

INFORMATION ABOUT VESTAS VIVEIRO FACTORY.

14/10/2021

PRODUCTION

1.- INFORMATION AND DETAILS OF MANUFACTURED PRODUCTS AND PRODUCTION CAPACITY. WORKLOAD (%) HISTORICAL DATA 3-5 YEARS.

Viveiro site is a factory which manufactures following Vestas Wind turbine components:

- **2MW Electrical Generators for 2MW platform,**
 - 2MW 50Hz Optislim and
 - 2MW 60Hz Superslim
- **Electrical Control Panels for V164-V174 for 9MW platform “Offshore”.**
- **Coil kitsets for SFIG Generator for 4MW platform:** it is a subassembly of the generator which is being produced in a Vestas factory in Germany.
- **2MW Generator Assembly (kitset)** with parts coming from Vestas Gen Factory in China.

The production capacity in Viveiro allows resources assignment and production volume variation/balance of the different manufactured products. Considering the production mix it can have the following **Max. capacity per product**, taking into account the fact that the situation of max capacity for one product means capacity reduction or no production of the other product:

		Capacidades de producción máximas si la producción se centra en un solo producto	
		Semanal	Anual
Generadores 2MW (completos)	Actual (2 turnos)	23	1.150
	Máxima (3 turnos)	28	1.400
Paneles Eléctricos de control V164-174	Actual (2 turnos)	6	300
	Máxima (3 turnos)	9	450
Kit de bobinas para generador 4MW	Actual (3 turnos)	17	850
	Máxima (3 turnos)	20	1.000

Viveiro Factory Production Capacities (Max. capacities weekly/yearly per product)

This means with current production structure in 2 shifts, **if we only produce complete generators**, 23 generators per week can be produced, but if we increase to 3 shifts then it can reach 28 generators per week, which means a yearly production capacity of 1.150 generators in 2 shifts and 1.400 generators per year in 3 shifts.

In the same way, if there's only Control Panels kits production, in current 2 shifts there's a weekly capacity of 6 kits and can reach 9 kits per week in 3 shifts, which means 450 kits per year.

In relation to 4MW coil kitsets for the SFIG generator produced in Germany, with current resources 17 kitsets per week can be produced, and there's a max capacity up to 20 kits per week, meaning, 1.000 kits per year.

The real situation in Viveiro is a **hybrid or mix production**, which means the material resources and manning are being distributed in the manufacturing operations of different products mentioned before.

In the table below there're details of yearly production of any product manufactured in Viveiro factory, both real production in 2019 and 2020 and also 2021 estimated production.

	2019		2020		2021e	
Generadores 2MW	Completo	Kitset	Completo	Kitset	Completo	Kitset
Generadores 2MW Superslim	184	1227	266	663	170	208
Generadores 2MW Optislim	163	0	6	0	74	0
Total Generadores 2MW	347	1227	272	663	244	208
	2019		2020		2021e	
Kits de Paneles de Control	150		120		151	
	2019		2020		2021e	
Kits de Bobinas 4MW	419		315		187	

Production in units per product in Viveiro Factory.

Following data shows calculation combining historical data of produced units in 2019 and 2020 with direct hours needed per unit of product in order to quantify the percentage of the Viveiro factory resources assigned to each product. For this is necessary the input of the direct hours per product coming from Viveiro production systems.

	Número de horas por unidad de producto	
	Completo	Kitset
Horas de trabajo directo por generador 2MW	106	17
Horas de trabajo directo por Kit de Paneles de Control		465
Horas de trabajo directo por Kit de bobinas 4MW		21,8

Direct working hours por product unit.

Below total working hours needed for producing each product in 2019, 2020 and estimated workload for 2021:

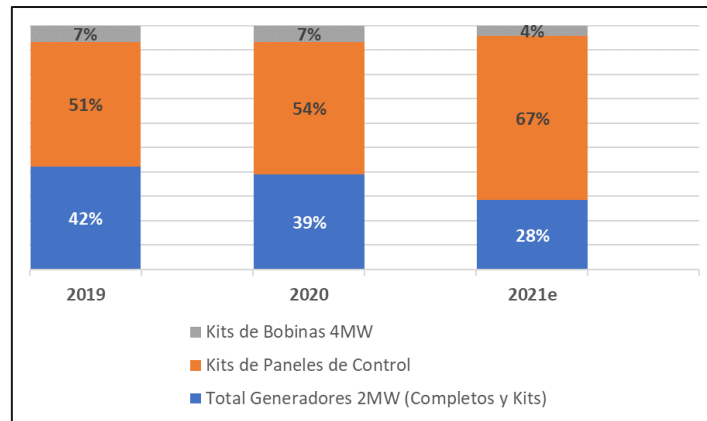
	2019		2020		2021e	
Generadores 2MW	Completo	Kitset	Completo	Kitset	Completo	Kitset
Generadores 2MW Superslim	19.504	20.859	28.196	11.271	18.020	2.329
Generadores 2MW Optislim	17.278	-	636	-	7.844	-
Total Generadores 2MW	36.782	20.859	28.832	11.271	25.864	2.329
	2019		2020		2021e	
Kits de Paneles de Control		69.750		55.800		66.960
	2019		2020		2021e	
Kits de Bobinas 4MW		9.134		6.867		4.142

