

The Italian Green Certificates market between uncertainty and opportunities

Arturo Lorenzoni^{a,b,*}

^a *Dip Di Ingegneria Elettrica, Università degli Studi di Padova, via Gradenigo 6/a, Padova, Italy*

^b *Università L. Bocconi, Milano, Italy*

Abstract

With the overall reform of the electricity industry in 1999, Italy has started the implementation of a new support mechanism for renewable energy sources that is based upon a Green Certificates market. Such certificates will be delivered for 8 years for electricity production to renewable power plants commissioned after 31 March 1999. All the electricity production based on non-renewable energy sources and import have an obligation to cover 2% of its total with Green Certificates. This support mechanism is open to foreign production, but only from countries with reciprocal opportunities for Italian production. The new market has formally started on January 2002, even if some important rules have not yet been defined. This paper describes the new support mechanism, investigates the critical aspects for its activation and shows some possible trends for the quantity of the supplied certificates and their prices in the coming years.

© 2002 Elsevier Science Ltd. All rights reserved.

Keywords: Tradable Green Certificates; Renewable energy; Electricity market

1. Introduction

All over the world, the electricity industry is facing a radical restructuring aiming at improving efficiency and stimulating technological innovation. In Europe, the leading force in this direction has been the European Commission, which forced the Member Countries to introduce competition with the EU Directive 96/92/EC. At the same time, the lack of sustainability of the energy sector imposes to the Member Countries the challenging goal of improving the environmental soundness of the industry. Reconciling these different tasks is not easy and requires a joint effort of all concerned parties in order to reach the targets without compromising economic development. In this framework, one of the most important and debated issues is the increase of use of renewable energy sources for electricity generation (RES-E) (EC, 2000).

During the 1990s, Italy, on its way to designing an efficient energy industry, opted for the simultaneous privatisation and liberalisation of the electricity and gas

industries. The transition from a vertically integrated, state-owned sector to a private industry facing competition requires adjustments that cannot be accomplished overnight. Many aspects concerning the regulation and the organisation of the future markets are not yet known, and some milestones of the reform have not been respected (such as the start of power exchange in January 2001). In fact, the philosophy of the reform itself is not fully developed, and the future regulatory regime could be far different from that sketched by the legislative documents issued so far, as a consequence of the political change that occurred in 2001.

With the restructuring of the energy sector, the policy to support renewable energy has also changed, and new instruments suited for market operation have been introduced, based on:

- the creation of a “new renewables” portfolio, mandatory for all fossil thermal producers and
- competitive biddings managed by the regions at the local level for new RES-E schemes.

A long transition from one regulatory regime to another started in 1999 and is not yet concluded, creating an uncertain framework for newcomers.

*Corresponding author. Dip Di Ingegneria Elettrica, Università degli Studi di Padova, via Gradenigo 6/a, Padova, Italy. Tel.: +39-049-827-7559; fax: +39-027-005-22304.

E-mail address: arturo.lorenzoni@unipd.it (A. Lorenzoni).

The operators that suffer the most from such uncertainty are those targeting the niche market created by the obligation for new renewable energy, as the most competitive among them are often companies of small size and means. The risk is thus to displace investments in renewable energy again, like in the past, with an array of stop-and-go measures that made renewable energy technologies lose credibility.

This paper deals with the characteristics of the new market of Tradable Green Certificates (TGCs) enforced in Italy from 2002. We will describe its operation in the context of the restructuring of the electricity industry, and speculate on the future prices of the TGCs. Finally we will highlight the limits of the present design and propose some amendments that may help the system become more readily operational.

2. An outlook of the past policy to support renewable energy

Italy's electricity industry has experienced 30 years of strict monopoly since the creation of ENEL, the national electricity board, in 1962, with a progressive concentration of activities in the hand of the state. ENEL alone, apart from some minor exceptions, could produce, import, transmit, distribute and sell electricity in the country.

At the beginning of the 1990s, three main drivers contributed to reverse this path:

- new economic and political trends at the international level with the affirmation of competition even in sectors once controlled by a monopoly and the retirement of the state from the direct involvement in economic activities,
- a situation of capacity deficit in the Italian electricity sector that advocated the involvement of private investments in generation,
- the need to promote investments in renewable energies in order to improve the environmental performances of the electricity sector.

These factors led to the liberalisation of electricity production from renewable energies (Law 9/1991) and to the start of a process aimed at the privatisation of ENEL with its transformation in a company with all its shares owned by the Ministry of the Treasury (July 1992).

