Chapter 11
Italy

11.1 INTRODUCTION

Although 2001 was a good year for wind plant deployment, this unfortunately was not the case for 2002. In fact, at the end of December 2002, cumulative wind capacity reached 788 MW, with only 106 MW of new plants installed since January 2002. Two main reasons could explain this result. The first reason is the difficulty that exists in dealing with a new incentive scheme based on green certificates. The second reason is in part composed of a strong battle by a minority of environmentalists against the installation of wind turbines on the mountains (due to visual impact) and in part due to uncertainty and aversion on behalf of regional authorities in at least two regions.

An agreement between the Ministries for Culture, Environment, and Productive Activities and the Conferenza delle Regioni for supporting wind energy deployment and its proper insertion into the landscape should improve and speed up the authorization process. However, so far only the Ministry of the Environment has approved the agreement, and the other approvals are expected soon.

11.2 NATIONAL POLICY

Strategy

The Italian parliament, through Law 120 of 1 June 2002, ratified the *Kyoto Protocol on Climate Changes*. The Ministry of the Environment implemented a *National Plan for Greenhouse Gas Reduction*, approved by the Interministerial Committee for Economic Planning (CIPE) in December 2002, aimed at complying with the planned objectives on gas emissions. In August 2002, CIPE approved another document issued by the Ministry of the Environment: *Environmental Action Strategy for Sustainable Development*. On the basis of these CIPE resolutions, the actions, tools, targets, and monitoring aspects of the *National Plan for Greenhouse Gas Reduction* and the *Environmental Action Strategy for Sustainable Development* will be updated. In this context, the role played by the regions is decisive, including implementation of the energy-environmental plans that should support renewable energy sources.

The Italian white paper for the exploitation of renewable energy sources (RES), approved by CIPE in August 1999, establishes that the annual amount of electricity produced by renewables should increase from 10.2 Mtep in 1997 to 16.7 Mtep from 2008 to 2010, corresponding to 75 TWh per year. An additional 11 TWh could be added to the reference value. In addition, the *European Directive 2001/77/CE*, which will be considered the reference document, sets as an indicative target that the electrical energy generated by RES should increase from 16% of the total internal gross electricity consumption in 1997 to 25% in 2010.

In accordance with *European Union Directive 96/92 EU* on the liberalization of the electricity market, the restructuring of the domestic energy sector is in progress.

In March 1999, *Legislative Decree 79/99* was issued, which fixed new rules in the national electricity sector. An important aspect of this decree is the obligation of a percentage of electrical energy produced or imported annually from conventional sources (beginning at 2%) to be generated from RES the subsequent year. This decree foresees a change in the system of stimulation and exploitation of renewable energy sources.

Pursuant to this provision in November 1999, a specific decree introduced a new support system based on the green certificate mechanism. This new system, actually in force from the beginning of 2002, should provide a satisfactory replacement to the previous system based on buy-back prices. Electricity produced by RES is labeled with green certificates issued by the Italian Independent System Operator (GRTN), which manages the electricity transmission grid; the green certificates are tradable.

In the summer of 2002, the government approved a draft law on restructuring and reform of the energy sector, prepared by the Ministry for Productive Activities and then passed it to the parliament, where it is now under discussion. Article 22 of the law is devoted to the increase of the mandatory quota of electrical energy from renewables. From 2005 through 2012, the electricity quota produced by renewables that must be put into the national electric grid is increased each year by 0.35%.

Beginning in 2003, subjects that have not fulfilled the quota obligation, now 2%, will be fined one-and-a-half times the money that would have been necessary for acquiring the amount of green certificates corresponding to the obligation for the previous year. The reference unit price for calculating the penalties is the maximum price of green certificates on the market the previous year, or, if more expensive, the price of green certificates issued by the GRTN. The revenues of such penalties will be credited to the account for new renewable and assimilated plants.

Progress Towards National Targets

According to Italy's national white paper, the Italian targets on wind energy are the following 700 MW by 2002, 1,500 MW by 2006, and 2,500 MW for 2008 to 2012.

The first objective was nearly reached at the end of 2001 under the old incentive system issued by the Interministerial Committee for Prices (CIP). This incentive system, *CIP Provision 6/92*, is based on feed-in tariffs, and in 2002, wind developers have installed wind farms with the new incentive mechanism based on green certificates. Due to difficulties faced by developers in tackling this new incentive scheme, growing environmentalist opposition, and bureaucratic and authorization barriers, the number of wind plants installed in 2002 (with a capacity of 106 MW) was less than that of 2001 (with a capacity of 263 MW). This was therefore not in accordance with the rate of 200 MW per year necessary to achieve the subsequent targets.

11.3 COMMERCIAL IMPLEMENTATION

Installed Capacity

During 2002, wind power capacity in Italy increased by 106 MW, and the total wind capacity at the end of the year reached 788 MW. Figure 11.1 shows the installed capacity (annual and cumulative) and the annual energy production.