Total direct working hours per product.

Based on the above data below there's the calculation of workload in percentage per product, which shows a **significant change in working hours assignment** for producing the different products.

	2019	2020	2021e
Total Generadores 2MW (Completo y Kits)	42%	39%	28%
Kits de Paneles de Control	51%	54%	67%
Kits de Bobinas 4MW	7%	7%	4%

Direct hours Workload distribution in % per product



Direct hours Workload distribution in % per product

Production distribution and workload (%) in previous years (2017-2018 period)

Plan de Producción	Número de Unidades		Horas Directas		Carga Trabajo horas		Carga Trabajo %	
	2017	2018	2017	2018	2017	2018	2017	2018
Producto / Año	2017	2018	2017	2018	2017	2018	2017	2018
2MW Superslim	348	11	139	122	48372	1342		
2MW Optislim	148	284	139	122	20572	34648		
Total 2MW (SS+OS)	496	295	139	122	68944	35990	68,9	26,1
3MW DFIG	92	165	197	197	18124	32505	18,1	23,6
SFIG Coil Kits 4MW	565	405	23	22	12995	8910	13,0	6,5
Control Panels Kits (*)	0	109	554	554	0	60386	0,0	43,8

(*) aprox. calculation of number of control panels kitsets based on workload for the 35 items included in each kitset.

2.- PRODUCTION PROCESS DESCRIPTION

The Generator production process it is equal between 2MW and 3MW generators, there're only minor dimensional and characteristical differences in some components, but same machinery and processes are used.

Everything starts obviously in the **Warehouse** where the raw material is received, materials are distributed to production and there's also the final product handling. For these activities there's a complete warehouse **equipment**, which includes different forklift models, and several internal/external transportation equipment with different capacity (from 1.5Ton to 10Ton), shelves, picking equipment and extractors, and also Automated warehouse systems KARDEX.

GENERATORS PROCESS AND PRODUCTION LINE.

The production process is Split in 5 areas:

- Coil Production (Coil Forming)
- Rotor line
- Stator line
- Impregnation, balancing and housing line (VPI).
- Assembly, Test and packing line. (Assembly).

The **coil forming line** is where the coils for rotor and stator are being produced. It includes different manual insulation operations and connexion, coil ends preparation, coil shape, and also

other Automated operations with robots (both for 2MW GEN produced in VIV and also for the 4MW SFIG which is being delivered to Travemünde factory in Germany).

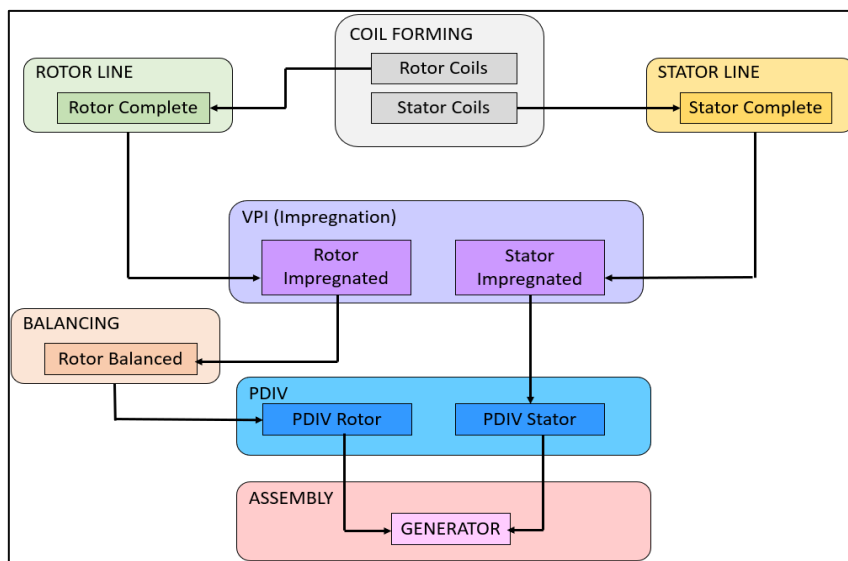
These coils are being inserted in the rotor and stator, together with several insulation layers and conforming the designed electrical configuration.

