

TITLE: COMBINATION OF WIND POWER UNITS WITH A PUMP STORAGE POWER PLANT ON CRETE	PROJECT N°: WE./00009/97
CONTRACTOR: HELLENISCHE ENERGIEKONTOR KISSAMOU STREET 55 GR - 73131 CHANIA	

VERSION : 26/08/1997

AIM OF THE PROJECT

- Reducing the production costs for wind energy through better performance of windfarm
- Demonstration and testing of wind power units in combination with a pump storage power plant
- Reducing the energy production costs for peak and intermediate load by substituting fossile power plants through hydroelectric and windpower
- Efficient energy storaging of exceeding wind energy by a pump-storage unit
- Integration of renewable energies in weak islands grids
- Reducing of emissions (in particular CO2) of fossile power plants by windturbines and hydroelectrical power plants
- Integration of pump storage plant in the environment of arid islands by using a closed water circuit and desalination by reverse osmosis
- Avoiding stabilisation problems by wind power in weak island grids.

PROJECT DESCRIPTION

The Hellenic Energiekontor is planning a 15 MW windfarm (10 units of 1,5 mW) at the Monastery Epanosifi on Crete. The mountain near the monastery has promising wind conditions which allows low generation cost. The latest technology with 1,5 MW machines will be used to minimize investment and generation costs. Within this project the wind farm will be combined with a pump storage power plant (5MW) with a closed water circuit. Losses due to evaporation will be replaced by desalinated seawater due to reserve osmosis. The reason for linking the wind power plant to the pump storage plant is the following : During the night the base energy load of the grid has its minimum (about 100/140 MW) and is generated by steam units fueled by heavy oil. The intermediate and the peak loads are generated by gas turbines. During the nighttime (about 8h.) the wind units can not operate because of problems relating to the stability of the grid which make it necessary to turn off the wind power plant. This circumstance would cause a loss of 33% of the possible wind power production and consequently increasing costs for wind energy production.

A pump storage power plant gives the possibilities to store the exceeding wind energy druing the night and to supply power during daytime as intermediate or peak loads. This causes better performances of the windfarm, lowers energy production costs for windfarm and peak and intermediate load and reduces emissions (CO2) due to fossile power plants.

INNOVATIVE TECHNOLOGY :

The whole concept of the combined wind park/pump storage unit is in so far innovating as it could open application in market, where the meteorological and geological conditions are given, but limitation to the isolated networks regarding the generated power is existing. Potential areas could be islands of the Cyclades in Greece or the Canary islands. The development of standardised modules could also reach to the exploitation of smaller and bigger potentials.

STATE OF ADVANCEMENT

Ongoing

The design phase began at the end of 1996. Co-contractors and manufacturers for the necessary equipment were contacted. Wind measurements at the site Epanosifi and a wind study were already finished in 1996.

Discussions with the local energy supplier PPC took place over the last year and are ongoing. The technical and administrative documents for the wind farm building permission should be completed in the next weeks. Discussions with banks about the financing and conversations with lawyers about the possible legal form of the operation company are ongoing.

RESULTS

1. Energy production costs (ECU/kWh) of wind turbines in combination with pump storage power plant 20-30% lower than energy production costs for gas turbines.
2. Integration of renewable energies in weak island grids without stability problems for the grid.
3. Implemenattion of the experiences and the know-how in further projects in similar regions.

TITLE: BLANKS BANKS WINDFARM	PROJECT N°: WE./00011/97
CONTRACTOR: WIND ENERGY GROUP LTD TAYWOOD HOUSE RUISLIP ROAD 345 MIDDLESEX GB - UB1 2QX SOUTHALL	TELEPHONE N°: 441815752366 FAX: 441815758318 EMAIL: weg@taywood.co.uk

VERSION : 12/12/1997

AIM OF THE PROJECT

The aim of this 3 MW project is to demonstrate the successful application of the innovative MS4-600 wind turbine on the grid system in County Leitrim, Ireland. The project is expected to be the first windfarm of this model of machines and will demonstrate the potential for a reduction in the price of electricity from the norm, by the use of this innovative machine. The key feature to be demonstrated is the light-weight flexible rotor of this machine which gives lower weights throughout the machine and hence lower costs.

PROJECT DESCRIPTION

This 3MW project will be sited in County Leitrim about 15 km from the Arigna power station. The aim is to construct the 3 MW project in one phase although only the first 2.5 MW is supported by Thermie.

