Energy Certificate Systems

Introduction – What are Energy Certificates?

Electricity flows to our houses and businesses from a mix of sources: from all the power stations that are connected to our power system. Hence, in the physical sense, the origin of the energy that lights up our living rooms is always a mix of sources. Energy certificates introduce an efficient and reliable tracking mechanism for the energy origin of electricity.

Practically all highly developed electricity markets make use of energy certification in some form, most commonly for renewable energy. An Energy certificate contains information of the *generation attributes* (such as the energy source, capacity and age of the plant) of the electricity production to which it relates.

The basic functioning of energy certificate systems can be divided into three steps: 1. Producers are issued electronic certificates for units (typically MWh) on electricity they inject into the grid. 2. They can then sell these certificates separately from the selling of electricity. 3. The value of the certificates is derived from their end-use, which is either to comply with a set green quota and/or to prove that sold or consumed energy originates from the source identified in the certificate.
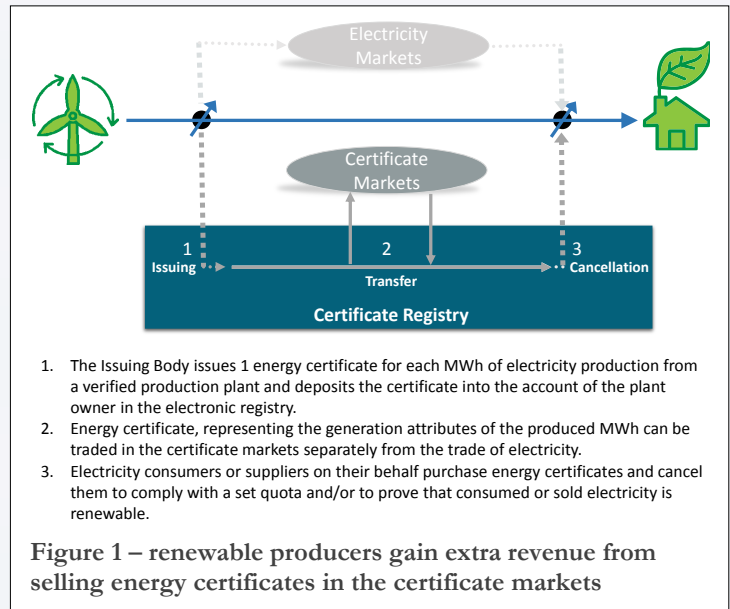

1. The Issuing Body issues 1 energy certificate for each MWh of electricity production from a verified production plant and deposits the certificate into the account of the plant owner in the electronic registry.
2. Energy certificate, representing the generation attributes of the produced MWh can be 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 1 – renewable producers gain extra revenue from selling energy certificates in the certificate markets

Two Types of Certificates - Quota and Tracking

In a quota system (such as Renewable Portfolio Standard (RPS) or Renewable Purchase Obligation (RPO)) an obligation to buy energy certificates is imposed on a suitable party such as electricity suppliers and large electricity consumers. The quota obligation is set as a percentage of total electricity sales/consumption, and non-compliance with the quota leads to a financial penalty, which is set higher than the market price of the certificates.

The certificates are commonly named Green Certificates, but also Renewable Energy Certificates/Credits (RECs), elcertificates or Renewable Obligation Certificates (ROCs).

In some systems the quota is set for producers of electricity from conventional sources.