Once the coils and insulation insertion is finalized, and also the soldering processes, crimping, connecting, etc. and the specified quality controls and electrical tests, both components go to the Vacuum Pressure Impregnation plant in order to be impregnated with resin which is being cured afterwards in ovens.

The rotor then goes into a Balancing process, and the Stator is being inserted into the housing. Once the stator is inserted and connected into the housing, the rotor is balanced, and both electrical/insulation tested, they move into the Assembly line, where the rotor is introduced into the stator and bearings, endshields, caps and all the mechanical components are mounted.

After some electrical connections and quality checks, the Generator goes into a Test Bench where the performance is measured as generator and motor, checking all electrical and mechanical data (vibration, etc.). After Final Test is passed successfully it goes into the final assembly and packing operations.

Note: In case of executing an hybrid production process with Rotors and Stators coming from Tianjin factory (kitset), the process goes directly to the Assembly line.



Generator Production Process Flow diagram

Below there's an explanation of the production and processes resources to produce 2MW Generators, the same used for 4MW coil production (which is a minor activity in the plant).

COIL FORMING: Winding Machines (2), Forming Machines (3), Taping Robots (2), etc. This machinery together with many different manual processes and hand tools, with the factory electrical, compressed air, etc. installations is the equipment used in the area.

In the 4MW SFIG Coil Production the copper is received rolled in *drums*, passing for the first step which is the winding or initial forming, after a small manual operations for insulation removal in the coil ends and preparation, they go into the Robot in order to apply mica tape and glass fiber

tape insulations. Then they go into 2D forming process in the Stretching Machine. After some manual insulation operations, coil ends preparation, etc. they go into a 3D forming process in the Forming Machine, where they acquire the final shape in order to be inserted in the 4MW SFIG Stator slots. Then some insulation manual operations and final preparations are performed and then packed to be sent to the customer.

In the 2MW Rotor Coil Production, there're only 3 steps due to the designed insulation system based on varnishes instead of different tape insulation layers as in SFIG. The copper is received in the same way (rolled in drums), then there's a first 2D forming process, and after a minor manual operations of insulation material placement and pre-assembly of different copper wires, they go into a 3D forming process in the Forming Machine, where they get the final shape needed to be inserted in the 2MW Rotor slots.

The 2MW Stator Coil production is fairly simple, because due to design specifications the type of copper is different from the others mentioned above. It consists only in 1 step in a Winding Machine. The copper is received in wires rolled in a special recipients and the different copper wires are directed into the winding machine, using the needed number of wires and also the appropriate template in order to fit to the design of the model to produce (50Hz Optislim or 60Hz Superslim).

ROTOR LINE: The machinery used in this line is an Oven, overhead cranes, Induction soldering machines (2), self moving devices, Bandaging machine and some hand and manual tools. It is a production line with mainly manual work. It is a flexible line, meaning it can be adapted in all the steps to whatever of the products manufactured in the factory.

The process starts with the insulation insertion and then coil insertion in rotor slots. Next steps is an induction soldering process and the connecting ring is also mounted. Then it goes into the bandaging machine with glassfiber+resin which is being cured in an oven, in order to provide mechanical strength and electrical insulation to the component in the coil overhang. In this line there're also may different quality controls and electrical and insulation test equipment.

STATOR LINE: In this line the following machinery is used. Self moving devices, overhead cranes, crimping machines, and some hand and manual tools, also several quality control equipment and electrical/insulation test equipment. Same as in the rotor line there's a high content of manual work. The lamination iron core is received in the line, in which slots many layers of insulation material and coils are being inserted. Finally the coil ends are crimped to be connected together. This is a long time operations line.

IMPREGNATION, BALANCING, AND HOUSING LINE (VPI):

In this line there're the following machinery in use. Vacuum Pressure Resin Impregnation plants (2), curing Ovens (2) and shrinking oven (1), balancing machine(1), overhead cranes, and manual tools.

Once rotors and stators are finalized in their respective lines they go into the impregnation chambers, where they are impregnated and overpressed with resin which is being cured in ovens

right after. This resin applies mechanical strength and electrical insulation, and also fix the insulations and coils in their position.

The rotor then goes into the Balancing Machine in order to ensure lack of vibration, while the stator goes through the housing line.