As the first major using this machine, the project will help to establish its track record and will assist WEG to reduce costs of manufacture through value engineering.

This will be a windfarm of wind turbines in County Leitrim, in the Irish Republic. The wind turbines will be supplied by WEG and will be the MS4-600 model with the following main features :

rating : 600 kW

diameter : 41m

nr.of rotor blades : 3

tower height : 40m

rotational speed : 30rpm.

The main innovative features of this machine are :

- light weight and flexible rotor
- damped nacelle nodding and yawing
- downwind rotor with blades 7-8 tower diameters from the tower in order to avoid 'blade thump noise'
- offset nacelle tube and winch system allowing the machine to self erect without the use of large cranes
- stall regulated rotor with narrow tip chord and only 64 m/s tip speed for low noise
- main shaft and gearbox on 3 point mounting for low noise transmission
- aerodynamic braking by whole blade towards stall using a fail safe mechanism.

It will be connected to the ESB grid at 22 kV with a 2 km link to a windfarm which has just been completed by Ms De Pietro of Orlliven. This grid connection for this windfarm will also carry the output from Black Banks Windfarm.

The wind turbine has been developed and its prototype built with the support of the Joule programme. This project is expected to be the first major windfarm utilising this machine.

STATE OF ADVANCEMENT

Ongoing

TITLE: 3 MW WIND FARM COMPOSED OF 6 WIND ENERGY OPTIMISED FOR LOW WIND SPEED ON THE ISLAND OF MENORCA	PROJECT N°: WE./00021/97
CONTRACTOR: GEDISA JUAN MARAGALL 16 ES - 07006 PALMA DE MALLORCA	TELEPHONE N°: 971467711 FAX: 971461622

VERSION : 17/11/1997

AIM OF THE PROJECT

- to show the technical and economic feasibility of the installation of 500 kW aerogenerators, which are designed to provide an efficiency that is 20% greater than that of conventional generators for wind speeds that are below the nominal speed for the machine.
- to produce a significant amount of electricity - 3% - with a view to contributing to electricity demand of the island, by means of a system that does not cause contamination, thereby collaborating with the implementation of the objectives of Menorca, Reserva de la Biosfera (Minorca, Biosphere Reserve).
- to turn a zone which has been subjected to deterioration owing to the presence of a former rubbish dump, into a location which is put to correct use, thereby collaborating with the implementation of the objectives of Minorca, Biosphere Reserve.

PROJECT DESCRIPTION

The installation consists of two distinct parts :

1. The aeolian part, comprising six 500 kW aerogenerators, designed and optimised for light winds, which will be connected to a conventional electricity network on the island. The aerogenerators will be located on a zone belonging to the Borough of Maó, exposed to the predominant winds of the first and third quadrant. Work is currently taking place on the site, with a view to making it revert to its original characteristics given that it was used as a rubbish dump for many years.

The installations will be supplemented with an electric power transformation plant, for connection to the 15000 V.network run by the local electricity company.

The aerogenerators will be of the fixed pitch type, the height of the propeller hubs being 45 m, the diameter of the blades also being 45m, and they will be equipped with disc brakes on the high-speed side and a triphasic asynchronous generator designed to operate at two different speeds, depending on the instantaneous output.

The existing building will be used, the environmental impact will be reduced to a minimum and the new electricity line will be buried underground.

2. The second part, not included in this proposal, will involve the production of desalted water by means of a 300 kW asynchronous generator and a reverse osmosis drinking-water plant which will provide 700m³/day, using a control and regulation electrical system that will operate upon the two sub-systems, all of which will work independently of the conventional electricity network, or using another type of support, such as diesel.

STATE OF ADVANCEMENT

Ongoing

The project is in the design phase

TITLE: MW SIZE WIND FARM IN IRELAND WITH UPGRADED VESTAS 600 KW TURBINES RESULTING IN CONSIDERABLE SAVINGS ON INVESTMENT	PROJECT N°: WE./00050/97
CONTRACTOR: FUINNEAMH GAOITHE TEORANTA AN SPIDDAL IE - CO. GALWAY	TELEPHONE N°: 35391553480 FAX: 35391553480

VERSION : 15/11/1998

AIM OF THE PROJECT

The aim of the project is to build an app. 2.8 MW windfarm consisting of 4 x Vestas newly developed 650-700 kW turbine in order to prove how this optimised version of the well-proven 600kW turbine can achieve a considerable decrease both in investment cost and production cost compared to the revolutionary Vestas 600 kW OptiSlip and OptiTip features. Once the test programme of the prototype is completed, detailed examination of these data together with the collected wind data of the Connemara site, will determine the exact rated capacity. The wind project in Connemara will be the first demonstration project of the optimised new turbine.