IVPC4, a company of the IVPC group, and Edison Energie Speciali (Edens) were also active this year, installing at the end of 2002 and at the beginning of 2002, respectively, several wind farms in the mountains of the Abruzzo, Basilicata, and Sardinia regions.

A trend towards larger machines was noticed in Italy in spite of the mountainous terrain of most sites. Particularly, IVPC4 added 34 Vestas V-52s of 850 kW, built in Taranto, to the previous wind installations in Sardinia. Also in Sardinia, a 12-MW wind farm of seven 1,750-kW Vestas V-66 units was set

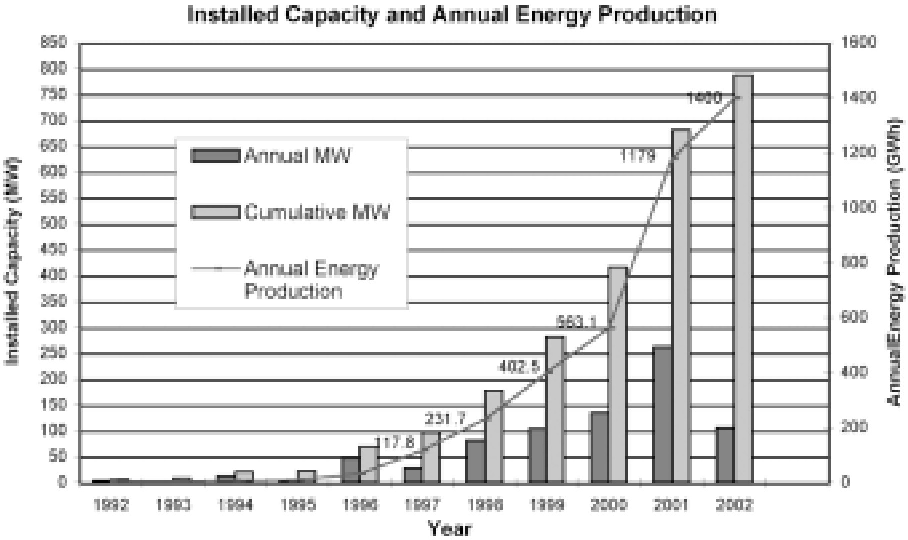

Figure 11.1 Installed capacity (annual and cumulative) and annual energy production

up at Enel GreenPower's Alta Nurra site in mid-2002 and has since been running well. This is the first production plant with turbines above 1 MW ever set up in Italy.

A new company that has recently entered the wind sector, Fin.so Energy, has completed its first wind farm at Ginestra degli Schiavoni (Campania), installing 21 Vestas V-52s of 850 kW each. Civil work on an additional 15-MW wind farm began in late September in the Campania region. The site is located on a hill 800 m above sea level (a.s.l.) and will host a total of 15 Fuhrländer FL1000 turbines. The operator is Harpen AG, which belongs to the RWE group.

Several new wind projects by IVPC, Edens, FRIEL, Lucky Wind, Eolo, and Enel GreenPower are ready to start at the beginning of 2003. An important contract was signed in August between Enel GreenPower and IWT, the Italian Vestas subsidiary, for supplying 134 V-52, 850-kW units with an option for 35 additional V-52 and V-47 turbines. The turbines will be delivered over the next two years and will be placed in nine new wind farms located in Sicily, Sardinia, Basilicata, and Molise, with an expected production of approximately 300 million kWh per year.

In the last year, Enel GreenPower has expanded its activities in wind energy significantly and aims to double its installed wind power capacity by June 2003 to reach a total wind capacity in Italy of 240 MW by the end of 2003. As a whole, the company plans to reach 900 MW installed capacity in Italy in five years. Enel GreenPower has also been working as a manufacturer of small-sized wind turbines – four MiniWind E20s of 20 kW each were in operation at the end of 2002, and there are plans to build an additional 20 units by March 2003. Jonica Impianti manufactures the blades of these small turbines. In this way, Enel GreenPower is confirming its commitment towards the development of wind energy in addition to its traditional renewable energy sources (geothermal plants and small hydro-power). Work has also been in progress abroad, in countries such as the United States and Costa Rica, Enel GreenPower has been acting for