In the housing line the housing passes trough an oven in an expansion process, then stator is inserted with the overhead crane and through an shrinking process during cooling it is fixed into the housing. So the Stator is inserted into the termal expanded housing in order to be fixed inside due to shrinking process.

After this there's a connection process of the stator with the Generator Connection box.

ASSEMBLY, TEST AND PACKING LINE (Assembly): The machinery used is the PDIV cabinet (installation for electrical and insulation tests), assembly machine, self moving devices, Test Bench (Final Test equipment) and some manual and hand tools.

The finalized Rotor and Stator (already into the housing) go into many different quality controls and electrical/insulation tests in order to have the green light to pass to the next step in the Assembly line. When they are in the assembly area some components, as bearings, are mounted and then the rotor is inserted into the stator with the Assembly Machine. Then there're some electrical Connections, temperature sensors, etc. and now the assembled generator goes into the Final Test, where it is run as generator and motor, measuring and checking many different electrical and mechanical parameters to ensure the performance is according to design specifications.

Next step is the Final Area, where the Grease system, Coupling, Cooling system, etc. are mounted, then it is prepared and packed to be sent to the Customer.

In all lines and processes there're are many different quality checks and controls, which are not specifically mentioned as there're a wide in variety and number. They are performed by the production operators, by the process instructors or by the quality inspectors, depending on the level of inspection.

In all the steps and operations warehouse Workers are delivering the operations material & components kitsets needed for each production step, in line with the production planning.

ELECTRICAL CONTROL PANELS FOR OFFSHORE TURBINES (9-10MW) PROCESS AND PRODUCTION LINE.

The production process is Split in 4 areas:

- **PAN 1** – Assembly and connection of panel boards.
- **PAN 2** – Main Panel assembly, mounting and connection of panel boards.
- **TEST** – Test operations, function simulation in turbine.
- **PACKING** – Packing line.

The Control Panels kistsets consists in 35 items (35 electrical panels). 1 kit which contain all these references is needed per installed turbine. Within those references there're very simple panels which only need some of the process steps, but there're also very complex ones which needs the complete production processes and tests.

The process starts in the Boards mounting line (PAN1). Where different electrical and electronic components are mounted in the base boards and are being connected. Due to the different complexity of the control panels, there are some which consists only in a small and simple board, while other have a more complex setup with big and many different boards per panel.

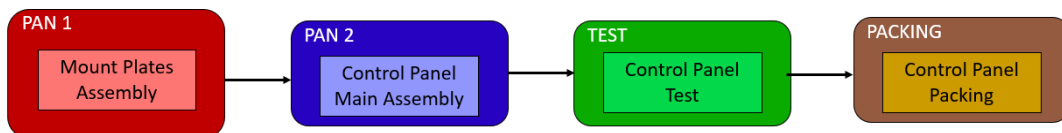
Once the boards are being finalized they go to the PAN2 Area. In this area the different boards which take part of the final control panels, are being assembled in the main panel structure and are being connected between them, having then the final configuration of the panel in place. In the simple panels the next step is just go directly to the packing operation.

The more complex panels have to go to a Test Process, where the real function in the turbine is simulated, through many different electrical and data connections, inputs and outputs.

Once hardware and software function and performance is tested, including the correct assembly of the components, the panels go to the packing line. Where they are prepared and packed to be sent to the Customer after a final quality/dispatch inspection.

Below there's the Process Flow diagram for the generic control panels production:

Control Panels Production – Process Flow Diagram



Now there's a detailed explanation for the production resources and processes used in the electrical control panels production.

PAN 1 – Assembly and connection of panel boards: Ergonomic work benches with electrical height/tilt regulation, individual computers, hand and manual tool sets for wiring and component assembly operations per position, precision screwdrivers for torque control, etc.

In this line the material/components kitsets are received from warehouse, with base boards, electronic components, wiring sets, etc. Once the boards are being fixed to the work station with ergonomic regulation the component mounting process starts according with the production work instructions and wiring diagrams Digitally available in each individual computer. Then component mounting continues and also connection and wiring according to the instructions. In parallel there're several quality checks and controls, as torque control/assurance or others.

In the more simple and small control panels, there's also the mounting operation of the finalized board into the final panel structure, and in some cases the component mounting and connection into the final structure directly, being after this point ready for packing after the corresponding quality control.

The more complex panels, which are being formed for more than 1 board, once the boards are being finalized in PAN1 they are placed in a kitset trolley to be moved to the PAN2 area and continue the control panel production process.

PAN 2 – Main panel assembly, mounting and connection of panel boards. Ergonomic elevators, overhead cranes, computers, manual tools and precision tools for torque control, transport systems and displacement tools, etc. are used.