PROJECT DESCRIPTION

A MW size windfarm consisting of 4 of Vestas' newly developed 650-700 kW turbine will be build on a site located in the West of Ireland in County Galway, Connemara area. A site specific WASP analysis shows wind speed of 8.4m/s at 40 meters hub high. The grid in south Galway/Connemara is, in line with other grids in the outlying coastal area of the western coast of the island, very weak. The area is served by 38 kV single spur. All electricity produced from the windfarm will be exported to the grid. The main areas of improvements of the new turbines are the following :

- rotor size is optimised by the use of longer and lightweight blades to give 47 (against 44) meter rotor diameter.
- the blade profile has been improved to yell almost 2% more energy from the same swept area.
- the very advanced OptiSlip system introduced in the 600 kW turbines is further improved. This facilitates the re-use of a great number of existing components, thus improving cost of manufacture, stock holdings, and service ability.
- the generator is upgraded to between 650 and 700 kW without physically changing the size. The OptiSlip system has facilitated such upgrade.
- a second- smaller generator can be fitted as optional measure to improve low wind energy production and to reduce noise emission during lower wind conditions.

The turbines are expected to be erected in Spring 1998. The test programme will then go ahead.

STATE OF ADVANCEMENT

Ongoing

Construction work began on site in June 1998; At the end of July 1998, work began on the excavation of the basis, and work commenced on the turbine foundations. During the autumn months the civil engineering work and the electrical work were completed.

The electrical contractor was ESB Contracts.

Turbine production continued and was completed towards the end of November. The turbines arrived in Ireland end November/ beg. december 1998 and were immediately erected.

Construction of the project is complete and awaiting the completion of grid connection.

RESULTS

The expected cost-efficiency improvements are the following :

- the combination of longer blades, better profiles and the higher maximum output of the generator improves output by almost 15% compared to the 600 kW turbine.
- the consequent re-use of many components from the 600 kW series ensures that cost will not go up more than 8-9%.
- Maintenance costs will remain the same for a 600 kW standard turbine and the new optimised version, which also is the case for insurance.
- resulting cost-efficiency will thus improve with 7-8% per kWh produced.

TITLE: MODIFIED 1,5 MW WIND TURBINE ON A HIGH WIND SPEED SITE (TARIFA, SPAIN)	PROJECT N°: WE./00057/97
CONTRACTOR: GAMESA EOLICA SA POLIGONO AGUSTINOS CALLE A. ES - 31013 PAMPLONA	TELEPHONE N°: 3448309010 FAX: 3448309009

VERSION : 01/11/1997

AIM OF THE PROJECT

1. Design, install, test and demonstrate a 1.5 Mw wind turbine strongly modified to high wind speed conditions on a selected site in the Tarifa area in the Southern Spain.
2. Verify project economics compared to smaller (600 Kw) wind turbines
3. Install the first 1.5 Mw wind turbine in Spain, which is necessary to demonstrate technical abilities and reliability before investing in larger wind farms.
4. Measure structural loads on the WTG
5. Measure and analyse wind conditions on the site
6. Measure the power quality in relation to the connected grid.

PROJECT DESCRIPTION

The innovation part of the project must be seen in relation to the prospected results of the project : to install test and operate MW size wind turbines in high wind areas, to lower the future production cost level of wind generated electricity.

Innovative elements can be listed as adoption of a new rotor diameter (design & production), correlated change in rotor speed, change in gearbox, tower height because change in own-frequency level, new design parameters for the whole WTG structure.

The project consists of : wind monitoring of the site, design of modified 1.5 Mw wind turbine, manufacture, assembly, commissioning and monitoring of loads beard by the new designed WTG.

