OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

2021

FEASIBILITY STUDY FOR AN INDUSTRIAL PLANT DESIGNED TO MANUFACTURE WIND GENERATORS IN ARGENTINA

baldo & C. s.r.l.
CONSULTING ENGINEERS
MILANO

U.N.I.D.O.
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

FEASIBILITY STUDY FOR AN INDUSTRIAL PLANT DESIGNED TO MANUFACTURE WIND GENERATORS IN ARGENTINA

UNIDO PROJECT NR. USD/GLO/84/086
CONTRACT NR. 89/178

FINAL REPORT

JUNE 1994

1. PROJECT BACKGROUND AND HISTORY

This project has been originated within the framework of a programme, executed by UNIDO and financed by the Italian Governement, finalized to the identification and promotion of industrial investment projects for the production, in developing countries, of machinery and equipment for the utilization of new and renewable energy from solar, biomass (excluding biogas) and micro-hydro sources.

The Italian sponsor Riva Calzoni signed a letter of intent with a Somali company interested in a Joint-Venture for the production of wind generators.

Within the framework for the programme Baldo & c. was awarded with the contract for the preparation of the feasibility study for the Joint-Venture.
Due to the situation in Somalia, however the project was delayed until the moment it was clear that the local sponsor was no longer able to commit for an industrial venture.

The Italian partner Riva Calzoni therefore proposed UNIDO to switch the project to Argentina where it was going to sign Joint-Venture agreements for the production of wind generators.

This feasibility study deals therefore with the manufacturing of wind generators in Argentina.

2. MARKET AND PLANT CAPACITY

2.1. Generalities

Apart from firewood combustion, wind is the eldest renewable source used in the world especially for water pumping and wheat milling.

Tropical areas in general have comparatively low average wind velocity, while some tropical areas suffer periodic extremely high wind velocities (Fig. 1).
Temperate aras in general have reasonable average wind velocities and certain locations are very suitable for the production of energy.

A WECS (wind energy conversion system) can be of many different designs and sizes (Fig. 2).
Some types are particularly fitted for winds of low average speed (about 6 m/s) and are normally used to drive pumps directly coupled to the wind motors; WECS of this type are normally called wind pumps.

Other types are suitable only for winds of high speed (9 up to 12 m/s) and are normally used for electricity production; WECS of this type are thus normally called wind generators.
Therefore the selection of a WECS (mechanical driving or electricity wind speed is largely dependent on the local electricity production). Wind generators can operate interconnected with an existing electric network or can stand alone with or without energy storage; it can run coupled to a diesel generator or a hydroelectric power plant to save conventional fuels or water; it can operate night and day.

The load factor will vary between 20 and 40 percent for normal machines.
In the small scale range an overall efficiency, from wind to final output, in the 30-40 percent range can be achieved.
The map shown in Fig. 1 indicates that Argentina, and particularly the Southern part has one of the highest availability of wind energy in the whole world. Map shown in table 3 and 4 provides more detailed information.

On the other hand this area has limited amount of population and very scattered.
The supply of electric energy is therefore relying on diesel generators that are costly and need maintenance and supply of fuel.
The area is therefore a potential good market for eolic (wind) generators both of small size (5-10 kW) and medium/large size (300 kW).

2.2. Data on present situation and potential demand

The population in the Southern part of Argentina (Provinces f Chubut, Neuquen, Rio Negro, Santa Cruz and Tierra del Fuego) is very scattered due to the major economic activity of the region: cattle breeding and agriculture.

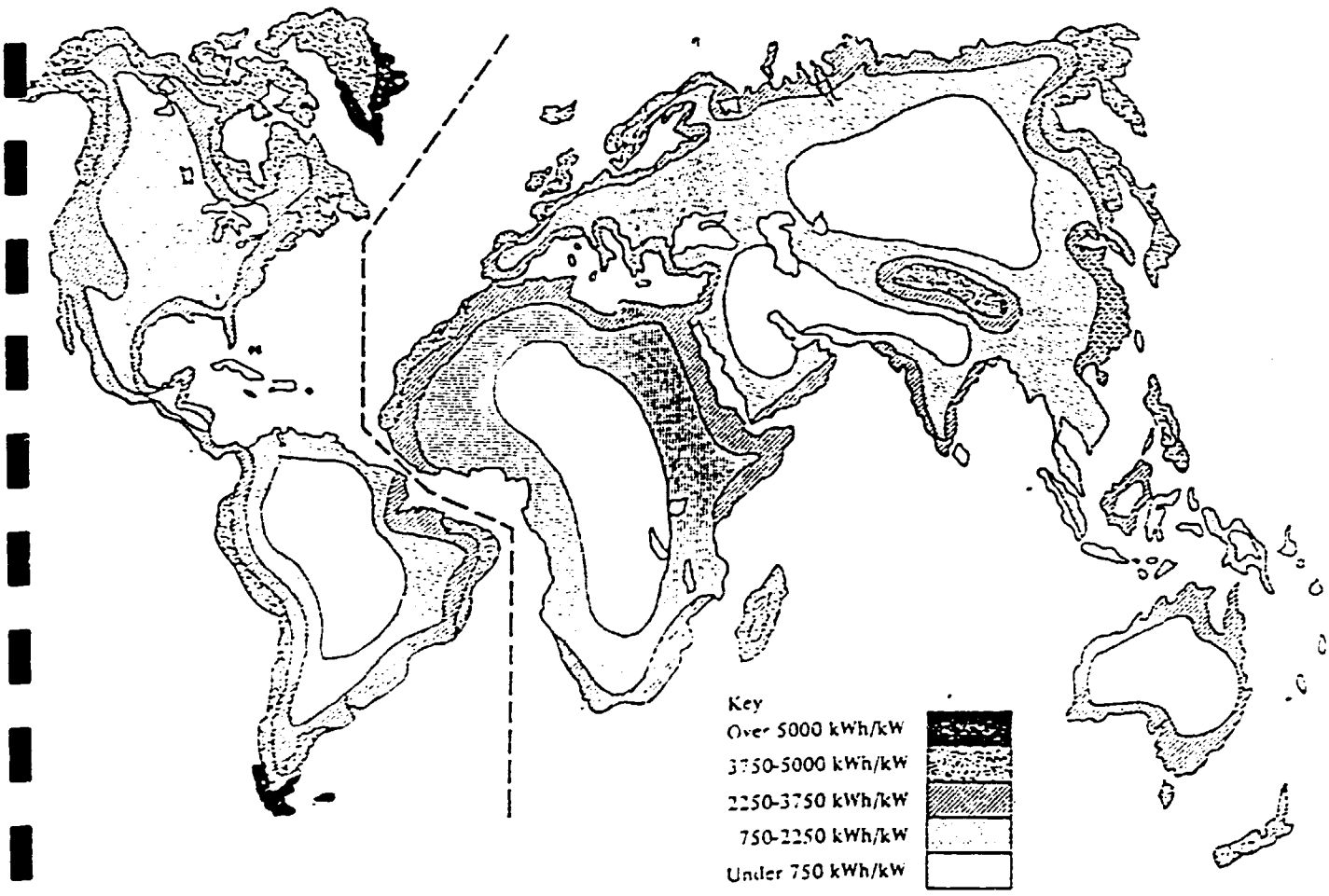
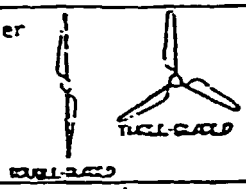
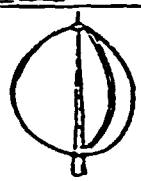
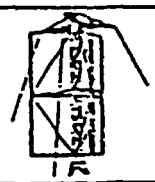
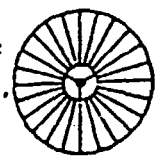
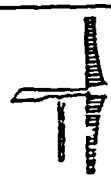
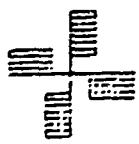


Fig. 1 Availability of wind energy (annual specific output of windmills rated at 25 mph). *(Courtesy of WMO/DOE.)* (REF. 10)

Fig. 2 Operating characteristics of major rotor types (REF. 10)

Rotor Type	Tip/Speed Ratio Range	C_p*	RPM	Torque	Typical Load
Propeller (lift) 	6 to 10 (up to 20)	0.42	High	Low	Electrical Generator
Darrieus (lift) 	5 to 6	0.40	High	Low	Electrical Generator
Cyclogiro (lift) 	3 to 4	0.45	Moder-ate	Moder-ate	Electrical Generator or Pump
Chalk Multi-Blade (lift) 	3 to 4	0.35	Moder-ate	Moder-ate	Electrical Generator or Pump
Sailwing (lift) 	4	0.35	Moder-ate	Moder-ate	Electrical Generator or Pump
Fan-Type (drag) 	1	0.30	Low	High	Pump
Savonius (drag) 	1	0.15	Low	High	Pump
Dutch-Type (drag) 	2 to 3	0.17	Low	High	Pump or Mill Stone

* C_p - power coefficient

TABLE 3

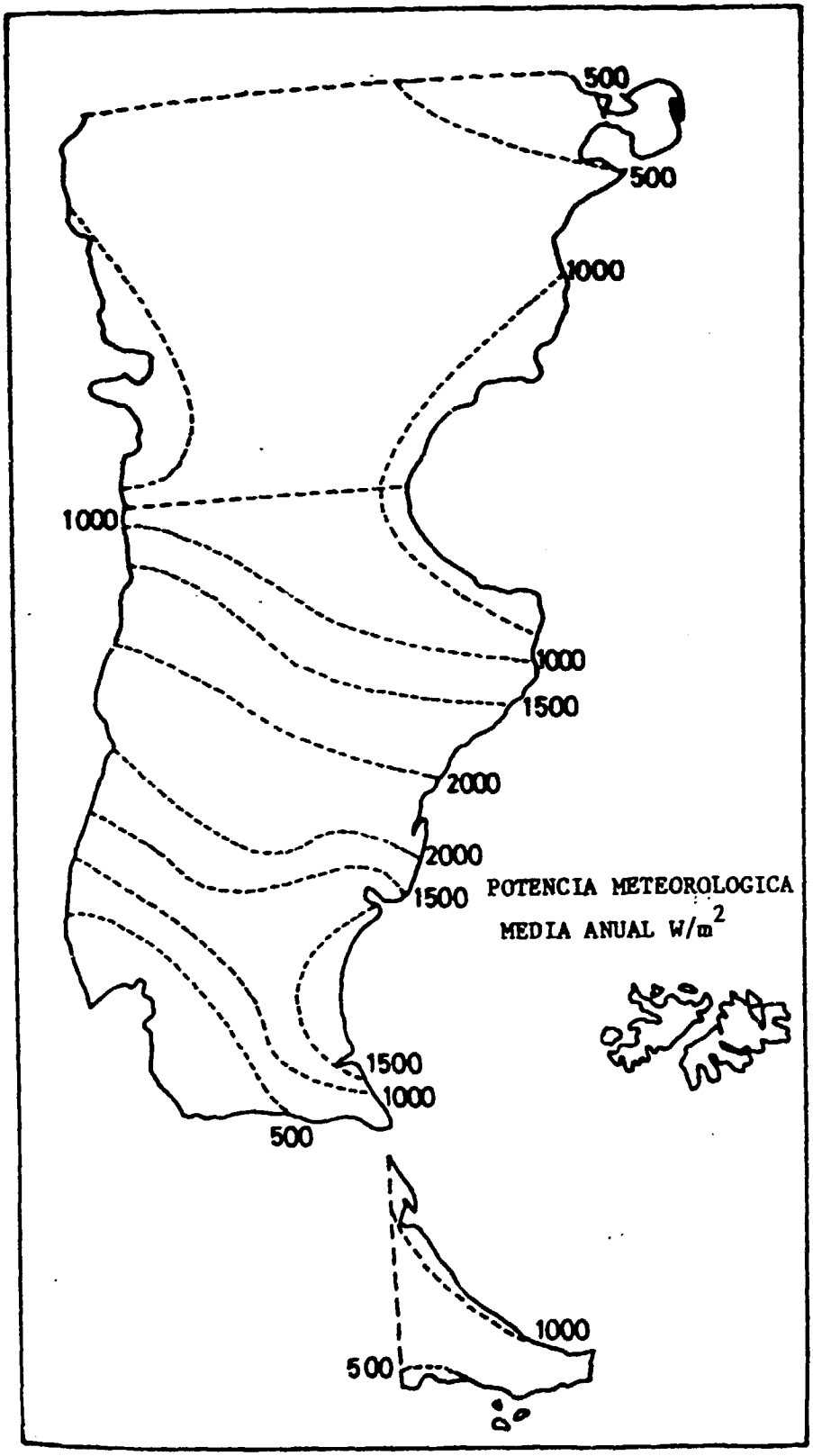


Figura 10. Idem Figura 9 pero para 50 m. sobre el nivel de superficie.

TABLE 4

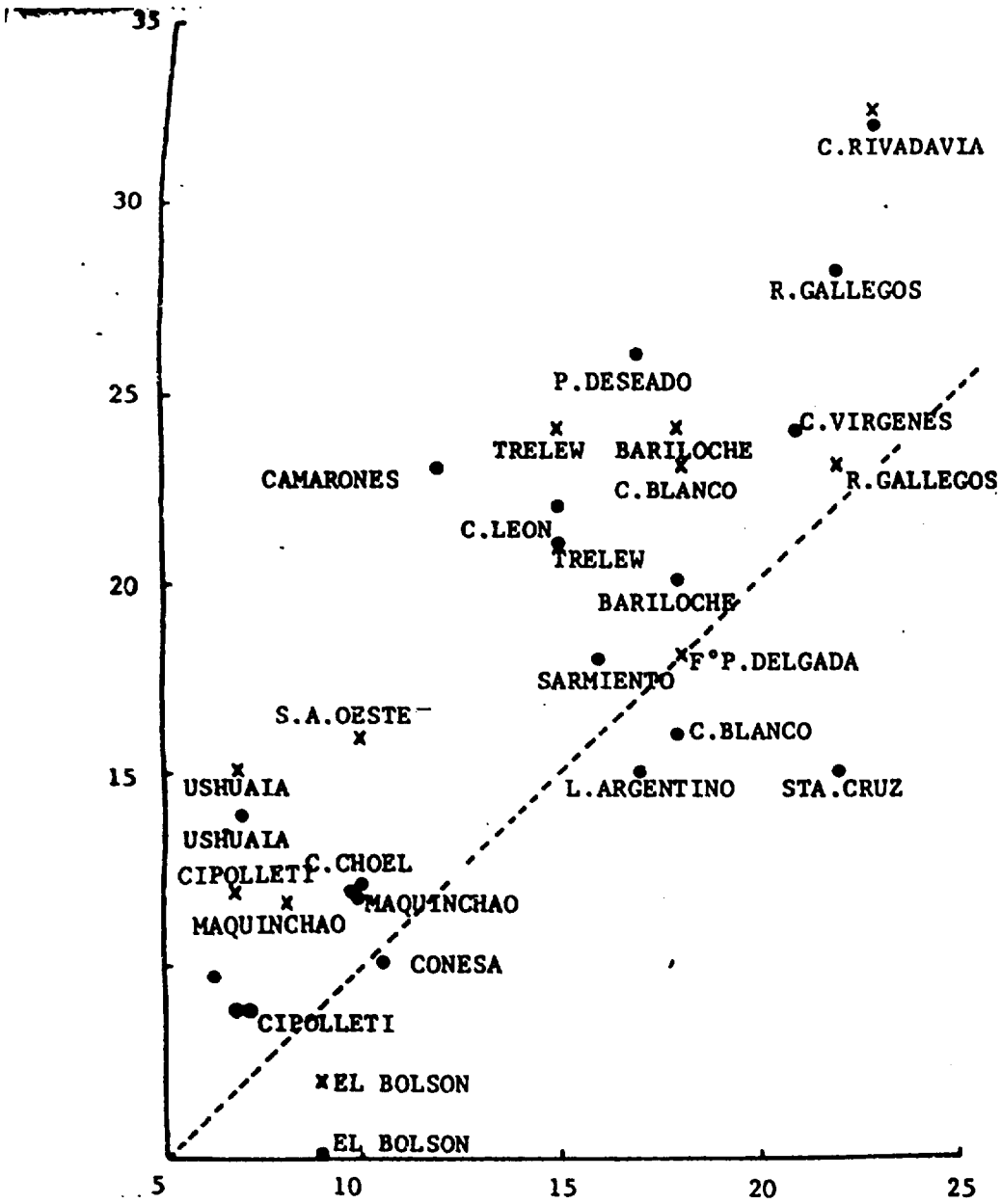


Figura 1. Velocidad media del viento de las décadas 51-60 en función de los valores de las respectivas estaciones en la década 41-50.

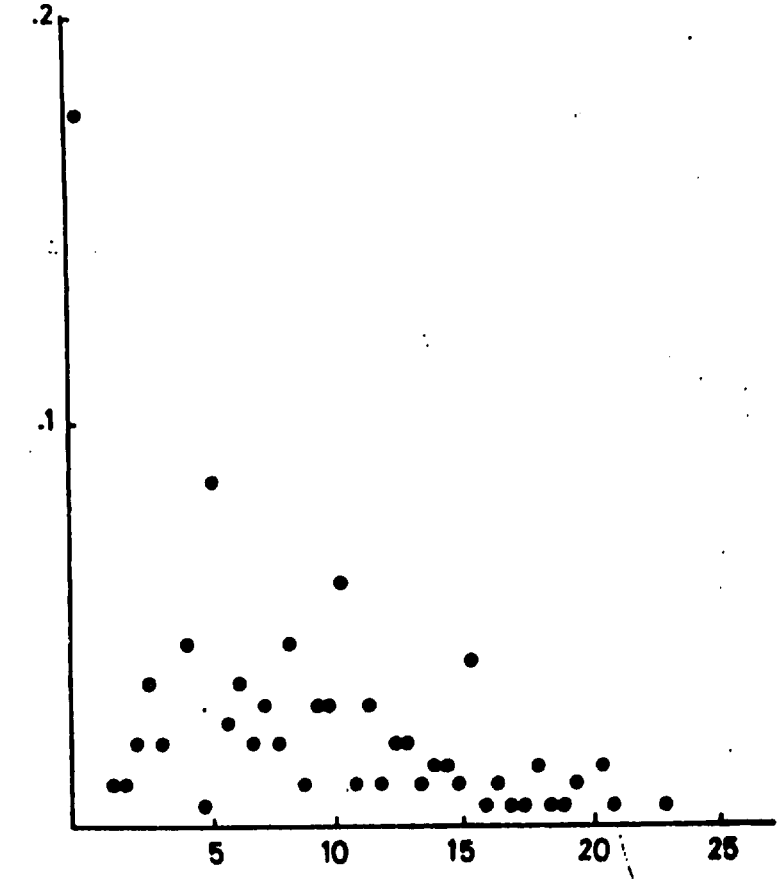


Figura 2. Histograma de velocidades de viento cada 0.5m/s Río Gallegos 1968-1975. Abcisas en m/s.

