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THE CURRENT WIND ENERGY PROGRAMME IN ITALY

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ABSTRACT

In Italy, the main activities in the field of wind energy are carried out by two state-owned organisations, ENEA and ENEL, and two major wind turbine generator manufacturers, Alenia/WEST and Riva Calzoni, within the framework of a national programme which is supervised by the Ministry of Industry and Commerce. The work currently under way concerns both wind power plant siting and the development and testing of Italian-made wind turbine generators ranging from 5 to 1500 kW in power. In addition, programmes aimed at constructing wind-farms made up of medium-sized machines (200-400 kW) have recently been launched.

ORGANISATIONS INVOLVED

The Italian wind energy programme is supervised by the Ministry of Industry and Commerce, in accordance with the guidelines laid down in the National Energy Plan (PEN). The latest version of PEN, which has been drafted by the Government and is now being discussed in Parliament, provides for significant use of wind in electricity production, albeit only as a supplementary source. Specifically, the new PEN sets a target of 300 MW of generating capacity to be installed, with medium-sized (200 - 400 kW) wind turbine generators (WTG's) by the year 2000. This capacity may be raised to 600 kW, provided competitive large-sized machines (1 MW or more) subsequently become available.

The organisations involved in the Italian wind energy programme act in such a way as to be complementary to each other. As for state - owned organisations, these include:

* ENEA (The Italian National Committee for Research and Development on Nuclear and Alternative Energies), which supports wind power projects both financially and technically.

In particular, ENEA promotes the development of stand-alone small-sized WTG's and wind-pumps as well as projects of

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medium and large-sized WTG's to be connected to the national grid or included in small local electricity systems. In addition, ENEA is also engaged in a wind-energy survey involving most of Italy, aimed at pinpointing potential sites for wind power stations (wind-farms). Feasibility studies of wind-farms are, at present, also being supported by ENEA.

ENEA's financial commitment up to 1989 totalled about US \$50 mill.

An overall expenditure of US \$70 mill has been foreseen for the period 1990 - 94.

* ENEL (the Italian National Electricity Board), which is the main electricity utility in Italy and, therefore, the main potential user of wind turbine generators, especially with regard to medium - sized and large units to be used in grid-connected wind-farms.

ENEL has been active in the area of wind energy since 1980, the year in which the first programme (the VELE Project) was launched. January 1988 saw the beginning of a new programme that, on the one hand, continues research on wind plant siting in co-operation with ENEA, and, on the other, provides for the testing of small, medium and large-sized WTG's. Specifically as regards medium and large machines, a formal working agreement exists between ENEA and ENEL. More recently, ENEL has also launched another major programme, which provides for the setting up of two large demonstration wind-farms.

ENEL's wind-energy activities involved an overall financial commitment of US \$20 mill up to 1989. A total expenditure of US \$104 mill has been decided on for the period 1990-94.

A clear, strong commitment both by the chief industrial promoter (ENEA) and by the main electricity utility (ENEL) is seen as the vital counterpart to industry in the evolution of the wind energy market in Italy, that will give manufacturers the support they need at the present stage of product development.

As for industry, the main manufacturing companies concerned are the following:

* Alenia, a new company formed by the merger of Aeritalia (the leading Italian aerospace company) and Selenia. Alenia has taken over Aeritalia's activities in the wind energy field, which concern development of small, medium and large-sized WTG's. Particularly, the WEST company, a subsidiary of the Alenia Group, has been entrusted with the manufacture of medium and large machines.

* Riva Calzoni, a manufacturer of turbines for hydro power plants and hydraulic equipment. This company is also engaged in the design and manufacture of small and medium-sized WTG's in co-operation with the German MBB Group.

A small number of minor firms are also working in Italy on small and medium-sized WTG's and wind-pumps.

WTG PROJECTS UNDER DEVELOPMENT

This section briefly reviews the main projects currently in progress in Italy for the development of wind turbine generators.

Small-sized WTG's

Alenia has developed the AIT-03 two-bladed machine rated at up to 26 kW and intended mainly as part of a stand-alone wind system with storage batteries.

Riva Calzoni, based on the experience gained with the MP-5 3.6 kW WTG, has now developed the M7. This single-bladed machine, which has a power rating of about 5 kW, is intended mainly for rural electrification in developing countries. Two M7 prototypes are being tested by ENEA and ENEL.

Medium-sized WTG's

In this field, Alenia (formerly Aeritalia) and Riva Calzoni are working on the development of two WTG's (the Medit and M30 machines) designed both for connection to power grids, and for the supplying of isolated communities in parallel with diesel generating units (see Table 1).

A prototype of the 225-kW Medit WTG is operating at ENEL's Alta Nurra test field in Sardinia. The development of this unit has been supported by ENEA and also partially funded by the European Community. Based on the experience gained with the prototype, an improved version of the machine (the 320-kW-rated Medit I) has then been designed for industrial production.