In order to attract the investments of private operators of renewable energy and co-generation plants, a scheme of subsidised prices was put in place (Provvedimento CIP6/1992, April 29, 1992). All the new power plants submitting applications would get a contract to sell to the grid electricity produced at a price made up of two factors: (1) an avoided cost (investment,

operation and maintenance, fuel) based on an estimate for the investment in a new gas-fired combined cycle, (2) an extra price based on the estimated extra costs of each different technology (De Paoli and Lorenzoni, 1999).

The extra price would apply during the first 8 years of operation, while the avoided cost would apply for the whole length of the supply contract (often 15 years). Both factors were linked yearly to the retail price index, except for the fuel avoided cost, which is linked to the price of a mix of fuels, so that the resulting risk of the investments was quite low. The money required for paying the subsidies for RES-E and co-generation was collected directly from the electricity bills, while the avoided cost was paid by ENEL. At that time ENEL as a publicly owned monopolist still playing the role of "regulator" of the industry, directly implementing the energy policy of the government. Nevertheless, in the following years the liberalisation process made ENEL increasingly one of the competitors, with a critical confusion of the roles of regulator and regulated body.

This price structure was extremely appealing, and the applications for the CIP6 contract so overwhelmed ENEL that in 1992 it proposed to create a waiting list to be updated every 6 months. ENEL was at the time worried that there would be a wild rush to the grid connection, considering that many combined heat and power plants had applied to the programme, thanks to the easy technical conditions required for inclusion in the co-generation plant category.¹ Moreover, ENEL and other distributors, attracted by the high prices, included also their own renewable plants in the programme, sometimes even bypassing the waiting list, making it impossible for all the applicants to be accepted. The demands made after June 1995 were ultimately scrapped, and the programme closed in January 1997, when most of the accepted plant had not yet been built.

It appeared soon that many projects included in the list had little chance of being commissioned, as they had been proposed by investors who were attracted by the high rate of return, but lacked a proper background in the electricity sector. Nevertheless, they did not withdraw these applications and instead simply postponed the expected commission date without receiving any fines. With the reform of the electricity sector in 1999, it was necessary to deal with many of these projects which were scheduled to come on line after the year 2000, in order to give them the chance to get the CIP6 contract and allow at the same time the transition to the new regime. These subsidised contracts actually impact the first phase of the new support mechanism based on

¹CIP6/92 required an overall efficiency, thermal and electric superior to 51%, without limits to the thermal energy supplied. Modern combined cycles could fulfil the condition producing almost only electricity (Gulli, 1999).

Table 1
CIP6 extra prices for the year 2000 (yearly updated), to be added to the avoided cost (6.9 Eurocent/kWh)

Technology	Single price (Eurocent/ kWh)	Dual price (Eurocent/ kWh)	
		Peak ^a	Off peak
a. Hydro: basin, run of river > 3 MW		8.9	
b. Hydro: run of river < 3 MW	3.1		
c. Wind and geothermal	5.3		
d. Photovoltaic, biomass, wastes	10.2		

^aPeak are 3550 h per year.

Table 2
Summary of the new renewable capacity developed by the CIP6 support programme (1992–2004)

[MW]	Third parties	Distributors	ENEL	Total capacity
Biogas	133	15	—	148
Biomass	266	2	—	268
Wind	749	—	20	769
Photovoltaic	2	—	3	5
Hydropower	702	8	2408	3118
Run of river	95	7	19	121
Wastes	56	—	—	56
RDF	30	—	—	30
MSW	408	139	—	547
Geothermal	—	—	443	443
Total RES-E	2.441	171	2893	5505
Cogeneration	6 188	540	—	6728
Total	8 629	711	2893	12 233

Source: Own estimates on GRTN and Ministry of Industry data.

market forces. The last RES-E schemes are expected to end construction in 2004. Table 2 shows over 5.5 GW of nominal new capacity promoted by the CIP6 programme. ENEL as a producer has the largest share of this new capacity.

Considering only the extra prices given to renewable power plants in their first 8 years (i.e. excluding the avoided costs and extra prices paid to co-generation plants), the cost of the whole CIP6 programme supporting renewable electricity production is estimated for the period 1992–2012 to be in the region of 13 billion Euro at year 2000 prices.²

The promotion of RES-E and energy efficiency under the CIP6 support scheme is certainly a heavy burden for electricity consumers (0.48 Eurocent/kWh for domestic users in October 2001) and implies a long-term

commitment. Moreover, the programme had some heavy limits:

- the full cost to be paid by consumers, while expected to be high, was not known in advance,
- access to supply contracts was not completely transparent and distributing companies were favoured,
- ENEL as the grid operator was not ready to connect so many independent producers and in some cases proposed connection charges that were unreasonably high.