Examples are provided in following two tables:

Table 5 gives the population in the Southern provinces

Table 6 gives the "major" settlements in the Santa Cruz Province with indication of the major utilities available

The list shown in table 6 (Santa Cruz) is a good example of the scattering of the population (settlement as little as with 30 inhabitants).
In addition there are other settlements usually including a school and few other towns serving the population of a large area.
Electric energy is usually provided by diesel engineers that are often out of work because:

- maintenance is not carried out properly or is provided with long delay
- supply of fuel is sometime difficult during winter period
- lack of spares

In the case of small settlements wind generators have been already installed (Argentinian manufacture) to operate in conjunction with the diesel generator. In Rio Mayo, for instance a mixed system eolic/diesel (60% wind energy and 40% diesel) has shown the efficiency of the system and a net saving of 105.000 liters of diesel oil in few months without event optimizing the thermal engine. (A good approach could be to operate at minimum levels with the diesel engine to maximize eolic generation but this will need a wide programme of optimization of diesel engines, sometime overdimensioned, to avoid problems of consumption, carbonization etc.)
A number of small eolic generators are installed. Two certified models exist:

- 2 kW
- 200 W

Both are optimized for wind speeds typical in the Buenos Aires region and not for the ones existing in Patagonia.
In addition the energy available would be enough only for very small applications (lighting, radio, etc.)
There is therefore the need of optimized wind generators to meet with the following users of energy:

- lighting and other household applications
- heating
- water pumping (also for irrigation)
- telecommunication
- artisanal and cottage type production (weaving for instance is traditional but limitated by lack of energy
- education (rural schools)
- energy production to be supplied to the grid

CREE CENTRO REGIONAL DE ENERGIA EOLICA

T.E. 054-0965-81572
Télex 87633 MESOP A.R. C.C. 213
9103 RAWSON CHUBUT R. ARGENTINA

TABLE 5

DATOS DE POBLACION

Provincia	Población censo 1980	Datos provisorios censo 1991
Chubut	263.116	356.452
Neuquén	243.850	----
Río Negro	383.354	----
Santa Cruz	114.941	----
Tierra del Fuego	29.392	----

TABLE 6

LOCALIDADES Y PARAJES DE LA PCIA. DE SANTA CRUZ CON SERVICIOS PUBLICOS AL 28 DE FEBRERO DE 1986

REGION	LOCALIDADES O PARAJES	CANT. HAB. S/CENSO 1.960	PRESTADORES DE LOS SERVICIOS									
			ENERGIA ELECTRICA		SANEAMIENTO						GAS POR REDES	
					AGUA POTABLE		DESAGUE CLOACAL		DESAGUE PLUVIAL			
			S.P.S.E	Otros	S.P.S.E	Otros	S.P.S.E	Otros	S.P.S.E	Otros	S.P.S.E	Otros
COSTERA	1 RIO GALLEGOS	43.479	●		●		●	■5		■5		■3
	2 PUERTO PUNTA LOYOLA	-		■1		■1						
	3 CALETA OLIVIA	20.141	●		●	■1	●	■1		■5		■5
	4 PICO TRUNCADO	9.626		■3	●					■5	●	
	5 PUERTO SAN JULIAN	4.278	●		●							■3
	6 PUERTO DESEADO	4.017	●		●		●					■3
	7 LAS HERAS	3.176	●		●							■3
	8 CMTE. L. PIEDRA BUENA	2.492	●		●					■5		■3
	9 PUERTO SANTA CRUZ	2.353	●		●		◍					■3
	10 PUERTA PUNTA QUILLA	-	●		●							
	11 CAÑADON SECO	1.264		■1		■1						■1
	12 JARAMILLO	250	●		●							
	13 FITZ ROY	146	●		●							
	14 KOLUEL KAIKE	60		■1		■1						■5
	15 TELLIER	52	●									
	16 CERRO REDONDO	-		■1		■1						■1
CENTRO COSTERA CORDILLERANA	17 YAC. RIO TURBIO	7.758		■2		■2		■2				
	18 PERITO MORENO	2.075	●		●							P ▨3
	19 28 DE NOVIEMBRE	1.751	●		●							
	20 ROSPENTECK	-	●	■4		■4		■4				P ■4
	21 GOBERNADOR GREGORES	1.362	●		●			■5				P ▨3
	22 EL CALAFATE	1.348	●		●		◍					P ▨3
	23 LOS ANTIGUOS	777	●		●							
	24 JULIA DUFFOUR	620	●		●							
	25 TRES LAGOS	146	●		●							
	26 EL TURBIO	60	●									
	27 PUERTO PUNTA BANDERA	45	●									
	28 HIPOLITO YRIGOYEN	45	●		●							
	29 BAJO CARACOLES	40	●		●							
	30 FUENTES DEL COYLE	30	●									
	31 EL CHALTEN	-	○		○							
TOTALES	TREINTA Y UNO (31)	107.931	●24	■7	●20	■7	●3	■5		■4	●1	■11
							◍2					▨3
			○1		○1							

● ■ EN SERVICIO ● ▨ EN CONSTRUCCION ○ □ EN PROYECTO 1 - YAC. PETROLIFEROS FISCALES 2 - YAC. CARBONIFEROS FISCALES
3 - GAS DEL ESTADO 4 - EJERCITO 5 - MUNICIPALIDADES (P) SERVICIO DE GAS PROPANO INDILUIDO PROVISION MEDIANTE CAMIONES

Some information on the various applications are provided in the following paragraphs.

2.2.1. Lighting and other household applications

In rural area energy provided by diesel engines is often lacking. The wind generator could be used mainly in district/village application, providing energy for low consumption lights, radio/TV set and, if needed, refrigerator for the household as well as for limited street lighting and light plus refrigeration plus Radio/TV/communication to local social services.

Beside the social aspect of the availability of electric energy there is the saving in fuel and in maintenance of thermal engines.

2.2.2. Heating

Heating is a must in the Southern part of Argentine and is traditionally assured, particularly in the rural area, by firewood, sometimes transported over long distances. Availability of electrical energy can assure electrical heating systems. This would be done with the simultaneous dissemination of information and technical assistance services in order to improve the thermal insulation of the buildings in order to decrease the amount of energy needed.

2.2.3. Water pumping

Application of extreme importance due to the vocation of the region where cattle breeding and agriculture are important. Therefore irrigation and boreholes for drinking water for man and animals.

2.2.4. Telecommunication

Radiotelephones are of very common use mainly in the scattered communities. Batteries reloading needs a reliable source of energy.

2.2.5. Artisanal and cottage type production

Include weaving, food processing, cold cells etc. All these activites need reliable source of energy at low cost.

2.2.6. Education

Rural schools are usually equipped with diesel type generators. The installation of wind generators would provide a more reliable source of energy that could also be used in the houses located near the school.

The increase in the supply of electrical energy would make possible also extended educational facilities (laboratories, workshops etc.)

2.2.7. Production of energy for the grid

This is one of the most important applications.
Due to the high wind speed and availability in selected areas on the South of Argentina the installation of wind generators farms has been the subject of a number of studies that have shown its profitability.

A typical wind generator farms as designed by the italian sponsor Riva Calzoni in cooperation with CREE, Centro Regional de Energia Eolica, Argentina, includes 40 wind generators Riva Calzoni model M33 each having 300 kW generator as shown in the next drawing.

The farm can generate electrical energy to be distributed in the 33 kW grid.
The typical farm above mentioned has a power of 12 MW.

2.3. Projected sales

Major customers will be institutional ones (town municipalities, Provinces Government, Utilities Companies) and the market will largely depend from the availability of Credit.
Taking into consideration that all major equipment for the production of the wind generators are already available the only thing missing being the licence and the training for key engineers, we anticipate a very conservative forecast as follows:

year 1: 5 machines
year 2: 10 machines
year 3: 15 machines

2.4. Sales prices and revenues

The suggested selling price for the 300 kW wind generator is 270 millions lires (approximately 180.000 $ at present exchange rate).
The following revenues can be anticipated:

year 1: 1.350.000.000 lires
year 2: 2.700.000.000 lires
year 3: 4.050.000.000 lires

3. MATERIALS AND INPUTS

3.1. Machine major components

The configuration of the wind energy converter includes:

- single-blade rotor made of compisite material (counterweight excluded), having a diameter of 33 m. and suitable also for sites having a low windiness, provided with teetering hub and fail safe regulation on the blade pitch. Positioned downwind.

- induction generator, 300 kW rated, in the basis version and double generator, 300/55 kW, as optional, for the best expoitation of sites with low wind speeds. In the following description, reference will be made to the double generator arrangement.

- drive train provided with a gear box rigidly attached to the nacelle, parking brake on the fast shaft, motor positioning the blade for maintenance, and safety joint for the generators.

- nacelle frame made of welded steel, provided with a steel covering and mounted on a ball bearing. Yawing by means of hydraulic motors.

- supercritical tubular tower made of steel, 33 m high

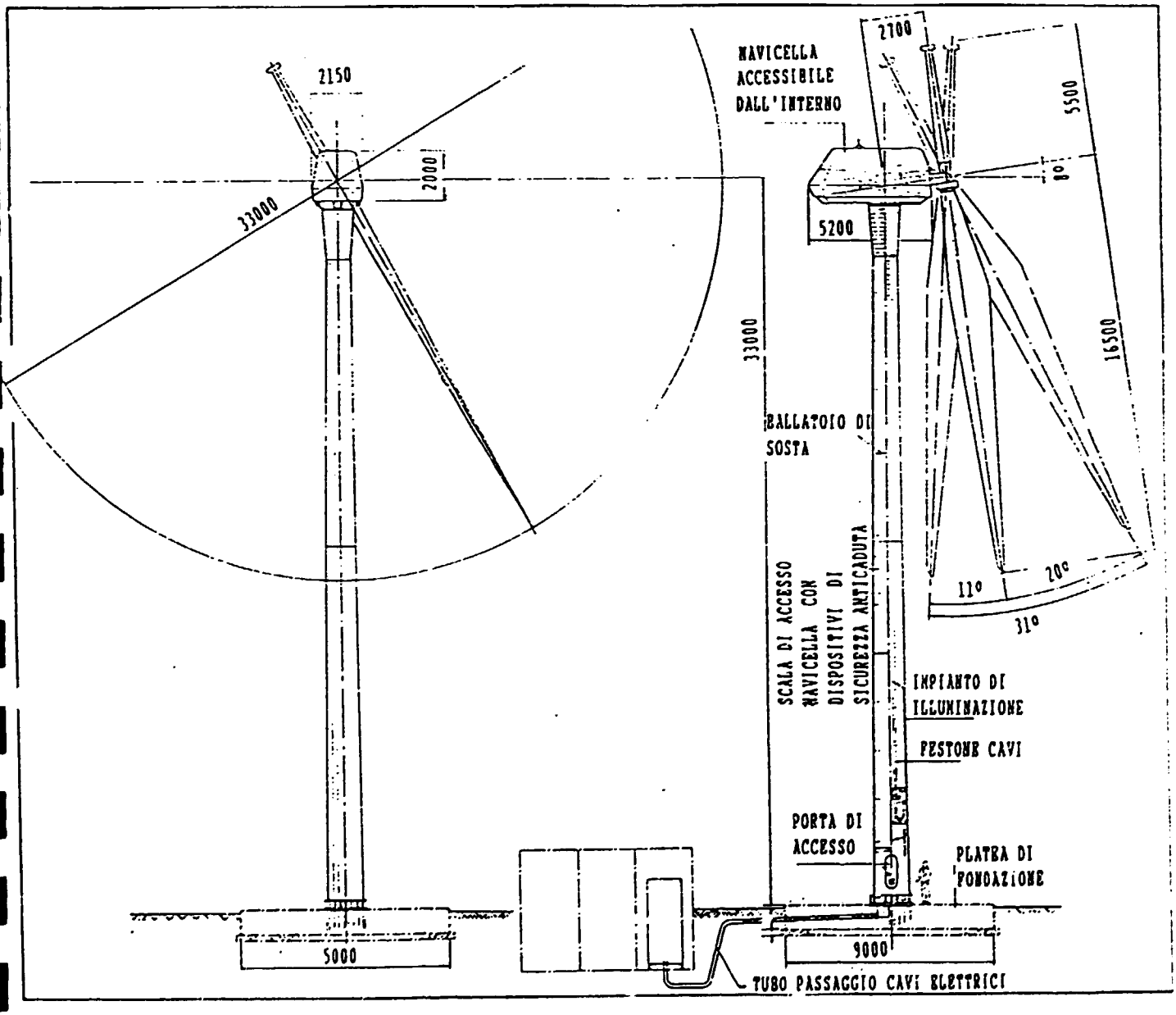
- control system by means of a microprocessor based on standard BUS

WEC'S care is the nacelle, palced on top of tower; it contains both the equipment to control wind impact onto the blade (blade pitch actuating device) and the wind energy conversion units (drive train and electric generator). Self-explanatory figures are shown in the following pages.

3.2. Local production

Most of the components could be locally produced or supplied by domestic market, particularly those parts made of steel carpentry or requiring cold-working. Other parts must be produced by casting and subsequent machining; these could be initially imported as rough-castings and locally machined to obtain the finished pieces.
In conclusion the main items that could be local by manufactured are: flap ring, counterweight, fork, nacelle cover, nacelle frame, yawing bearing, tower and gear box.
Electric generators should be supplied by a local manufacturer of electrical equipment, on the basis of technical specifications and data sheets of the licences's owner.
The blade of the WEC here considered will be imported, ready to be mounted, due to its special structure (monolythic longeron having a sandwich structure made of fiberglass and carbon fibers) and particular shape of the profile.

Figura 9 - Aerogenerador Riva Calzoni M33.



The following pages include draft and short description of the above mentioned components, in order to give a sufficiently detailed idea of the parts that this feasibility study foresees to be produced in the existing plant.

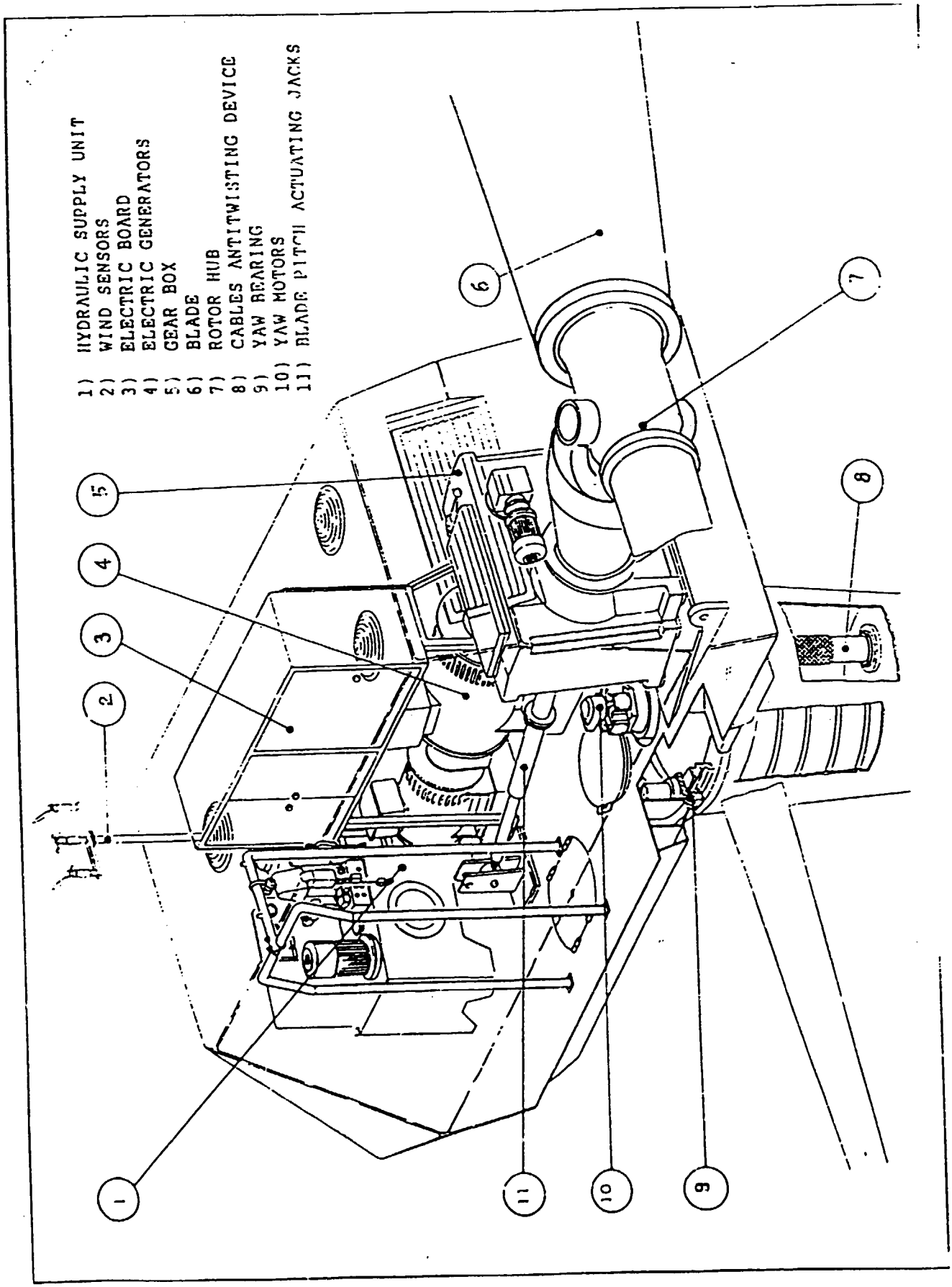
3.3. Materials and production equipment

Materials needed to manufacture the considered product mainly are cast iron, steel profiles and sheets, galvanized sheets and other various materials commonly used in manufacturing industries.

