

Tradable Green Certificates in selected European countries—overview and assessment

Lene Nielsen^a, Tim Jeppesen^{b,*}

^a *University of Southern Denmark, Department of Economics, Campusvej 55, DK-5230 Odense M, Denmark*

^b *Kommunernes Revision, Østre Stationsvej 43, Postbox 309, 5100, DK-5000 Odense C, Denmark*

Abstract

Tradable Green Certificates (TGCs) is a new market-based, cost-efficient instrument to regulate the deployment of renewable energy. A European system of TGCs is currently being considered by the European Commission. However, a number of EU countries are either already in the process of designing a system of TGCs or are considering the use of TGCs. Consequently, a European system of TGCs may evolve as a harmonisation of different national systems. We show that due to different political priorities, national systems of TGCs differ on four crucial points. If these points are not harmonised prior to the establishment of a European TGC system, efficiency is unlikely to be obtained. Potential obstacles to the harmonisation of a TGC market will be identified and analysed. Finally, the paper examines the relation between EU's state aid policies and a system of TGCs.

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1. Introduction

It has become increasingly clear that the use of renewable energy (RE) must be an essential part of sustainable energy generation and thus sustainable development. In the EU, 95% of CO₂ emissions originate from fossil fuel combustion. Around 25% of these emissions are related to transport while the remainder arises from various energy-related activities (Collier and Löfstedt, 1997, p. 15). Given that the scope for expansion in nuclear energy and large hydro-power installations is limited, there is a strong need for deploying RE to reduce CO₂ emissions. Another and equally important reason for increasing the share of RE in the EU is to reduce dependencies on imported fuel to the EU region.

In the late 1990s a number of events accelerated the need to increase the share of RE. First, with the ratification of the Kyoto Protocol, EU agreed to reduce greenhouse gas emissions by 8% in 2012 relative to 1990 levels. Second, in the Commission's White Paper on

renewable energy (COM (1997) 599) an indicative objective specifies that EU governments must double their share of RE supplies from the present 6% to 12% of gross inland energy consumption by 2010. Third, the EU has started to liberalise energy markets in which monopoly market structures are to be replaced by competitive markets (Directive 96/92/EC). In this process both cost-efficiency, low consumer prices and environmental policy goals must be achieved.

A fully competitive energy market will be characterised by short-term energy sales and price volatility, where investors usually prefer investments with low capital costs and short payback periods. Under these circumstances, sufficient investments in capital-intensive RE technologies are unlikely to take place. Consequently, when RE is planned to be doubled in a liberalised energy market, supportive instruments are needed. These instruments must be compatible with the liberalised energy market, sustain RE investments, and ensure that investments are made in the most effective technologies and sites.

Tradable Green Certificates (TGCs) is an instrument capable of achieving the specified RE goal while at the same time ensuring cost-efficient development of RE in a liberalised energy market (Voogt et al., 2000; Nielsen and Jeppesen, 2000; Olsen et al., 2000; Morthorst, 2000,

*Corresponding author. Kommunernes Revision, Postbox 309, 5100 Odense, Denmark. Tel.: +45-66177707; fax: +45-66158790.

E-mail addresses: lni@sam.sdu.dk (L. Nielsen), tje@kr.dk (T. Jeppesen).

2001). Presently, a number of EU countries are either in the process of designing a system of TGCs or are considering the use of TGCs. The parliaments in Denmark and Italy have already adopted the necessary legislation. In the Netherlands, the distribution companies have established a voluntary system comparable to TGCs. Moreover, since early 1999 representatives from the energy sector, governments, and research institutions in nine EU countries have worked to establish a scheme under which harmonised national markets for renewable energy certificates are stimulated. This scheme operates under the name of Renewable Energy Certificate System (RECS). It is envisaged that an international pilot project will be undertaken to test if the concept is valid and realisable, and if the means of its implementation is robust and effective.

So far, Denmark, Belgium (the Flanders region), Germany, Italy, the Netherlands, and UK have the most developed systems of TGCs in Europe. This paper compares and discusses how these countries envisage that their national systems of TGCs should be designed. The purpose is to identify the differences between the national approaches, and to analyse how these differences affect the achievement of an efficient international system of TGCs.

We define an efficient system of TGCs as one that is able to reach the specified RE goal cost-efficiently. This is done by inducing sufficient investments in the most cost-effective technologies and at the most effective locations. Moreover, an efficient system of TGCs must be compatible with the liberalised energy market.

We find that the national TGC systems, which are envisaged, differ with respect to technologies eligible for certification, market stabilisation mechanisms, and mechanisms to initiate demand. Finally, there is a difference between co-existing renewable energy regulations. In order to implement an efficient European TGC system, it is necessary to eliminate these differences. Another condition for an efficient European TGC market is that TGC regulation be accepted by the institutions of the European Union as a cost-efficient tool of regulation. In a recent proposal for a directive on promoting RE electricity in the internal electricity market, Green Certificates are mentioned as a support mechanism, implying that TGCs are considered to be a form of state aid (Eurelectric, 2000). If this directive proposal should be accepted in its present form, prospects for a well-functioning and cost-efficient European TGC market would not be good.

