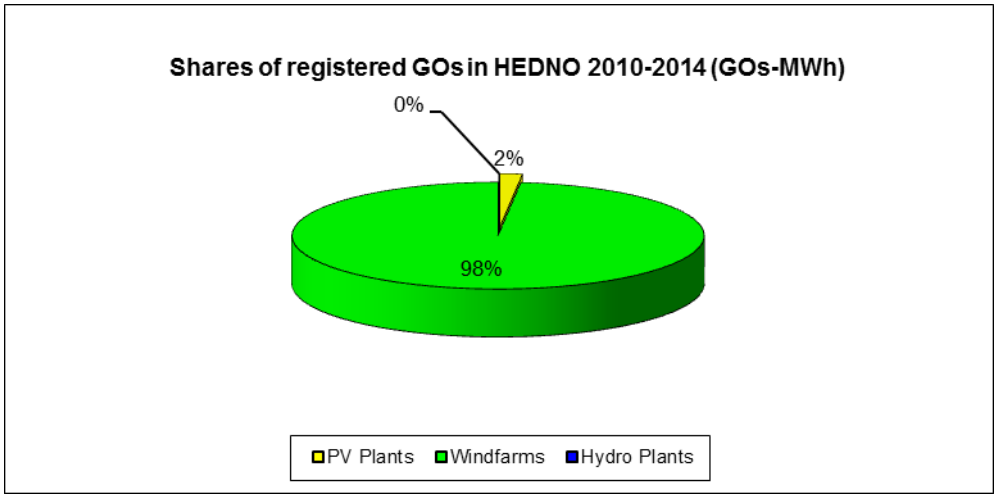


Figure 5.14. The shares of registered GOs in HEDNO (2010-4).

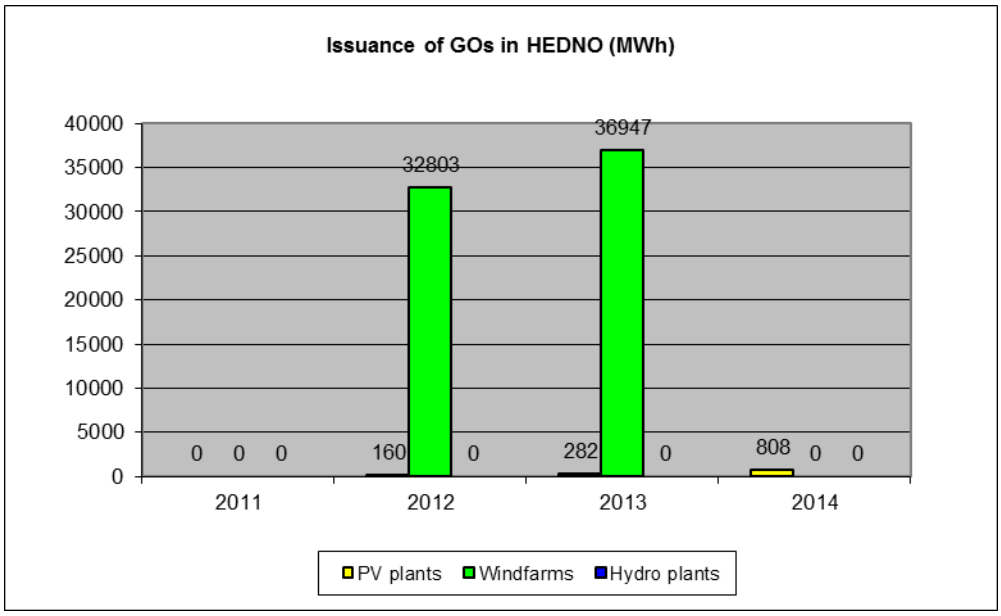


Figure 5.15. The issued GOs in HEDNO (2010-4).

From HEDNO statistics we extract the following conclusions:

i. The great majority (93%) of the registered RES plants in installed capacity has the windfarms. The second place has 7% PV plants.

ii. Taking into account the installed capacity in the end of 2014 of the Greek non-interconnected electric system, the registered windfarms are 13% of the total installed capacity; and only 2% PV plants. The percentages of registrations in the GOs system of HEDNO shows that the producers are not familiar with the procedures of GOs and even more the current status doesn't offer a chance to trade their GOs. The percentages of PV plants are extremely low.

iii. There are no transfers of GOs in non-interconnected system.