As far as the production equipment is concerned, no particular tooling nor machineries are required, except for manufacturing of gear-cutting; lathe, drill, grinding machine, welding equipment and mechanical tooling are already existing in the here considered production plant, that also includes utilities (electricity, water, compressed air, etc.)

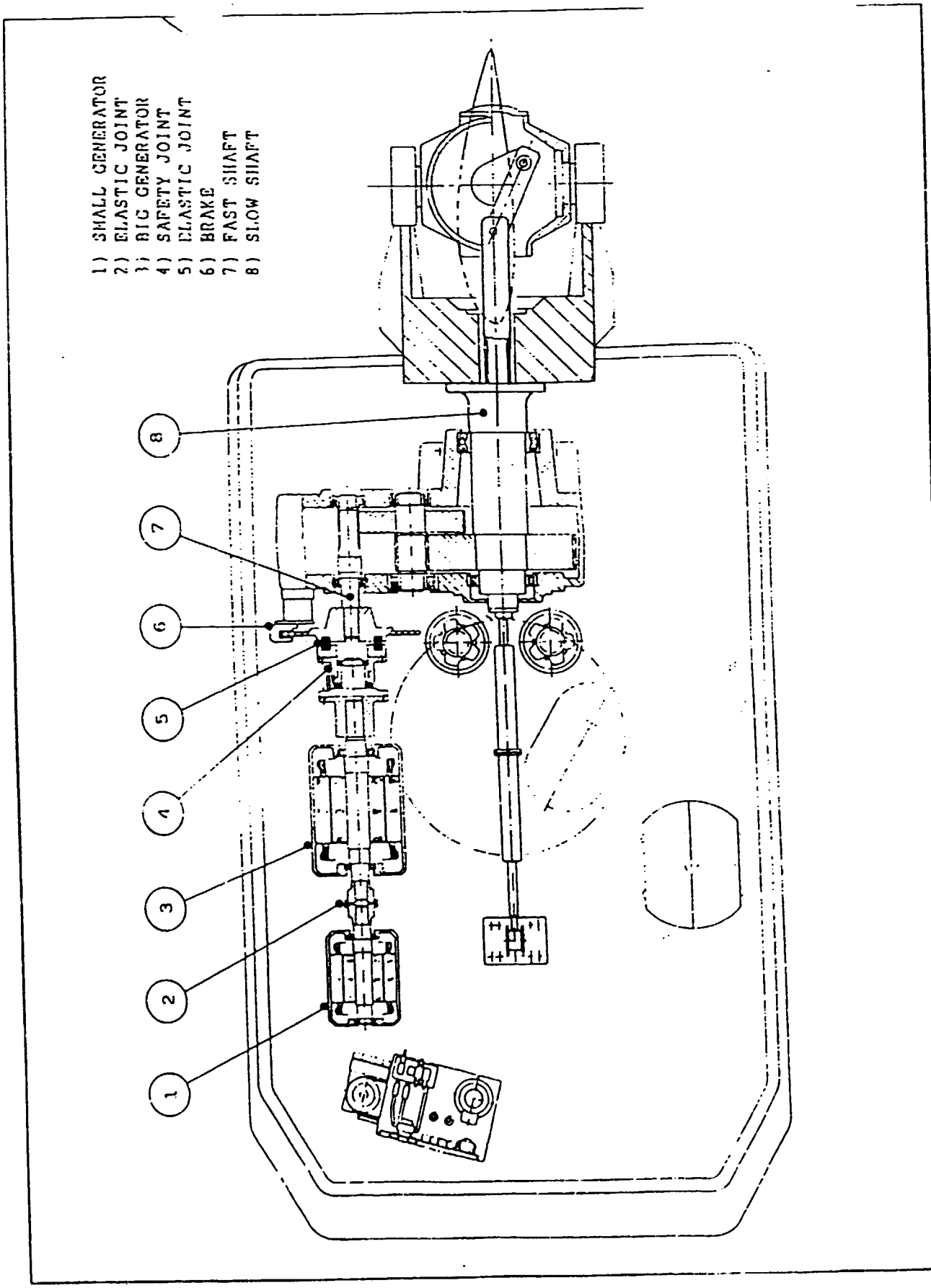
M33 Wind Energy Converter

Perspective view of the nacelle



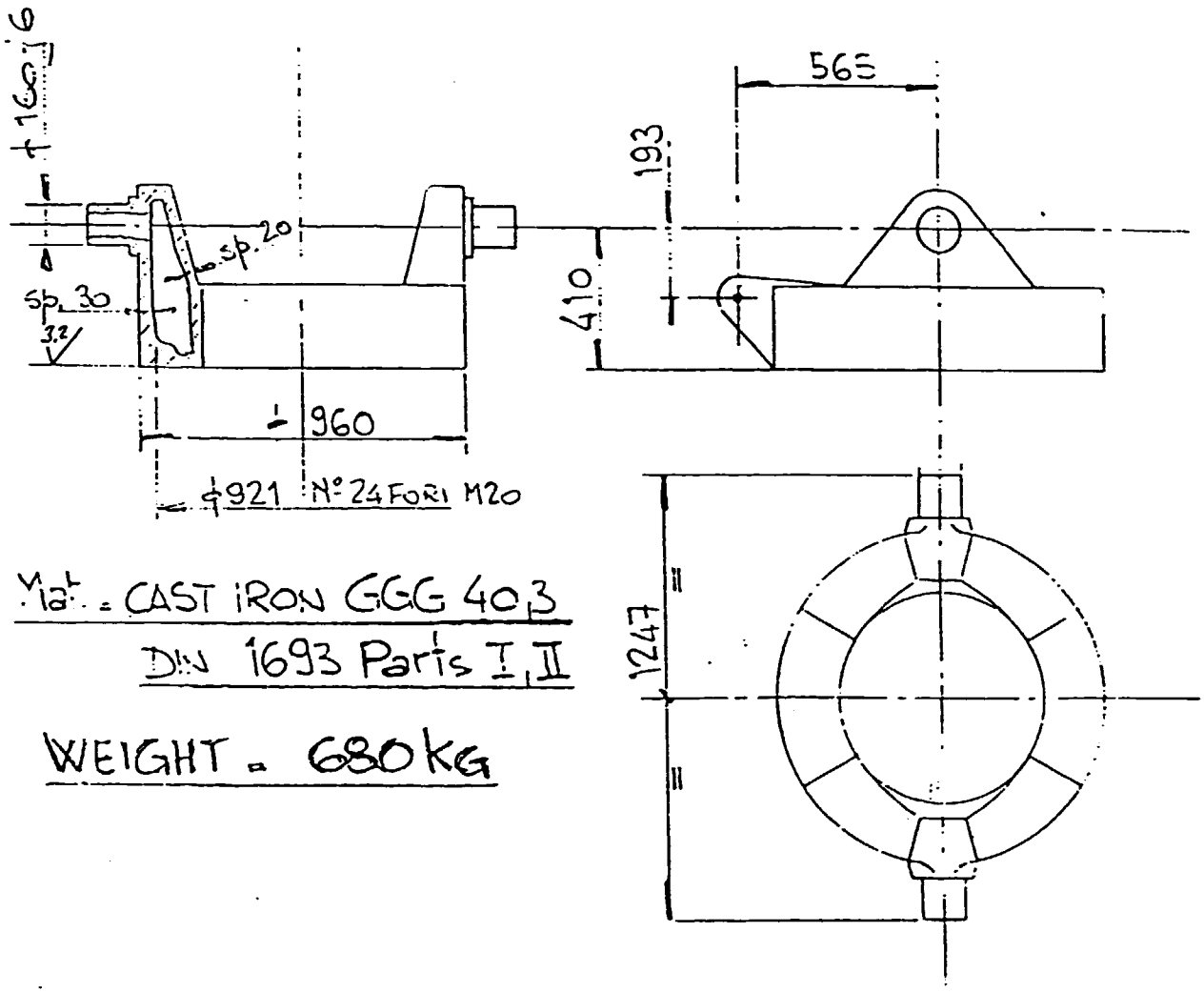
M33 Wind Energy Converter

Drive train view



M30 WIND ENERGY CONVERTER

FLAP RING



Mat. = CAST IRON GGG 403
DIN 1693 Parts I, II

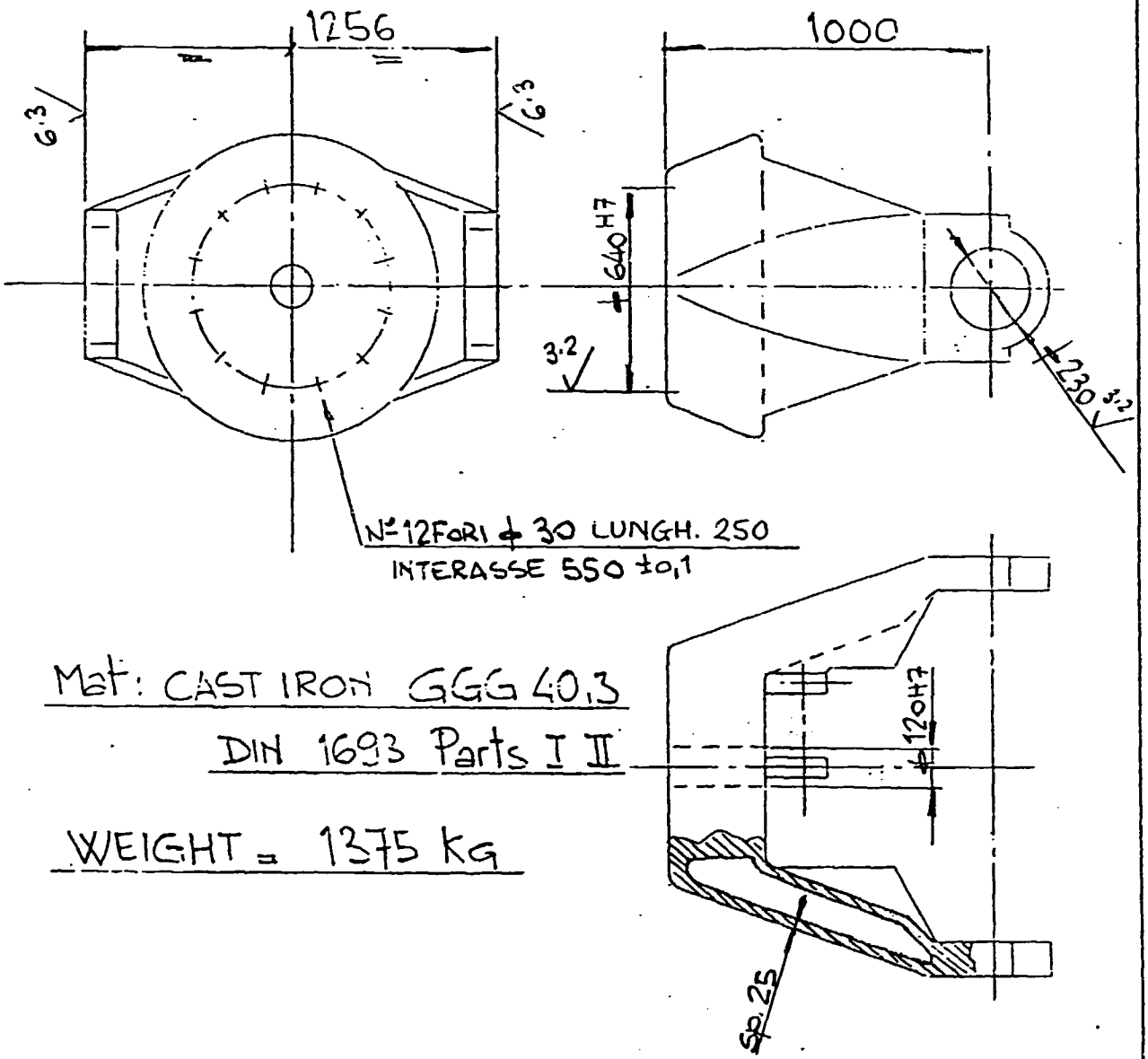
WEIGHT = 680 KG

Blade support.
The blade is connected to the slow shaft by means of the hub, consisting of an oscillating ring and a fork.

The hub bears the ball bearing allowing the blade pitch variation; the shape of the bearing allows the movement of the linkage permitting the pitch adjustment. Hub is made of a spheroidal cast iron having characteristics similar to those of steel (elongation 18%, yield strength 250 N/sq.mm).

M30 Wind Energy Converter

FORK



Mat: CAST IRON GGG 40,3

DIN 1693 Parts I II

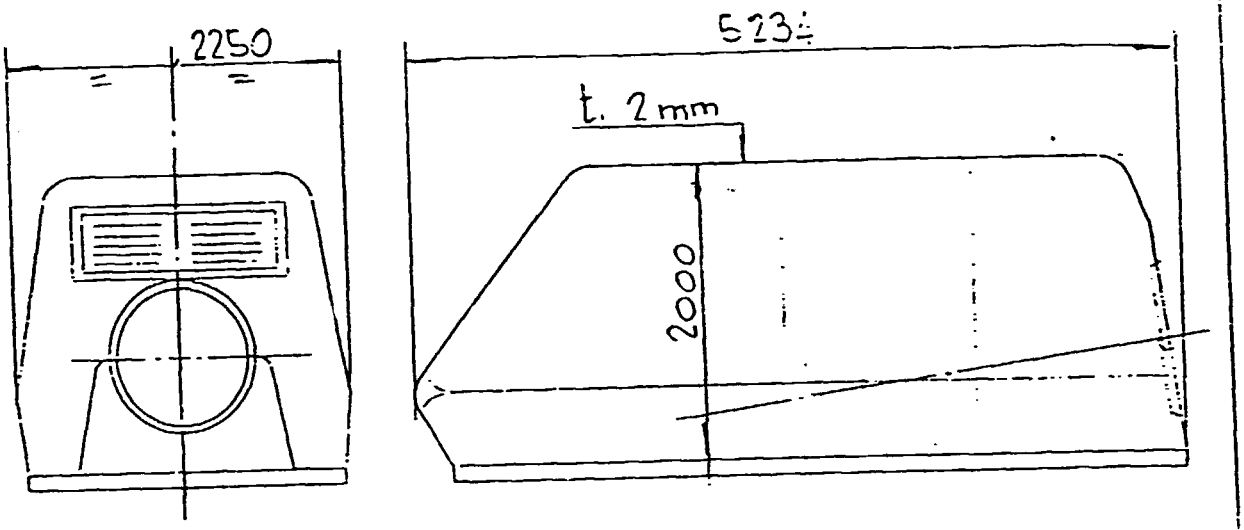
WEIGHT = 1375 kg

The fork is directly flanged on the rotor transmission shaft, which goes inside the gear box and supports a ring oscillating with respect to the fork, to which it is connected by means of two pins.

Fork is made of a spheroidal cast iron having characteristics similar to those of steel (elongation 18%, yield strength 250 N/sq.mm).

M33 Wind Energy Converter

Nacelle cover

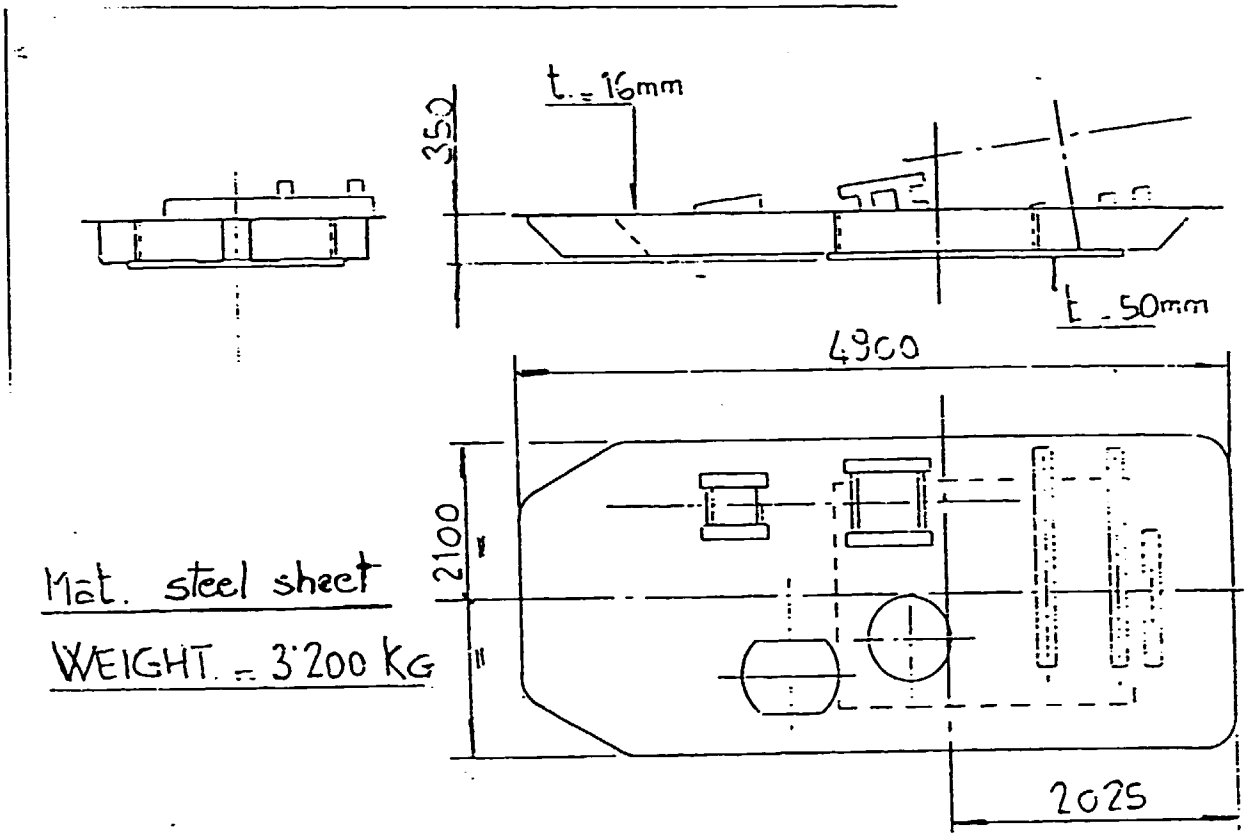


mat. = steel sheet WEIGHT = 550 kg

Nothing is fixed to the upper cover, although the latter is very rigid and sturdy thanks to its ribs, with the exception of the wind sensor. Two circular windows are provided in the cover for lighting. An opening provided with a grating on the rotor side allows the exit of the cooling air, which is directed inside trhough an opening in the frame, provided with grating and filter. This opening is located in correspondence with the generators. Where the fork comes out the cover is so shaped as to form a kind of labyrinth seal enough to prevent any possible penetration of rainwater or animals.