Nevertheless, some important positive results have been achieved under the CIP6 programme:

- after 30 years of strict monopoly, the figure of the independent electricity producer appeared for the first time in Italy,
- new RES-E (wind, biomass, wastes) was successfully deployed, thanks to the confidence inspired by the stability of the programme,
- important investment opportunities have been created (> 10 billion Euro).

3. A legislative overview

The electricity sector in Italy was entirely restructured by the Decree Law 79/99 of February 19, 1999 that implemented the European Directive 96/92/EC. As a matter of fact, Italy chose to go beyond the implementation and opted for the unbundling of the monopoly and the creation of a power exchange, while simultaneously re-organising the regulation of the electricity sector.

3.1. The framework of the reform of the electricity industry

The law reforming the electricity sector (Decreto Legislativo 16 Marzo 1999, n. 79) is somehow a compromise between two opposite positions, one that wanted the full liberalisation of the electricity sector and one that tried to keep the monopoly of ENEL untouched.

The electricity sector designed by the new law combines competition and public service obligations in a rather original way. The main characteristics of the reformed sector are recalled below.

The *consumers* are classified as eligible and captive, with a threshold decreasing in time: 30 GWh from the liberalisation of the European market, 20 GWh from January 1st 2000, 9 GWh from 2002. Interestingly, consortia of consumers can also reach this minimum consumption, given that each consumes more than 1 GWh. This opened the access to the market to some 4500 small consumers in the year 2000. A further liberalisation was decided later on in 2001, opening the

²This figure was estimated by multiplying the year 2000 extra prices by the energy produced in 8 years by all the RES-E projects admitted to the programme

free market to all commercial consumers greater than 0.1 GWh per year, 90 days after the sale by ENEL (in early 2003 at the latest) of the last of the three generating companies, as imposed by the 1999 law.

The *generation* of electricity is free and an authorisation procedure is in place. Renewable energy and co-generation plants have priority of access to the grid. After January 2003 no generator is allowed to produce or import more than 50% of the electricity sold in Italy with the aim of favouring competition. By this same date, ENEL has to sell at least 15 GW of its capacity. ENEL, according to the law, has spun off three new generating companies, Eurogen, Elettrogen and Interpower, and in 2001 Elettrogen was sold to a consortium led by the Spanish utility Endesa.

The *despatch* of all the power plants is done by a new independent transmission system operator, GRTN, owned by the government, responsible for the security of the system, the quality of the supplied energy and the provision of information concerning the system.

GRTN as *transmission* system operator becomes the kernel of the system. It created two other new institutions of crucial importance: the Single Buyer and the Power Exchange.

The Single Buyer (Acquirente Unico, AU), created in 2000, has to sign the purchase contracts for all the energy sold on the franchise market, even if the future size of such market is not yet clear. It is unknown, in

fact, how many small consumers will opt for the free market. With the creation of separate markets for eligible and captive customers, and under the political mandate of a single tariff for the captive customers, AU has been created to supply captive customers at minimum cost, with a no-profit constraint. The distributors are thus obliged to buy electricity from AU.

The Power Exchange, GME, Gestore del Mercato Elettrico S.p.A., based on a Pool model, had to be operational from January 2001, but its start-up is expected in 2002 at the earliest, considering the delayed publication of its operational rules.

Concerning the structure of ENEL, in addition to the sale of part of the generating plants, the law required separate companies to be constituted for:

- generation of electricity,
- distribution to captive customers,
- sale to eligible consumers,
- ownership of the transmission grid,
- decommissioning of nuclear power plants.

In response to the new regulatory framework, ENEL made the strategic choice to diversify its activities in other sectors, like telecom, water management, and gas distribution, changing its structure into a multi-utility operating at the international level. A new reform law under discussion and expected to be issued in July 2002 foresees the merger of GRTN with Terna and its