STATE OF ADVANCEMENT

Ongoing

TITLE: INNOVATIVE DIRECT DRIVE VARIABLE SPEED WIND TURBINE	PROJECT N°: WE./00093/97
CONTRACTOR: JEUMONT INDUSTRIE RUE DE L'INDUSTRIE 27 BP 189 FR - 59573 JEUMONT CEDEX	TELEPHONE N°: 0033327699215 TELEX: MELEC 130000 FAX: 0033327699465

VERSION : 05/11/1997

AIM OF THE PROJECT

To set up a wind turbine using a direct generator (low speed, directly coupled generator) thereby avoiding the use of a gearbox. Such a system would reduce the cost (investment, maintenance) significantly in the long run, thereby increasing the penetration of wind energy in general. The new system allows larger power design in a reasonably small volume, especially interesting for installation in remote areas and offshore applications.

The following design goals are as follows :

- modular component layout : easy integration of Jeumont Industrie generator into supplied components, easy change of suppliers, assembly of major components on site, reduction of hydraulics, easy maintenance.
- up scaling possible.
- grid supporting : necessary for large machines in countries with high requirement on grid quality.

PROJECT DESCRIPTION

1. INNOVATIVE TECHNOLOGY :

The innovative characteristics of the project mainly consists of the following :

- the permanent magnet discoid generator which allows compactness, and easy transportation and erection. It allows also the cancellation of the gearbox and so lower maintenance costs. The discoid topology brings the modularity and so makes possible the up scaling for future power development by using additional rotor and stator discs.
- the electronic converter which bring the variable speed running, and which allows the soft connection of the wind turbine on all types of grid. These use for the Pulse Width Modulation control rectifier allows the limitation of torque pulsations on the main shaft.

The variable speed running on the stall regulated rotor which allows an additional saving of 5% energy in comparison with conventional technologies.

2. THE CONTEXT OF THE TECHNOLOGY :

The equipment consists in a 750 kW wind turbine on a 53 meters tower; Nevertheless the concept and design are completely different from previous existing wind turbine designs.

Avoiding the use of a gearbox and replacing it with an AC/DC/AC conversion system would solve many problems which all wind turbine manufacturers have had in the past. For that reason, Jeumont Industrie and Aerpac are considering the direct driver generator directly connected to the rotor (mechanical) and through an inverter, to the grid (electrical). this solution is the most advantageous when maintenance cost, reliability and efficiency are compared. The use of the inverter allows the use of the wind turbine in a large speed range which results in an increase of the supplied power.

3. ECONOMIC ASPECTS :

The variable speed running allows an additional saving of 5% energy compared with conventional technologies. The overcost of the wind turbine is evaluated at 5% at the moment and in serial production. However, this overcost may be reduced in future through cost optimization and technology improvement.

STATE OF ADVANCEMENT

Ongoing

Design phase in progress

TITLE: APPLICATION IN A WECS OF A DOUBLY FED GENERATOR WITH ROTOR FREQUENCY CONTROL	PROJECT N°: WE./00104/97
CONTRACTOR: WINDMASTER NEDERLAND BV ZUIVERINGSWEG 26 NL - 8243 PZ LELYSTAD	TELEPHONE N°: 31320254940 FAX: 31320254576

VERSION : 26/08/1997

AIM OF THE PROJECT

The aim is to introduce an innovative conversion system for variable speed operation in a wind class III 48 diameter horizontal axis turbine with 600 kW installed power. The present conversion system is based on a 100% inversion of the produced power, that is recognized to produce an optimised power curve and excellent power quality. These aspects and the load spectrum remain the same, but the cost of the system can be reduced with 35%. The aim is to verify these specifications by means of a measurement programme and to verify the target of 35% cost reduction on the conversion system (generator, inverter and cabling). The aim is to release, after verification, the proven design for series manufacturing and to give the WindMaster product range a better market position. It is expected to install 100 turbines a year, what, regarding present interest in the turbines, is a conservative assumption.

PROJECT DESCRIPTION

The main effort in the project is the installation of a WM 600 VS 48 with doubly fed asynchronous generator with rotor frequency control.

The objective is to demonstrate the proper functioning of the above mentioned conversion system. The specifications regarding power curve, noise level, power quality and load spectrum for the same turbine equipped with asynchronous generator coupled to a full size inverter system will have to be met. The objective is to reduce the cost of the generator - inverter system with 35%.

Technical aspects :

The turbine is specified in published documentation. Due to the modular design the generator can be replaced by the double fed generator with minor chargings only.

DESIGN : To implement the conversion system following design work has to be done. For the conversion system the basis is a working 100 kW prototype system. This system will be engineerd towards a 600 kW model for series production.

MANUFACTURE : Standard procurement procedures will be followed for the turbine. The conversion system will extensively be tested on a testbed in the Weier workshop.