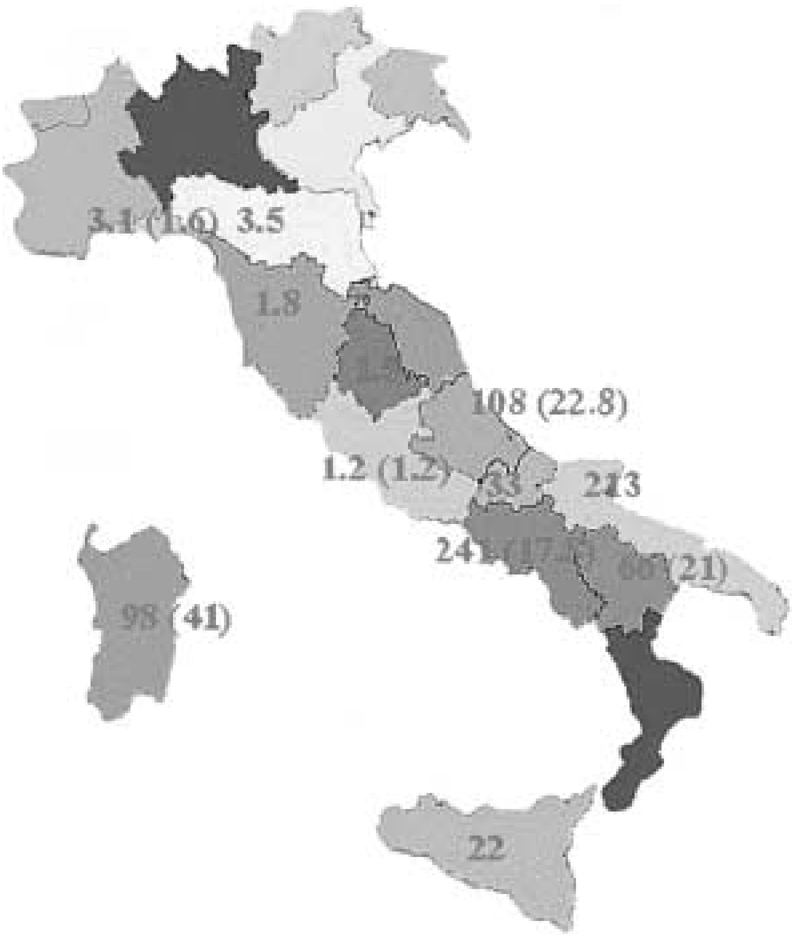

Figure 11.2 Wind capacity at the end of 2002 in Italian regions (new capacity for 2002 is in brackets)

some years through the acquisition of local renewable energy companies.

Rates and Trends in Deployment

The 106 MW of new wind power capacity installed this year are, as mentioned above, below the rate of deployment necessary to reach the next installation target. According to main developers, the decreasing rate of wind power in 2002 is likely to be temporary. In fact, some large wind projects are currently under evaluation by local authorities and, in the case of a positive response, the growth trend beginning in 2003 could be in line again with the national target.

Contribution to National Energy Demand

Due to the long time necessary to obtain definitive statistical data on electrical energy production, the 2002 figures presented here are provisional.

Domestic electrical energy demand was 310.4 TWh (including transmission and distribution losses) in 2002, increase of 1.8% from 2001. Of this amount, 50.6 TWh, 4.6% more than in 2001, were imported from foreign countries. In 2002, the gross electrical energy produced in Italy was 283.7 TWh, 1.7% more than the previous year.

Thermal plant production grew by 4.8% compared to 2001, with a total gross production of 229.8 TWh, while the gross contribution of renewable sources, including large and small hydro, was 53.8 TWh, with a slight drop from the previous year due to hydro-power (the total gross production of hydro-power plants was 48 TWh in 2002).

In 2001, the contribution of wind energy to electricity generation was 1,179 GWh, approximately 110% more than 2000. In 2002, the total wind energy production was estimated at 1,400 GWh. However, wind energy's share of the country's total energy demand remains small at less than 0.5%.

11.4 MARKET DEVELOPMENT AND STIMULATION

Main Support Initiatives and Market Stimulation Incentives

Finally, in 2002, all the wind plants entitled to obtain the premium tariff granted by *CIP6 Provision 6/92* were completed, and a new phase began with incentives for the building of renewable energy plants. Through the previous incentive system, more than 90% of Italian wind farms (corresponding to a total capacity of approximately 700 MW) were installed, particularly in southern regions.

Legislative Decree 79/99, in force since 1999, on the liberalization of the electricity market, states that the quota of energy produced by renewables should correspond to 2% of the annual conventional energy produced or imported annually until 2005. A subsequent specific decree regarding renewable energy sources defines the rules related to the emission of green certificates.

Electricity produced by renewable energy sources is labeled with green certificates issued by the GRTN. Green certificates are tradable, and one green certificate corresponds to 50 MWh of electricity generated by a renewable source. In order to stimulate the use of renewables by small energy producers, the value of one green certificate has recently been cut back from 100 MWh to 50 MWh.

This new mechanism for supporting clean energy sources is based on market competition, which began in January 2002. The green certificates can be sold or purchased on the basis of bilateral contracts or in an exchange organized by the Electricity Market Operator (GME). In practice, however, the exchange mechanism did not operate during 2002 – but it is likely to begin in 2003.

The following conclusions are based on the most recent information reported by the GRTN on green certificates related to renewable energy sources.