5.5. GOs data from CRES

After communication with the responsible for GOs system of CRES, referred that there isn't any activity in autonomous plants and this market remains frozen.

5.6. Total GOs statistics in Greece

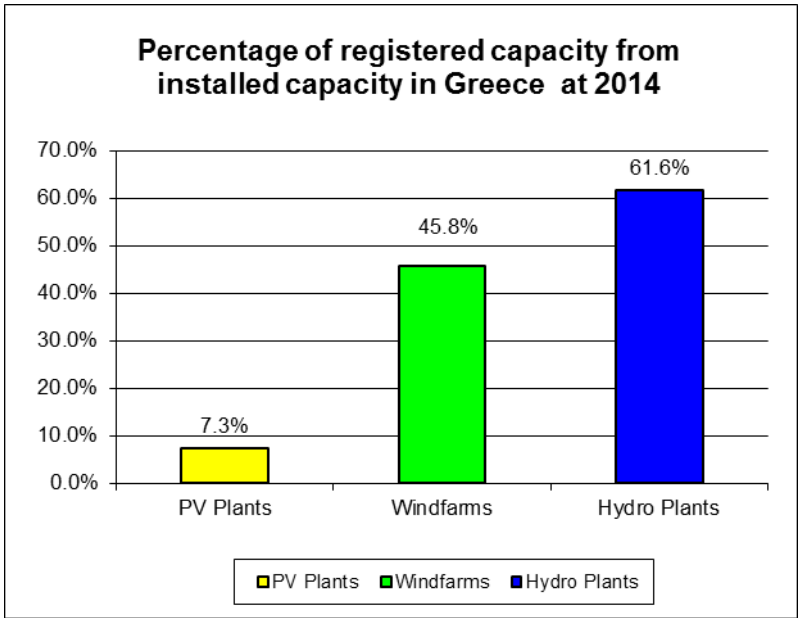


Figure 5.16. The percentage of registered capacity from installed capacity in Greece at the end of 2014.

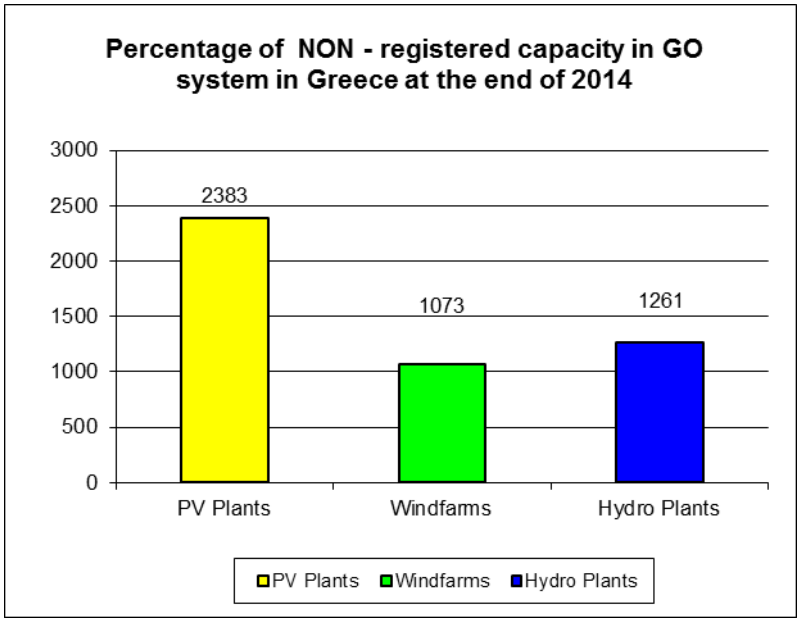


Figure 5.17. The non- registered capacity in GO system in Greece at the end of 2014.