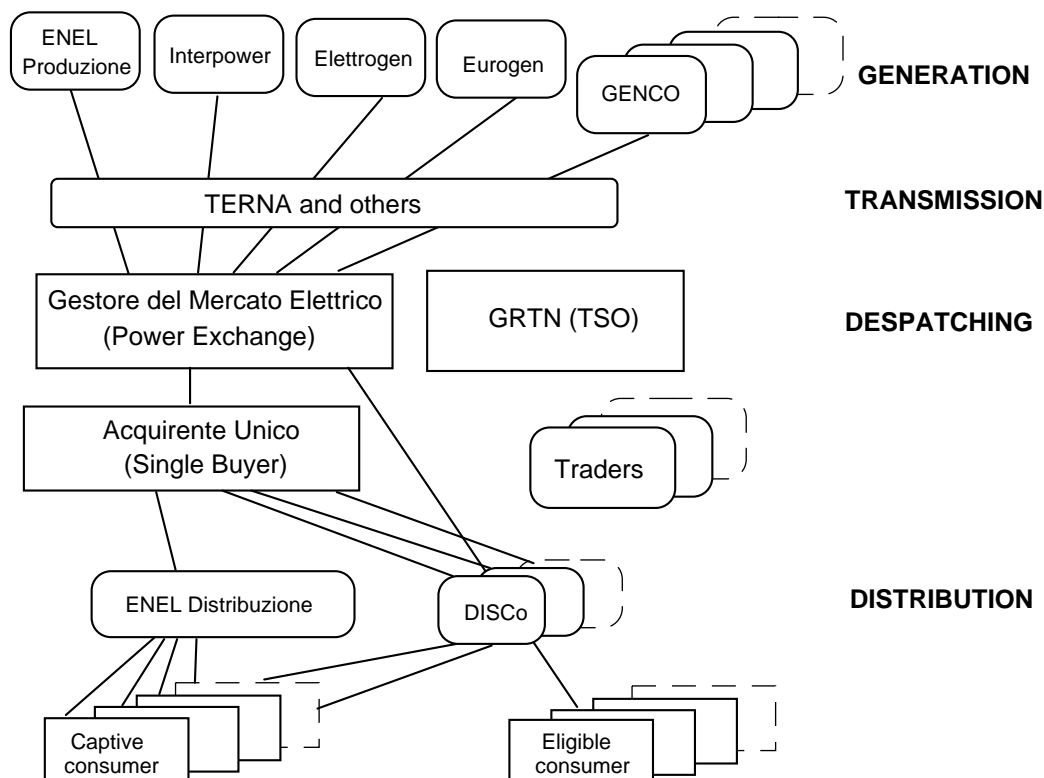


Fig. 1. The structure of the new Italian electricity sector (contractual relationships are not shown).

vesting on the market with a cap at 10% for the share of any electricity company.

In Fig. 1, the structure of the new Italian electricity sector is schematically represented.

3.2. The measures to support renewable energy growth

The reform of the electricity industry was a privileged occasion for the implementation of new support measures for the exploitation of renewable energy. The challenge for the legislator was to put into practice a scheme compatible with a competitive market without creating unnecessary rents to the owners of the existing renewable power plants—mainly big hydro—which already benefited from other sources of support in the past.

The idea of a Renewable Portfolio Standard, proposed in the United States at the beginning of the 1990s, seemed to fit the Italian goal of boosting renewable electricity generation, as required by the documents of energy policy at the European level. The portfolio, if properly designed, could guarantee a market for renewable energy sources while maintaining at the same time a competitive environment in generation (Espey, 2001). A problem emerged with the existing large hydro power plants which are already depreciated and thus quite competitive (over 17 GW). They are renewable even if they do not need support to operate in a market environment. The portfolio has been thus limited to new renewable power plants, i.e. those that came on line after April 1, 1999, with the aim of supporting only the construction of new renewable capacity.

From 2002 all the electricity producers or importers have an obligation to certify that at least 2% of their net sales come from new RES-E. Renewables, co-generation (satisfying an efficiency requirement not yet established by the energy regulator) and the first 100 GWh per year produced by each company are excluded from this obligation.

In order to facilitate the fulfilment of the obligation, GRTN issues a TGC for each 100 MWh produced in the first 8 years—after up to 18 months of test operation—to plants deemed qualified by the GRTN. After 8 years, the renewable plant can no longer obtain TGCs and has to compete on the electricity market. TGCs are an instrument to distinguish the sale of electricity from the environmental value of renewables and can be sold separately from electricity (GRTN has an obligation to give priority to the supply of electricity from renewables and co-generation). A specific market for these Green Certificates will be operated by the GME, as soon as it starts working. GRTN will withdraw the TGC from circulation when required by its owner, in order to satisfy the obligation.

The mechanism has an implicit strength in promoting the construction of new power plants, as after 8 years the capacity required to satisfy the portfolio in the first

Table 3

RES-E penetration (new and existing) in the Italian electricity sector in our forecast

Year	RES-E estimated share of electricity production
2001	19.3%
2002	18.8%
2003	18.4%
2004	18.0%
2005	17.5%
2006	17.1%
2007	16.8%
2008	16.4%
2009	17.2%
2010	16.8%

year has to be replaced. In this way, not only the growth of demand implies a growth of RES-E generation, but also the replacement of qualified plants after 8 years. Nevertheless, the trend of growth due to the mechanism is not sufficient to raise the contribution of RES-E to 25% as required by the EU Directive on renewable energy (EC, 2001), and an increase of the 2% quota would be necessary in the coming years (Table 3).