In this area the control panel structures are received from the warehouse and also the diverse boards already finalized (mounted and wired) in PAN1.

Once the structure is received it is placed in the transport devices with the overhead crane in order to be able to easily move it through the different steps until the final packing operations. Then the panel is placed in the corresponding position into the area to assemble the boards coming from PAN1. Depending on the panel type and design, it is placed in the ergonomic elevators, which also contain tool sets and computer, or in horizontal movable work positions. In the corresponding order the boards are being mounted into the panel structure. Once all are mounted (or manually or with overhead crane support, depending on size and weight) the interconnection processes both electrical and data (optical fiber, bus, etc.) starts.

Once the control panel contains all boards and all interconnected, there's a quality control and verification process in place for Connections, etc. called FAT.

Note: During the processes there're some additional quality controls performed by the production operators.

Next is mount the panels doors in the panels structure which, in many of them, there're some electrical and/or electronic components which need to be connected.

Once this is finalized the control panel is ready for the Final Test.

TEST – Test operations, function simulation in turbine. Test Equipment, electrical interconnection panels, control and measurement equipment, computers, etc. are used.

Once the control panel is finalized in PAN2 and the corresponding quality checks were performed then the panels goes into one of the 3 Test Cages.

The panel is now in the test area, then the testers (operators specially qualified for these operations) proceed to connect the control panel to the IT Test System. Depending on the panel it is also necessary to perform some software upload in some specific components.

Now the panel is connected, the Test Process starts. It is a very complete process, where the function and performance of the control panel in the turbine is completely simulated, checking the función of all the components, data transfer lines, hardware and software, inputs and outputs and also wiring and connections.

If Final Test is passed successfully then the panel is ready to the final part of the production process.

PACKING - Packing line: Packing Robot, overhead crane, lifting equipment, manual tools, etc. are used.

Once the control panel has successfully passed the Final Test it goes into the packing line. Before the packing there's a final quality and dispatch control. Once this quality and dispatch control is passed, there are a few mounting operations (re-mount some doors if they needed to be dismantled during test for instance), and also some components which need to be sent to the customer (kits of small components, screws, etc.). With the overheadcrane the Control Panel is placed on the pallet. Once Fixed in the pallet there's a plastic packing operation using the packing robot, and then there're some operations to final prepare, fix and protect the panel for the final shipment and transport to the customer.

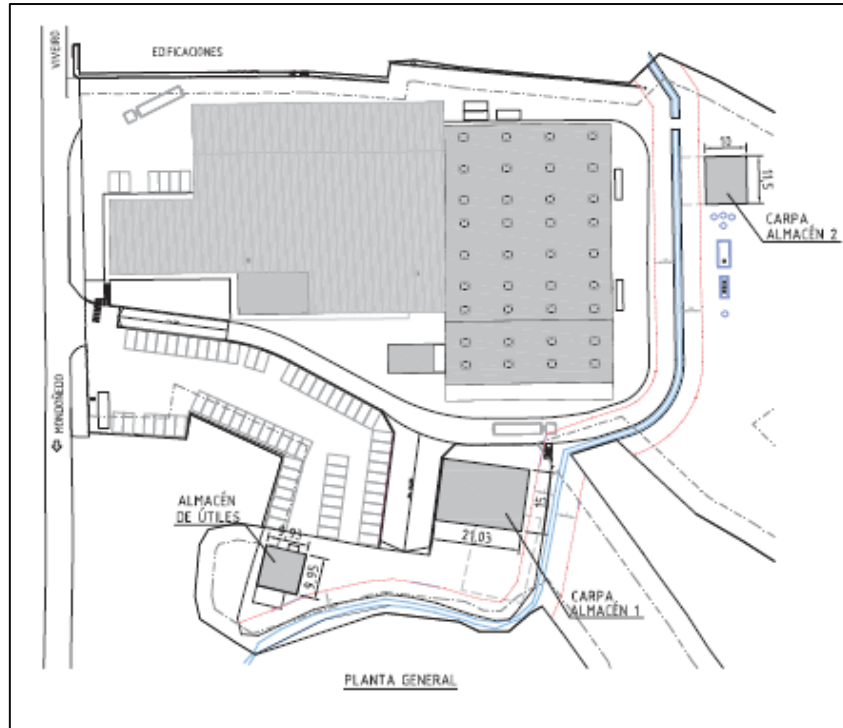
3.- RESOURCES AND INFRAESTRUCTURE (INSTALLATIONS, DIMENSIONS, INSTALLATIONS DESCRIPTION, INSTALLATIONS SIZE -m², NUMBER OF EMPLOYEES, EQUIPMENT).