ASSEMBLY, INSTALLATION, ERECTION : Assembly of the turbine will take place in the WindMaster workshop and except from the standard factory test an extensive function test of the whole system will be executed. Installation and erection will be executed according to standard procedures.

COMMISSIONING : On site a standard commissioning procedure will be applicable except for the conversion system a testplan will be executed in order to check the behaviour of the system in real windconditions. Also the controller function will be subject of additional tests.

MONITORING AND MEASUREMENTS: The power performance will be measured during a period of 6 months after commissioning. Measurement of acoustic noise. The power quality of the turbine will be measured in accordance with the current German guidelines. Functional tests will be done.

STATE OF ADVANCEMENT

Ongoing

TITLE: THE FIRST WINDFARM FOR THE ISLE OF CORSICA	PROJECT N°: WE./00162/97
CONTRACTOR: GROUPEMENT FONCIER AGRICOLE DES COTEAUX DE FIGARI FR -	TELEPHONE N°: 330495250765 FAX: 330495254243

VERSION : 01/02/1999

AIM OF THE PROJECT

The project consist of the establishment of 4 aerogenerators with a total power of 2.4 MW directly coupled up with the national network of Electricity of France (EDF). It will permit to deliver the annually energy for the consumption of several hundred users. The estimated production is about 6.2 GWh. This project would reduce the energy dependence of the island because the amount of fuel saved would be about 700 tons. The rejects of sulphured and carboned compounds in the air would be less important. In economic terms it represents an economy of five millions of french francs.

PROJECT DESCRIPTION

By this project, the builder NORDEX becomes involved in a new design of assembly machines specially adapted to the islands and the mountains areas. It will prevent from the use of a crane. In effect, it would be necessary but very difficult to brig a crane of hundred tons by boat. NORDEX develops a system named "Self Erecting System". This experience is a real innovation in an insular context because such, a system does not exist for a machine of 600 kW. The fact of applying this system to define again the concept of the turbines and the towers which will have to be modificadoed in the purpose. Moreover the supplier NORDEX, more filed to very irregular winds. This blade will be employed in the aim of checking the results obtained with the first tests.

STATE OF ADVANCEMENT

Ongoing

The self Erecting System and the new blade are on final phase of design and now the construction of machines is necessary to valid the result on situation.

TITLE: ST PIERRE ET MIQUELION WIND DIESEL REMOTE INSTALLATION	PROJECT N°: WE./00164/97
CONTRACTOR: WINDMASTER NEDERLAND BV ZUIVERINGSWEG 26 NL - 8243 PZ LELYSTAD	TELEPHONE N°: 31320254940 FAX: 31320254576

VERSION : 01/12/1997

AIM OF THE PROJECT

To install a 1.8 MW wind farm consisting of six 300 kW turbines on a remote island location, without conventional crane erection techniques. To demonstrate diesel fuel savings for the existing diesel generation facility. To build on the experiences of the 2.7 Dunkerque wind farm project by continuing the development of the Francisation of the WindMaster 300 kW turbine, by successful integration of French manufactured components. Redesign of existing turbine technology to facilitate shipment by means of standard containers i.e. a self-contained unit for application in remote regions. Design and implementation of self erection technology for application in remote regions. Delivery of advanced control and inverter technology for wind-diesel hybrid systems for application in remote regions.

STATE OF ADVANCEMENT

Ongoing

Design stage

TITLE: THE DESIGN AND ERECTION OF TWO 750 KW WIND TURBINES ON SLIP FORM CAST IN-SITU STEEL REINFORCED CONCRETE TOWERS.	PROJECT N°: WE./00178/97
CONTRACTOR: IRISH ELECTRICITY GENERATING CO.LTD ROSS KILMEADEN CO.WATERFORD IE - WATERFORD TECHNICAL DIRECTOR: FINBAR TYMON	TELEPHONE N°: 35351384303 FAX: 35351384277

VERSION : 01/12/1997

AIM OF THE PROJECT

The aim of the project is to reduce the installed cost of wind power plant. This in turn will lead to reduction in the cost of electricity produced from wind power.

PROJECT DESCRIPTION

1. Manufacture of wind turbines towers in-situ using concrete and reinforced steel.
2. The use of a lifting beam to mount the turbines thereby dispensing with the need for a large mobile cranes.
3. The use of a new method of securing the wind turbine towers to the foundation base without the use of holding down bolts.