The increase of RES-E promoted by the 2% TGC market does not keep the pace with the electricity demand increase, with a net effect of reduction in the penetration of renewables in the electricity sector, as is shown in Table 3. Only after 8 years, when the TGCs issued on the first year have to be replaced, will an increase of the quota occur, with the bulk of the production still coming from old big hydro power plants.

The fossil fuel producers and importers have to present to GRTN the TGCs, attesting to the fulfilment of obligation before the 31 of March of the following year. As an example, before March 31, 2003 the TGCs related to 2002 (and based on the electricity produced in 2001) have to be presented to GRTN to be withdrawn.

3.2.1. The enforcing Decree 11/11/99

Some details of the new TGCs market have been set in an enforcing decree issued on November 11, 1999 (Decreto Legislativo 11 Novembre 1999), the main points of which are the following:

- Re-powered plants are eligible for Green Certificates only for the part of new production; renewed ones can obtain qualification for the whole production according to some technical rules not yet fully known.³

³ For plants abandoned for more than 5 years, the decree defines for each technology which parts would have to be replaced in order for the plant to be qualified as new, but in practice it remains unclear when a renewed plant can attain qualification. A commission made by GRTN, the Ministerial staff and the Electricity and Gas Authority should decide according to technical criteria set in March 2002 (Gazzetta Ufficiale no. 171 of March 25, 2002).

- Very small plants producing less than 100 MWh seem to be eligible for TGCs only if they aggregate their production.
- A system of self-certification is established for the issue of certificates to new power plants in the following year.
- The decree also arranged the transition of the old CIP6 support scheme to the new TGC market. Many of the plants admitted to the CIP6 programme (shown in Table 2) were not yet on-line on April 1 1999. Considering that they had the right to get the CIP6 price as well as the Green Certificate and that they would receive twice the support premium, they are given two choices:
- They can give up the CIP6 contract and choose the TGC. This option is reputed to be quite uncertain because the TGC price is unknown;
- They can keep the CIP6 contract, but their TGCs are traded by GRTN, who pays their extra price. GRTN then sells the TGC on the market at a price set by law as the average of the extra prices paid to acquire electricity in the CIP6 programme that year. GRTN can recover at least part of its extra costs or even all of them, in case it can sell all its TGCs.

Most of the producers are expected to keep the CIP6 contract, as it assures cash flow for 8 years, instead of betting on the TGC market.

With these rules, GRTN will strongly influence the TGC market in the first years of its operation, as it will sell most of the certificates at a regulated price. It is expected, in fact, that the plants with a CIP6 contract would satisfy almost all demand of TGCs, even though the construction of some of these plants are highly uncertain.

The role played by GRTN under these rules is quite odd, as it will be in one of the following positions:

1. In a situation of TGC lack, with a price presumably soaring, GRTN would be forced to maintain a lower price, thus giving up part of its prospective revenue. The question of which operators will have the right to buy from GRTN below market price also arises.
2. With excess TGCs supply, the clearing price would be below GRTN price, and it can be expected that at least some of its TGCs will remain unsold.

4. The role of the grid operator GRTN

As already said, the kernel of the new support system is the grid operator GRTN and its affiliated company Gestore del Mercato Elettrico. Even if the details of the new market are not fully known, GRTN has been given a list of duties of primary importance:

- Issue the guidelines for the procedure of qualification of facilities (done in November 2000) and be responsible for the qualification of the power plants, including the much debated re-powering processes and renovations. It published the first list of qualified plants (IAFR) in July 2001.
- Collect the information on RES-E production and publish information on the qualified plants. Much of the transparency of the market depends on its ability to communicate this information properly.
- Release the TGCs to the entitled electricity producers.
- Control the RES-E production and the TGC demand self-communicated by the operators.
- Redeem the TGCs supplied by the operators fulfilling their obligation of sold electricity.
- Certify the renewable origin of the electricity produced by qualified facilities for other commercial purposes, i.e. green prices.

GRTN owns the TGCs of the projects commissioned after 31 March 1999 under CIP6 contract. It has the right to sell and purchase TGCs in order to compensate the yearly production fluctuations, or even to sell “virtual TGCs”, i.e. ones not covered by any real production, in order to satisfy the quota in case of excess demand, with the obligation to cover the virtual emission within a 3-year period. As an example, in 2002 GRTN could sell virtual TGCs if it thinks that there are not enough certificates, with the obligation to cover them with real production in the three following years 2003–2005. With this mechanism, the scarcity of RES-E that could boost the price of TGC could be postponed.

While it has to sell its TGC at a regulated price, it should purchase them on the market at an unknown price, with the risk of not covering its purchase costs. Considering the large production of new CIP6 projects, GRTN, conscious that it could strongly influence the future market, is likely to not resort to virtual emissions.

5. The market for TGCs

While GRTN has the technical duties shown above, its daughter company GME has to operate a market where Green Certificates can be freely traded.