- The Green Certificate Demand value for 2002 was approximately 3.3 TWh, which corresponds to 33,000 green certificates. This involves 35 operators, producers, and importers of conventional energy who are subject to the obligation.
- Green Certificate Supply is composed of certificates relating to *CIP Provision 6/92* plants put into operation after 1 April 1999 issued by the GRTN (to avoid double benefit), and by those relating to private plants that have the qualification of Renewable Energy Sources Plant (IAFR) from the GRTN commission.
- On the basis of the production foreseen from plants qualified as IAFR and expected to be in operation during the year 2002, green certificate supply from private producers is evaluated at approximately 1.2 TWh (12,000 green certificates). Green certificates issued by the GRTN will cover the

remaining demand value (2.1 TWh).

- The GRTN has fixed the supply price per kWh of its green certificates for 2002. This price is equal to 8.418 Euro cents/kWh, which is the difference calculated between the average cost of the *CIP Provision 6/92* energy purchased by the GRTN in 2002 (generated from renewable source plants receiving incentives) and the revenue arising from the sale of the same energy in 2002.
- Green certificates can be sold or purchased on the basis of bilateral contracts or in an exchange organized by the GME.

With the aim of facilitating wind turbine installations, an agreement between the Ministries for Culture, Environment, and Productive Activities and the Conferenza delle Regioni has been approved by the Ministry for the Environment. The approval of the other subjects involved should happen soon. The main objectives of the agreement are as follows.

- Facilitating the pursuit of the national target.
- Favoring a proper insertion of wind plants into the landscape.
- Determining a framework to make authorization procedures easier, certain, and homogeneous.

Two additional main financing opportunities exist. The first is a tax credit for RES investments in favor of enterprises' corporate income tax declaration or on Value Added Tax (VAT) payments. Law 388 dated 23 December 2000 provides this opportunity. In fact, Article 8 of this law provides for the grant of a tax credit from 14 March 2001 to 31 December 2006 for the following. (However, the grant is not compatible with other types of financial support.)

- Interested subjects: Enterprises, particularly Small and Medium-sized Enterprises (SME), with new investments. Tax credit amounts are up to 50% for the SME and 35% for other enterprises.
- Territories concerned: Investments must be made in the South or in depressed areas of the Centre-North included in the list of "Objective 1 and 2" areas eligible for European Structural Funds.
- Investment categories: Purchasing of real estate, infrastructures, and durable equipment for new productive structures existing or to be developed in the areas mentioned, among which RES technology investments can be included.

The second financing opportunity is public aid from direct subsidies that assist RES investments, included in important laws such as the ones listed below.

- According to *Law 10/91* for the promotion of RES technology, the regions currently grant subsidies, mainly from revenues derived from carbon tax and excises on fossil fuels and in accordance with the provision of *Legislative Decree 112/98* for the decentralization of administration.
- *Law 488/92* has as its main national objective the increasing and improvement of production, the economy, and employment (particularly in the depressed areas included in "Objectives 1 and 2"). With this aim, the law provides for subsidies on investments to enterprises in various sectors, including electricity. The categories of eligible investments are: construction of new plants; enlargement, re-conversion, renovation, and updating of existing plants; rehabilitation of decommissioned productive plants; transfers of production plants; and restructuring of the organization of enterprises.

Like tax credits, subsidies are given in percentages of up to 50% for SMEs and 35% for other enterprises. Some categories of initiatives, such as those concerning the energy sector, can be co-financed with European Structural Funds.

The energy plans (Piani Operativi Regionali or PORs) of the Campania and Sicily regions have granted financial support to RES initiatives. This support is 235 million Euros and 125 million Euros, respectively, to RES initiatives including wind energy plants for the period of 2000 to 2006, according to the laws mentioned above. In regards to the wind sector, the Sicily region provides financial support to plant installations with power capacity more than 1 MW, constituted by wind turbines larger than 0.5 MW each.

Unit Cost Reduction

The ex-works cost of medium-sized wind turbines produced in Italy is approximately 640,000 Euros/MW, with a slight decrease compared to the previous year. Adding on-site assembly and transportation costs can increase total cost to 680,000 Euros/MW.

To these costs must be added the balance-of-system cost, which is approximately 25% to 30% of turbine cost, bringing the total cost per megawatt installed to approximately 900,000 Euros/MW. In particular, the contribution of the various balance-of-system items can be estimated as follows: civil engineering work, 15%; electro-mechanical engineering work, 7%; and grid connection usually ranging from 2% to 7%.

11.5 DEPLOYMENT AND CONSTRAINTS

Wind Turbines Deployed

During 2002, the number of new wind turbines installed was 137, with an average capacity of 774 kW, bringing the total number of wind turbines in Italy to 1,346. The average turbine size rose to 585 kW (see Figure 11.3).

Three new wind farms in the Campania and Sardinia regions are composed of 850-kW V-52 turbines, which were manufactured in Denmark and Italy.

The first wind farm ever built with large-sized machines, namely a plant with seven Vestas V-66s of 1,750 kW each, was installed at Enel's Alta Nurra site in Sardinia (see Figure 11.6).