M33 Wind Energy Converter

Nacelle



Subsystem nacelle

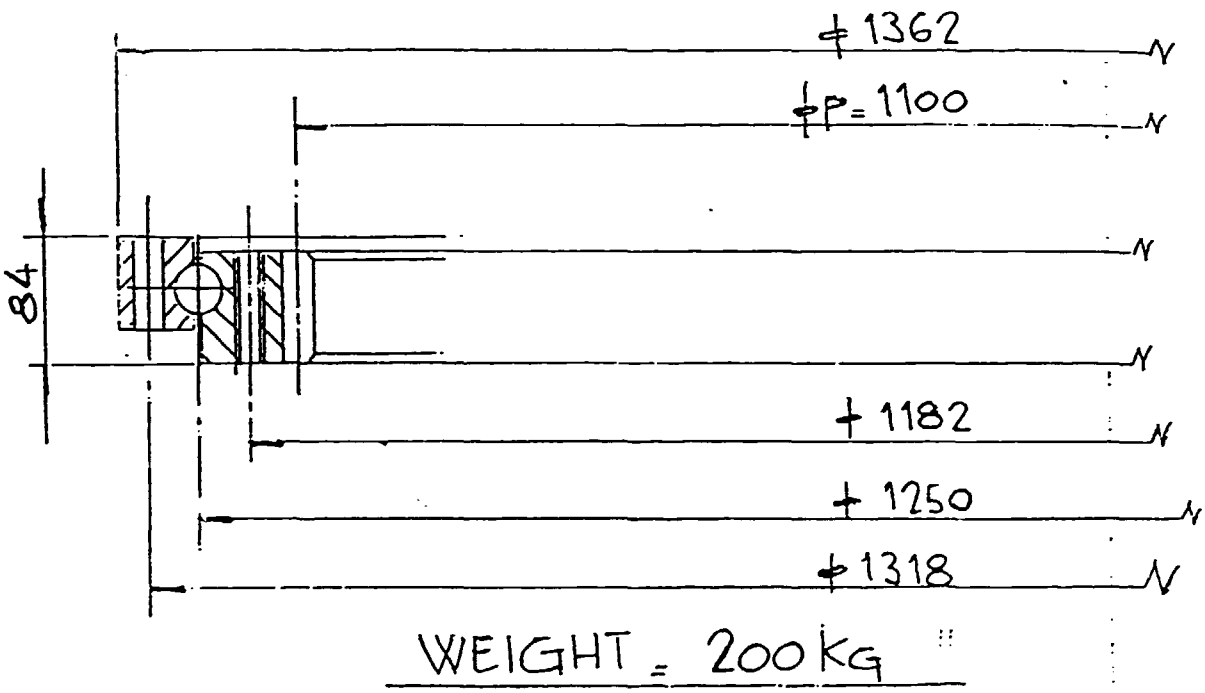
This subsystem includes the frame and its fittings, the yawing unit, and the hydraulic plant.

Frame and fittings.
The frame is the nacelle bearing structure, transferring the structural stresses it receives from the point for the fixation of the shaft line to the tower, throught the thrust bearing and the yaw brake unit.
The frame of the M30 wind turbine generator is made of steel plates having different thicknesses, bent and welded so as to make an open structure (therefore accessible to make and check welds), especially rigid and sturdy. The most stressed parts, therefore requiring a greater care in the manufacture, are those on the walking platform, where the latter is connected to the gear box base platform. Very accurate calculations allowed to optimize the design of these details, which have been checked for an infinite life.

The nacelle base level can be sectioned, in case of maintenance, by means of a fume stopping trapdoor which is kept open during operation. The frame is the only solid structural support, and all the nacelle equipment is fixed to it.

M33 Wind Energy Converter

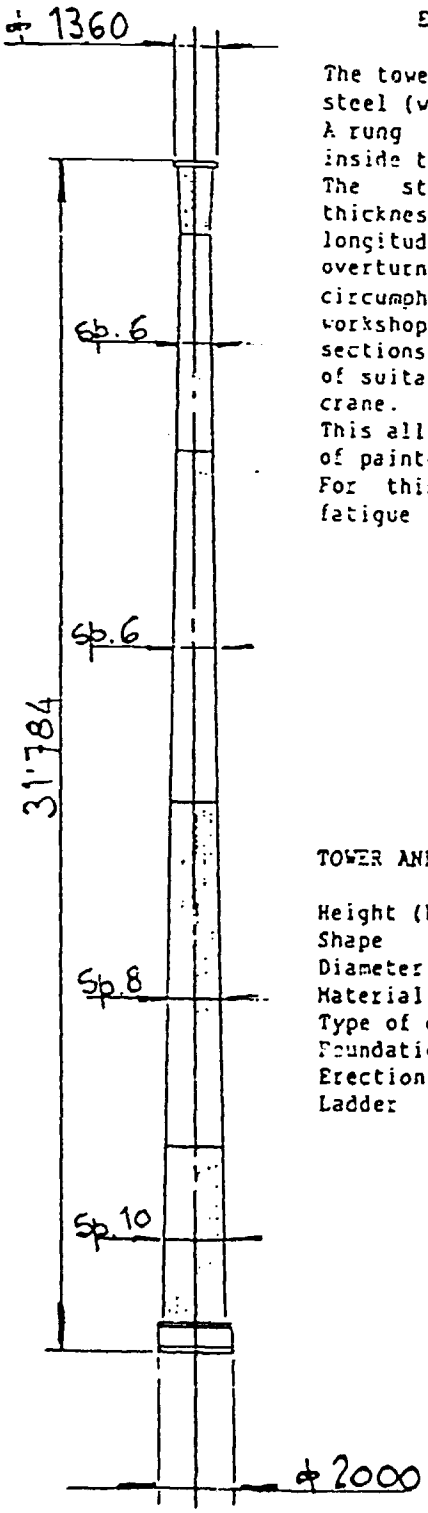
Yawing bearing



Yawing bearing
In correspondence with the stiffening ring connecting the two horizontal levels forming the frame, there is the flange for the connection to the thrust bearing, which in its turn must interface, at erection on site, with a similar flange on the tower top.

M33 Wind Energy Converter

Tower



WEIGHT = 18'000 KG

E. Subsystem support

The tower is a conical tubular structure made of self-bearing steel (without stays).
A rung ladder provided with fall preventing system is fixed inside the tower.
The structure is made of steel plates having different thicknesses, bent so as to obtain a polygonal section with two longitudinal butt welds to join the two halves of the cone. The overturned cone interfacing with the nacelle is circumpherentially welded to the rest of the tower in the workshop. The structure is built and delivered on site in four sections, which are afterwards longitudinally precharged by means of suitable hydraulic jacks before erection which takes place by crane. No reinforcement welds are made on the telescopic joint. This allows to deliver the tower galvanized and painted instead of painted only.
For this component too the dimensioning criterium followed is fatigue resistance.

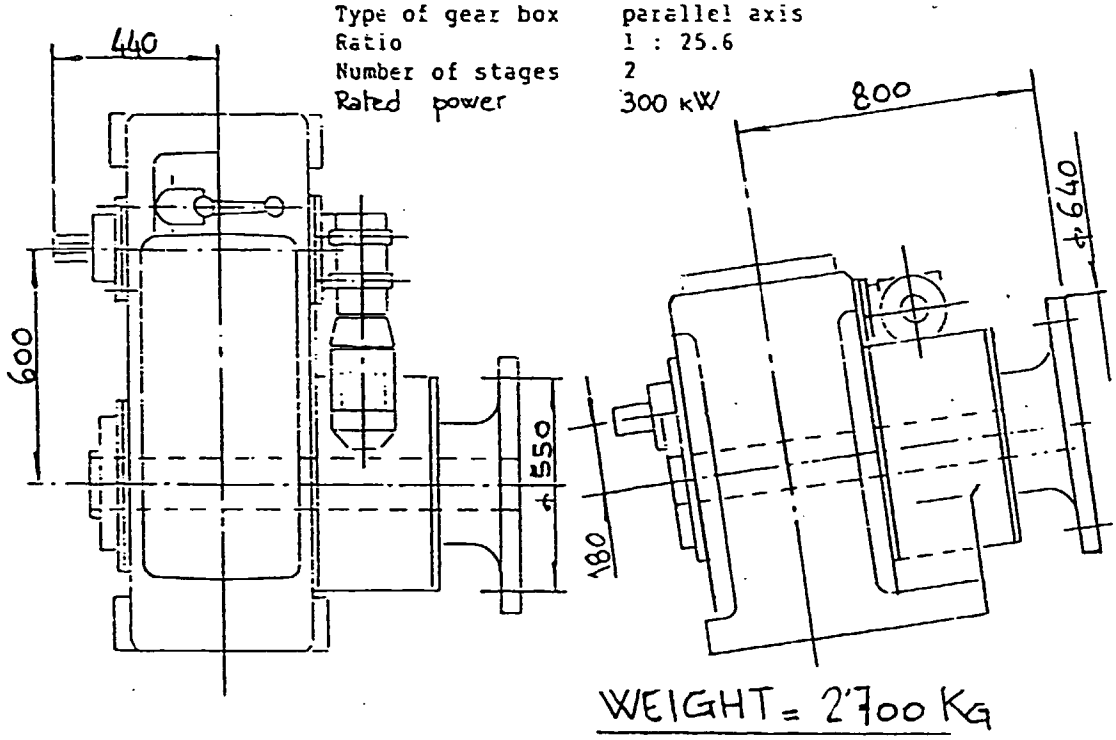
TOWER AND FOUNDATIONS

Height (base - hub)	33 m
Shape	cone tubular structure
Diameter	1.6/1.1 m
Material	steel
Type of connection	through base flange
Foundations	concrete
Erection system	through moving crane
Ladder	internal ladder with safety system.

M33 Wind Energy Converter

Gear box

Type of gear box	parallel axis
Ratio	1 : 25.6
Number of stages	2
Rated power	300 kW



Mechanical parts :

The mechanical parts referring to energy transmission essentially consist of the drive train

The slow shaft, flanged to the fork, may be locked to the nacelle frame by means of tie rods. The slow shaft is provided with a clutch wheel connected to a rotation speed sensor.

The gear unit consists of a spheroidal graphite cast iron casing provided with a large cover on top, facilitating ordinary maintenance operations (oil change, etc.). Lubrication is of the splash type. An active cooling system is not needed thanks to the remarkable size of the casing and to the particularly high efficiency (97.5%).

The gear box is rigidly fixed to the nacelle frame by means of bolts.

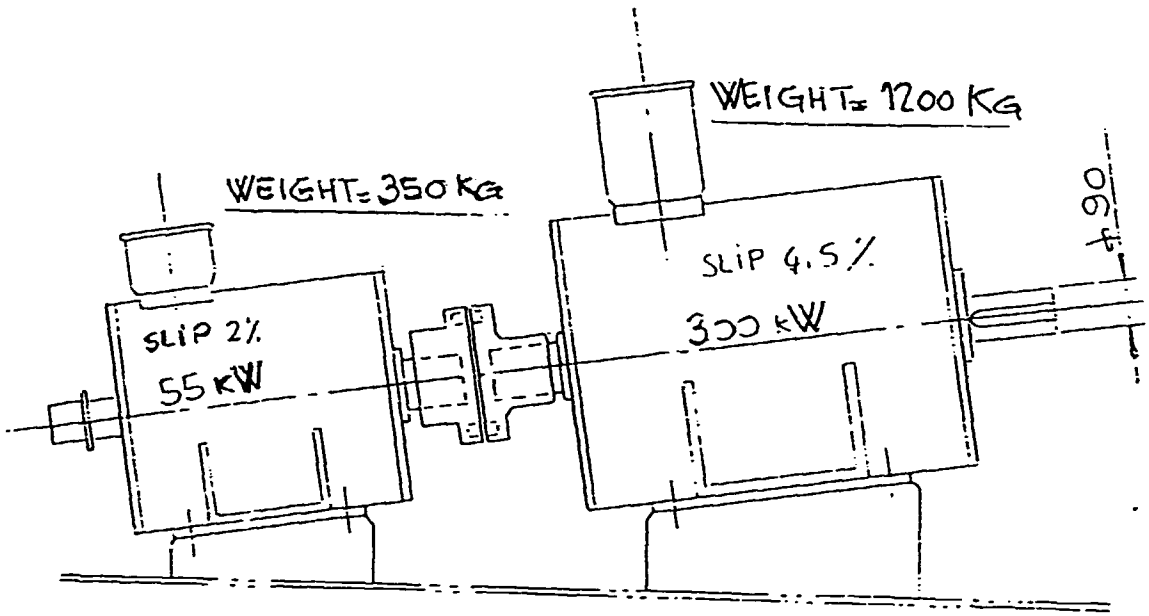
The slow shaft, provided with a through hole, is supported by two bearings, through which the stresses transmitted by the rotor are discharged.

The gear train is of the two-stage type, with parallel shafts, helical wheels with ground and hardened teeth. Seals are of the labyrinth type.

The fast shaft is provided with a device monitored by a microswitch with the purpose of engaging a small gearmotor to suitably position the rotor in case of maintenance operations; there is the possibility of carrying out manually controlled slow rotations. On the fast shaft, opposite to the generator side, it is possible to fit a motor drive to carry out rotating operations during workshop tests. The conditions of the gear box are continuously monitored by means of bearing temperature sensors.

The multiplier casing also bears the support for the manually operated parking brake.

M33 Wind energy converter
Electric generators



The two in-line electric generators are connected by means of a second flexible coupling. The generators are of the high slip type in order to allow a reduction in the torque pulsation. Protection level IP45.
Both the generators and the gear box are designed for the whole life of the installation, with particular reference to bearings.
In the back part of the smaller generator there is a rotation speed sensor sending to the computer a supplementary signal for a comparison with the analogous signal coming from the sensor located on the slow shaft.

Generator for high winds:	
. type	asynchronous
. power	300 kW
. number of poles	4
. rated speed	1547 RPM
. slip	4.5 %
Generator for low winds:	
. type	asynchronous
. power	55 kW
. number of poles	6
. rated speed	1022 RPM
. slip	2%
Rated voltage	380 V - 50 Hz

4. LOCATION AND SITE

The wind generators will be produced under licence by the LEONARDO S.A. a company established in 1956 and located at Granadero Baigorzia, near Rosario, Province of Santa Fe the company has a modern mechanical and electromechanical workshop and is specialized in construction of spare parts and maintenance service to the steel and mechanical heavy industry in the area.

Leonardo S.A. has been involved in the design and construction of wind generators too, small size and is presently produces large, industrial type, fans.
A comprehensive description of the Leonardo Company is enclosed to this study.

5. PROJECT ENGINEERING

The Leonardo S.A. workshop has been visited by both the consultant and the Riva Calzoni representative and found to meet necessary requirements for the local manufacture of the wind generators.

6. IMPLEMENTATION SCHEDULING

6.1. Plant erection and installation

This production of WECS will take place in an existing factory, already provided with tools, machinery and equipment suitable to mechanical working. So duration of plant erection and installation can be practically disregarded.

6.2. Production

Production of WEC units shall be implemented according to the following table;
components locally produced are increasing from the 1st to the 3rd year (standard production), taking into account the complexity of the parts.

YEAR OF PRODUCTION	WEC UNITS PRODUCED	COMPONENTS LOCALLY PRODUCED
1ST	5	TOWER FLAP RING NACELLE COVER FORK
2ND	10	NACELLE FRAME YAWING BEARING GEAR BOX
3RD AND FOLLOWING	15	WHOLE UNIT (BLADE EXCLUDED)

It is foreseen a training period for the local personnel, both in Italy and in Argentina.

7. FINANCIAL ANALYSIS

The following considerations have been made:

7.1. Fixed capital investment

The Leonardo S.A. workshop is already well equipped to manufacture most of the components of the wind generator.
An investment of 500 Million lires (in local currency) has been considered for specific tooling and limited improvements/updating to existing production machinery.