GRAPHIC AND DIMENSIONAL DESCRIPTION

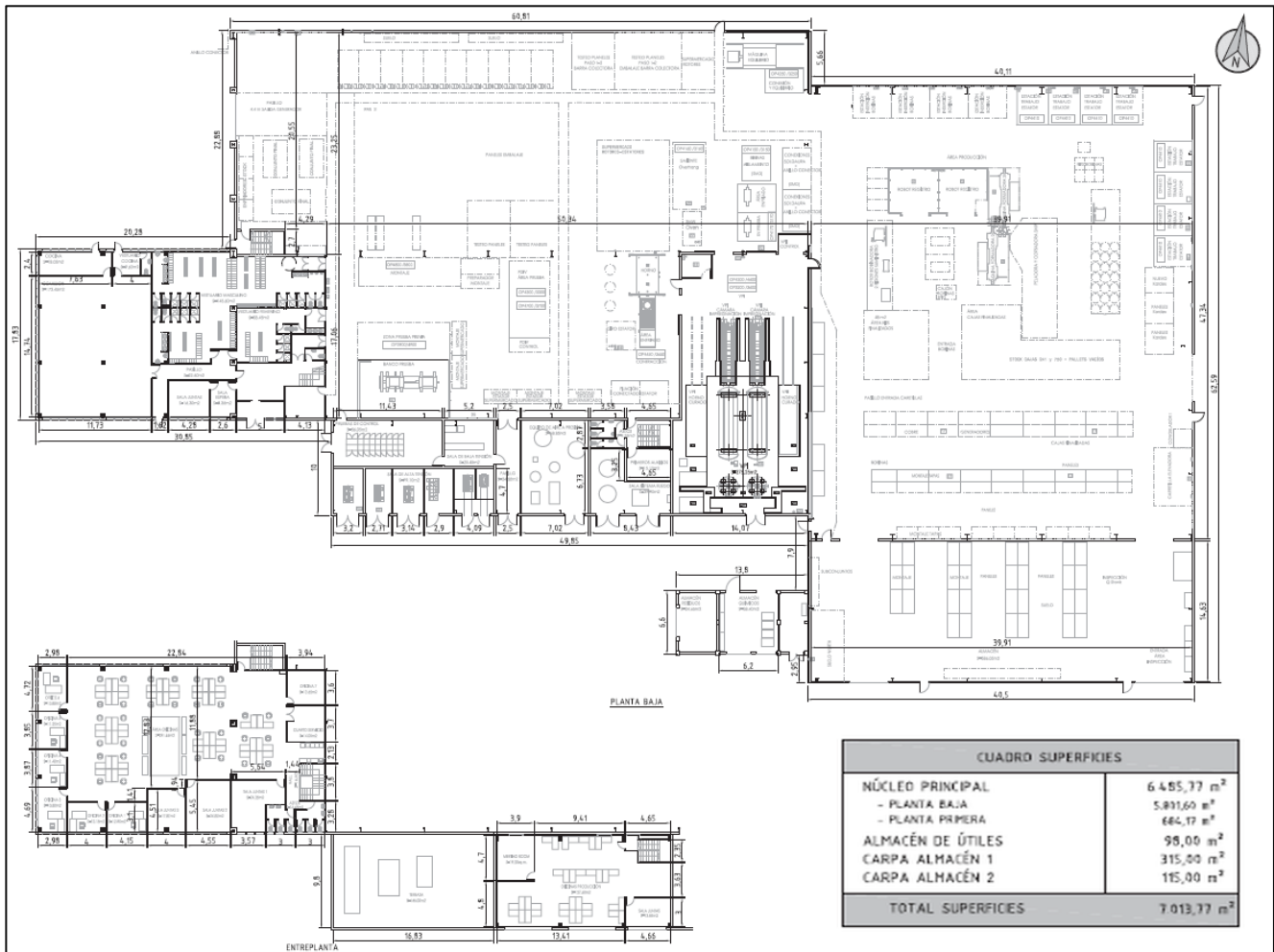
Below there's a graphic description of the property, both land and buildings.