The paper is organised as follows: In Section 2, we define a system of TGCs in which we identify the components necessary to make TGCs an efficient instrument in energy policies. This system will serve as a benchmark against which in Section 3 we compare the national systems of TGCs in six EU countries. The purpose of this comparison is to identify the different

national concerns, and potential problems for efficient RE development in Europe. Section 4 analyses whether a system of TGCs interferes with EU's state aid policy, and if so how it would affect the effectiveness of TGCs. Conclusions are presented in Section 5.

2. A benchmark system of TGCs

2.1. The market

A system of TGCs is both an accounting system that certifies RE production and a regulatory instrument available for public authorities to reach a specified goal for RE production. The market for TGCs consists of supply and demand for certificates. Demand is driven by a politically determined target for RE consumption, e.g. the EU goal of 12% of energy consumption. RE-producers supply the certificates.

The supply of certificates is ensured by giving the producers of RE a certificate for each unit of RE sold to the grid. Certificates are tradable financial assets, sold on a market separate from the physical energy market. Since RE and conventional energy cannot be distinguished from one another, both are sold in the energy market at the same price. The additional cost of producing RE is realised through the sale of certificates on the certificate market. In this way the obtainable price for the RE producer will be the sum of the market price for physical energy and the market price for certificates.

The demand for certificates is induced by transferring the national target for RE to either the consumers or the distribution companies.¹ Consumers or distributors will be required to prove that they consume at least the specified amount of RE. Proof of compliance is carried out when consumers hand over certificates to the authorities at a given time. Sanctions are imposed if the target is not met. In this way certificates become valuable, and consumers face an incentive to buy certificates while producers face an incentive to produce them.

Demand must be induced by a politically determined demand obligation specifying the RE part of the total energy consumption. Furthermore, if the demand obligation is not met non-compliers must be sanctioned. TGCs are cost-neutral to RE producers. All additional costs of RE production are borne by consumers. In the existing incentive schemes to promote RE throughout the EU, the most widespread instruments are subsidies

¹This obligation could also be imposed on the supplier. In Italy every supplier of energy, except RE producers or importers, are required to ensure that 2% of the energy, that is put on the grid, is RE. This can be done by installing RE capacity or buying certificates. In the remaining, economic agents subject to the certificate obligation are simply referred to as 'consumers'.

and tax exemptions (IEA, 1997; Voogt et al., 2000). This regulation is financed by public funds, and ultimately by the taxpayers. TGCs pass this burden from the taxpayers to the energy consumers, which is in accordance with the Polluter Pays Principle.

In the Netherlands, a system of TGCs was introduced in 1998 (see e.g., Voogt et al., 2000; Nielsen and Jeppesen, 2000). However, this system is not based on a politically determined consumption quota. Instead, demand is determined by a voluntary commitment by the Dutch association of energy distributing companies to generate 3.2% RE of the total energy supply. This is realised by issuing certificates. Demand that is voluntary instead of mandatory makes a fundamental difference. When it is voluntary, TGCs cannot be used as a regulatory instrument to achieve a national target of RE. Only if the national RE target and the level of voluntary demand coincide, will the national target be achieved by a system with voluntary demand. In a system of mandatory demand, on the other hand, public authorities can raise the RE quota to induce long-term planning for RE. Moreover, non-compliers can be sanctioned to assure that the RE target is reached. In a system of voluntary demand there are by definition no non-compliers and thus no sanctions. When demand is voluntary, certificates are a means to ensure that the voluntary demand for RE results in an equivalent production of RE, and that the production of RE is financed. In this way it is an accounting system and not a regulatory instrument.

Consequently, in order to stimulate RE generation beyond voluntary demand, green labels are supplemented by a number of financial and fiscal instruments in the Netherlands. These include an energy tax, accelerated depreciation of environmental investments, the exemption of green funds from paying taxes, and capital subsidies for private investors in wind turbines. These instruments are also effective in accelerating RE investments. In combination, these instruments are expected *ex post* to reach the *ex ante* politically determined goal. If the goal is not reached, the instruments must be adjusted.

Hence, a system of TGCs may consist of two elements. The first is the certification of produced RE. This element solves the problem that renewable energy cannot be distinguished from conventional energy. Certification ensures that the claimed production of RE is in fact produced. The second element is to reach a specified RE goal. This can be done by either a politically determined demand for certificates (Command-and-Control approach) or by financial and fiscal instruments (price regulation approaches).

If TGCs are seen as a certification instrument only, then voluntary demand is sufficient. But if TGCs are seen as both a means to certify RE generation and to achieve a specific RE target, then demand should be

determined politically or additional financial and fiscal instruments would have to be implemented.

All countries, except the Netherlands, that currently consider the use of TGCs envisage a system with a politically determined demand. Compared to the use of several fiscal and financial instruments, the politically determined demand may be viewed as a simpler and more direct way to achieve the specified RE goal. In the remainder of this paper we thus refer to a system of TGCs as one with politically determined consumption quotas.

The demand for TGCs is relatively inelastic since it is specified as a minimum consumption quota. Their supply is also relatively inelastic since marginal costs are low on most RE technologies. The position of the supply curve may, however, fluctuate due to for instance climatic variations. Fig. 1 shows three different supply curves. S' represents a year with low RE production. In that year, consumers are unable to fulfil the quota, since supply is lower than demand. Consequently, certificate prices will be infinitely large. In years with larger RE production, as represented by S'' and S''' , prices will of course be lower (P'' and P''' , respectively).