7.2. Production costs

The production cost of the various components of the wind generator as calculated by Leonardo S.A. on the basis of Riva Calzoni drawings and specifications are as follows:

	000.000 Italian Lires	
FLAP RING	5.6	
FORK	11.2	
NACELLE COVER	7.0	
NACELLE FRAME	16.0	
YAWING BEARING	11.2	
TOWER	42.0	
ELECTRIC GENERATOR 300 KW	20.0	
ELECTRIC GENERATOR 55 KW	7.4	
GEAR BOX	40.0	
BLADE	15.6	(Imported from Italy)
ASSEMBLING	30.0	

7.3. Other costs

The following costs have been taken into consideration:

- General expenses and commercial expenses = 100 mil/lires/year
- Technical assistance to be provided by Riva Calzoni = 100 mil/lires/year
- Royalties = 10% of the value of the components produced in Argentina
- Expenses for training of two specialists in Italy = 18 mil/lires

WIND ENERGY CONVERTER SYSTEM
JULY 1994
ARGENTINE

1 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: MILLIONS OF ITALIAN LIRAS

Total initial investment during construction phase

fixed assets:	525.00	3.429 % foreign
current assets:	0.00	0.000 % foreign
total assets:	525.00	3.429 % foreign

Source of funds during construction phase

equity & grants:	600.00	0.000 % foreign
foreign loans :	0.00	
local loans :	0.00	
total funds :	600.00	0.000 % foreign

Cashflow from operations

Year:	1	2	3
operating costs:	1229.10	2324.00	3545.60
depreciation :	62.50	62.50	50.00
interest :	0.00	0.00	0.00
production costs	1291.60	2386.50	3595.60
thereof foreign	48.10 %	19.28 %	9.29 %
total sales :	1350.00	2700.00	4050.00
gross income :	58.40	313.50	454.40
net income :	58.40	313.50	454.40
cash balance :	-228.66	116.11	209.15
net cashflow :	-228.66	116.11	209.15

Net Present Value at: 10.00 % = 2299.25
Internal Rate of Return: 36.09 %
Return on equity1: 48.84 %
Return on equity2: 33.61 %

Index of Schedules produced by COMFAR

Total Initial Investment in MILLIONS OF ITALIAN LIRAS

Year	1995
Fixed investment costs	
Land, site preparation, development	0.000
Buildings and civil works	0.000
Auxiliary and service facilities	0.000
Incorporated fixed assets	0.000
Plant machinery and equipment	500.000
Total fixed investment costs	500.000
Pre-production capital expenditures.	25.000
Net working capital	0.000
Total initial investment costs	525.000
Of it foreign, in %	3.429

Total Current Investment in MILLIONS OF ITALIAN LIRAS

Year	1996	1997	1998
Fixed investment costs			
Land, site preparation, development	0.000	0.000	0.000
Buildings and civil works	0.000	0.000	0.000
Auxiliary and service facilities	0.000	0.000	0.000
Incorporated fixed assets	0.000	0.000	0.000
Plant, machinery and equipment	0.000	0.000	0.000
Total fixed investment costs	0.000	0.000	0.000
Preproduction capitals expenditures.	0.000	0.000	0.000
Working capital	349.556	259.889	295.247
Total current investment costs	349.556	259.889	295.247
Of it foreign, %	55.995	0.000	0.000

Total Production Costs in MILLIONS OF ITALIAN LIRAS

Year	1996	1997	1998-2005	2006-10
% of nom. capacity (single product).	0.000	0.000	0.000	0.000
Raw material 1	841.200	1681.000	2640.000	2640.000
Other raw materials	0.000	0.000	0.000	0.000
Utilities	2.500	5.000	7.500	7.500
Energy	2.500	5.000	7.500	7.500
Labour, direct	150.000	300.000	450.000	450.000
Repair, maintenance	100.000	100.000	100.000	100.000
Spares	0.000	0.000	0.000	0.000
Factory overheads	100.000	100.000	100.000	100.000
Factory costs	1196.200	2191.000	3305.000	3305.000
Administrative overheads	32.900	133.000	240.600	240.600
Indir. costs, sales and distribution	0.000	0.000	0.000	0.000
Direct costs, sales and distribution	0.000	0.000	0.000	0.000
Depreciation	62.500	62.500	50.000	0.000
Financial costs	0.000	0.000	0.000	0.000
Total production costs	1291.600	2386.500	3595.600	3545.600
Costs per unit (single product)	0.000	0.000	0.000	0.000
Of it foreign, %	48.095	19.275	9.289	9.420
Of it variable,%	0.000	0.000	0.000	0.000
Total labour	150.000	300.000	450.000	450.000

Net Working Capital in MILLIONS OF ITALIAN LIRAS

Year	mdc	coto	1996	1997	1998	1999-2010
Coverage						
Current assets &						
Accounts receivable	30	12.0	102.425	193.667	295.467	295.467
Inventory and materials	33	10.9	112.790	169.347	239.521	239.521
Energy	1	360.0	0.007	0.014	0.021	0.021
Spares	0	---	0.000	0.000	0.000	0.000
Work in progress	30	12.0	99.683	182.583	275.417	275.417
Finished products	30	12.0	102.425	193.667	295.467	295.467
Cash in hand	30	12.0	31.908	52.750	74.217	74.217
Total current assets			449.239	792.028	1180.108	1180.108
Current liabilities and						
Accounts payable	30	12.0	99.683	182.583	275.417	275.417
Net working capital			349.556	609.444	904.692	904.692
Increase in working capital			349.556	259.889	295.247	0.000
Net working capital, local			153.822	467.444	801.692	801.692
Net working capital, foreign			195.733	142.000	103.000	103.000

Note: mdc = minimum days of coverage ; coto = coefficient of turnover .

Source of Finance, construction in MILLIONS OF ITALIAN LIRAS

Year	1995
Equity, ordinary ..	600.000
Equity, preference.	0.000
Subsidies, grants .	0.000
Loan A, foreign .	0.000
Loan B, foreign..	0.000
Loan C, foreign .	0.000
Loan A, local....	0.000
Loan B, local....	0.000
Loan C, local....	0.000
Total loan	0.000
Current liabilities	0.000
Bank overdraft	0.000
Total funds	600.000

Source of Finance, production in MILLIONS OF ITALIAN LIRAS

Year	1996	1997	1998
Equity, ordinary ..	0.000	0.000	0.000
Equity, preference.	0.000	0.000	0.000
Subsidies, grants .	0.000	0.000	0.000
Loan A, foreign .	0.000	0.000	0.000
Loan B, foreign..	0.000	0.000	0.000
Loan C, foreign .	0.000	0.000	0.000
Loan A, local....	0.000	0.000	0.000
Loan B, local....	0.000	0.000	0.000
Loan C, local....	0.000	0.000	0.000
Total loan	0.000	0.000	0.000
Current liabilities	99.683	82.900	92.833
Bank overdraft	153.656	-116.111	-37.545
Total funds	253.339	-33.211	55.289

Cashflow Tables, construction in MILLIONS OF ITALIAN LIRAS

Year	1995
Total cash inflow . .	600.000
Financial resources .	600.000
Sales, net of tax . .	0.000
Total cash outflow . .	525.000
Total assets	525.000
Operating costs . . .	0.000
Cost of finance . . .	0.000
Repayment	0.000
Corporate tax . . .	0.000
Dividends paid . . .	0.000
Surplus (deficit) .	75.000
Cumulated cash balance	75.000
Inflow, local	600.000
Outflow, local	507.000
Surplus (deficit) .	93.000
Inflow, foreign . . .	0.000
Outflow, foreign . . .	18.000
Surplus (deficit) .	-18.000
Net cashflow	-525.000
Cumulated net cashflow	-525.000

Cashflow tables, production in MILLIONS OF ITALIAN LIRAS

Year	1996	1997	1998	1999	2000	2001
Total cash inflow . .	1449.683	2796.333	4152.583	4050.000	4050.000	4050.000
Financial resources .	99.683	96.333	102.583	0.000	0.000	0.000
Sales, net of tax . .	1350.000	2700.000	4050.000	4050.000	4050.000	4050.000
Total cash outflow . .	1678.339	2680.222	3943.431	3545.600	3545.600	3545.600
Total assets	449.239	342.789	388.081	0.000	0.000	0.000
Operating costs . . .	1229.100	2324.000	3545.600	3545.600	3545.600	3545.600
Cost of finance . . .	0.000	0.000	0.000	0.000	0.000	0.000
Repayment	0.000	13.433	9.750	0.000	0.000	0.000
Corporate tax . . .	0.000	0.000	0.000	0.000	0.000	0.000
Dividends paid . . .	0.000	0.000	0.000	0.000	0.000	0.000
Surplus (deficit) .	-228.656	116.111	209.153	504.400	504.400	504.400
Cumulated cash balance	-153.656	-37.545	171.608	676.008	1180.408	1684.808
Inflow, local	1398.667	2796.333	4152.583	4050.000	4050.000	4050.000
Outflow, local	819.389	2282.956	3648.431	3211.600	3211.600	3211.600
Surplus (deficit) .	579.278	513.378	504.153	838.400	838.400	838.400
Inflow, foreign . . .	51.017	0.000	0.000	0.000	0.000	0.000
Outflow, foreign . . .	858.950	397.267	295.000	334.000	334.000	334.000
Surplus (deficit) .	-807.933	-397.267	-295.000	-334.000	-334.000	-334.000
Net cashflow	-228.656	116.111	209.153	504.400	504.400	504.400
Cumulated net cashflow	-753.656	-637.544	-428.392	76.008	580.408	1084.808

COMFAR 21 UNIDO

Cashflow tables, production in MILLIONS OF ITALIAN LIRAS

Year	2002	2003	2004	2005	2006	2007
Total cash inflow . .	4050.000	4050.000	4050.000	4050.000	4050.000	4050.000
Financial resources .	0.000	0.000	0.000	0.000	0.000	0.000
Sales, net of tax . .	4050.000	4050.000	4050.000	4050.000	4050.000	4050.000
Total cash outflow . .	3545.600	3545.600	3545.600	3545.600	3545.600	3545.600
Total assets	0.000	0.000	0.000	0.000	0.000	0.000
Operating costs . . .	3545.600	3545.600	3545.600	3545.600	3545.600	3545.600
Cost of finance . . .	0.000	0.000	0.000	0.000	0.000	0.000
Repayment	0.000	0.000	0.000	0.000	0.000	0.000
Corporate tax . . .	0.000	0.000	0.000	0.000	0.000	0.000
Dividends paid . . .	0.000	0.000	0.000	0.000	0.000	0.000
Surplus (deficit) .	504.400	504.400	504.400	504.400	504.400	504.400
Cumulated cash balance	2189.208	2693.608	3198.008	3702.408	4206.808	4711.208
Inflow, local	4050.000	4050.000	4050.000	4050.000	4050.000	4050.000
Outflow, local	3211.600	3211.600	3211.600	3211.600	3211.600	3211.600
Surplus (deficit) .	838.400	838.400	838.400	838.400	838.400	838.400
Inflow, foreign . . .	0.000	0.000	0.000	0.000	0.000	0.000
Outflow, foreign . . .	334.000	334.000	334.000	334.000	334.000	334.000
Surplus (deficit) .	-334.000	-334.000	-334.000	-334.000	-334.000	-334.000
Net cashflow	504.400	504.400	504.400	504.400	504.400	504.400
Cumulated net cashflow	1589.208	2093.608	2598.008	3102.407	3606.807	4111.207

Cashflow tables, production in MILLIONS OF ITALIAN LIRAS

Year	2008	2009	2010
Total cash inflow . .	4050.000	4050.000	4050.000
Financial resources .	0.000	0.000	0.000
Sales, net of tax . .	4050.000	4050.000	4050.000
Total cash outflow . .	3545.600	3545.600	3545.600
Total assets	0.000	0.000	0.000
Operating costs . . .	3545.600	3545.600	3545.600
Cost of finance . . .	0.000	0.000	0.000
Repayment	0.000	0.000	0.000
Corporate tax . . .	0.000	0.000	0.000
Dividends paid . . .	0.000	0.000	0.000
Surplus (deficit) .	504.400	504.400	504.400
Cumulated cash balance	5215.607	5720.007	6224.407
Inflow, local	4050.000	4050.000	4050.000
Outflow, local	3211.600	3211.600	3211.600
Surplus (deficit) .	838.400	838.400	838.400
Inflow, foreign . . .	0.000	0.000	0.000
Outflow, foreign . . .	334.000	334.000	334.000
Surplus (deficit) .	-334.000	-334.000	-334.000
Net cashflow	504.400	504.400	504.400
Cumulated net cashflow	4615.607	5120.007	5624.407

Cashflow Discounting:

a) Equity paid versus Net income flow:

Net present value	2452.83 at	10.00 %
Internal Rate of Return (IRRE1) ..	48.84 %	

b) Net Worth versus Net cash return:

Net present value	2224.25 at	10.00 %
Internal Rate of Return (IRRE2) ..	33.61 %	

c) Internal Rate of Return on total investment:

Net present value	2299.25 at	10.00 %
Internal Rate of Return (IRR) ..	36.09 %	

Net Worth = Equity paid plus reserves

Net Income Statement in MILLIONS OF ITALIAN LIRAS

Year	1996	1997	1998	1999	2000
Total sales, incl. sales tax	1350.000	2700.000	4050.000	4050.000	4050.000
Less: variable costs, incl. sales tax.	0.000	0.000	0.000	0.000	0.000
Variable margin	1350.000	2700.000	4050.000	4050.000	4050.000
As % of total sales	100.000	100.000	100.000	100.000	100.000
Non-variable costs, incl. depreciation	1291.600	2386.500	3595.600	3595.600	3595.600
Operational margin	58.400	313.500	454.400	454.400	454.400
As % of total sales	4.326	11.611	11.220	11.220	11.220
Cost of finance	0.000	0.000	0.000	0.000	0.000
Gross profit	58.400	313.500	454.400	454.400	454.400
Allowances	0.000	0.000	0.000	0.000	0.000
Taxable profit	58.400	313.500	454.400	454.400	454.400
Tax	0.000	0.000	0.000	0.000	0.000
Net profit	58.400	313.500	454.400	454.400	454.400
Dividends paid	0.000	0.000	0.000	0.000	0.000
Undistributed profit	58.400	313.500	454.400	454.400	454.400
Accumulated undistributed profit	58.400	371.900	826.300	1280.700	1735.100
Gross profit, % of total sales	4.326	11.611	11.220	11.220	11.220
Net profit, % of total sales	4.326	11.611	11.220	11.220	11.220
ROE, Net profit, % of equity	9.733	52.250	75.733	75.733	75.733
ROI, Net profit+interest, % of invest.	6.678	27.635	31.783	31.783	31.783

Net Income Statement in MILLIONS OF ITALIAN LIRAS

Year	2001	2002	2003	2004	2005
Total sales, incl. sales tax	4050.000	4050.000	4050.000	4050.000	4050.000
Less: variable costs, incl. sales tax.	0.000	0.000	0.000	0.000	0.000
Variable margin	4050.000	4050.000	4050.000	4050.000	4050.000
As % of total sales	100.000	100.000	100.000	100.000	100.000
Non-variable costs, incl. depreciation	3595.600	3595.600	3595.600	3595.600	3595.600
Operational margin	454.400	454.400	454.400	454.400	454.400
As % of total sales	11.220	11.220	11.220	11.220	11.220
Cost of finance	0.000	0.000	0.000	0.000	0.000
Gross profit	454.400	454.400	454.400	454.400	454.400
Allowances	0.000	0.000	0.000	0.000	0.000
Taxable profit	454.400	454.400	454.400	454.400	454.400
Tax	0.000	0.000	0.000	0.000	0.000
Net profit	454.400	454.400	454.400	454.400	454.400
Dividends paid	0.000	0.000	0.000	0.000	0.000
Undistributed profit	454.400	454.400	454.400	454.400	454.400
Accumulated undistributed profit	2189.500	2643.899	3098.299	3552.699	4007.099
Gross profit, % of total sales	11.220	11.220	11.220	11.220	11.220
Net profit, % of total sales	11.220	11.220	11.220	11.220	11.220
ROE, Net profit, % of equity	75.733	75.733	75.733	75.733	75.733
ROI, Net profit+interest, % of invest.	31.783	31.783	31.783	31.783	31.783

Net Income Statement in MILLIONS OF ITALIAN LIRAS

Year	2006	2007	2008	2009	2010
Total sales, incl. sales tax	4050.000	4050.000	4050.000	4050.000	4050.000
Less: variable costs, incl. sales tax.	0.000	0.000	0.000	0.000	0.000
Variable margin	4050.000	4050.000	4050.000	4050.000	4050.000
As % of total sales	100.000	100.000	100.000	100.000	100.000
Non-variable costs, incl. depreciation	3545.600	3545.600	3545.600	3545.600	3545.600
Operational margin	504.400	504.400	504.400	504.400	504.400
As % of total sales	12.454	12.454	12.454	12.454	12.454
Cost of finance	0.000	0.000	0.000	0.000	0.000
Gross profit	504.400	504.400	504.400	504.400	504.400
Allowances	0.000	0.000	0.000	0.000	0.000
Taxable profit	504.400	504.400	504.400	504.400	504.400
Tax	0.000	0.000	0.000	0.000	0.000
Net profit	504.400	504.400	504.400	504.400	504.400
Dividends paid	0.000	0.000	0.000	0.000	0.000
Undistributed profit	504.400	504.400	504.400	504.400	504.400
Accumulated undistributed profit	4511.499	5015.899	5520.299	6024.699	6529.099
Gross profit, % of total sales	12.454	12.454	12.454	12.454	12.454
Net profit, % of total sales	12.454	12.454	12.454	12.454	12.454
ROE, Net profit, % of equity	84.067	84.067	84.067	84.067	84.067
ROI, Net profit+interest, % of invest.	35.280	35.280	35.280	35.280	35.280

Projected Balance Sheets, construction in MILLIONS OF ITALIAN LIRAS

Year	1995
Total assets	600.000
Fixed assets, net of depreciation	0.000
Construction in progress	525.000
Current assets	0.000
Cash, bank	0.000
Cash surplus, finance available	75.000
Loss carried forward	0.000
Loss	0.000
Total liabilities	600.000
Equity capital	600.000
Reserves, retained profit	0.000
Profit	0.000
Long and medium term debt	0.000
Current liabilities	0.000
Bank overdraft, finance required	0.000
Total debt	0.000
Equity, % of liabilities	100.000

Projected Balance Sheets, Production in MILLIONS OF ITALIAN LIRAS

Year	1996	1997	1998	1999	2000
Total assets	911.739	1192.028	1701.716	2156.116	2610.516
Fixed assets, net of depreciation	462.500	400.000	350.000	300.000	250.000
Construction in progress	0.000	0.000	0.000	0.000	0.000
Current assets	417.331	739.278	1105.892	1105.892	1105.892
Cash, bank	31.908	52.750	74.217	74.217	74.217
Cash surplus, finance available	0.000	0.000	171.608	676.008	1180.408
Loss carried forward	0.000	0.000	0.000	0.000	0.000
Loss	0.000	0.000	0.000	0.000	0.000
Total liabilities	911.739	1192.028	1701.716	2156.116	2610.516
Equity capital	600.000	600.000	600.000	600.000	600.000
Reserves, retained profit	0.000	58.400	371.900	826.300	1280.700
Profit	58.400	313.500	454.400	454.400	454.400
Long and medium term debt	0.000	0.000	0.000	0.000	0.000
Current liabilities	99.683	182.583	275.417	275.417	275.417
Bank overdraft, finance required	153.656	37.545	0.000	0.000	0.000
Total debt	253.339	220.128	275.417	275.417	275.417
Equity, % of liabilities	65.808	50.334	35.259	27.828	22.984

Projected Balance Sheets, Production in MILLIONS OF ITALIAN LIRAS

Year	2001	2002	2003	2004	2005
Total assets	3064.916	3519.316	3973.716	4428.116	4882.516
Fixed assets, net of depreciation	200.000	150.000	100.000	50.000	0.000
Construction in progress	0.000	0.000	0.000	0.000	0.000
Current assets	1105.892	1105.892	1105.892	1105.892	1105.892
Cash, bank	74.217	74.217	74.217	74.217	74.217
Cash surplus, finance available	1684.808	2189.208	2693.608	3198.007	3702.407
Loss carried forward	0.000	0.000	0.000	0.000	0.000
Loss	0.000	0.000	0.000	0.000	0.000
Total liabilities	3064.916	3519.316	3973.716	4428.116	4882.516
Equity capital	600.000	600.000	600.000	600.000	600.000
Reserves, retained profit	1735.100	2189.500	2643.899	3098.299	3552.699
Profit	454.400	454.400	454.400	454.400	454.400
Long and medium term debt	0.000	0.000	0.000	0.000	0.000
Current liabilities	275.417	275.417	275.417	275.417	275.417
Bank overdraft, finance required	0.000	0.000	0.000	0.000	0.000
Total debt	275.417	275.417	275.417	275.417	275.417
Equity, % of liabilities	19.576	17.049	15.099	13.550	12.289

Projected Balance Sheets, Production in MILLIONS OF ITALIAN LIRAS

Year	2006	2007	2008	2009	2010
Total assets	5386.916	5891.315	6395.715	6900.115	7404.515
Fixed assets, net of depreciation	0.000	0.000	0.000	0.000	0.000
Construction in progress	0.000	0.000	0.000	0.000	0.000
Current assets	1105.892	1105.892	1105.892	1105.892	1105.892
Cash, bank	74.217	74.217	74.217	74.217	74.217
Cash surplus, finance available	4206.807	4711.207	5215.607	5720.007	6224.407
Loss carried forward	0.000	0.000	0.000	0.000	0.000
Loss	0.000	0.000	0.000	0.000	0.000
Total liabilities	5386.916	5891.315	6395.715	6900.115	7404.515
Equity capital	600.000	600.000	600.000	600.000	600.000
Reserves, retained profit	4007.099	4511.499	5015.899	5520.299	6024.699
Profit	504.400	504.400	504.400	504.400	504.400
Long and medium term debt	0.000	0.000	0.000	0.000	0.000
Current liabilities	275.417	275.417	275.417	275.417	275.417
Bank overdraft, finance required	0.000	0.000	0.000	0.000	0.000
Total debt	275.417	275.417	275.417	275.417	275.417
Equity, % of liabilities	11.138	10.184	9.381	8.696	8.103

ANNEXE A

leonardo s.a.