P_E = Price of electricity
P_C = Price of Green Certificate (GC)
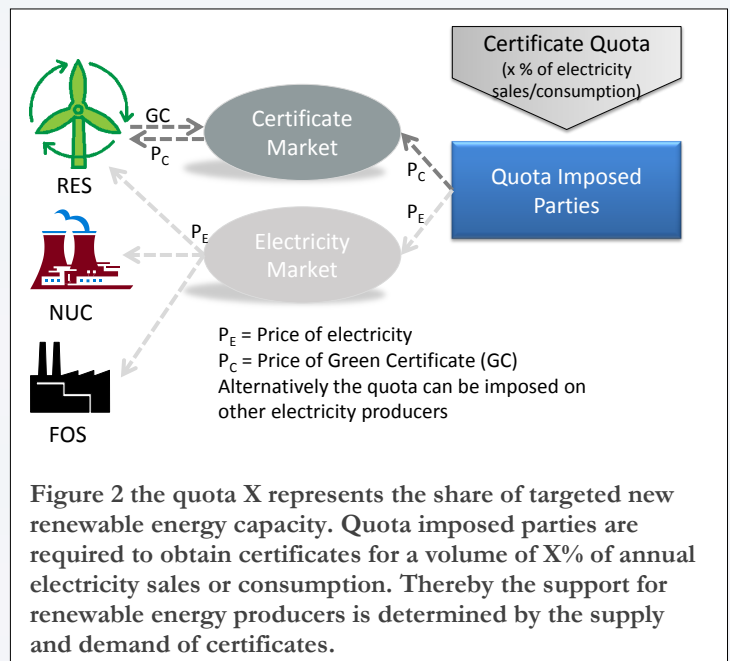Alternatively the quota can be imposed on other electricity producers

Figure 2 the quota X represents the share of targeted new renewable energy capacity. Quota imposed parties are required to obtain certificates for a volume of X% of annual electricity sales or consumption. Thereby the support for renewable energy producers is determined by the supply and demand of certificates.

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Tracking certificates, such as Guarantees of Origin (GOs) in the EU and Renewable Energy Credits (RECs) in the US, are used (cancelled/redeemed) by consumers or electricity suppliers on their behalf to guarantee the energy source of consumed or sold electricity.

Private consumers purchase certified electricity from suppliers to express environmental values, whereas large consumers use it to "green" their energy mix for e.g. labeling, adding value to secondary products, meeting environmental standards, carbon accounting, altruism etc…

Electricity, which is not tracked with tracking certificates, constitutes the residual mix and is disclosed to customers not buying certified electricity from a specific energy source. This is crucial for the reliability of the tracking system

The key difference between quota and tracking system is that in the former the purchase of certificates is based on obligation whereas in the latter on a voluntary choice.
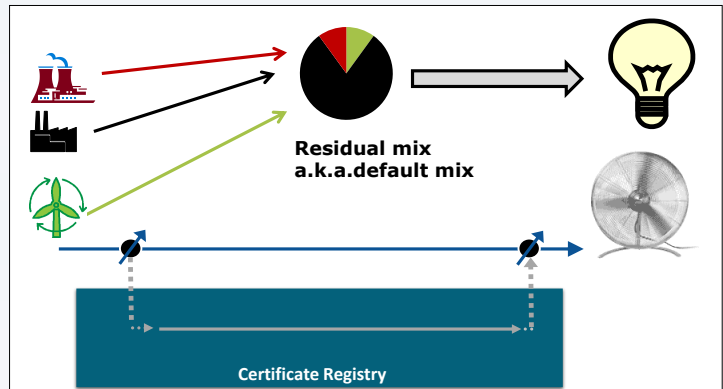

Figure 3 – Tracking certificates have the sole purpose of providing proof about the energy source of electricity to the end-consumer. Since part of electricity is explicitly tracked, a residual mix is required to determine the origin of untracked electricity, which is usually darker than the whole production mix. Residual mix is only affected by tracking certificates.

Hybrid System

Despite the difference, hybrid systems exist. This means a single certificate is usable for both quota and tracking. In the US, for example, the two systems are bundled so that a REC certificate can be used for both, complying with quota and for claims regarding the origin of electricity.

A separated approach (multi-certificate system) is taken by Sweden and Norway, where two certificates are issued for each MWh of production for different purposes: an elcertificate, for quota, and a Guarantee of Origin, for tracking. A quota imposed party can't use the guarantee of origin to fulfill its quota, nor can it use the elcertificate to make claims for the energy source.

Energy Certification Process

The mandated national competent body, which is often the Transmission System Operator (TSO) or Energy Market Agency of the country, is the responsible party for the energy certification process. Certificates are issued, traded and cancelled in accounts residing in central registries, of which usually one exists per country.