Approximately 40 additional wind turbines, totaling approximately 30 MW, were installed by IVPC4 in the Campania and Apulia regions but are not yet connected to the grid. Work is in progress, and the high-voltage line

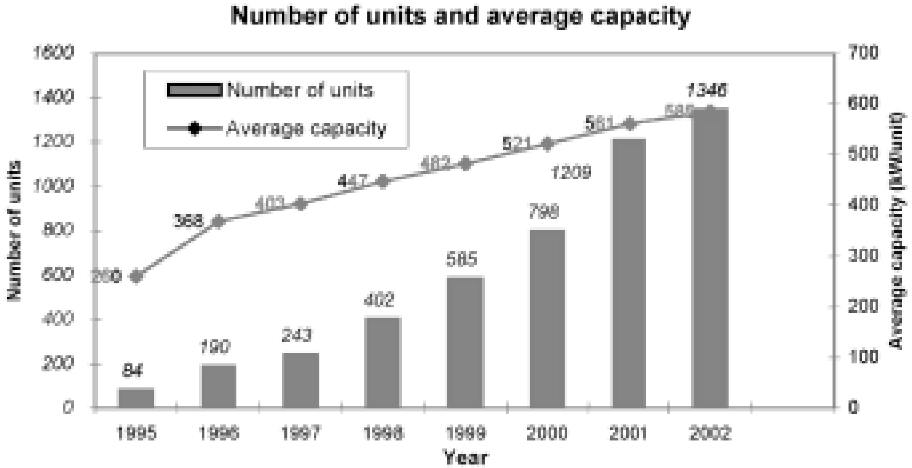

Figure 11.3 Number of turbine units and average capacity

necessary to transmit the energy produced will be completed at the beginning of the summer of 2003.

Figure 11.4 shows market shares for wind turbine manufacturers at the end of 2002, and Figure 11.5 shows the 2002 contribution by electricity producers from wind.

In Denmark and Italy, Vestas and IWT (an Italian Vestas subsidiary) have manufactured 65% of wind power capacity. Enercon, the other important manufacturer acting in Italy, has a 22% share.

The energy producers IVPC and Edison Energie Speciali confirmed their leading position in 2002. Two other new developers, FRIEL and Fin.so Energy have entered the Italian market, with approximately 18 MW and 9 MW, respectively.

Operational Experience

The wind regime in Italy during 2002 was not as good as the previous year. In fact, the load factor even in the most windy sites was equal to or less than 0.3. Wind turbines availability in 2002 was at the same level as 2001 with percentages of 98% and 99%. There were no particularly significant damages reported by developers.

Main Constraints on Market Development

In 2002, a minority of Italy's environmental associations, acting particularly at a local level, showed a growing opposition and increased the difficulties for new wind projects and installations. The main reason for this conflict with wind operators is the visual impact of wind turbines located on the top of hills and mountains.

Another main constraint on market development is represented by grid weakness and, sometimes, by the difficulties encountered in getting permission to build new electricity lines. The ongoing construction of a dedicated, 150-kV network for collecting power from wind farms in the most thickly developed area of Southern Italy has been suffering some delays, mainly for permitting reasons. More information can be found in the 2001 International Energy Agency (IEA) Wind Energy Annual Report.

In regard to authorization procedures, the agreement between ministries and regions

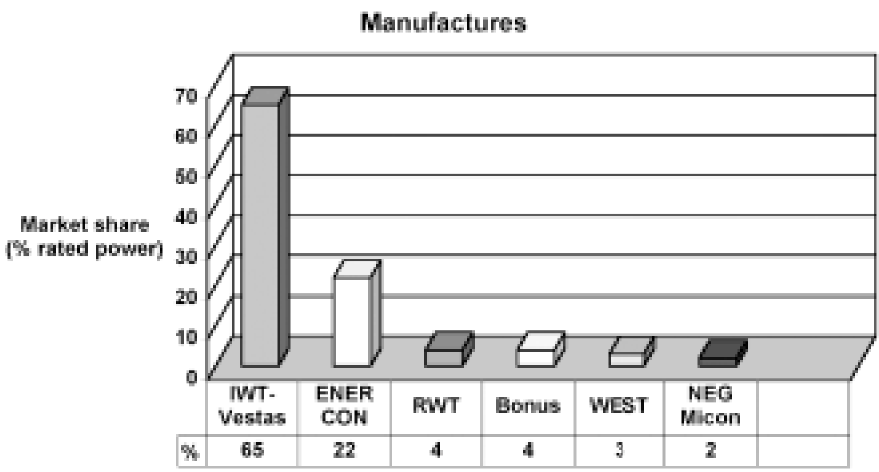

Figure 11.4 Market shares of wind turbine manufacturers at the end of 2002 (as a percentage of total online capacity)