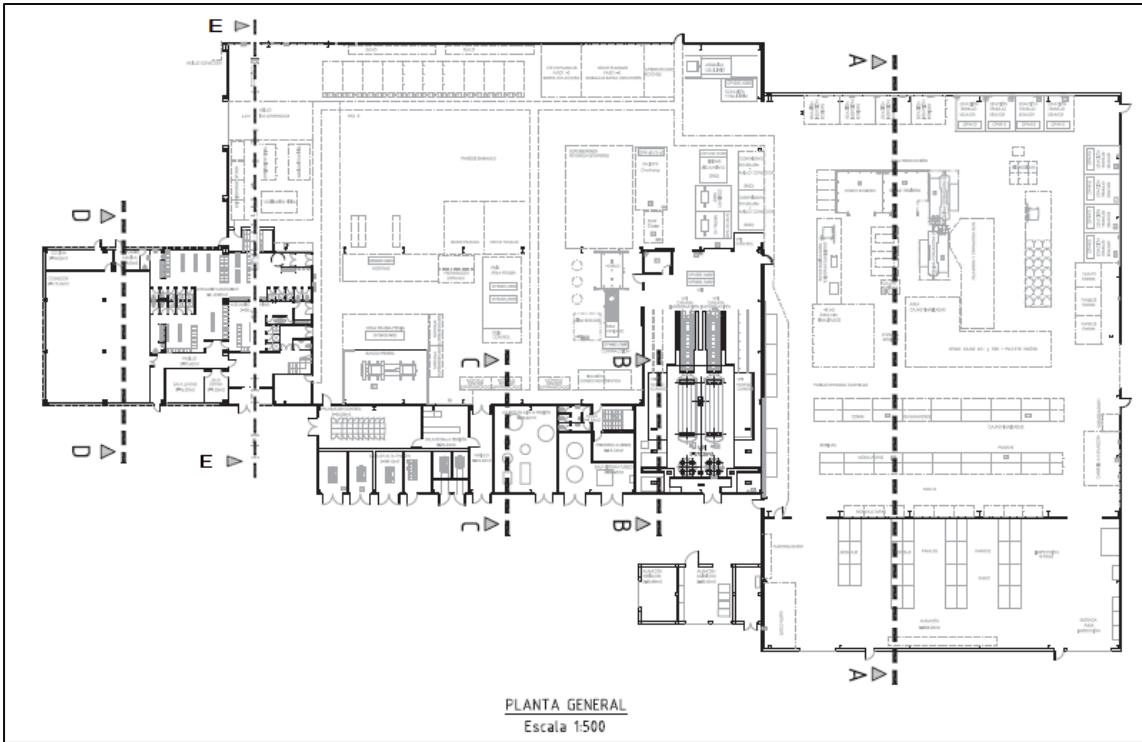
Property (factory) location Graphic description, Address: Chavin s/n. 27864. Viveiro. Spain.



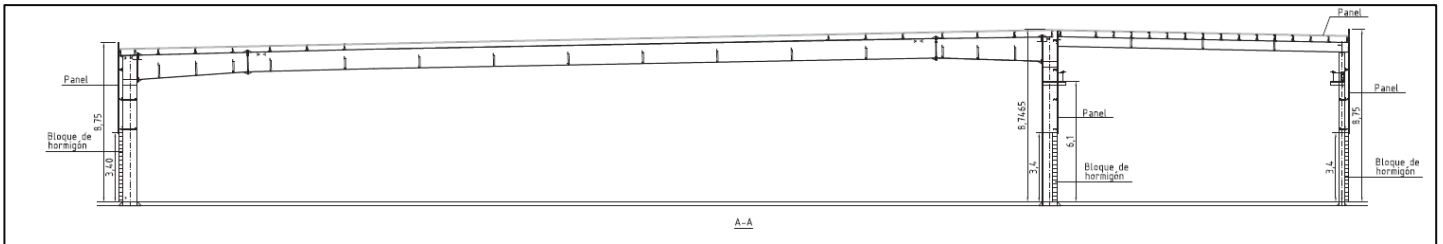
General Graphic description of buildings and urbanized areas.