The M30 200-kW WTG has been developed by Riva Calzoni in co-operation with MBB and with the support of ENEA. The first prototype, which has also been funded by the European Community, is now operating at ENEL's Alta Nurra test field. Another unit (for stand-alone operation) has been installed in Germany.

TABLE 1 Main Features of Medit and M30 Prototypes

Feature	Medit	M30
Rotor position	upwind	downwind
Number of blades	2	1
Rotor diameter	32	33 m
Type of hub	rigid	teetering
Hub height	26 m	33 m
Rotor speed	40 r.p.m.	41/61 r.p.m.
Power control	full span pitch control	full span pitch control
Generator	induction	2 induction (55/200 kW)
Rated power output	225 kW	200 kW
Rated wind speed at hub	11.6 m/s	11 m/s

Large-sized WTG's

Within the framework of a co-operation agreement with ENEA, Alenia (acting as the lead company of an industrial consortium) has been working on the design and manufacture of the prototype of a large (1500 kW) WTG, the GAMMA 60, which has also been granted partial funding by the European Community. ENEL has placed an order for the supply of this prototype, which should start operating at Alta Nurra by mid - 1991, plus two further units to be built after successful testing of the first one. The technical features of GAMMA 60 (see Table 2) include quite innovative solutions, such as operation at broad-range variable speed and power regulation through yaw control.

TABLE 2 Main Features of GAMMA 60

Rotor position	upwind	Type of hub	teetering
Number of blades	2	Hub height	66 m
Rotor diameter	60 m	Rotor speed	15-44 r.p.m.
Power control		through yaw control	
Generator		synchronous with a.c./d.c./a.c. converter	
Rated power output		1500 kW	
Rated wind speed (at hub)		13.5 m/s	

PROJECTS OF DEMONSTRATION WIND-FARMS

To comply with the guidelines of PEN, ENEL and ENEA have embarked on activities aimed at installing Italy's first large wind-farms consisting of industrially-available medium - sized machines, both for demonstration purposes and for the promotion of a WTG market.

ENEL's Projects

In 1989 ENEL launched a programme falling into two stages. The first stage involves comparing Italian and foreign technologies by testing a number of Italian and foreign-made medium-sized WTG's at the same sites. The second consists in setting up two full-scale wind-farms, each equipped with 40 machines supplied by Italian manufacturers. Both stages will be performed in two environmental situations, typical of nearly all sites where wind power plants are likely to be installed in Italy:

- * A site on or near the coast, with seaboard climatic conditions (i.e., involving saline pollution, etc.).
- * A mountain site, in the south-central Apennines, involving such problems as high wind turbulence, heavy snowfalls, and ice-accretion.

First stage: technology comparison. With regard to seaboard environment, two foreign units (an MS-3 manufactured by Wind Energy Group from the United Kingdom and a Windane 34 made by Vestas-DWT from Denmark) have been installed at the Alta Nurra test field in Sardinia. Here, these units are run side by side

with the Medit and M30 prototypes (see above). As for mountain environment, another test field is being constructed by ENEL at the Acqua Spruzza site, located at an altitude of 1,340 m in the Apennines (Molise Region in Central Italy). Here, two units of each of the four WTG models under test at Alta Nurra will be set up and operated under very harsh environmental conditions. For this test field, ENEL has received partial financial support from the European Community. Construction is expected to start in autumn 1991.

Second stage: demonstration wind-farms. A wind-farm will be built at the Monte Arci site in Sardinia, located on a mountain ridge near the coast, and will be equipped with 40 units for an overall capacity of 12.5 MW. The machines will be an upgraded version of the Medit and M30 prototypes (the 320-kW "Medit I" by Alenia/WEST and the 300-kW "M33" by Riva Calzoni, respectively). Construction should start in the second half of 1991. Another wind-farm with the same features will subsequently be built in the Apennines, if tests performed at Acqua Spruzza can show the viability of wind plants in such a mountain environment. A further 32 "Medit I" and "M33" units would therefore be installed at Acqua Spruzza or at another site in the Apennines in south-central Italy.

ENEA's Projects

ENEA is promoting two feasibility studies regarding wind-farms with medium-sized units. The first study is being carried out by Riva Calzoni and concerns a 10-MW wind - farm to be set up in the Region of Emilia Romagna. Ten potentially suitable sites for installing the plant have already been pinpointed, where wind measurements are currently under way to assess existing resources. The second study is being performed by Alenia and is aimed at building another wind-farm in the Campania Region.

If constructed, these wind-farms would be financed and owned by their respective local (regional) authorities. The energy produced would be fed into the ENEL grid. Lastly, given Italy's very long coastline, ENEA is also undertaking feasibility studies for offshore wind power plants.

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