STATE OF ADVANCEMENT

Ongoing

TITLE: DEMONSTRATION OF NORDIC 1000 WIND TURBINE	PROJECT N°: WE./00211/97
CONTRACTOR: NORDIK WINDPOWER AB SE - 191 29 SOLLENTUNA SE -	TELEPHONE N°: 4686571500 FAX: 4687549947

VERSION : 26/08/1997

AIM OF THE PROJECT

The aim of the project is to demonstrate a wind turbine for series production, Nordic 1000; which is comparatively lighter, less complicated and more economical than today's wind turbines. One wind turbine will be built for demonstration.

PROJECT DESCRIPTION

Nordic 1000 is a two-bladed wind turbines that is characterised by a flexible, light-weight and uncomplicated design. the blades were deisgned especially for the project in co-operation between Nordic Windpower and LM Glasfiber A/S. The outer parts of the blades have got LM2 profiles in order to increase performance and aerodynamic stability.

The teetering movements of the hub are contracted by rubber bumpers that restrict the movements to a few degrees. this is enough to reduce loads to a level that makes the design as resistant to fatigue as to extreme loads. The hub is compact with comparatively low weight and a short over-hang. It is cast of nodular iron and designed for infinite life. The planetary gear-box also contains the main shaft bearings. The gear-box is specially designed for the project by Flender AG in Germany that also was a contractor in the Joule II project.

The machinery bed is welded from cylindrically shaped sections, which makes it compact and easy to manufacture The gear-box is flanged to the front end of the bed, the generator to the aft section and downwards the bed is connected to the yaw bearing. The electrical system consists of a two-speed induction machine directly coupled to the grid. In the prototype there was an AC/DC/AC system for variable speed.

The nacelle is made of glass-fibre reinforced polyester in a top and a bottom half, made from the same mould, which are bolted together.

The yaw drive consists of two geared electric motors that acts on the inner cogged ring of the yaw bearing. Hydrodynamic couplings provide damping of the rocking yaw moment during both yawing and non-yawing conditions. There is no yaw brake.

The controller is based on standard type microprocessor control with computers in both the bottom of the tower and in the nacelle. data transfer is by means of a serial interface with an optical link. Access to the system can be provided through a modem and any PC.

STATE OF ADVANCEMENT

Ongoing

TITLE: CONSTRUCTION OF THE 37.5 MW SCROBY SANDS OFFSHORE WIND FARM, EAST ANGLIA, ENGLAND	PROJECT N°: WE./00218/97
CONTRACTOR: POWERGEN RENEWABLES LTD WESTWOOD WAY, WESTWOOD BUSINESS PARK GB - CV4 8LG COVENTRY	TELEPHONE N°: 441203424913 FAX: 441203425443

VERSION : 12/08/1997

AIM OF THE PROJECT

To further the utilisation of offshore wind resource throughout the EU through construction of a commercial size (37.5 MW) windfarm using high output wind turbines and to demonstrate that such a windfarm shows a substantial reduced cost/output ratio (£/MWH) compared to existing offshore installations. To achieve this it will be necessary to fully define the technical requirements of an offshore wind farm on a sand bank site in a tidal environment involving large wind turbines (1.5 MW) monopile foundations and new construction methods. The energy payback from the windfarm once in operation is estimated to take less than one year with a reduction in the level of carbon dioxide emissions from Uk thermal power plants approaching 100000 tonnes/Y.

PROJECT DESCRIPTION

The project involves the construction of an 37.5 MW windfarm on an offshore sandbank approximately 3 km off the coast of Great Yarmouth, Norfolk, England. The use of an offshore sandbank in a tidal environment for harvesting wind energy is new at present although other sites for replication are known to be available. The scale of the project is much larger than existing truly offshore windfarms, the largest to date being the 5MW Tuno Knob windfarm off the Danish coast, which has 500 kW Vestas turbines. The marinisation of the Vestas V60 1.5MW series design will be innovatory in respect of its size and maximum rating together with the greatly increased wind harvesting capability compared to smaller turbines. The innovatory use of the steel monopile foundation in a tidal offshore environment subject to the forces of the North Sea is another key innovative feature. The challenges of building and maintaining a windfarm on an offshore sandbank will be overcome through the use of innovatory construction techniques, adapted from existing proven offshore experience in the oil and gas industries. The windfarm will utilise a fibre optic cable to transport control signals and data between the windfarm and the shore monitoring location.