Having as basis the data from LAGIE (EMO) and DEDDIE (HEDNO), it is clear the low percentages of registered capacity (especially in PV plants) and the enormous capability of the Greek RES Market to contribute in this green mechanism.

5.7. The economic view of the Greek GOs market

Taking into account the official data of the produced energy from windfarms, PV plants and hydro plants [52] for the year 2014 and the assumption of prices of GOs (April 2014 – figure 4.19) we have the following results:

- Windfarms
  Installed capacity: 1.987 MW
  Energy production: 3.689.000 MWh or GOs
  Estimated price from EEX 0,35 Euro/MWh (or GO)
  Total estimated revenue: 3.689.000 x 0,35 = 1.291.150 Euro
- PV plants
  Installed capacity: 2.596 MW
  Energy production: 3.829.000 MWh or GOs
  Estimated price from EEX 0,35 Euro/MWh (or GO)
  Total estimated revenue: 3.829.000 x 0,35 = 1.340.150 Euro
- Hydro plants
  Installed capacity: 3.173 MW
  Energy production: 2.361.021 MWh or GOs
  Estimated price from EEX 0,80 Euro/MWh (or GO)
  Total estimated revenue: 2.361.021 x 0,80 = 1.888.817 Euro

So, the total estimated revenue from the possible sell of GOs in EEX is 4,52 million Euros per year.

5.8. The GOs transfers to OTE/COSMOTE - Case study in Greece [53]

Every year OTE/COSMOTE publish a Sustainability Report which covers a period of the previous year, the operations and activity in Greece of OTE S.A. and COSMOTE S.A. This approach represents a continuation and integration of the scope and boundary approach used in the CR reports of previous years by OTE and COSMOTE and at the same time the initiation of a process of providing gradually more information on the full OTE Group approach to sustainability.

The content of the Report is defined according to the following principles, guidelines and directives:

- The Global Reporting Initiative's Sustainability Reporting Guidelines (GRI G3.1).

- The Account Ability AA1000 Principles on Inclusivity, Materiality and Responsiveness.

- The United Nation's Global Compact Principles.

About the third one from the above mentioned, OTE and COSMOTE support the UN Global Compact, the largest voluntary corporate citizenship initiative in the world, and abide by its ten universal values in the areas of human rights, labor standards, the environment and anti-corruption.

The last Sustainability Report of OTE and COSMOTE (year 2014) includes a detailed presentation of the Companies' priorities, activities, goals and outcomes, structured in a four pillar approach, concerning the employees, the market, the environment, and the society.

Figure 5.18 shows the structure of UN Global Compact Principle: Environment.

Issue	Principle	Report Location	Coverage Level
Environment			
	7. Support a precautionary approach to environmental challenges	Environmental Policy Greenhouse Gases and Other Gas Emissions Improving Energy Efficiency and Emissions Reduction Resource Use and Waste Management Electromagnetic Fields Other Environmental Aspects	Full
	8. Undertake initiatives to promote greater environmental responsibility	Environmental Strategy Telecommunications for the Environment Greenhouse Gases and Other Gas Emissions Improving Energy Efficiency and Emissions Reduction Resource Use and Waste Management Environmental Awareness Initiatives	Full
	9. Encourage development and diffusion of environmentally friendly technologies	Responsible Products and Services Telecommunications for the Environment Improving Energy Efficiency and Emissions Reduction	Full

Figure 5.18. The structure of the Environmental Strategy [53].

OTE and COSMOTE implement a comprehensive program for inventorying greenhouse gases (GHG) and other gas emissions on the basis of the principles and methods described in the GHG Protocol developed by the World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI).

In the issue of the indirect GHG Emissions from energy, OTE and COSMOTE indirect GHG emissions from energy (scope 2 emissions due to electricity consumption and district heating) for 2014 were estimated at 280,980 t CO_2 eq (OTE: 172,723 t CO_2 eq, COSMOTE: 108,257 t CO_2 eq), presenting a decrease of 4,8% compared to 2013. The majority of OTE and COSMOTE scope 2 GHG emissions are attributed to the operation of the fixed and mobile telecom network (about 86% of total emissions). To cover scope 2 emissions due to electricity consumption, OTE and

COSMOTE have secured Guarantees of renewable Origin (GOs) which when taken into account reduce the effective scope 2 GHG emissions to about 57,700 t CO_2 eq.