When demand and supply are relatively inelastic, the price of certificates is characterised by high volatility. This reduces the level of investment. There are three options available to ensure that the level is sufficient. First, it is important that RE is produced by different technologies. It is, for example, important to include both wind and biomass, because in the latter production can be regulated but not in the former. Second, prices should be capped. Non-compliers must pay a penalty for each unit of energy for which they should have bought Green Certificates. This penalty will effectively be the maximum price since no consumer demands certificates at a price higher than the penalty. The minimum price works to reduce the downward pressure on prices in years with excess supply. Third, demand can be made more elastic by enabling producers and

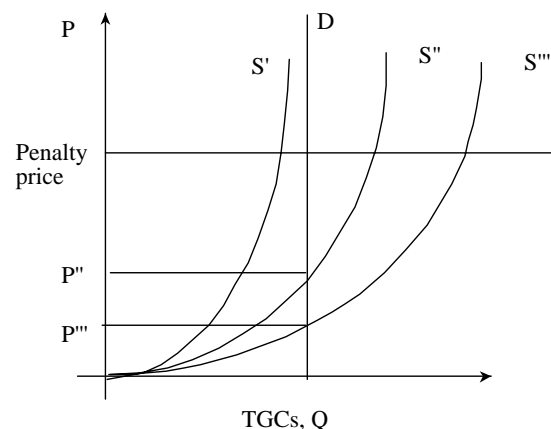


Fig. 1. TGC supply and demand. Source: Olsen et al. (2000).

purchasers to bank certificates. If certificates have a limited lifetime, then the certificate price is likely to equal either the maximum or minimum price. Banking implies that certificates can be used in future periods. The consequence is that consumers can buy certificates in years with excess supply and use them in years with low supply. Likewise, producers can withhold certificates in years with excess supply and low prices and sell them in years with excess demand and higher prices.

The two first options to reduce price volatility change the shape of the supply curve and make supply more elastic. The third option makes demand more elastic. Fig. 2 shows supply and demand with a price-cap and banking opportunities. On this market, price fluctuations will be smaller than on the unregulated market and fluctuations may be controlled by regulating the penalty price and minimum price. The penalty price should be set above long-term investment costs to induce investments in RE. The minimum price should be set high enough to ensure a minimum pay-off on investments.

In order to accomplish the sufficient mix of RE technologies it is necessary to induce research and development (R&D) in technologies that are not yet competitive. This may be done by giving these technologies additional subsidies. It is important though, that these subsidies do not hinder efficient competition between competitive technologies. Therefore, subsidies to technologies not yet competitive should be temporary and in force only until these technologies become competitive.

2.2. The institutions

When a system of TGCs is under consideration, four institutional questions must be settled: (1) How and by whom should the certificates be issued? (2) What is the scope for certification? (3) Which information must a

certificate contain? And finally, (4) How should trade take place?

2.2.1. Issuing

The issuing procedure contains several steps to be performed by various organisational bodies. In particular, three administrative tasks must be handled during the issuing procedure: formal issuing, execution, and monitoring.

The formal Issuing Body (IB) is responsible for the legal framework and overall co-ordination. The IB should define and establish criteria and rules for certification, trade, and consumption as well as appoint appropriate executors and monitors. In order to assure consistency between general policies and a TGCs system, it is important that the responsible organisation be either a governmental organisation (in a national system) or an EU organisation if the system is implemented at the EU level.

The Executive Body (EB) is responsible for the actual issuing and redeeming of certificates. This body could be an independent private organisation or an independent public authority.

The monitoring organisation monitors, registers, and approves all certificate trades. In addition to these functions, the monitoring body controls whether or not the obligated parties are in compliance with consumption quotas and if the renewable generators actually deliver renewable energy according to the number of certificates issued. If the monitoring body is to carry out sanctions against non-compliers, this body should be a governmental organisation in order to possess the appropriate authority.

2.2.2. Scope

One important parameter to take into consideration when establishing a system of TGCs is cost-efficiency. Cost-efficiency is closely related to market potential. Larger market potential provides a larger potential for cost-efficiency. To increase market potential, the certificate system should comprise all types of renewable energy generation. This includes the generation of electricity, gas, and heat. Market potential is also the main argument for including all existing energy production along with newly installed capacity. There are, however, other arguments for not including existing capacity. If the purpose of TGCs is to increase the installation of new RE capacity, existing capacity should not be included. Once installed and financed, it may be argued that existing RE capacity should be able to survive without the extra bonus from the TGCs.