The completion of the windfarm will prove the environmental acceptability of large machines on an unconventional offshore site and specifically their public acceptance through limited environmental impact. By demonstration on a commercial scale valuable lessons will be learned and disseminated from the design optimisation of this project which will enhance future market prospects and the commercial viability of offshore windfarms. The operating experience gained from the wind turbines will

enable the marinsation measures introduced to be assessed in order to avoid over engineering designs for the future.

The innovative aspects are estimated to result in major reductions in the costs of energy generated from offshore winfarms.

STATE OF ADVANCEMENT

Ongoing

Site investigations and the Environmental aspects of the project are presently being carried out and assessed. The project is in the design phase.

TITLE: DEMONSTRATION OF TWO UNITS OF 1 MW WIND TURBINES OF GERMAN-IRISH CO-PRODUCTION IN THE IRISH WIND REGIME	PROJECT N°: WE./00233/97
CONTRACTOR: HUSUMER SCHIFFSWERFT RODEMIS-HALLIG STRASSE DE - 25813 HUSUM TECHNICAL DIRECTOR: GEROLD R.	TELEPHONE N°: 04841-6300

VERSION : 20/11/1997

AIM OF THE PROJECT

Demonstration of two units of the latests generation of large size wind turbines (MW class) under the specific conditions of Ireland to obtain operational data and reliability information by correlation of data from one machine against the second machine as further reference for the successful marketing and series coproduction of the HSW 1000 at minimized costs in the German and Irish shipyards.

PROJECT DESCRIPTION

The use of wind energy is policy in the EU member countries to reduce CO2 emission. Areas for installation of wind turbines get more and more less due to many restrictions. This situation on the one hand asked for the development of large size wind turbines. On the other hand aims this development to lower specific costs of the systems.

The installation also shall contribute to the production of pollution-free electricity and give more information on the economical use of wind energy in the MW-class under the Irish and UK conditions.

At present several MW turbines are being developed and series production has just started. The HSW 1000 has one of the largest experience, but further demonstration, also under different conditions and in different regions is urgently necessary for receiving more reference data and experience; Only the application in a larger scale leads to the economic advantage of significantly lower specific costs during series production itself.

Ireland has a good market for wind turbines. The Irish policy asks for Irish content of wind turbines to be installed in the country. This project will be the first cooperation for joint production of large wind turbines between a German and an Irish company. In anticipation of future sales in the Irish and UK market the local production content shall increase substantially. Because of the lower labour costs in Ireland the total manufactured machine can be sold at a very competitive price. the wind turbines to be installed in this project will have already a local content of approx. 20 to 30% and shall be the basis of know - how transfer for manufacture, installation and maintenance to the Irish shipyard partner. It is expected to offer the HSW 1000 ex Arklow at a lower price basis than ex Husum due to the lower production costs in

Ireland and the smaller content of transport. The non-availability of an 800 tons crane which is required to lift the fully assembled nacelle into position leads to the stepwise assembly during erection of the turbine (component by component) at the site which will give a significant saving in craneage costs. In view of the high wind regime in Ireland it is intended to prove the efficiency, the reliability and the significant production gains of this machine. In view of the proximity of this demonstration wind farm to both the Irish and the UK market, potential customers can visit and see in operation this farm as comparable to any site or projects in these areas.

STATE OF ADVANCEMENT

Ongoing

TITLE: WIND TURBINE VERGNET GEV 16/75 : A NEW WIND TURBINE WITH ARTICULATED BLADES	PROJECT N°: WE./00250/97
CONTRACTOR: VERGNET SA RUE HENRI DUNANT 6 FR - 45140 INGRE TECHNICAL DIRECTOR: BILLEREY J.	TELEPHONE N°: 3338433634

VERSION : 30/06/1997

AIM OF THE PROJECT

The aim of this project is to test and validate the new VERGNET GEV 16/75 wind turbine equipped with an innovating and economic (1100 FRF per unit) epoxy blade articulation, on a particularly windy (9.41 m/s) site of La Desirade, FWI.

This major innovation, compared to current GEV 15/60, has permitted to lower investment cost by 25% by increasing productivity, and operating cost by 12%, by increasing lifespan of major components.

It also allows significant lowering of noise level (by 3db(A)). It will be tested on four GEV 16/75, on extreme site of La Desirade, regularly subject to hurricanes and tropical storms.