In total, if GOs are not taken into account, OTE and COSMOTE scope 2 emissions decreased by 6,3% from 2008 (OTE: – 9,3%, COSMOTE: 1,0%). Changes in scope 2 GHG emissions depend on changes in electricity consumption but also reflect changes of the fuel mix used for electricity generation in Greece.

OTE and COSMOTE have secured from PPC S.A., their electricity provider for 2014, Guarantees of Origin (GOs), assuring that for the total electricity consumption of OTE and COSMOTE, from PPC S.A., an equivalent amount of energy has been produced from Renewable Energy Sources.

PPC cancelled GOs from LAGIE system.

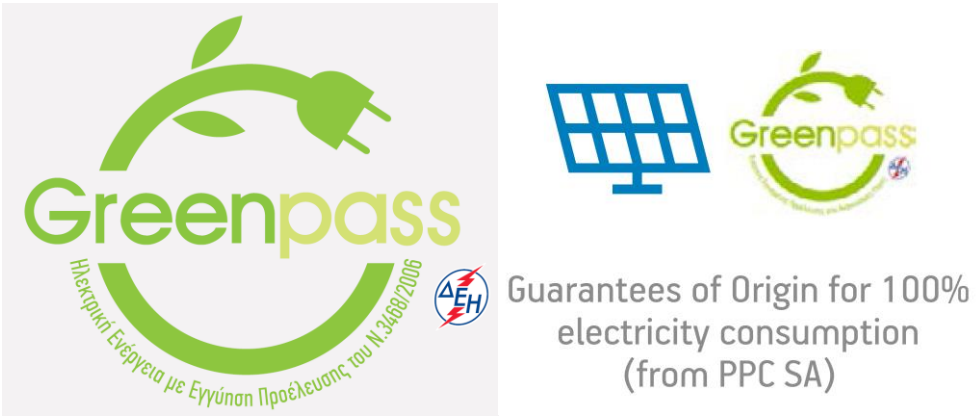


Figure 5.19. Informative material from Sustainability Report of OTE/COSMOTE about the use of GOs.

CHAPTER 6 - The future of GOs

6.1. General

National rules and regulations on GOs differ considerably though they are all based on same European Directives. AIB and RE-DISS have played an important role in harmonizing over Europe, but there is still work to be done e.g. regarding the acceptance of foreign GOs, the connection to AIB-hub, the problematic situation in some countries etc.

Trust in GOs tends to be low as tools for power disclosure and transparency improvement to end customers; frequently considered as being tools for green-washing. The credibility of GOs could be strengthened by more closely matching energy generation by expanding to all generation types and thus making a universal tool for disclosure.

Figure 6.1. The future is green. GOs will be a reliable tool for the sustainable electricity market?

6.2. Proposals regarding GOs

- The implementation of GO in all countries in Europe should be based on the European Energy Certificate System (EECS) operated by the Association of Issuing Bodies (AIB). In case those national GO systems are established outside of EECS, then EECS should at least be used for transfers between registries.

- Reliable linkages should be established with countries which are not EECS members. So-called ex-domain cancellations of GO, where a GO is cancelled in one registry and a proof of cancellation is then transferred to another country in order to be used there for disclosure purposes, should only be used if there is no possibility for a secure electronic transfer and if there is an agreement on such ex-domain cancellations between the competent bodies

involved. Statistical information on all ex-domain cancellations should be made available in order to support Residual Mix calculations.

- Competent bodies should press to making the use of GOs mandatory for all electricity supplied to final consumers.

- Green power quality labels should use GO as the unique tracking mechanism. GOs as a mandatory tracking tool should also be obligatory for labels in order to strengthen transparency in the Green Power Market.