The price of TGCs should be set by the equilibrium of supply and demand. Nevertheless, in the first years of operation, when GRTN will trade great amounts of certificates at a regulated price (the difference between the subsidised price paid for the purchase of the CIP6 electricity and the income from the sale of this electricity on the market), the price is expected to be strongly influenced by the GRTN offer. As shown in Fig. 2, the GRTN estimated offer alone is sufficient to cover the

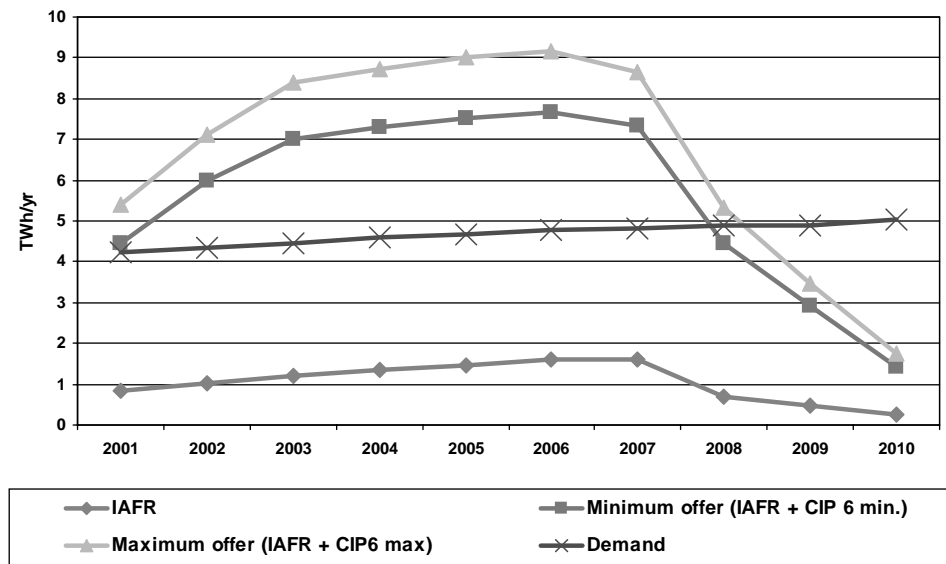


Fig. 2. Estimate of the future trend of the Green Certificate market

demand of TGCs. The investors are looking at this price (linked to the retail price index) in their investment plans. Our simulations, based on the prices of Table 1 for the electricity purchased by GRTN from CIP6 contracts and the quantities of Fig. 2, find a reference price for these TGCs at some 6.5–7 Eurocent/kWh, to be added to the price of the electricity sold by the RES-E producer. In case of excess of supply, private producers can sell their TGCs at a lower price displacing the GRTN offer. The GRTN offer price becomes an upper limit to the price of traded certificates.

TGCs can also be traded privately out of the official trading floor of the GME. This poses some problems of control of the validity of the certificates (the details about the registration of each sale of a TGC have not yet been issued). At the same time there is the opportunity for the renewable producers to stipulate long-term contracts (up to 8 years) for selling certificates at a price maybe lower, but secure.

5.1. Timing

The Green Certificates' market has been conceived in the frame of the initiatives for the fulfilment of the environmental goals set at Kyoto, which should give their results by 2010. The market has to start the operation soon, and the investors need to have confidence in the new mechanism. The obligation on the producers and the issue of the certificates are thus effective from 2002. The milestones are as follows:

- July 2001: begin qualification of facilities,
- 20 February 2002: qualified facilities can require TGCs from GRTN with reference to the certified production of 2001. New plants can require TGCs for

the production expected in the current or even following year, if properly justified. Compensation on the basis of real production in the next year or with other power stations of the same operator will be done at the end of the year. The TGCs emitted in advance remain valid only for the year they are issued for.

- 31 March 2002: deadline to communicate to GRTN the amount of thermal electricity produced and imported in the previous year burdened with the obligation.
- 31 March 2003: terms for the presentation of TGCs related to 2002, equal to 2% of the electricity from non-renewable fuels or imported in 2001 exceeding 100 GWh.
- 31 March 2006: GRTN must cover the eventual emission of "virtual certificates" in 2002, closing the transition time of the mechanism.