The demonstration of the essential contribution of this innovating disposition will be realised in real conditions : suppression of the effects of bending moments, flutter, of twist movements, of gyroscopic moments and of transmission of blades vibrations to the rest of the machine.

PROJECT DESCRIPTION

This new machine comes within the scope of Vergnet's conception, that is to say :

- light machine,
- various applications,
- simple,
- of lowest maintenance,
- can be lowered for maintenance and in case of cyclones.

Its target price is 4500 FRF/kW machine or 8000 FRF/kW installed anywhere in the world, that is to say 25% reduction on cost of systems currently available on difficult sites in this power range.

The project consists in installing 4 of these new performant wind turbines, connected to the grid on the site of Vergnet wind farm of La Désirade in Guadeloupe (This wind farm has been realized in 1992 with the help of the European Commission).

This project benefits from various favourable elements :

- an innovating construction with epoxy blades articulations, which allows to increase both power and life span of the wind turbine GEV 15/60 (15 m diameter, 60 kW, 13.5

m/s) up to more than 25% without increasing the cost, and thus an effective reduction of 25% of the cost of installed kW.

- a perfectly well-known wind (four years measurements), particularly important (9.41 m/s mean wind speed).

- extreme climatic conditions (zone subject to hurricanes)

- high cost of conventional sources of energy

- technical presence on site, which will allow to follow the operation of the wind farm in terms of performances as well as of maintenance costs which should be significantly reduced (12% foreseen).

The innovating design consists in epoxy blade articulations : Use of epoxy blade articulation has been tested in Lastours and is conclusive in terms of global behaviour of the wind turbine, in its movements of both pitching and twisting. This flexible articulation is given by geometric rigidity of the blade due to centrifugal forces when the turbine spins.

Stability of the wind turbine, vibrations and aerodynamic noise have considerably been improved, particularly during regulation.

STATE OF ADVANCEMENT

Ongoing

TITLE: EUROPEOPLE PORTUGAL	PROJECT N°: WE./00254/97
CONTRACTOR: VERGNET SA RUE HENRI DUNANT 6 FR - 45140 INGRE TECHNICAL DIRECTOR: BILLEREY J.	TELEPHONE N°: 3338433634

VERSION : 25/08/1997

AIM OF THE PROJECT

The main objective of this project is to improve the competitiveness and the reliability of a new generation of wind electrical plant for remote sites, isolated houses, and agricultural estates in Europe.

Different configurations of a wind turbine coupled to a solar battery charging system will be tested on three pilot sites in the south of Portugal. This aims of reducing the cost of the energy produced through :

- * better efficiency of the blades
- * better system design and use of the battery
- * flexible consumption patterns adapted to the production.

PROJECT DESCRIPTION

The project consists of the installation of three wind turbines in isolated villages (6 km far away from the grid) located in South Portugal :

- villages of Cegonha, Cerro de Guincho and Cimalhas : 55 inhabitants - 1 GEV 11/25
- village of Sambros : 36 inhabitants - 1 GEV 10/15
- village of Estieiros : 27 inhabitants - 1 GEV 10/15

These wind turbines will be connected to a solar battery charging system (the solar part of the project is included in a Thermie proposal presented by EDP in 1997). The energy will be distributed through a mini electric grid, to satisfy the need of 120 people (+ drinkable water pumping, irrigation, public lighting...), plus 20 houses to be refurbished by the city council for tourism.

The generation of wind turbine used is based on Vergnet technology, which has shown its quality and its reliability through the experience led on our wind test in Lastours, the off grid electrification program in Aude (FR), and small grids fed by Wind turbines in Cabo Verde, Carribean and Indian Ocean.

The innovation relies in the application on small 15 kW and 25 kW wind turbines of some principles already studied, or implemented on bigger 50 kW machines.

- * High performance design :
 - innovative composite articulation of blade roots
 - new high performance blade profiles
- * High performance operation tools :

- battery charging simulation and management software
- user friendly interface
- adaptation of the consumption to the potential energy output

Through this project, which will have a major effect on the diffusion of wind energy installations for remotes sites, we hope to achieve :

- * 20% equipment cost cutting (wind turbine and battery) for a given energy output
- * 10% increase in efficiency of energy management
- * Increase in service quality
- * Technology available to a wider spectrum of users and sites.

STATE OF ADVANCEMENT

Ongoing