In summary, AIB [54] suggests for the forthcoming RES Directive for 2030, the following:

- Disclosing the source of all consumed electricity to consumers by GOs, regardless of the energy source and the technology employed, and according to a set of common rules.
- Using GOs as a way of providing to consumers evidence of the carbon emissions associated with the production of the electricity they consume
- Setting out GOs and Electricity Disclosure in a single Directive, because GOs and Electricity Disclosure are essentially components of the same mechanism. The main aims of these proposals are to: create a level playing field for renewable, nuclear and fossil power, empower consumers to affect the carbon content of their electricity consumption, and to foster GO market development by harmonising national rules.
- As the current purpose of GOs is consumer empowerment and information, that is what the Reflection Paper addresses. Consideration of RES support schemes and targets is a wholly different topic, and should therefore be addressed separately.

6.2.1. Proposals about Greece

There is a consultation between RAE and LAGIE (EMO), probably with DEDDIE (HEDNO) and CRES about the future of Greek GOs and the full activation of their use. Unfortunately from the spring of 2015 RAE doesn't give in public consultation the draft documentation and was not possible to have access to the documentation between the above mentioned Authorities.

It is valuable that LAGIE make an application to AIB on July of 2015 to be recognized as a "Member". There is any news until the start of January 2016.

The market of GOs is Greece is hopelessly frozen and an evolution will be possible if in a short time the chain of parts of Power Public Corporation (PPC), companies HEDNO (DEDDIE), Independent Power Transmission Operator (IPTO or ADMIE) will be completely independent (ownership unbundling scheme). The independence and transparency of EMO (LAGIE) and Regulatory Authority for Energy (RAE) will be enhanced. The entry of private investors with experience in the activities of electric transmission, distribution will help to the start of a motivation about the issues of the green transition, the confrontation of climate change and the energy security.

The involved Greek Bodies (RAE, LAGIE, DEDDHE, CRES) should manage Greek Guarantees of Origin and the electronic interface with the AIB Body, but not

shortsighted because currently there isn't almost no demand for the issuance and cancellation of guarantees of origin, but understanding the future value of the Greek Guarantee of Origin in wider energy context of the European objectives prescribed 2020 and future returns of carbon footprint and emissions.

It is proposed to have an exclusive body and only one (e.g., LAGIE) the issuance and transfer of all the Greek Guarantee of Origin. Also, RAE would make the necessary actions so to set the functionality of the GOs system so the Greek energy producer to have motivation to continue the investments in green energy.

It is suggested that GOs will be granted independently from the support scheme, having or not FiT due to the fact that the tracking of electricity generation attributes is separate from the physical energy flow and the electricity market (Trade in electricity). The oldest power plants before the support mechanisms (FiT, Quota schemes) or subsidies have granted by the State, owned to the State monopoly company. Thus there is any value to not grant GOs projects that take FiT financial support or subsidy.

CHAPTER 7 - Summary and conclusions

7.1. Summary

The GO system makes it possible for electricity customers to specifically demand renewable electricity. However, as the price for a GO is marginal when compared to the other income, and too uncertain, the GO market has currently very low, or no, impact on investor decisions [2]. It should be emphasized that if the GO demand and prices increase and customers are willing to make long-term commitments to purchase GOs, the GO system may, in the future, influence the decisions of renewable energy investors.

Voluntarily purchased renewable electricity products like GOs have an impact on the environmental footprint of products, services and companies and thus may create a great increase in the demand of renewable electricity by end-customers.

A GO is a means of proving the origin of electricity, regulated by the Renewable Energy Directive. It represents a tracking system, thus providing a contractual obligation between a supplier and a customer related to the origin of a specific electricity volume produced from a specific generation plant.

Electricity Disclosure requires all suppliers of electricity to disclose their electricity portfolio with regard to energy source and environmental impact, specifying the emissions of CO_2 and the production of radioactive waste. It aims at increasing the market transparency, complying with the consumers' right to information about purchased products, enabling consumers to make informed choices, educating consumers and stimulating electricity production contributing to a secure and a greener electricity system.

It will be a priority to inform end consumers thoroughly about the assets and merits of GOs. Any additional details and information provided should be critically evaluated as to whether it provides additional value to the consumer. Already today, it is difficult to communicate to end consumers that GOs need to be distinguished from renewable energy produced under national support schemes. The Electricity Disclosure and GO systems are based on the principle of distinguishing the physical electricity from the related environmental attributes. This makes it possible to allocate the environmental value of renewable electricity generation to the customers who are willing to pay for it. Other customers must disclose the corresponding Residual Mix.