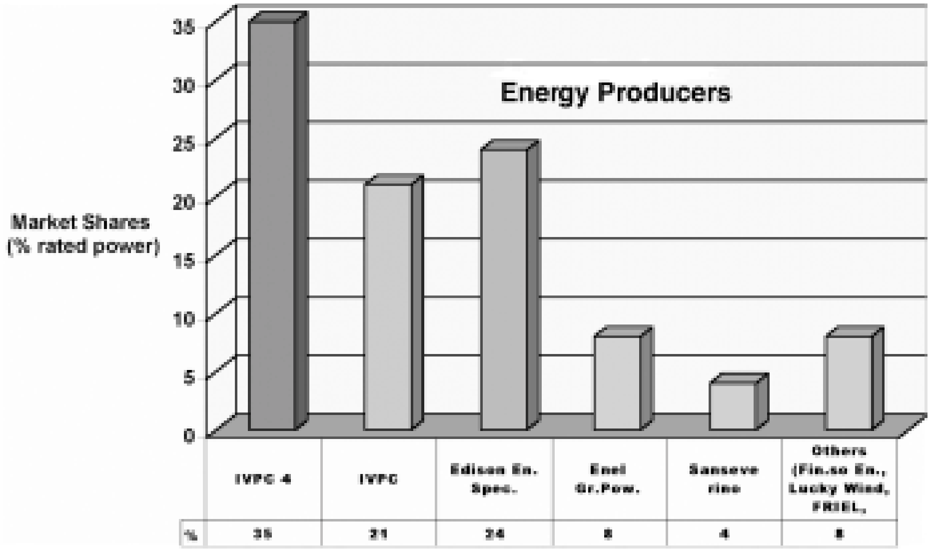

Figure 11.5 Contribution by electricity producers from wind at the end of 2002 (as a percentage of the total online capacity)

(as mentioned above) should reduce the barriers faced previously by developers.

11.6 ECONOMICS

Trends in Investment

Uncertainties due to the delay of the introduction of the green certificates exchange organized by the GME and growing difficulties encountered by wind investors in dealing with permit procedures have reduced the total capital invested in wind power in 2002 to approximately 100 million Euros.

Trends in Unit Costs of Energy and Buy-Back Prices

The wind plants installed in Italy under *CIP Provision 6/92* (about 90% of total wind power capacity) are entitled to obtain a premium tariff for the energy generated during the first eight years of operation. In 2002, the buy-back price for these plants was the same as the previous year, corresponding to 0.124 Euros/kWh.

GRTN has already fixed the selling price per kilowatt-hour of its own green certificates (ensuing from the energy produced by *CIP Provision 6/92* plants) for 2002. This value is equal to 8.418 Euro cents/kWh, calculated as the difference between the average cost of the *CIP Provision 6/92* energy purchased by GRTN in 2002 (only the share generated from renewable source plants receiving incentives) and the revenue from the sale of the same energy on the market in 2002.

When the green certificate exchange is fully operating, qualified wind producers that are not entitled to *CIP Provision 6/92* feed-in tariffs will obtain an overall income per kilowatt-hour corresponding to the sum of the electricity market price plus the green certificate value. As for the latter, in all likelihood it will have to be set equal or very close to the price of GRTN certificates at least in the next few years when the offer of certificates from *CIP Provision 6/92* plants will be prevailing.

Figure 11.6 Enel GreenPower's 12.25-MW wind farm, with seven Vestas V-66 units of 1,750 kW, at Alta Nurra site, in Sardinia

11.7 INDUSTRY

Manufacturing

IWT is the only wind turbine manufacturer in Italy involved in the production of blades and assembly of components. The factory is located in Taranto. In 2002, as a consequence of the fall in the internal market, it proved necessary to reduce IWT personnel significantly from 349 in 2001 to 250 in 2002.

In 2002, IWT began production of 850-kW turbines, and the first units made in Taranto were installed in Sardinia in November. The factory is able to produce about 400 medium-sized turbines (660 kW to 850 kW) per year, while bigger installations (1,750 kW to 2,000 kW) will be built by Vestas, for the time being, until the Italian large-sized turbine market grows enough to justify the construction of a new factory. Some components, such as steel towers and hubs, are built in Italy for IWT and Vestas according to Vestas specifications.

Through the acquisition of a new facility in Foggia, Wind Power Service (WPS) is enlarging its activity in the service and maintenance of Enercon and Riva Calzoni turbines installed in Italy.

The following component suppliers carry out additional activities in the wind sector.

- ABB-ASI for engines and generators.
- Brevini-Bonfiglioli for reduction gears.
- Ring Mill for forging.
- Colombo-Ariotti for casting.
- Magrini-Schneider for transformers.
- Pirelli for cables.
- Monsud-Leucci-Pugliese for towers.

Industry Development and Structure

In addition to IWT launching a new, 850-kW, V-52 production line, other developments were also made by the component industry. In particular, Monsud is very active in building tubular and lattice towers. A new Monsud factory devoted to the manufacture of wind towers is under construction in the province of Avellino. Colombo is a firm involved in the construction of hubs for medium-sized and large-sized turbines.