6. The demand of TGCs

According to the present law, the renewable portfolio is set on the electricity produced and imported. The choice to charge the producers with the obligation is due to the reduced cost of control, as it is much easier to assure fulfilment of obligation from dozens of operators, rather than hundreds of distributors or millions of consumers. On the basis of the available data, we made a forecast of the demand and supply of TGCs in the coming years. On the demand side, we assumed a reasonable growth rate for the demand of electricity and combined heat and power production, with an increase of RES-E production minimum to satisfy the 2% obligation. The results of our scenario are shown in

Table 4

Estimate of the future demand of electricity and RES-E portfolio (TWh per year)

Year	Final Electricity Demand	RES-E	Cogeneration	Production and import with obligation	2% Quota
2001	307.660	59.378	32.771	211.510	4.230
2002	315.505	59.410	34.771	217.324	4.346
2003	323.708	59.526	36.771	223.411	4.468
2004	332.286	59.648	38.771	229.867	4.597
2005	340.760	59.777	42.771	234.211	4.684
2006	349.108	59.864	46.771	238.473	4.769
2007	357.487	59.949	51.771	241.767	4.835
2008	365.888	60.015	56.771	245.102	4.902
2009	374.486	64.312	60.771	245.403	4.908
2010	383.287	64.435	62.771	252.081	5.042

Source: IEFÉ, Bocconi University, mimeo 2001.

Table 4. The demand of TGCs should be in the region of 4–5 TWh in the next decade, even if it seems certain a gradual increase of the quota from 2005.

7. The expected offer of TGCs

An important matter in the operation of the market is its correct tuning; the price of TGCs and the capability to promote RES-E are strongly influenced by the equilibrium of supply and demand. Many situations could occur, depending on, among other things, also the behaviour of GRTN and the setting of the details of the market, with a price of TGCs ranging from zero to infinite, in theory. The challenge for the regulator today is to keep a quota that can be changed according to the law, at the right level to be effective in promoting RES-E. On the supply side, we have taken into account two categories of plants:

1. the new projects proposed after April 1999 and certified as renewables by GRTN (IAFR),
2. the projects from the CIP6 programme that received formal acceptance in two deliberations of the Italian Energy Authority of July 2001, discarding other projects that could not demonstrate to have the required permissions.

At October 2001, the IAFR-qualified, extra-CIP6 plants were 91, with a total capacity of 480 MW and an estimated production of 1.2 TWh. The result of our estimate is reported in Fig. 2.

The production of CIP6 plants with TGC is expected to range from 6 TWh in 2002 and 7.5 TWh in 2005, decreasing to zero in 2013.

As a matter of fact, even among those considered, the feasibility of some CIP6 projects is still uncertain, especially biomass and waste combustion plants that are meeting strong opposition at the local level. This fact

suggested that a reduced estimate should also be made, considering the mortality rate of CIP6 projects in the 1999–2001 timeframe (–30% in energy terms). The result based on our assumptions for the production of the new RES-E plants gives an idea of the market trend and fits well with the calculations made jointly with GRTN in November 2001.

8. The indeterminate aspects

At the end of 2001, several aspects of the mechanism are still undefined, and it seems quite urgent to give to prospective investors the required information and assurances indispensable for financing the projects. The most urgent and critical aspects to be dealt with in order for the TGC market to start effectively are briefly recalled below.

- *Definition of fines for defaulting producers.* At the moment, nothing is said about what would happen to fossil generators that do not consign to GRTN the required certificates. This aspect is extremely important, as all the credibility of the instrument depends on its firmness. Proposed penalties/disincentives include a fine (with some administrative complications) or the exclusion of the defaulting fossil fuel plants from participating in the electricity market in the following year (a quite severe measure).

The problem could be solved if GRTN could sell a sort of “buy-out certificate” at a price higher than that of the traded TGCs (1.5 times the average price on the TGCs market in the previous year). A producer that did not acquire the TGCs related to its production could purchase this buy-out certificate in order to fulfil its obligation. The revenue from such sales could be given to the development of new renewable energy plants.

- *Emission of “virtual certificates”.* As said above, GRTN can issue certificates not related to a real renewable production, with the obligation to cover them in 3 years time. This could be a powerful instrument to influence the operation of the market. For instance, it could hide the scarcity of TGCs and keep the price low, while high prices could attract new investors. GRTN should specify how it intends to use this opportunity.
- *Validity of the certificate.* The TGCs related to 1 year expire after 31 March of the following year. In other words, they can only be sold in the year to which they are related. Two consequences derive:
 - a. In case of over-supply of TGCs, they cannot be held in order to keep the price high. The risk would be a continuation of excess supply in the following years.
 - b. A strong power could be given to the buyers, especially in presence of a market dominated by one single fossil producer (ENEL).

It is hard to say if TGCs without expiration would be a better solution.