GOs as the only tool with clear and reliable standards should be the basis for all disclosure systems and should be used Europe-wide. This approach also increases the liquidity of the GO market, thereby making a significant contribution to the transparency of the origin of electricity throughout Europe.

Having a reliable and transparent standardization with the European Energy Certificate System (EECS), end electricity customers are empowered to make an informed choice of guaranteed electricity from RES. Through GOs electricity customers choose contracts which guarantees green electricity and give a strong and clear signal to the market via their supplier. Thus, the electricity suppliers pass this

signal to electricity producers, so influencing future investments and pushing for more green electricity.

GOs can help create a green consumer market for electricity but high levels of trust/reliability in the system are needed if it is to be effective and valued.

7.2. Conclusions

The GO system gives consumers the possibility of demanding a specified electricity generation technology. This shows that the GO system may represent an "environmental liberalisation" of the electricity market's relationship with customers, moving from "fixed" average grid mixes (based on the actual geographical electricity production facilities as well as physical import and export of electricity) to specific electricity mixes based on customers demand and choices. As consumers become more aware of sustainability and environmental issues, companies who would like to be front-runners with regard to environmental issues need to be more innovative to stand out from the competition (Bloomberg New Energy Finance, Vestas Wind Systems A/S, COSMOTE).

Issuing GOs should be mandatory for all power production in the European Union, thus including all renewable energy sources, regardless of whether they are covered by renewables support schemes. In Germany, only the amount of renewable energy production may receive GOs that does not receive any support at all. As a result, only a very small share of Germany's renewable energy production may be issued GOs. The remainder cannot be marketed as green power. The aim of this approach is to avoid that the green quality is marketed twice and support received twice. As a result, it is difficult for German end consumers to understand that they can hardly get German Green Power while a very large number of renewable power plants have been built This situation clearly demonstrates the importance of making the issuance of GOs mandatory for all electricity produced from renewable energy sources. EPEX SPOT, a joint venture between EEX and Paris-based Powernext, has presented a model showing how the revenues generated by marketing GOs can be used to reduce the levy paid by electricity customers in Germany to support the production of energy from RES.

Moreover, GOs have important effects on renewable electricity generation. GOs is mechanism giving customers the opportunity of selecting electricity based on environmental requirements, which means that the systems create a mechanism for a customer driven demand for renewable electricity. There is an existing and increasing market with the willingness to pay more for renewable electricity (by purchasing GOs), thus generating extra income for the energy companies. Also, GOs is in phase of liberalised market where there is interaction between supply and demand.

The issuing of GOs should be extended to all sources of electricity to make the basis for the disclosure system more consistent and reliable, but also to provide opportunities for market offers for electricity based upon specific non-renewable sources in a trustworthy manner. The extended use of GOs for all energy sources as the only tracking tool for power. Reliability and comprehensibility of the system would be strengthened by such a step as the residual mix would no longer have to be calculated. Such a system should be mandatory in order to maximize its efficiency

through avoiding the emergence of parallel systems. As the disclosure system is already legally required, the extended use of GOs is a logical step towards making the best use of it.

GOs should be issued for energy produced with and without the support of RES support schemes. Once this aim has been achieved, no more distinction is required when disclosing information on the origins of electricity to consumers. GOs should be used as a tracking tool for the whole European energy production. As a means to avoid over- or double support, adequate measures should be taken, e.g. by reducing support by the revenues gained by marketing GOs.

The integration of European electricity market should be accompanied by the development of a European GO-market. This market could first be developed for RES-GOs and later extended to other kinds of GOs. Trading participants have the possibility to trade three different European GO-products up to three years before delivery. It is our aim to establish a European market for GOs. Already today, GO-trading companies as well as GO-producers and utilities using GOs are spread all over Europe. However, market development is hindered by differing national regulations on GOs. The final aim will be the developing a European market for GOs accompanying the European electricity market, in order to pave way for the Energy Union.

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Annex 1