Market participants are required to open an account in the central registry in order to register production devices, own certificates and perform transactions. Owning and trading certificates is generally not restricted, but usually only companies acting in the electricity wholesale market apply to open an account.
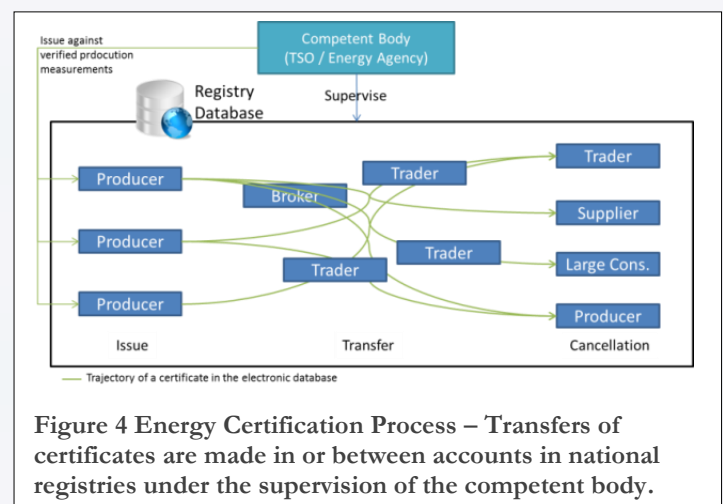

Figure 4 Energy Certification Process – Transfers of certificates are made in or between accounts in national registries under the supervision of the competent body.

Certificates are issued in the nominated account against verified meter readings of registered production devices, e.g. deriving from imbalance settlement calculation of the TSO. After the certificates are issued, account holders can execute transactions on certificates. Typically the first transaction is a transfer, in which the ownership of the certificate is transferred to another account holder. In practice transfers are made in electronic registries over the internet using a standard web browser in similar manner to making payments using internet banking.

The final user of the certificate uses (cancel/redeem) it for one or both of the purposes previously described, depending on the type of the certificate (quota, tracking or hybrid).

Energy Certificate Markets

National Quota Certificate Markets

Quota certificate schemes are used for renewable energy support in e.g. Belgium, Great Britain (ROC), India (REC), Italy (Certificati Verdi), Romania, as well as in Norway and in Sweden (Elcertificates). The systems can be compared to the EU Emission Trading System (ETS) with the exception that they are national (besides Elcertificates) and promote the positive instead of capping the negative (CO_2).

The trading volume of the Swedish-Norwegian elcertificate market in 2012 was 46.5 Million certificates and these were traded at an average price of EUR 23.44€ (currency rate of 3.1.2013).

The Renewable Obligation Certificate ROC-scheme has been running in Great Britain since 2002. For the compliance period 1.4.2010-31.3.2011, 25 million ROCs were cancelled. The value of a ROC was estimated at £51.34 based on the penalty fee and remuneration.

European EECS-GO Market

As the primary mechanism for electricity tracking, all EU members are required to implement a Guarantee of Origin system based on electronic certificates and to recognize GOs issued by other Member States.

There are currently 16 member countries in the European Energy Certificate System (EECS), which introduces a standardized format for guarantees of origin. The market has grown rapidly during recent years (CAGR 31% of transfers during 2007- 2012).
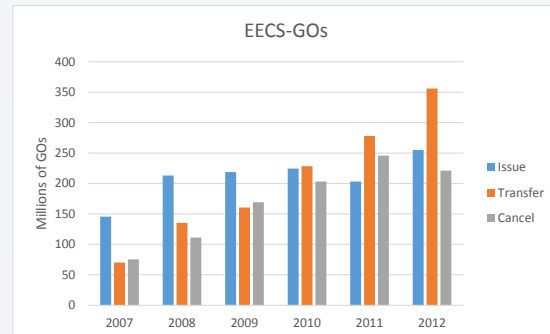

Figure 5 – Transactions of EECS certificates (Millions) during 2007 – 2012

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