ESTABLECIMIENTO METALURGICO

BALCARCE 982/80 - 2152 GRANADERO BAIGORRIA - PROVINCIA SANTA FE

☎ (041) 710181 - 710521 - FAX: 0054/41/710181

DOCUMENTACION BASICA

RAZON SOCIAL: LECNARDO S.A.

Constituida en junio de 1956 como sociedad de responsabilidad limitada y posteriormente, en 1974 se adopto la forma juridica de sociedad anonima.

DOMICILIO LEGAL : Administracion y Planta Industrial

Balcarce 982/90

Tel (041) 710-181/521

FAX:005441-710181

C.P. (3152)-GRANADERO BAIGORRIA

Prov.: SANTA FE

ARGENTINA

NUMEROS DE INSCRIPCION :Registro de Proveedores del Estado:
21485-5

Sociedad Mixta Siderurgica Argentina
07441-944

Registro Industrial de la Nacion
184265/9

CUIT Nro. 30-50456976-0

ANTECEDENTES

Leonardo S.A., es una empresa de capitales nacionales ,dedicada desde el año 1956 a la produccion metalurgica.

Su planta industrial ocupa una superficie cubierta de 9000 m2 en un area total de 10000 m2 en la ciudad de Granadero Baigorria Pv. de Santa Fe.

Sus instalaciones, recursos tecnicos y 35 años de solida experiencia le han permitido hacerse merecedora de la confianza de gran parte de las mayores firmas Argentinas.

La incorporacion de maquinaria de distintas capacidades, ha permitido satisfacer un mercado cada vez mas exigente, en cuanto a calidad y tiempos de ejecucion; calidad, que no solo se produce sino que se verifica, ya sea el tamaño a obtener, o especialmente para tal fin. Con la incorporacion de los mas variados elementos de control, puede garantizar asi sus trabajos.

Los recursos humanos con que cuenta la empresa suman mas de 54 personas entre Directivos, Profesionales y Personal calificado: sumandose el asesoramiento de empresas consultoras, para las areas de Economia, Ingenieria y Asuntos Juridicos.

DESARROLLO Y FABRICACION

NUESTRA FABRICACION COMPRENDE

a) Fabricacion de ventiladores a paso variable estatico y dinamico en diametros de 500 a 12000 mm.

b) Aerogeneradores de 0 a 200Kw.

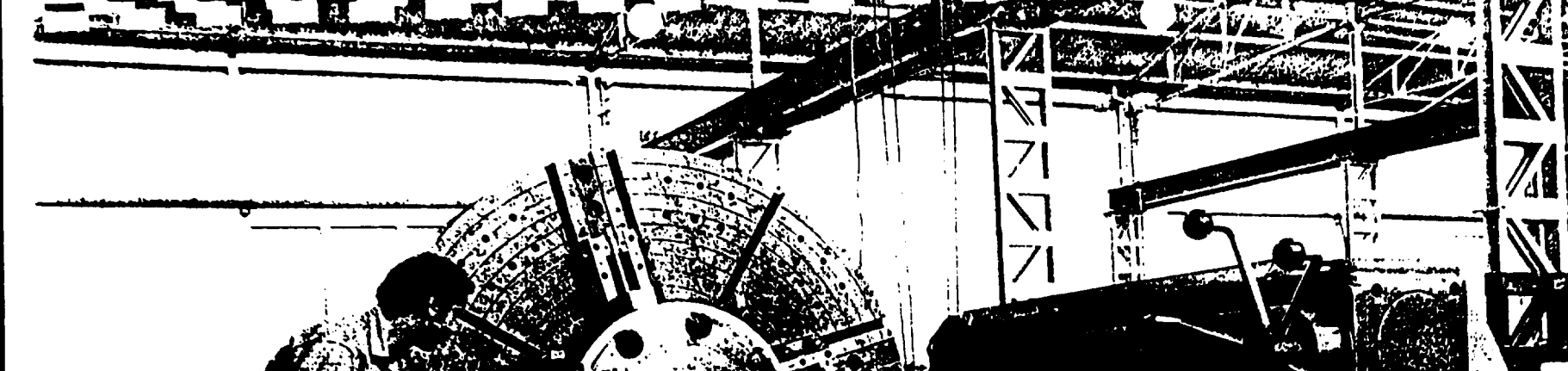
c) Mecanizados pesados o semipesados, desde piezas de poco porte a elementos de 30tt aprox.

d) Construcciones soldadas, estructuras, calderería, etc.

e) Recuperacion de piezas por aporte de soldadura y posterior mecanizado cualquiera sea su tamaño y especificaciones.

f) Construccion de conjuntos armados de grandes maquinas, piezas aisladas o maquinas especiales bajo normas de fabricacion fijada por nuestros clientes o por nuestro departamento de Ingenieria

g) Nuestros trabajos estan orientados para la industria : Siderurgica, Papelera, Energetica, Petroquimica, Cementera, y Minera entre otras.



ROL DE MAQUINAS

Nuestro listado de maquinas Y equipos da una idea cabal de nuestra capacidad operativa.

NAVE Nro. 1 - Seccion Maquinas y Equipos

Nro.	Maq./Equipo	Origen	Parametros
1	Puente Grua Nro. 1	Nacional	Izaje 16 tt.
2	" " 2	"	" 16 tt.
3	Agujereadora Radial " CZEPEL "	Hungri	Bandera: 1900 mm. Columna: 2500 mm.
4	Torno Paralelo Pesado " SAFOP " (ver Foto Nro.)	Italia	Dist. entre ptos. 6500mm Diam. torneable 1400mm Peso max. pieza 15 tt.
5	Torno Paralelo Pesado " SAFOP " (ver Foto Nro.)	Italia	Dist. entre ptos. 5300mm Diam. torneable 1200mm Peso max. pieza 15 tt
6	Torno Paralelo Pesado " SAFOP " (ver foto Nro.)	Italia	Dist. entre ptos. 7000mm Diam. torneable 2000mm Peso max. pieza 16 tt.
7	Torno Paralelo Pesado " RAVENSBURG " (ver foto Nro.)	Alemania	Dist. entre ptos. 8000mm Diam. torneable 3000mm Peso max. pieza 18 tt.
8	Horno Tratam. termico	Nacional	Volumen 7,56 m3 Temperatura Max. 1200 C
9	Prensa Hid. Vertical	Nacional	Capacidad 50 tt.
10	Serrucho Mecanico	Nacional	Capacidad de corte 450mm

NAVE Nro.2

Nro.	Maq./Equipo	Origen	Parametros
11	Puente Grua Nro. 3	Nacional	Izaje 30 tt.
12	Torno Paralelo Pesado " MOSVICH "	RUSO	Dist. entre ptos. 3000mm Diam. torneable 1150mm Peso max. pieza 8 tt.
13	Torno Paralelo " WECHECO "	Nacional	Dist. entre ptos. 2000mm Diam. torneable 500mm
14	Torno Paralelo " SANTOS VEGA "	Nacional	Dist. entre ptos. 1500mm Diam torneable 400mm
15	Torno Paralelo Pesado " WECHECO "	Nacional	Dist. entre ptos. 6000mm Diam. torneable 1000mm Peso max. pieza 3 tt.
16	Torno Paralelo " BATISTI "	Nacional	Dist. entre ptos. 2000mm Diam. torneable 600mm Peso max. pieza 3 tt.
17	Agujereadora Radial " WECHECO "	Nacional	Brazo: 1200mm Columna: 1000m
18	Rect. Cilindrica Univ. " JARVE "	Espana	Dist. entre ptos. 1000mm Diam. rectifi.sobre 200m. Peso max. pieza 2 tt.
19	Mortajadora Mediana " AGOSTA "	Nacional	Carrera torpedo 300mm
20	Limadora Mediana " WECHECO "	Nacional	Carrera 900mm.
21	Limadora Liviana	Nacional	Carrera 500mm.
22	Mortajadora Pesada " RAVENSBURG "	Alemania	Carrera torpedo 650mm. Peso max. pieza 3 tt.
23	Alesadora-Fresadora Semi-pesada " TOS "	Checosl.	Diam. husillo: 100mm. Recorridos: Longitudinal 1250mm. Transversal 1600mm. Vertical 1120mm. Mesa: 1250 x 1250mm. Montante fijo y Disp. Peso max. pieza 12,6 tt.

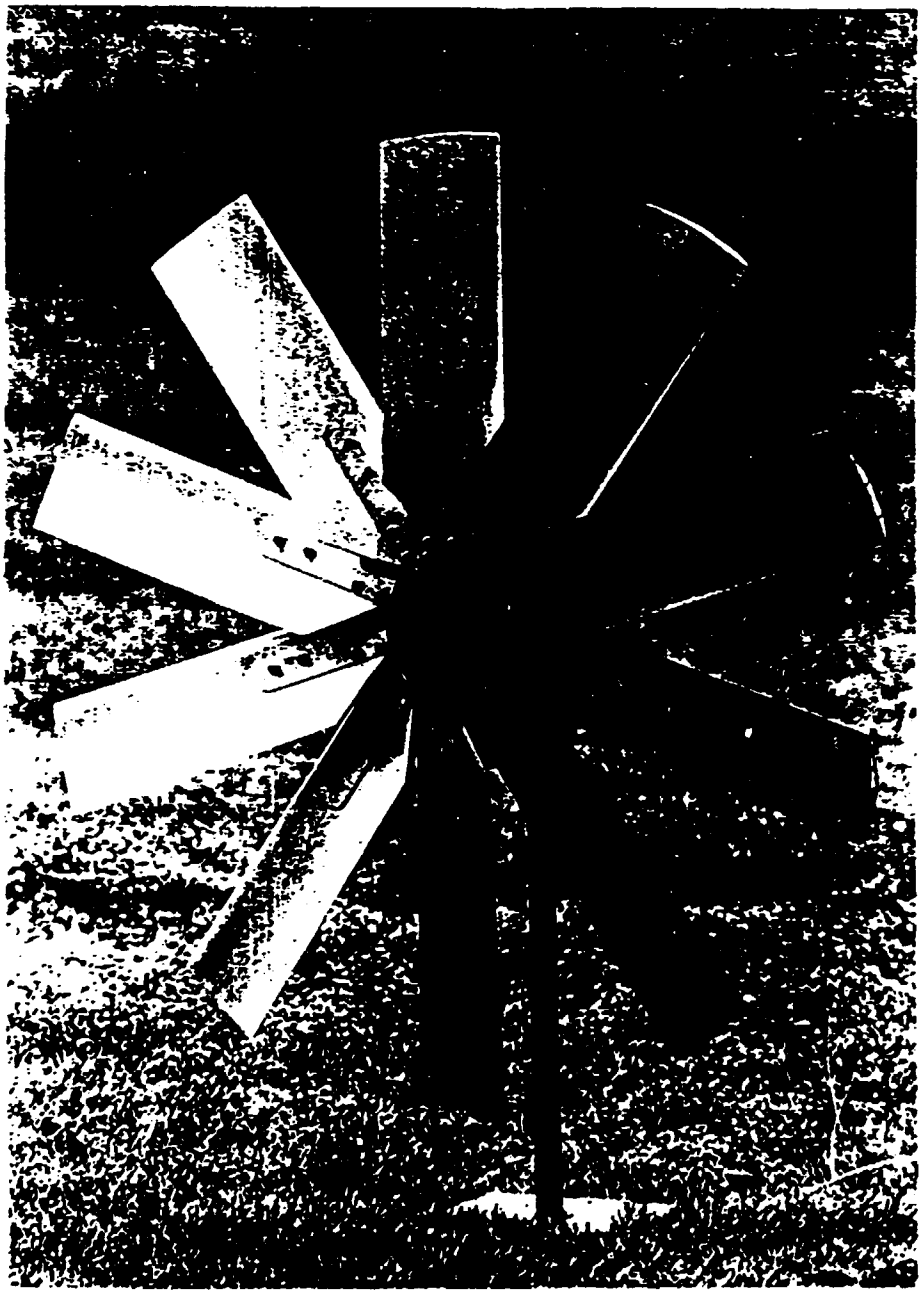
MORTAJADORA PESADA "RAVENSBURG"

NAVE Nro.3

24	Alesad.Fresadora Pesada por coordenadas digitales " UNION "	Alemania	Diam. husillo: 180mm. Recorrido: Montante movil 6200mm. Husillo movil 2500mm. Transversal 400mm. Vertical 2500mm. Mesa: 2000 x 2000mm. Plataforme:5250 x 6000mm Peso max. pieza 40 tt. Dipositivos y accesorios
25	Prensa Hidraulica Horz. " ITUSROSPE "	Nacional	Apertura max. 3500mm. Capacidad 250 tt. Carrera 800mm.

SECTOR SOLDADURA

Nro.	Maq./Equip.	Origen	Cant.	Capacidad
1	Soldadora Estatica " TAURO 250 "	Nacional	2	Amperaje: [illegible]
2	Sold. Semiautomatica " TAURO 500 "	Nacional	2	Sistema MAG-MIG Amperaje: 500
3	Soldadora Rotativa	U.S.A	1	Amperaje: 300
4	Soldadora Sist. TIG " TIG TAURO "	Nacional	2	
5	Sold. Oxiacetilenica	Nacional	4	



VENTILADOR PASO-VARIABLE ESTATICO

PRINCIPALES CLIENTES

SOCIEDAD MIXTA SIDERUGICA ARGENTINA (SOMISA) -ACERIA

ACINDAR INDUSTRIA ARGENTINA DE ACEROS S.A. -ACERIA

DALMINE SIDERCA S.A.-ACERIA

CELULOSA ARGENTINA S.A.-FABRICA DE PAPEL

AGUA Y ENERGIA ELECTRICA DE LA NACION -ENERGIA ELECTRICA

ACEROS BRAGADO S.A.-FUNDICION DE ACERO

FRANCOVICH S.A.-IND.METALURGICA

CERAMICA SAN LORENZO I.C.S.A.-IND.CERAMICA

PASA PETROQUIMICA ARGENTINA S.A.-PETROQUIMICA

PUPERIAL S.A.-PETROQUIMICA

ESTABLECIMIENTOS METALURGICOS UNIVERSAL S.A.I.C.-IND.METALURGICA

INDUSTRIAS METALURGICAS PESCARMONA S.A.-IND METALURGICA

ROMAQ INGENIERIA S.R.L.