2.2.3. Certificate contents

In order to be internationally tradable, certificates must be defined as similar commodities. As the certificate is a financial asset, the only way to establish

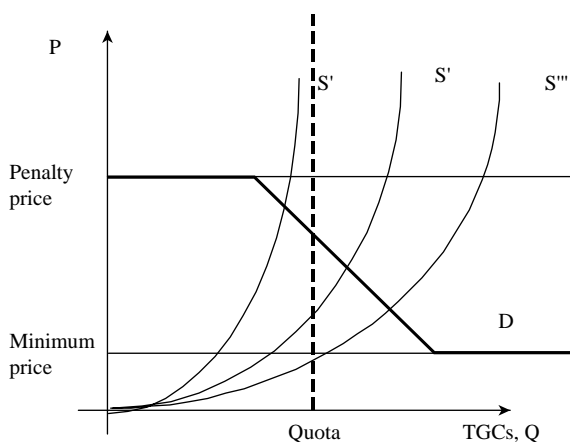


Fig. 2. TGC supply and demand when banking and price-caps are introduced. Source: Olsen et al. (2000).

the contents of the good is by a credible, informative label. Therefore, the certificate should contain information describing any particular characteristic. First, it should have a unique serial number in order to avoid any unintentional double counting or deliberate cheating. Second, it should describe any production characteristics, such as the identification of the generator, site of production, production unit, period of production, number of kWh produced, the source of the renewable energy, and production technology. Third, it should hold information pertaining to the issuer of the certificate and the date of issuing. Finally, it should contain information on certificate validity. Even though certificates contain detailed production characteristics, it is important that when traded as financial assets they should be homogeneous and non-separable. If it is possible to separate the market, for instance one for wind and another for solar energy, the markets become very thin. A certificate must be traded as a homogeneous standard commodity as electricity.

2.2.4. Trade

To reduce transaction costs TGCs should be traded at exchanges by broker organisations. Any trade that takes place at an exchange must be registered by the monitoring organisation in order to verify the production. Exchanges, brokers, and monitors should be organised as independent organisations to secure free trade and enable a large number of actors to enter the market. In order to provide for flexibility, a futures market should also be constructed with the exchanges.

An international market of TGCs enlarges the number of actors on the market as well as the market potential. Therefore, certificates should be traded internationally. In order to minimise trade restrictions there has to be some degree of harmonisation of the national TGCs systems. Once a certificate is issued it should be valid in all countries participating in the system of TGCs.

3. Different national approaches to TGCs

In the RECS group mentioned earlier, representatives from different national energy sector organisations, governments, and research institutions are currently working to establish an experimental system of TGCs. One part of the work has been to describe and discuss the different national TGC systems. Therefore, representatives from Germany, the Flanders region, the Netherlands, Denmark, UK, and Italy have filled in questionnaires regarding how the national systems are expected to be carried out when or if a system of TGCs is effectuated. This section compares the TGC schemes envisaged in the different countries. Data is collected from the national RECS questionnaires. However, it

should be kept in mind that the views presented are not necessarily those of the national governments. The RECS questionnaires have been filled in by energy companies holding a commercial interest in a TGC system.

3.1. The legal basis

One aspect in which the national systems differ is the legal status of the TGC systems. In most countries discussions regarding TGCs have been carried out at the political level; however, only the Danish and the Italian parliaments have so far taken decisions regarding the legal framework for a TGC system. This implies that at present Denmark and Italy are also the only countries establishing by law the date on which the system is to be operational, as well as the mechanisms to initiate a demand for TGCs. Table 1 shows that the Danish system is to go into operation in January 2002, while the Italian system will start from January 2001. In Italy, the demand for TGCs will be initiated by placing an obligation on the producers and importers of electricity. In Denmark, the demand will be initiated by placing a politically determined demand obligation on end-users. In the Flanders region, a legal framework is planned for adoption in the Belgian parliament. A starting date of January 2001 has been suggested. The demand is to be initiated by placing an obligation on energy suppliers. In the Netherlands, a system of TGCs has been operational since 1998. However, the Dutch system is organised by the energy companies on a voluntary basis and no legal framework has been defined so far. The energy companies expect that the Dutch parliament will adopt a TGC policy by law. If such a policy were to be adopted, a legal system of TGCs would be expected to be operational by early 2001. In contrast to the systems mentioned above, it is anticipated that the Dutch government does not plan to implement mechanisms to initiate demand. The demand for TGCs is expected to emerge out of the preferences of energy consumers for 'green' energy, and no obligation will be put on producers, suppliers, or end-users.

With regard to the UK and Germany, no legal basis for TGCs has been adopted yet and no starting date has been defined. At the moment, the UK is considering the legal basis for a system of renewable energy certification, and a starting date of April 2001 has been discussed.

The various countries differ with respect to the mechanisms planned to initiate demand for TGCs. Most countries plan to place the obligation on the energy suppliers; in Denmark, the obligation has been defined as a percentage share of the consumers' gross consumption. However, it is still under discussion whether Danish consumers should purchase certificates themselves or if energy suppliers should instead handle the obligation on behalf of the consumers. So far, Italy

Table 1
Legal status and mechanisms to initiate demand

Country	Legal basis	Start date	Mechanisms to initiate demand
Flanders (Belgium)	Planned	January 2001	Supplier obligation
Denmark	Yes	January 2002	End-user obligation
Germany	No	?	Grid company obligation ^a
Italy	Yes	January 2001	Producer obligation
Netherlands	No	January 2001	Voluntary purchase of TGCs
United Kingdom	Planned	?	Supplier obligation Tax exemptions

Source: RECS Country reports (2000).

^a At the moment the obligation is placed with the German grid companies. In the future it is possible that the mechanisms to initiate demand will be a supplier obligation combined with eco-tax exemptions.

Table 2
National targets for renewable energy

Country	2001	2002 (%)	2003 (%)	2004 (%)	2010 (%)	2020 (%)	2030 (%)
Flanders ^a				3	5		
Denmark ^b			20				50
Germany ^c							
Italy ^d		2					
Netherlands ^e					5	10	
UK ^f			5		10		

Source: RECS country reports (2000).