11.8 GOVERNMENT-SPONSORED R,D&D

Priorities

Although deployment trends have changed in Italy in the last year, the level of public and private involvement in research and development (R&D) is more or less the same as last year.

Apart from some universities – in particular Rome, Genoa, Bologna, and Perugia, which are engaged in aerodynamics, siting, offshore, and electrical systems – only the CESI company has carried research on wind energy. However, the Italian Agency for New Technology, Energy, and the Environment (ENEA) has some involvement under European Union (EU) contracts regarding offshore siting.

Perugia University has carried out a study on advanced aerodynamic methods for wind site selection. Wind potential in Italy has not yet been completely explored, and many investors are still looking into the most promising sites. The Perugia University study investigates and compares wind site characterization tools and methodologies based on aerodynamics. Simulations and tests were performed at sites in Central Italy, where the complex topography requires efficient methods for site characterization and selection, with the aim of speeding up wind turbine installations.

At a meeting held in Rome in February 2002 about the environmental compatibility of renewable sources, and in particular wind energy, some time was devoted to a new challenge for the design and architecture world, through the promotion of a competition on the subject of wind landscapes. The idea was to give a response to the growing opposition caused by the visual impact of wind turbines. This event was organized by Enel Green Power and Legambiente, the most important environmental association in Italy, and was supported by the Ministry of the Environment.

The main topic of the Rome meeting was the insertion in the landscape of wind energy production infrastructures in a manner that ensures that the relationship between man and the environment be the most correct, balanced and ethical. A particular subject discussed was the design of two wind farms at Cinisi, in Sicily, and at Pescopagano in the Basilicata region.

Qualified people from France, Germany, the Netherlands, and Switzerland carried out projects. This is a confirmation of the attention that the research and planning world is paying to renewable sources.

New R,D&D Developments

Researchers at three universities have investigated the possibility of using wind power for hydrogen production. This is due to an increasing interest in the application of hydrogen for remote autonomous power systems.

Elettronica Santerno, which has developed a hybrid solar generator integrated with fuel cells, has carried out another step towards the use of hydrogen generated from wind or photovoltaic (PV). The unit operates as a continuous source of energy capable of feeding either an isolated network or the existing electricity distribution network. The system, based on high-efficiency, solid-state switching converters, is capable of optimized and automatic exploitation of PV or wind energy. The energy storage function, compulsory to adapt the variable power level of the renewable sources to the power needed by loads, is performed by means of hydrogen.

CESI S.p.A.

The company CESI S.p.A. performs specialist services and research in all areas linked to electrical power. Its shareholders currently include companies of the Enel Group, GRTN, and several other utility and industrial companies.

The research work of CESI on wind energy has been supported by the fund appropriated for *Research on the Electrical System* as provided for by a decree of the Italian Minister of Industry, Trade, and Handicraft (now Ministry for Productive Activities) issued on 26 January 2000 and modified on 17 April 2001.

So far, the main activity has aimed at creating a general atlas of Italy's wind resources in order to provide local authorities and plant developers with a framework for singling out the best promising areas where search for wind exploitation sites can be focused. This activity was seen as the necessary follow-up from a number of wind surveys that had