YACIMIENTOS PETROLIFEROS FISCALES -PETROQUIMICA

ASTRA EVANGELISTA-PETROLERA/IND METALURGICA

SULZER ARGENTINA -TORRES DE ENFRIAMIENTO

INDUSTRIAS VICTORY -AERO ENFRIADORES

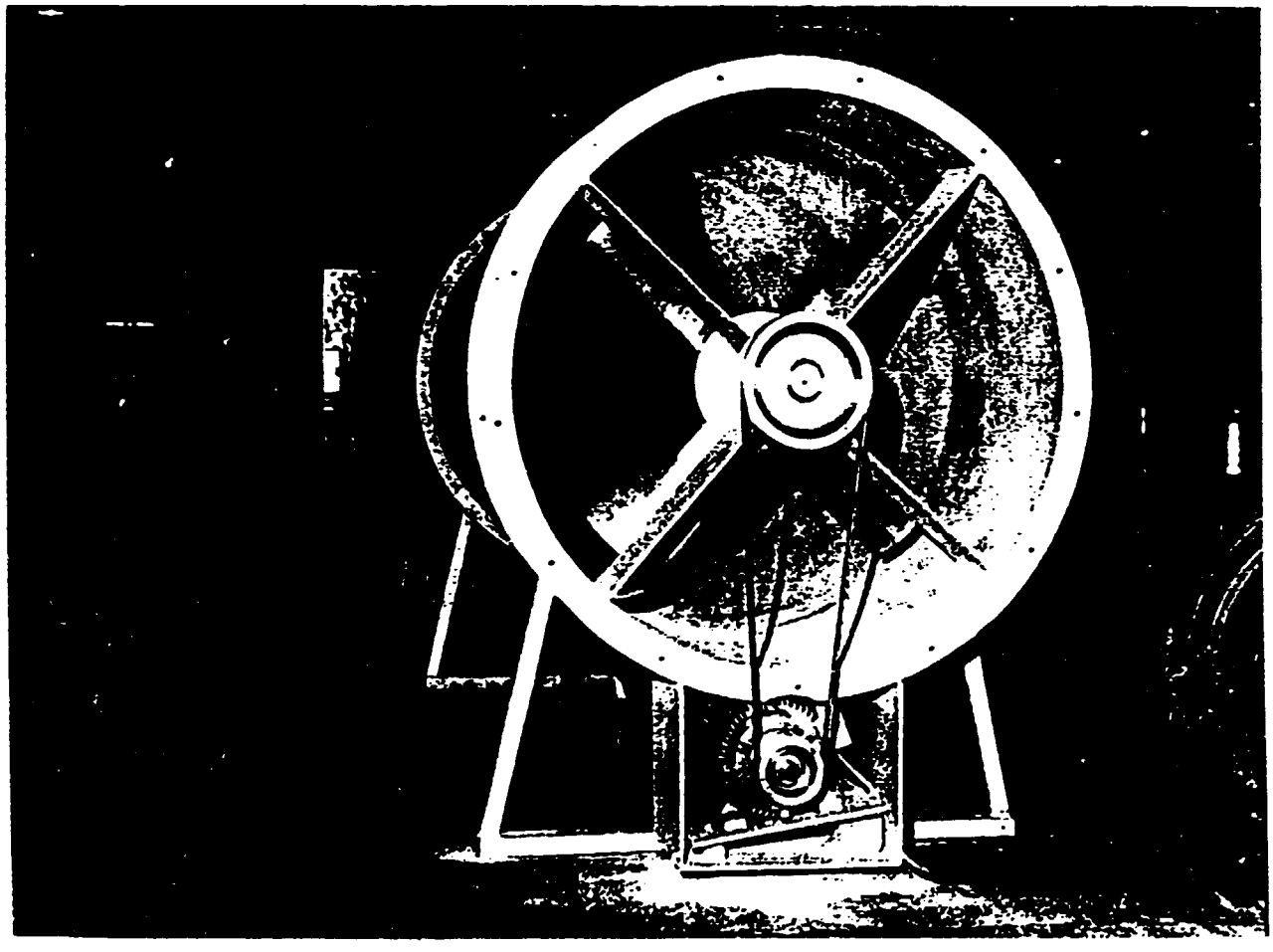
COLD-DROP -TORRES DE ENFRIAMIENTO

INDUSTRIAS PLA -MOTOFUMIGADORES

PEDRO FORTUNY S.A. -SECADORAS DE GRANOS

BUYATTI S.A.I.C.A. -ACEITERA

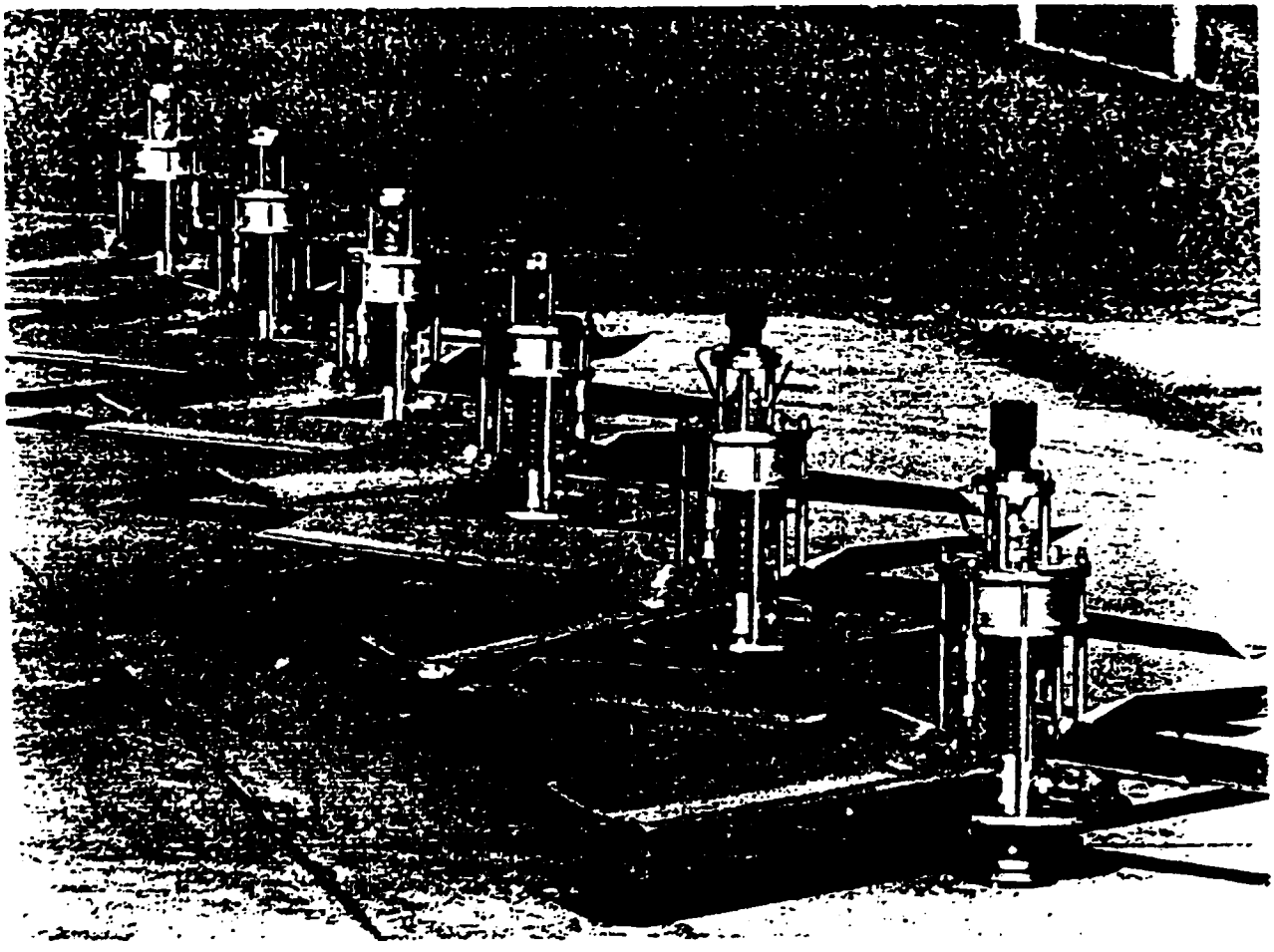
VICENTIN -ACEITERA



TUNEL DE ENSAYOS AERODINAMICOS

LISTADO DE MAQUINAS Y EQUIPOS

PUENTES GRUAS	3
TORNOS PARALELOS PESADOS	6
TORNOS PARALELOS	3
ALESADORA-FRESADORA PESADA	1
ALESADORA-FRESADORA SEMIPESADA	1
MORTAJADORA PESADA	1
MORTAJADORA	1
LIMADORA	1
RECTIFICADORA SEMIPESADA	1
AGUJEREADORA RADIAL	2
PRENSAS HIDRAULICAS	2
SERRUCHO MECANICO	1
HORNO DE TRATAMIENTO TERMICO	1
SOLDADORAS ELECTICAS	6
SOLDADORA OXIACETILENICA	4



VENTILADORES DE PASO VARIABLE
AUTOMATICO POR AIRE COMPRIMIDO

DATOS GENERALES

CANTIDAD DE OPERARIOS : 35

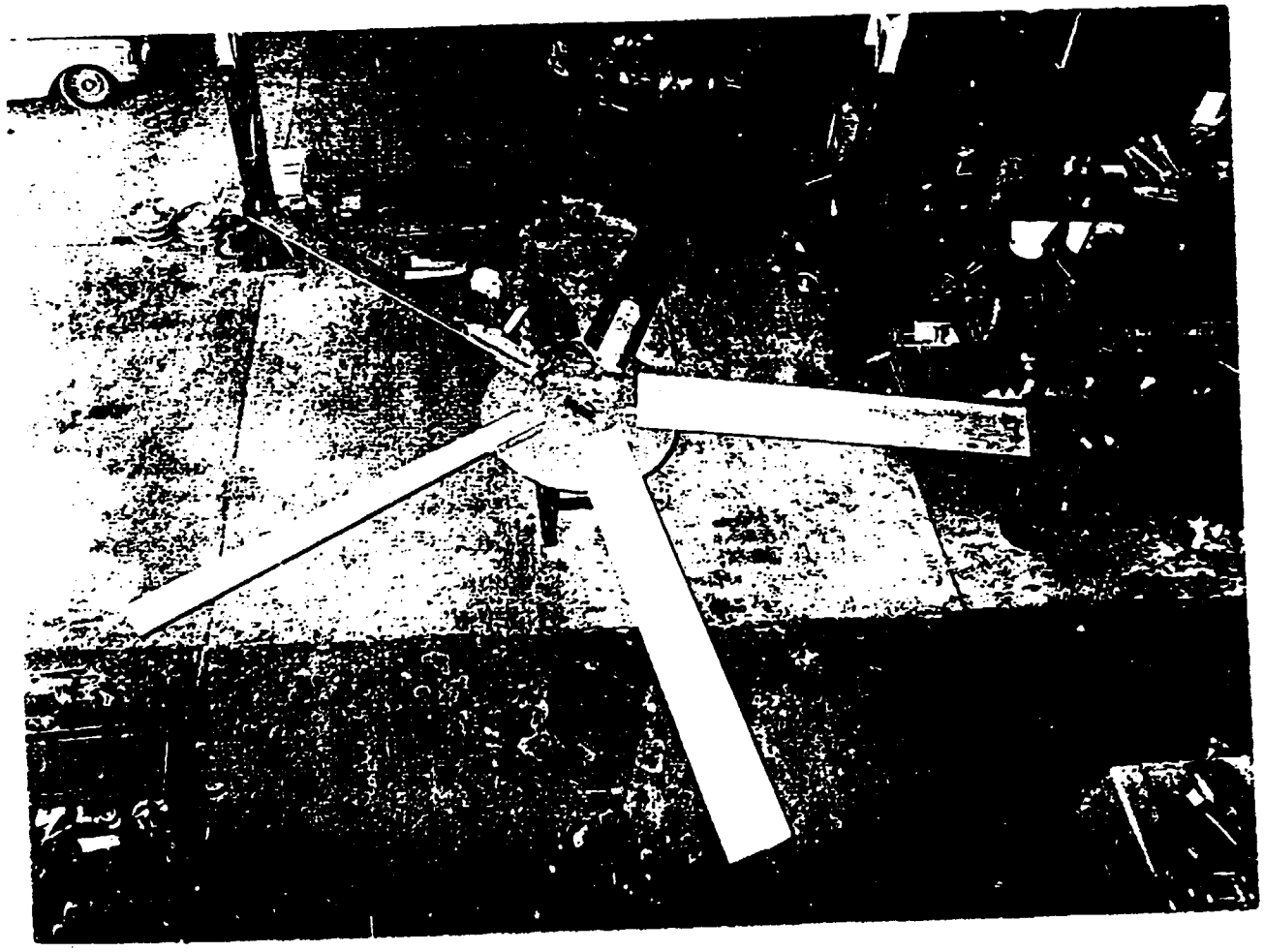
PERSONAL TECNICO: 3

INGENIEROS: 2

CONTADORES: 2

ADMINISTRATIVOS: 3

HORAS DE FABRICACION ANUALES: 93000



VENTILADOR PASO VARIABLE Ø 7060mm

REFERENCIAS COMERCIALES

C.P.S.A. (COMPAÑIA PETROLERA)
Av. Eduardo Madero 942 Piso 10
Buenos Aires - R.A.

SOCIEDAD MIXTA SIDERURGICA ARGENTINA
Planta Gral. Savio
San Nicolas - Pcia. Bs. As.- R.A.

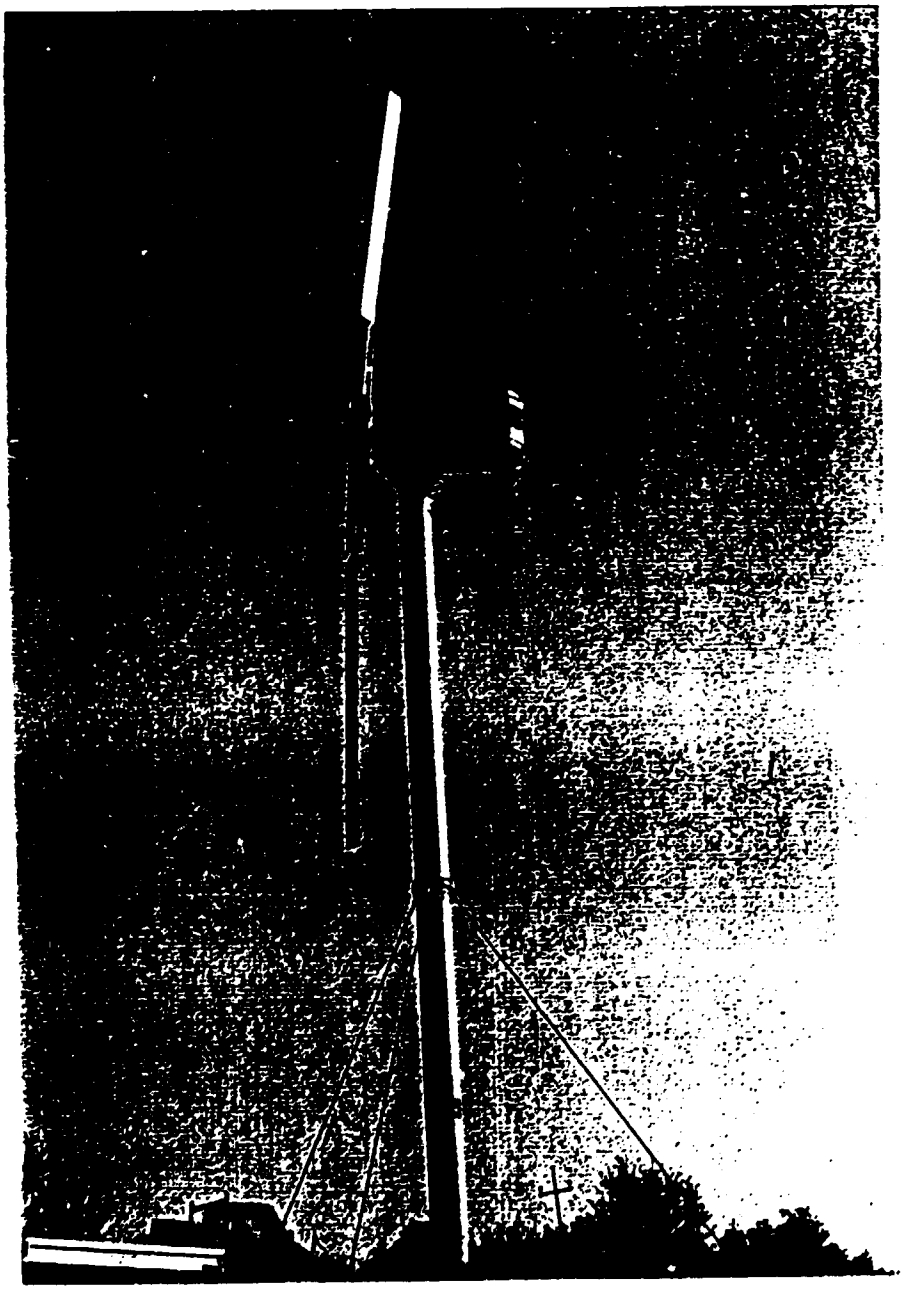
Francovigh S.A.
Av. Lagos 8298
Rosario - Pcia. Santa Fe - R.A.

REFERENCIAS BANCARIAS

The Chase Manhattan Bank,N.A.
Santa Fe 1827
Rosario - Pcia. de Santa Fe - R.A.

Banco Cooperativo de Caseros
Av. Alberdi 315
2000 - Rosario - Pcia. de Santa Fe - R.A.

Banco Aliancoop Coop. Ltdo.
Belgrano 31
2152 - Granadero Baigorria - Pcia. de Santa Fe - R.A.



AEROGENERADOR DE 230 Kw.