^a Share of end-use electricity consumption.

^b Due to a transitional phase, the quota for certificates will only cover around 6% of total electricity consumption in 2002.

^c n.a.

^d Share of energy based on conventional sources produced or imported the previous year.

^e Share of total energy demand.

^f Share of electricity supplied from renewable sources.

is the only country in which the obligation is to be handled by importers and producers of energy. The Netherlands is the only country in which the system is completely based on voluntary demand.

The imposition of the obligation on different national groups does not necessarily affect the ability to trade certificates internationally. Italian energy producers may purchase TGCs from producers or suppliers in other countries as long as the certificates traded bear identical characteristics. However, as the countries, except the Netherlands, have defined an obligated party and a penalty for non-compliance, the price of the Dutch TGCs may increase due to external quotas putting an upward pressure on TGC demand and TGC prices. If the price of TGCs increases relatively more than the Dutch consumers' willingness to pay for green electricity the Netherlands' national RE target cannot be fulfilled by domestic demand, but must be fulfilled instead by TGC exports. In this case the Netherlands have no effective TGC demand-side. This implies that consumers outside the Netherlands will be financing Dutch RE investments and that the Dutch consumers will be free-riding on the mandatory minimum consumption quotas

of other countries. This is clearly not a politically satisfactory solution. Targets for renewable energy sources of the different countries are presented in Table 2.

Table 2 shows that countries differ widely with respect to how ambitious they are concerned with the deployment of renewable energy. However, note also that targets should be compared with caution as some targets cover energy demand or production while others deal only with electricity. Different national targets for RE do not affect the ability to trade TGCs internationally. However, restrictive national quotas spill over to other countries through the price mechanism and induce investments in other countries.

3.2. The definition of a TGC

The national definition of renewable technologies is another aspect on which the countries differ and which may affect the ability to trade TGCs internationally. Some countries have decided to exclude certain technologies from certification. The reason for this is that these are already competitive without the extra financial

Table 3
The scope of certification

Country	Technologies excluded	Production eligible for certification	Existing plants included
Flanders region	Burning of non-organic waste	Electricity Heat Gas	Yes
Denmark	Waste Hydro > 10 MW	Electricity	After phase of transition
Germany	Non-organic waste	Electricity	?
Italy	Pumping hydro	Electricity	No
Netherlands	Non-organic waste Industrial heat pumps	Electricity Heat Gas	Yes
UK	Hydro > 10 MW	Electricity	?

Source: RECS country reports (2000).

compensation from the certificate. Table 3 shows that UK and Denmark have decided to exclude large hydro-power plants from certification.² In the Netherlands, Germany, the Flanders region, and Denmark non-organic waste is to be excluded. Furthermore, in Italy it has been decided that existing plants (with a few exceptions) are ineligible for certification and that new plants receive certificates for the first 8 years of production only.³

In Denmark, small biomass plants, PV, and perhaps also small hydro-power plants will be excluded from the certificate system. Existing Danish wind turbines will be phased into the system gradually, the length of the phase depending on the size of the facility.⁴ In the Flanders region and the Netherlands, existing plants are eligible for certification along with new plants.

While the scope for certification covers both electricity, heat, and gas production in the Netherlands and Flanders region. Denmark, Germany, Italy and the UK have decided that only electricity generation will be certified. Of course, TGCs must be convertible no matter how they have been produced and no matter from which energy supplier they come. Therefore, it may be a problem facing an international TGC system that TGCs may originate from types of production which are not certifiable in all countries.

In order that TGCs should be tradable, countries must agree on the definition of a TGC. A governments' decision to exclude particular TGCs from entering the country due to, for instance, the technology used, creates a trade barrier and violates EU law.

²In Italy large hydro-power is allowed for certification if these do not hold pumped storages.

³In order to deal with EU-law concerning state aid, the Italian government has decided to limit the period in which plants receive an extra payment from the TGCs.

⁴Existing facilities receive the fixed electricity price during the transitional phase.

3.3. Market conditions for TGCs

Another point to be made here considers the different national frameworks defining the institutions of the market for TGCs. If the institutional framework is not harmonised it may be difficult for demand to equal supply in an international market. Table 4 shows some of the institutional aspects of the national TGC systems.

Denmark and Italy, the two countries with a legally based TGC system, have both established or authorised a body to carry out market stabilisation. In Denmark, an independent fund has been designed to purchase certificates if the national quota is not met. As this fund is not to influence prices, certificates must be bought within a fixed price-cap. The procedures of the fund still need to be finally decided. In Italy, the IB has been assigned the task of market stabilisation. In this case, market stabilisation is implemented by giving the IB the authority to sell 'borrowed' or 'uncovered' TGCs at a fixed price. Borrowed TGCs refer to certificates related to energy not really generated and work to stabilise prices in years of TGC shortage.

In other countries planning a TGC system, no institution of market stabilisation has been planned so far. However, with an international trade of TGCs, market stabilisation may be less needed as the market potential is larger and as a shortage of TGCs in one country may be off-set by a large production in another. However, other instruments exist to secure market stabilisation, and intervention may not even be necessary if arrangements of banking and borrowing are provided for. Table 4 shows that several countries plan to provide for banking as well as borrowing. But, the table also reveals that the issue of flexibility has not yet been settled, except in the two aforementioned countries.