- *Size of the certificate.* The choice to set at 100 MWh the size of a TGC could displace some small producers. In fact, even if they can aggregate their productions to reach 100 MWh, for some technologies (PV) the cost for the aggregation of different producers could be high. Why not a smaller size?
- *Energy sources admitted.* The Italian energy policy advocated the inclusion of wastes and big hydro among the renewable technologies. Different choices have been made by other countries. Could this be an obstacle to the integration of the TGC market at the EU level?
- *Lack of a long-term target.* The TGC market is not backed by specific documents of energy policy setting long-term targets, as required by the EU Directive 2001/77/EC (DTI, 2000). A clear commitment to maintain support to RES-E in the long term is not taken, and investors perceive this as a risk. A focused policy act with targets for RES-E at the national level, as required by the renewable energy Directive, would boost the confidence of new investors in the new market. Of course, much depends also on the commitments taken at the international level in favour of RES-E
- *Administrative costs.* A basic requirement for a support scheme is its low administrative cost. In this case nothing is known about the cost of the market operation and control. Neither is it known who has to pay the costs of the TGC market and how. Is this a system cost to be socialised? Or should the suppliers pay a fee to participate? Or perhaps the consumers should pay a surcharge to their electricity bills?
- *Reciprocity.* It is provided that the obligation can also be fulfilled by importing electricity from power

stations fed by renewable sources commissioned after 31 March 1999, but only from countries adopting similar support systems for renewable energy, based on market instruments open to the power stations located in Italy. At this time such countries do not exist. Moreover, in the case of import, there is the additional barrier that the TGC is traded jointly with its electricity production and not separately as it happens for the Italian renewable production. Could these conditions ever be met? The varying definitions of RES-E in different EU countries and the national specificity of the support programmes make the reciprocity almost impossible if the programme is not jointly established (Hoogland and Schaeffer, 1999), (Morthorst, 2000), (Schaeffer and Boots, 2000). The reciprocity could be recognised also with non-EU countries. The participation to a joint EU market seems at the moment quite difficult as the reciprocity requirement would be hard to meet in full with other countries.

9. Conclusions

Italy has opted to support RES-E with a competitive market, equal to 2% of the thermal electricity produced and imported into the country, reserved for new renewable energy plants. In this market all new RES-E will compete, with a clear advantage for the least expensive technologies. Nevertheless, the price level in such a market seems to be quite high, considering that it is the dearest production included that clears the price and some quite expensive productions would be required to fulfil the obligation. In order to facilitate the fulfilment of obligation for the producers, from 2002 the grid operator GRTN will issue Green Certificates for new renewable energy production. A forced demand and a price free to fluctuate should be a favourable condition for renewable energy suppliers. Nevertheless, the uncertainty perceived by the operators for the coming years has not yet boosted investments, with abundant capacity still to be commissioned from the previous support system formally closed in 1995.

The challenge for the Italian electricity sector today is to define the details of the new support scheme and reduce the perceived risk for new investments.

References

- Decreto Legislativo 16 Marzo 1999, n. 79. Attuazione della direttiva 96/92/CE recante norme comuni per il mercato dell'energia elettrica. Gazzetta Ufficiale 31/3/1999, Serie generale n.75.
- Decreto Legislativo 11 Novembre 1999. Direttive per l'attuazione delle norme in materia di energia elettrica da fonti rinnovabili di cui ai commi 1,2 e 3 dell'articolo 11 del decreto legislativo 16 marzo 1999, n. 79. Gazzetta Ufficiale 14/12/1999, n. 292.

- De Paoli, L., Lorenzoni, A., 1999. *Economia e politica delle fonti rinnovabili e della cogenerazione*. Franco Angeli, Milano.
- DTI, 2000. New e renewable energy—prospects for 21s century—the renewables obligation preliminary consultation, October. <http://www.dti.gov.uk/renew/ropc.pdf>
- EC, 2000. Libro verde: Verso una strategia europea di sicurezza dell'approvvigionamento energetico, novembre. http://euro-pa.eu.int/comm/energy_transport/it/lpi_lv.it1.html
- EC, 2001. Directive 2001/77/CE of 27 September 2001, on Official Journal L283 of October 27, 2001.
- Espey, S., 2001. Renewables portfolio standard: a means for trade with electricity from renewable energy sources? *Energy Policy* 29, 557–566.
- Gulli, F., 1999. *Politica Ambientale e cambiamento tecnologico*. Scritti di Economia Aziendale, EGEA, Milano.
- Hoogland, F.C.J., Schaeffer, G.J., 1999. Green certificates; empowering the market? May, p. 5. <ftp://ftp.ecn.nl/pub/www/library/paper/1999/ecnenw99.pdf>
- Morthorst, P.E., 2000. The development of a green certificate market. *Energy Policy* 28, 1085–1094.
- Schaeffer, G.J., Boots, M.G., 2000. Options for design of Tradable Green Certificate Systems, Öko Institute, Institute for applied ecology, and SPRU, Science and Technology Policy Research, April.