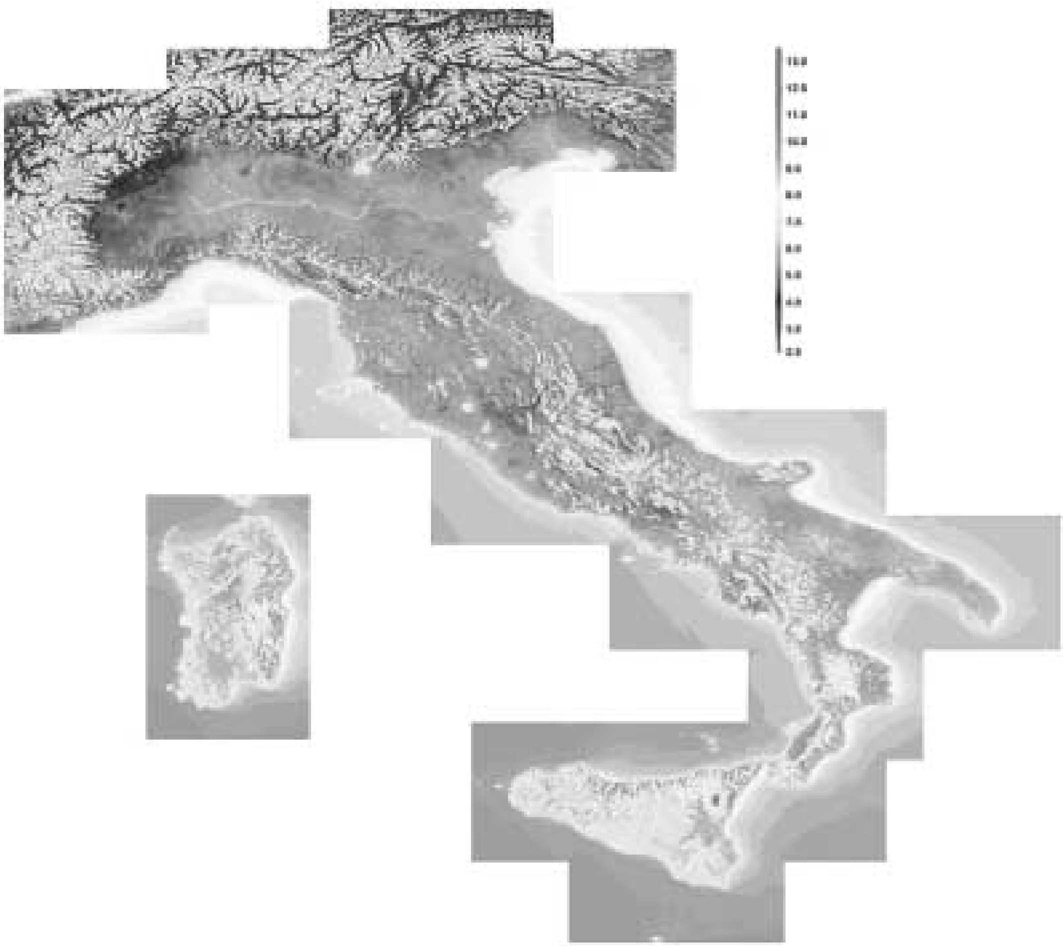

Figure 11.7 An overall wind map of Italy (annual average wind speeds at 25 m above ground) developed by CESI

been carried out by entities such as ENEA, the Enel Group, CNR, and other industrial companies over the past two decades.

The first phase of this work, conducted in 2000 and 2001, simulated the wind flow all over Italy, including Sicily and Sardinia, in co-operation with the University of Genoa. An up-to-date wind flow model (called WINDS) was used to obtain wind maps at various heights above ground from geotropic wind data provided by ECMWF of Reading (in the United Kingdom), taking into account topography and terrain roughness as worked out from data available from the U.S. Geological Survey.

A preliminary overall map of the annual average wind speeds at 25 m above ground is shown in Figure 11.7 as an example. Preliminary maps such as this, obtained by a simulation model, have been validated by comparison with measured data.

The second phase, conducted in 2002, aimed at fine-tuning these maps by comparing simulated wind speeds with data measured by current and historical stations throughout Italy. A method was developed to adjust maps in accordance with experimental data. A full atlas of validated maps will be made available at the end of 2002.

From 2000 to 2001, CESI also made a preliminary assessment on the feasibility of wind farms in mountain areas above 1,000 m. Since the results found this solution to be viable up to elevations of at least 1,800 m to 2,000 m, the methodology is now going to be developed further in 2003 to get an overall picture of Italy's usable high-altitude potential.

A 660-kW wind turbine was also bought with the intent of installing it at a 1,800-m site in the northern Apennines (Emilia-Romagna region) to check how well current technology can withstand in such an environment, especially in the winter. Unexpected delays that occurred during the permitting procedure for installing this machine in 2002 have caused the testing activity to be postponed until 2003.

In 2002, CESI also completed its general survey of the prospects for offshore wind farms by conducting a more in-depth analysis of some technical and economic aspects of wind plants in offshore situations typical of Italy. It was confirmed that some factors – such as deep waters, rocky sea bottoms, environmental constraints, and availability of erecting crafts – are likely to limit the extent of usable areas and bring about higher energy costs as compared to northern Europe. But this does not rule out the possibility to spot a number of sites where plants with 10 to 20 turbines could be feasible. Some additional information on offshore wind potential should be gathered next year.

CESI's average expenditure for wind energy research since 2000 has been approximately 700,000.00 Euros per year.

Offshore Siting

There has recently been some interest in offshore siting in Italy. In fact, after a feasibility study performed by the consultant group Garrad & Hassan on a site off the farthest Southern Sicily coast ordered by the province of Ragusa, the University of Bari prepared a feasibility study for an offshore wind farm in the Apulia region.

ENEA is involved jointly with the Nansen Institute (Norway) and the Risø National Laboratory (Denmark) in a European project (called WEMSAR). The Nansen Institute is coordinating the project, and so far the main results achieved are as follows.

- Wind retrieval algorithms for satellite data have been reviewed and presented in a report.

• SAR images have been obtained and analyzed to derive wind speeds at test sites in Norway, Denmark, and Italy.
• In-situ meteorological data have been acquired and analyzed for the three test sites for comparison with the SAR-derived wind speeds.
• Model simulations of the local wind fields at two test sites have been carried out.
• Validation has occurred of SAR data against in-situ data for all three test sites.

ENEA is also engaged in the organization of the fourth OWEMES seminar, which will be held in Naples in April 2003.

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