Does an international market for TGCs call for the harmonisation of flexibility instruments? In the absence of common rules for banking and borrowing, dilemmas

Table 4
Market conditions and institutional arrangements of the national TGC systems

Country	Market stabiliser	Banking/ Borrowing	Maximum price (kWh)	Minimum price (kWh)	Penalty for non-compliance	Period of validity
Flanders	No	Banking: Yes Borrowing:?	2001: 2 BF 2002: 3 BF 2003: 4 BF 2004: 5 BF	No	Maximum price to regulator	2 years
Denmark	Renewable energy fund	Banking: Yes Borrowing: With deposit sum	0.27 DKK	0.10 DKK	Maximum price to renewable energy fund	Unlimited
Germany	No	?	?	No	?	?
Italy	Issuing Body	Banking: No Borrowing: Against a penalty price	In principle no ^a	No	Access of supply to the grid denied	1 year
Netherlands	No	Banking: Probably yes Borrowing: ?	Not relevant	No	Not relevant	Unlimited?
UK	No	?	Maybe around 2p in excess of the market value of electricity	No	?	?

Source: RECS Country reports (2000).

^a As the Issuing Body it can sell certificates only at fixed prices similar to the former feed-in tariffs, the market price is captured to some extent.

may occur. For example, when banking is not allowed in Italy, may an Italian producer then save up TGCs in a Flemish TGC bank and thereby avoid national regulation? Can an international TGC system exist without the possibility for international banking and borrowing and will national restrictions on flexibility be impediments to trade and violate EU law?

The Flanders region, Denmark, Italy, and probably also UK plan to introduce a price-cap on the TGC market. When an international market for certificates is established, different national price-caps will converge into one. With different national maximum and minimum prices, TGCs will be traded at prices below the lowest penalty and above the highest minimum price. The reason why TGCs are traded within this narrow price span is that the cheapest TGCs are traded first. If, for example, TGCs are abundant and therefore cheap in Italy but scarce and expensive in the UK and if the British penalty price is higher than the Italian, British

consumers will purchase Italian TGCs until Italian TGCs are sold out and the Italian penalty price becomes the effective price. However, if the British penalty price is lower than the Italian market price for TGCs then the British penalty price becomes the effective price on TGCs. This again implies that no new RE capacity will be installed in Italy even though the market overall is short of TGCs. As such, a low penalty price in one country influences the RE expansion level in other countries because the lowest penalty price is the effective TGC price. This also implies that technologies are not necessarily implemented at the most efficient localities because different penalty prices become barriers to the free flow of TGCs.

Finally, the validity of certificates is another matter, which differs between countries. In Italy, certificates are valid for the reference year only. In Denmark and probably also in the Netherlands, certificates do not bear a date of expiry, while in the Flanders region

Table 5
Co-existing national renewable energy regulation

Country	Price support per unit of RES energy generated	Investment aid	End-use stimulation
Flanders	×	×	×
Denmark	×	×	
Italy			
Germany	×	×	
Netherlands			×
UK		×	×

Source: RECS country reports (2000).

^aFixed feed-in tariffs and investment aid will be used in the transitional period.

certificates are valid for 3 years. These different validity terms imply that TGCs are not completely similar commodities and that Danish and Dutch certificates may have a higher value as they can be banked for a longer period. Again, the harmonisation of validity periods may have to be carried out in order to insure fair competition.

3.4. Co-existing renewable energy regulation

A final factor influencing the ability to trade TGCs internationally concerns the prevalence of other instruments to promote the generation of renewable energy. Table 5 illustrates co-existing national arrangements.

Different national arrangements of price support, fixed feed-in tariffs and investment aid induce unfair competition among producers. Table 5 shows that all countries, except Italy, have implemented government-induced support schemes to stimulate the implementation of renewable energy supplies. The table also reveals that these government-supported arrangements are not harmonised between governments. In an international market for TGCs co-existing support schemes for renewable energy must be harmonised across countries in order to make the market more simple, transparent, and compatible with a liberalised electricity market.

If different national support schemes are not harmonised, they are likely to favour certain producers. This is incompatible with an efficient market and also with EU law. This section has illustrated that there may still be a long way to go before TGCs can flow freely between purchasers in the different countries. As a minimum, governments participating in a system of TGCs must agree on the definition of the good to be traded. Therefore, it is crucial for an international system of TGCs that agreement be reached on such vital issues as which technologies and sources are certifiable. Also, in order to make sure that the most cost-efficient technologies are implemented first, governments must agree on a single common price-cap. In addition, it is

important that schemes of national renewable energy regulation be harmonised and that countries agree on a common set of flexibility mechanisms to reduce investment risks.

The barriers facing international TGCs trade may be overcome if the EU decides to implement a system of TGCs in order to fulfil the EU target on renewable energy. If the certification of renewable energy is carried out according to specified EU standards, governments cannot discriminate against foreign TGCs and an efficient EU market is then realised.

4. The EU, TGCs, and the definition of state aid

Seen from the perspective of an economist, TGCs may be viewed as a cost-minimising and efficient instrument for deploying renewable energy supplies. However, from a legal point of view it has been claimed that TGCs should be regarded as state aid following EU law. Certification in itself does not violate this law. However, when politically determined consumption quotas are introduced, value is added to the product in question and, even though Green Certificates do not constitute a direct transfer, it may be argued that state aid is granted in a hidden form.