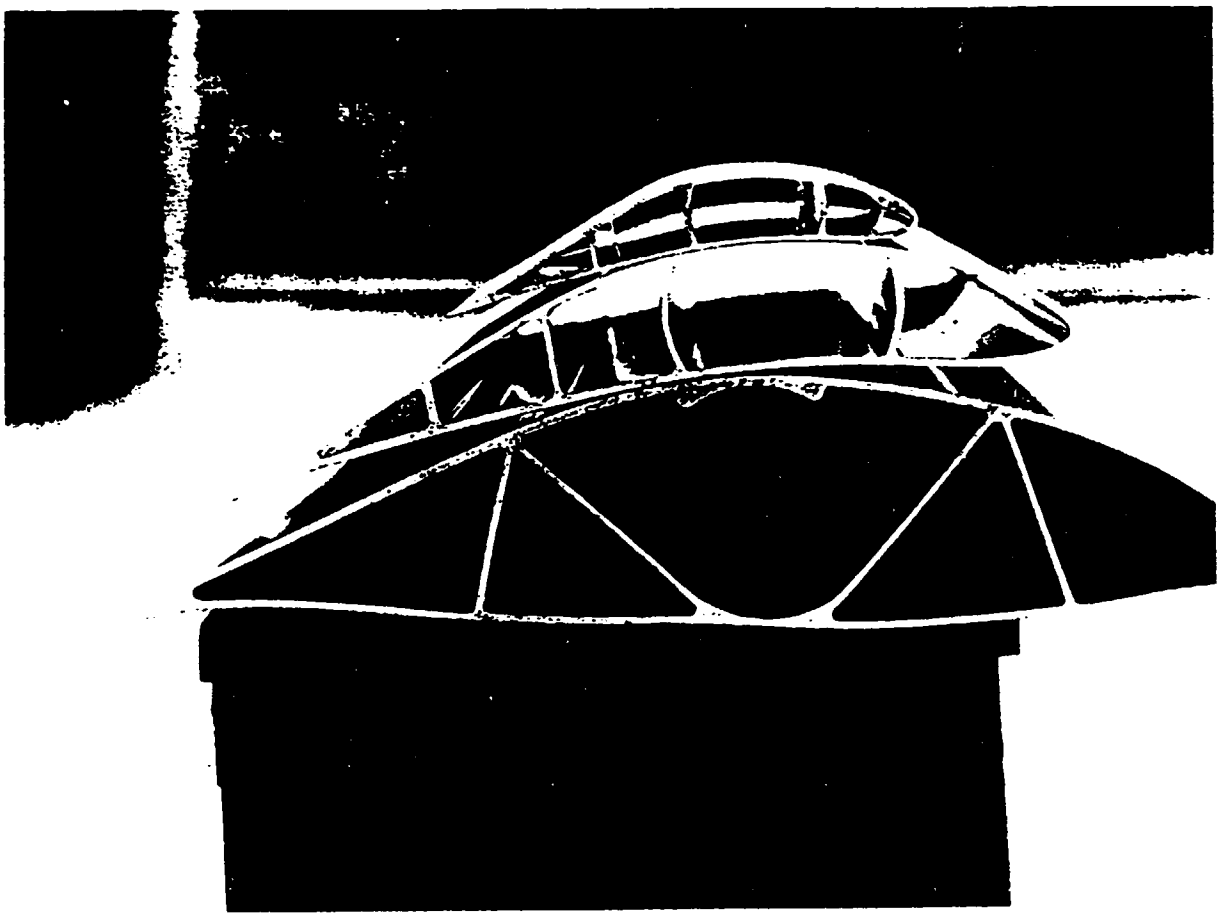
SITUACION ACTUAL DE LA DE LA EMPRESA

PRODUCCION ACTUAL:

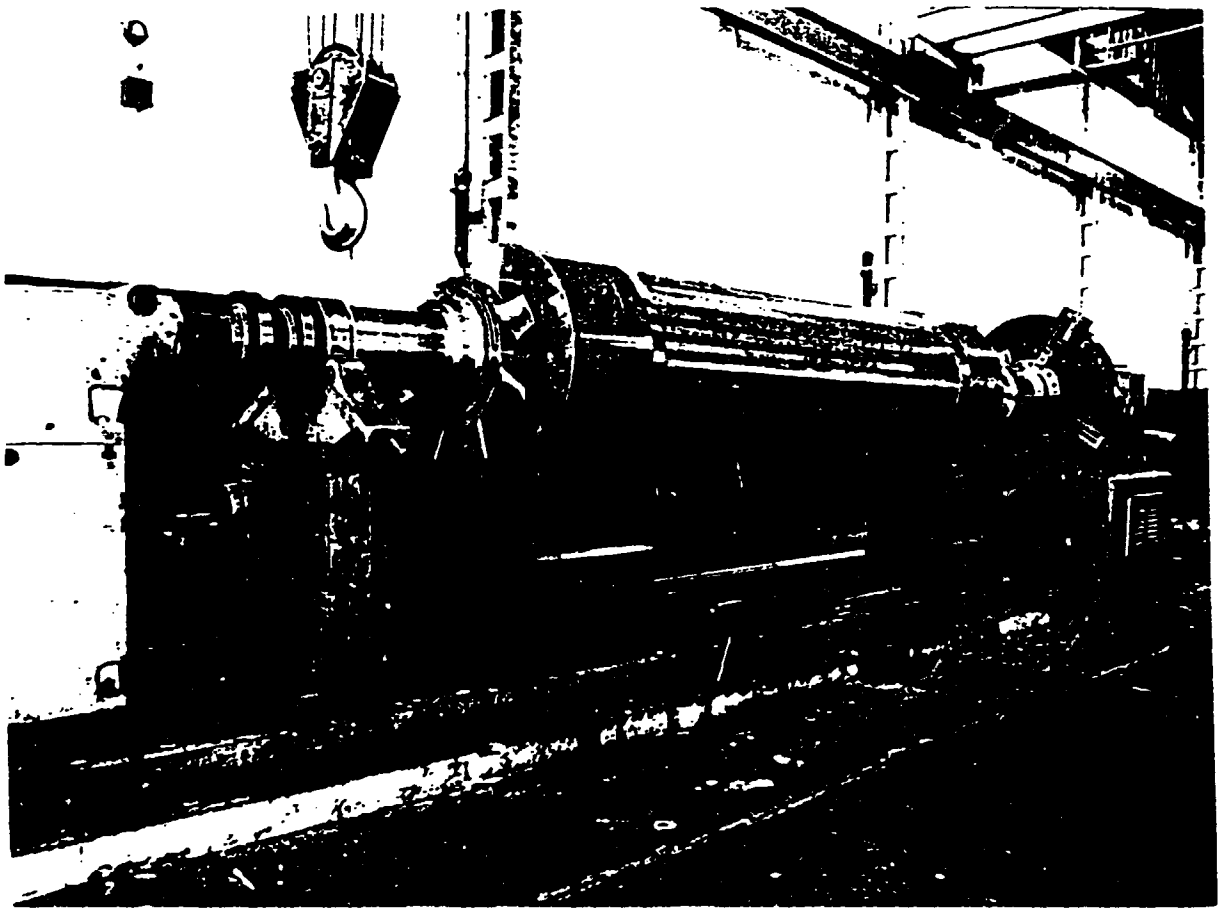
HORAS DE MECANIZADO: 2000 -MONTO PROMEDIO	U$S	40.000.-
CAJAS PORTA COJINETE: 2 CAJAS MENSUALES	U$S	50.000.-
VENTILADORES AXIALES: PROMEDIO 6 UNIDADES	U$S	6.000.-
MECANIZADO A TERCEROS:PROMEDIO 400 HORAS	U$S	3.000.-

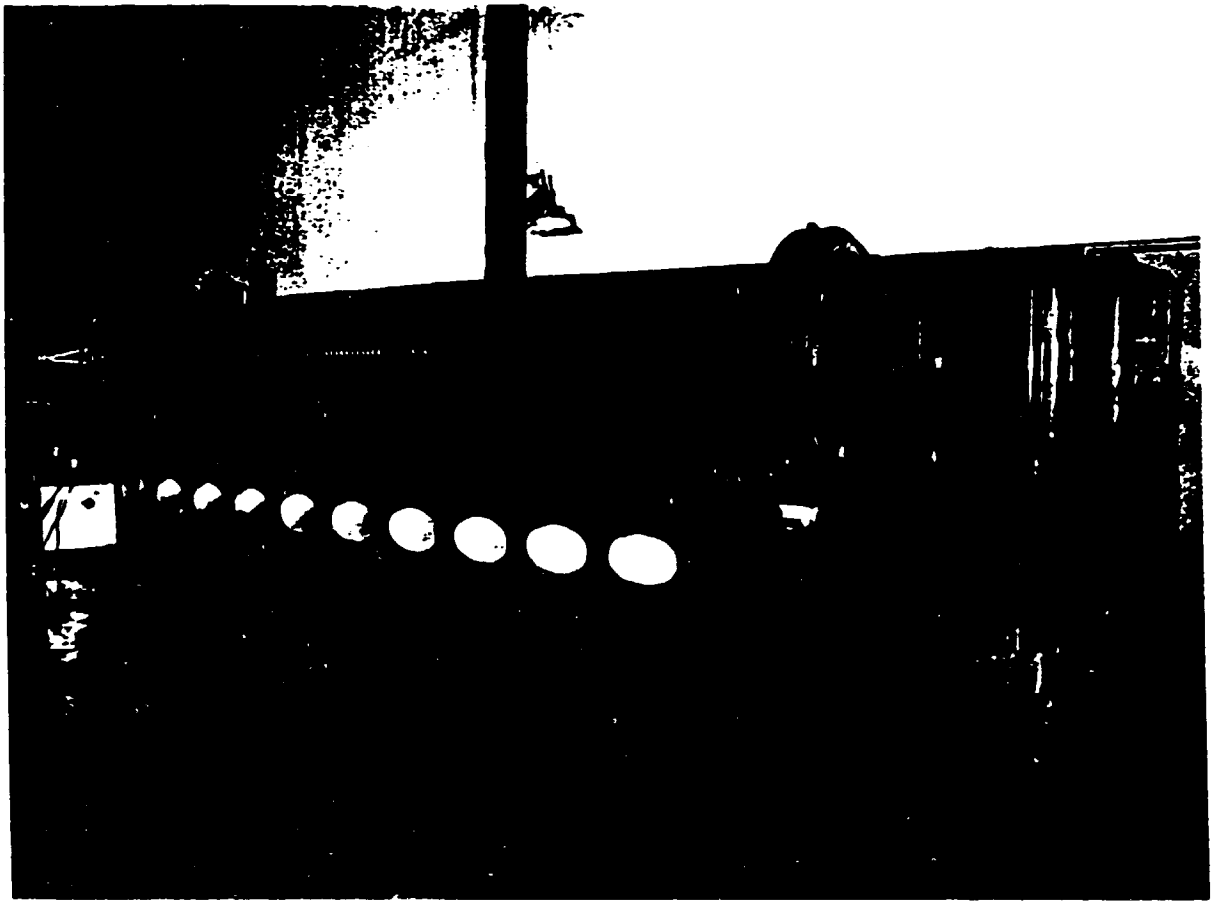
CAPACIDAD POTENCIAL DE PRODUCCION

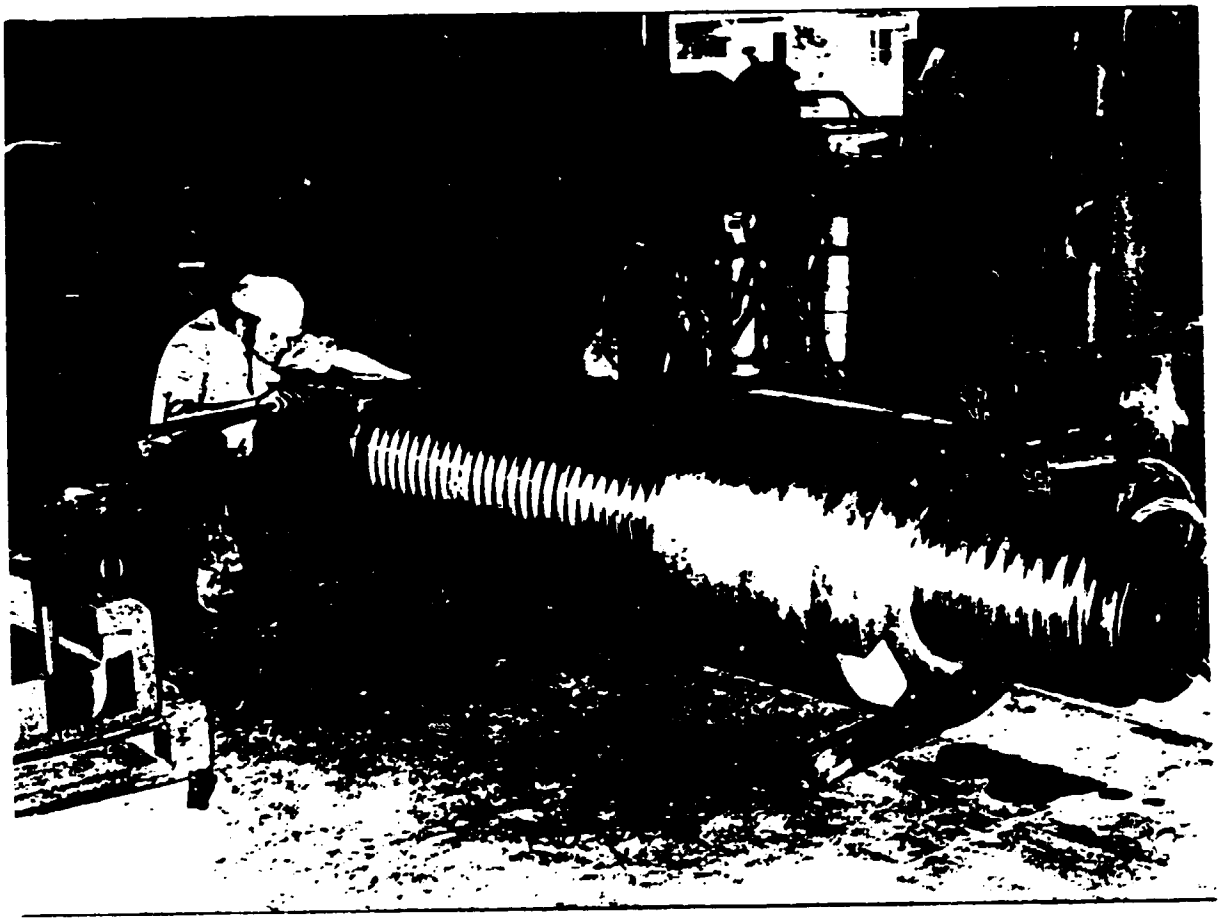
HORAS DE MECANIZADO: 8000 -MONTO PROMEDIO	U$S	250.000.-
CAJAS PORTA COJINETE: 2 CAJAS MENSUALES	U$S	50.000.-
VENTILADORES AXIALES: PROMEDIO 100	U$S	100.000.-
AEROGENERADORES: 1 x 10kw y 5 x 3000kw	U$S	45.000.-
MECANIZADO A TERCEROS: 3000 HORAS	U$S	30.000.-



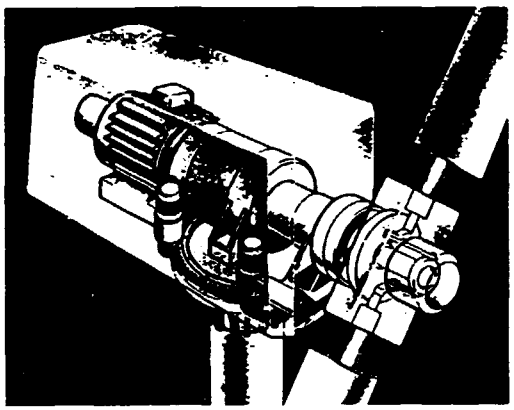
PERFILES DE ALUMINIO ESTRUIDO
PARA VENTILADORES

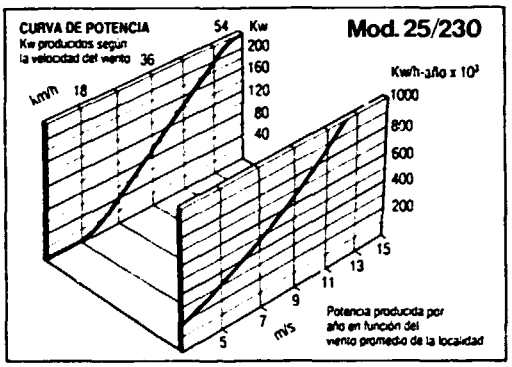


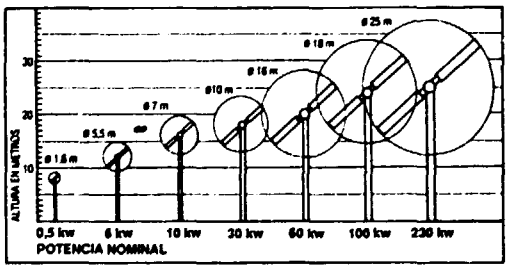




AERO GENERADORES







Tecnología que produce la mejor relación costo-eficiencia

En un aerogenerador las palas transmiten al eje de mando el movimiento giratorio. Este giro, aumentado por un multiplicador epicicloidal, mueve un motor asincrónico que genera la energía.
Sensores anemométricos accionan un sistema variador de paso de las palas lo que determina el mejor rendimiento según la **velocidad** del viento. La orientación de la máquina eólica es comandada por servomotores que automáticamente la posicionan según la **dirección** del viento (en los modelos de alta potencia).

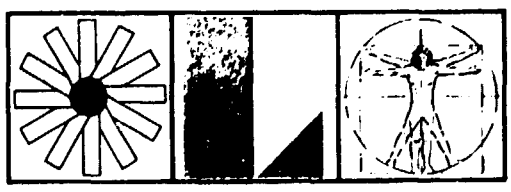
ALGUNAS APLICACIONES

- Asentamientos rurales
- Sistemas de iluminación
- Repetidoras de radio y TV
- Industrias
- Refugios e instalaciones meteorológicas remotas
- Generación para grandes sistemas eléctricos interconectados

TOTAL VERSATILIDAD

- Preparados para funcionar en forma aislada o en grupo (granjas eólicas).
- Pueden ser conectados a una red o funcionar separados de la misma.
- Se suministran en forma unitaria o en centrales eléctricas llave en mano, de alta potencia.
- No producen interferencias en las ondas electromagnéticas (radiales, televisivas, etc.).
- Pueden suministrar 24, 110, 220, 380 y 500 Volts. En 50 o 60 Hz.

LO CONOCIDO, YA ES HISTORIA.

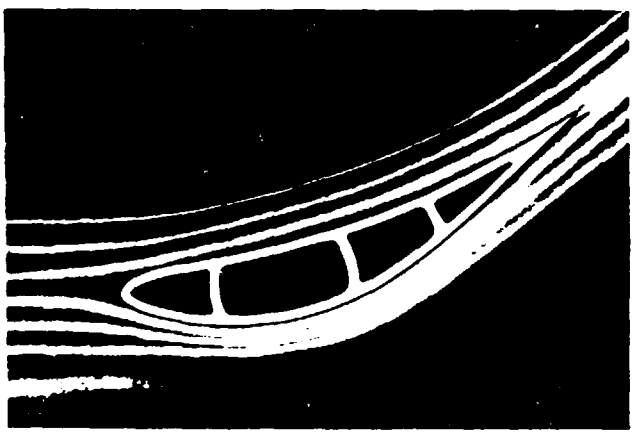


Leonardo S.A.

DIVISION AIRE

Balcarce 982/90 - Tel. (041) 710181/710521
Fax (041) 710181
2152 Granadero Baigorria (SF) Argentina

PERFIL SUPERCRITICO



La mejor relación eficiencia-consumo lograda hasta el presente.

El perfil de pala de diseño supercrítico, de última generación, permite un óptimo rendimiento a bajo número de Reynolds y escaso nivel de ruido -característica que mejora sensiblemente las condiciones de trabajo humano.

La posibilidad de obtener con un mismo ventilador, una amplia gama de curvas (presión-caudal) variando únicamente el ángulo de ataque, hacen de ésta unidad la más versátil del mercado.

CARACTERISTICAS UNICAS

- Resistencia adicional a la corrosión con recubrimientos especiales para el trabajo en ambientes altamente críticos.
- Mayor rango térmico de servicio (-100ºC a +150ºC).
- Reducido tiempo de entrega, gracias a su concepción modular.
- Menor peso del equipo (hasta un 50%): menos inercia
- Probados dinámicamente en nuestro propio túnel de viento. Seguridad total.

LO CONOCIDO, YA ES HISTORIA.

Leonardo S.A.
DIVISION AIRE

Balcarce 982/90 - Tel. (041) 710181/710521
Fax (041) 710181
2152 Granadero Baigorria (SF) Argentina