Community Guidelines on state aid for environmental protection (CEC, 1994), however, open up the possibility of granting this kind of state aid. These guidelines aim to strike a balance between the requirements of competition and those of environmental policy. The general rule is that state aid is justified when adverse effects on competition are outweighed by the benefits of the environment.

Since the fifth environmental program, adopted in 1992 (EAP, 1992), it is an important principle that environmental protection requirements must be integrated into other general community policies. Moreover, environmental policies should be based on the Polluter Pays Principle. This means that the polluter should pay the external costs of his production and hence leave it for the producers to internalise the external costs.

State aid to producers would contradict the Polluter Pays Principle and lead to insufficient internalisation of external costs. There are, however, two circumstances under which the Commission may accept the granting of state aid (CEC, 1994): (1) If it is impossible for producers in certain sectors to fully internalise external costs, state aid may give producers an incentive to adjust production to comply with the standards. This is called a 'temporary second-best solution'. (2) If state aid can give producers an incentive to either go further than that prescribed by the standards, or invest in technology that would make production less polluting.

A European system of Green Certificates is meant to initiate fulfilment of the existing target for the deployment of renewable energy sources. Therefore, TGCs cannot be granted state aid on the grounds of further environmental protection. However, state aid may be donated so that producers could adapt to existing standards and therefore could present 'a temporary second-best solution'. This explains the Italian decision to certify production in a limited period (8 years).

State aid in the form of TGCs may be placed under the category of 'Operating Aid', given to compensate for the extra costs of production. However, production support must be regressive and temporary, lasting for a maximum of 5 years. In order to respect unique circumstances, national governments may also provide support according to the amount of kW a plant must generate in order to be competitive.

Whether or not a system of TGCs is defined to be state aid is decisive for the functioning of an efficient EU market for TGCs. If a system of TGCs is defined to be state aid, it is possible for the Member States to implement their own requirements for TGCs irrespective of requirements in other Member States. For instance, if a Member State decides that only new capacity can generate certificates, this Member State will have then excluded one group of certificates from other countries. In this way, it is possible to discriminate against foreign producers. However, if a system of TGCs is not defined to be state aid, Member States cannot implement a system of TGCs that discriminates against foreign producers. In this case a Member State cannot enforce a decision to exclude certain types of production from certification.

If a system of TGCs is going to be regarded as state aid by the European Commission, international trade with certificates is, although limited, still possible. Trade may, for instance, be bilateral agreements between two countries that agree on common rules. What remains is that if TGCs are defined as state aid a 'level playing-field' is not established. A level playing-field is necessary if, for instance, cost-efficient development of renewable energy sources in Europe were to take place. This assumes that renewable energy generation will take place where it is the most cost-efficient because the demand for TGCs in one country may initiate investments in another Member State. This is not possible, however, if TGCs are regarded as state aid and if national rules discriminating against foreign TGCs remain intact.

Thus, if on one hand TGCs are defined as state aid, the integrity and sovereignty of Member States will be maximised. This gives Member States large possibilities to define their own systems of TGCs, what TGCs should include, additional support mechanisms, technical requirements for generators, etc. If, on the other hand, TGCs are not defined as state aid, possibilities for a

well-functioning European market are maximised. This would improve international certificates trade and induce cost-efficient deployment of renewable energy throughout Europe.

In May 2000, the European Commission presented a proposal for a 'Directive on the promotion of electricity from renewable energy sources in the internal electricity market' (COM (2000) 279). According to this proposal: 'support scheme(s) shall mean a mechanism according to which a generator of electricity, on the basis of state regulation, receives, directly or indirectly, public support, such as, for instance, direct price support, paid as a subsidy per kWh provided and sold (e.g. quota systems providing for tendering or Green Certificates, fixed feed-in prices and fixed premium schemes), investment aid and tax exemptions'. If the proposal presented by the Commission is accepted in its present form by the Parliament and the Council, then Green Certificates are included under the EU definition of state aid.

In the proposed Directive it is stated that 'the Commission has reached the conclusion not to include in the Directive at this stage rules on price support schemes'. This implies that it remains for the Member States to decide how to implement incentives for promoting renewable energy supplies. This again implies that national support schemes remain intact at least for the next 5 years and that the harmonisation of rules regarding support for renewable energy supplies is going to be carried out according to 'Community Guidelines on state aid for environmental protection'. In the light of these developments, prospects for a common EU market in TGCs do not seem promising at the moment. However, in the light of the various national attempts to develop a market in TGCs, countries may agree on a common set of rules according to which an international TGC market could be developed.

5. Conclusion

The European energy market is undergoing significant changes at the moment. On one hand, the EU Member States are in the process of liberalising their energy markets. On the other hand, the Commission has announced that the consumption of RE should be doubled over the next 10 years.

These two goals are obviously conflicting. RE is unlikely to survive on a liberalised energy market, as such a market will be characterised by short-term energy sales and price volatility. RE investments are typically capital-intensive projects for which financing will be difficult to obtain in a liberalised market.

Tax exemptions and subsidies are likely to contradict with EU state aid policies because domestic producers are given a comparative advantage. Moreover, if subsidy schemes comply with state aid rules they will

probably be politically unacceptable because foreign producers must receive the same subsidy as national producers. In this situation one country may find itself financing the deployment of RE in another country. Moreover, existing tax and subsidy schemes are not cost-efficient.

Consequently, regulation is necessary to induce sufficient investments in RE. TGCs is one instrument having the potential to induce sufficient investments in RE in a cost-efficient way and compatible with a liberalised energy market. At the moment, six EU countries are either in the process of designing a system of TGCs or are considering the use of TGCs.

A European market for TGCs can be established either by the EU implementing a system or by the harmonisation of existing national markets. In the first case, EU countries agree on certain rules for the system and that trade should be facilitated by avoiding trade restrictions. In this case, EU countries agree to one specific system of TGCs prior to its implementation in Member States. In the latter case, however, national TGC markets are implemented prior to the establishment of the EU market. In the light of recent developments, it is most likely that a European TGC market will be established by the harmonisation of existing national markets.

As minimum consumption quotas add an extra value to the generation of renewable energy, TGCs may be interpreted as state aid according to EU law. In addition to contradicting EU law, state aid contradicts the Polluter Pays Principle adopted in the EU with the fifth environmental programme. State aid may, however, be granted on the grounds of environmental protection (CEC, 1994), and if it is recognised that TGCs could help producers internalise the costs of conventional energy generation, then TGCs could be given as a 'temporary second-best solution'. In relation to energy generation, operating aid may be granted per kWh generated until renewable plants are competitive.

If TGC regulation is to be defined as state aid, it is unlikely that the EU will implement a common European system of TGCs. Instead, governments may decide to harmonise national TGC markets in order to allow for some degree of cost-minimisation. As only six member states are considering TGCs, the market will obviously be much smaller than if it was implemented at the EU level. Moreover, national governments will be free to choose the actual design of the TGC market. This gives the Member States an opportunity to implement specific requirements that discriminate against foreign certificates.

We have shown that the envisaged national markets for TGCs differ on the following crucial points:

- *Technologies eligible for certification.* One country's exclusion of waste imposes a trade restriction on

another country's certificates generated by waste technologies.

- *Market stabilisation mechanisms.* Different maximum and minimum prices cannot co-exist in an international market. Countries need to agree on one minimum and one maximum (penalty) price: otherwise, the highest minimum price and lowest maximum price will dominate. Moreover, different banking and borrowing rules will restrict trade. Finally, different periods of validity cannot coexist. Finite validity cannot be enforced if other countries have infinite validity.
- *Mechanisms to initiate demand.* In a system with voluntary demand there are no penalties because demand by definition equals the quota. Obviously, a situation where non-compliers in one country face a penalty while non-compliers in another country do not, is absurd in an international market.
- *Co-existing renewable energy regulation.* Additional schemes to stimulate RE investments or to support currently uncompetitive technologies are envisaged by a number of EU countries. These schemes may distort competition by favouring certain producers and may hinder efficient competition between present competitive technologies. Consequently, such schemes must be harmonised in an international market.

If national markets are not harmonised on these points, an efficient market for TGCs is unlikely to be realised.

References

- CEC (Commission of the European Community), 1994. Community Guidelines on State Aid for Environmental Protection. Official Journal C 072, 10/03/1994.
- Collier, U., Löfstedt, R.E., 1997. The energy dimension. In: Collier, U., Löfstedt, R.E. (Eds.), *Cases in Climate Change Policy: Political Reality in the European Union*. Earthscan, London, UK, pp. 15–29.
- COM (1997) 599 The Commissions White Paper on Renewable Energy.
- COM (2000) 279 Proposal for a Directive on the European Parliament and the Council on the Promotion of Electricity from Renewable Energy Sources in the Internal Electricity Market.
- Directive 96/92/EC concerning Rules for the Internal Market in Electricity. Official Journal L 027, 30/01/1997.
- EAP (Environmental Action Programme), 1992. *Towards Sustainability? 1993–2000*. May, 1993.
- Eurelectric, 2000. Eurelectric closely involved in the shaping of the new environmental state aid guidelines. Daily News to Members: 17/04/2000.
- International Energy Agency, 1997. *Renewable Energy Policy in IEA countries*, Vol. 1. Overview. International Energy Agency, Paris.
- Nielsen, L., Jeppesen, T., 2000. Green electricity certificates—a supplement to the flexible mechanisms of the Kyoto protocol.

- In: Carraro, C. (Ed.), *Efficiency and Equity of Climate Change Policy*. Kluwer, The Netherlands, pp. 221–244 (Chapter 10).
- Morthorst, P.-E., 2000. The development of a green certificate market. *Energy Policy* 28, 1085–1094.
- Morthorst, P.-E., 2001. Interactions of a tradable green certificates market with a tradable permits market. *Energy Policy* 29, 345–353.
- Olsen, O.J., Frstrup, P., Munksgaard, J., Skytte, K., 2000. *Konkurrence i Elsektoren? Jurist og Oekonomforbundets forlag*. Copenhagen, Denmark.
- Voogt, M., Boots, M.G., Schaeffer, G.J., Martens, J.W., 2000. Renewable electricity in a liberalized market—the concept of Green Certificates. *Energy and Environment* 11, 65–79.