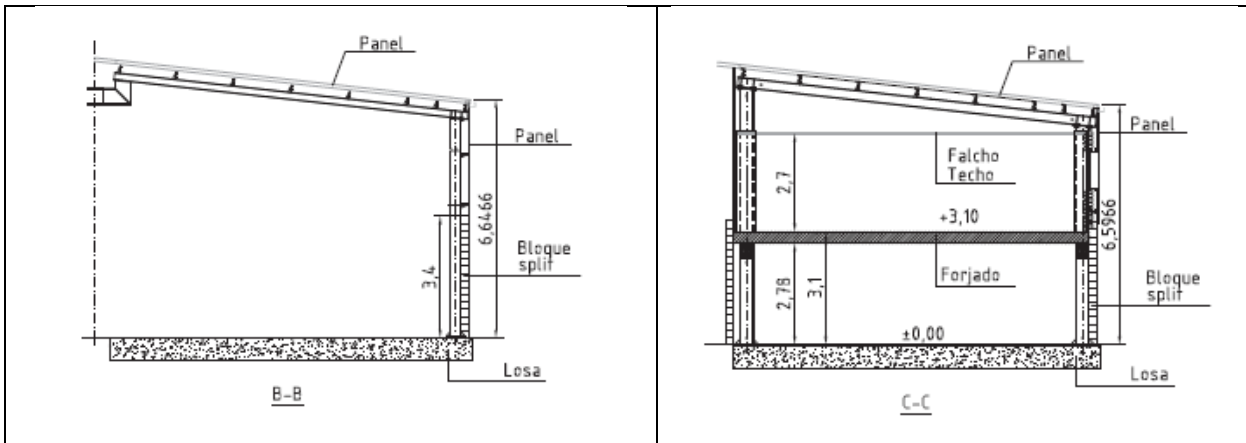
Factory layout and dimensions (m²).



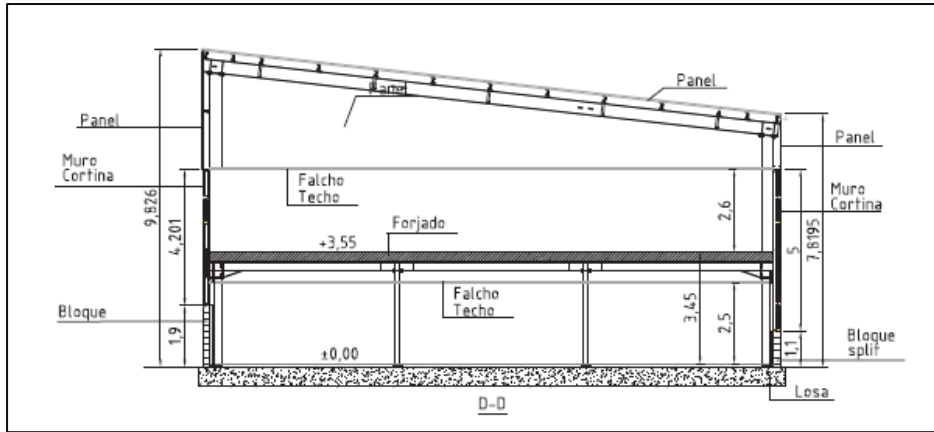
General View of main building and different section views



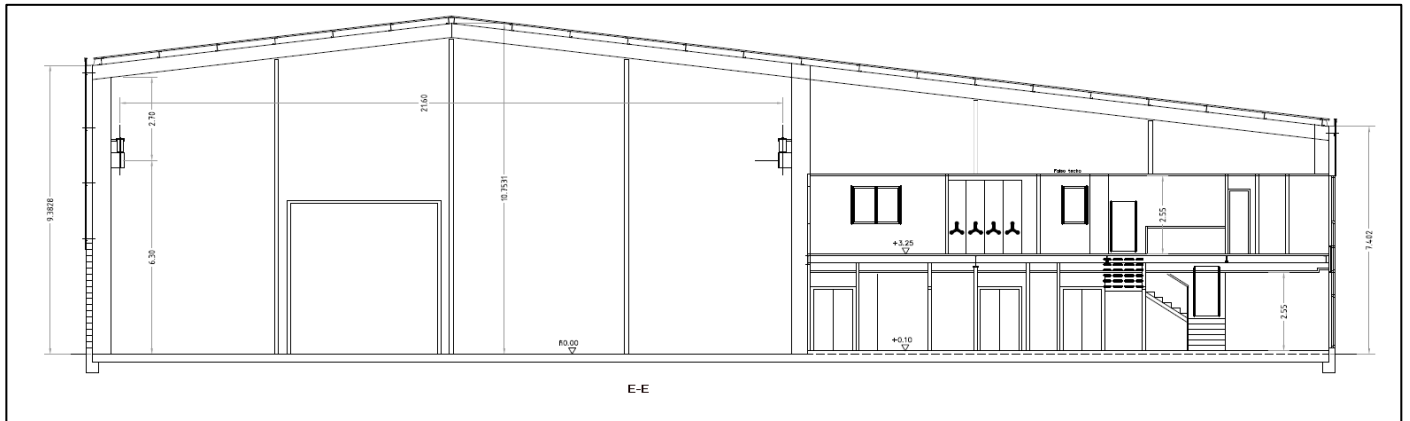
Detail section A-A



Detail sections B-B y C-C

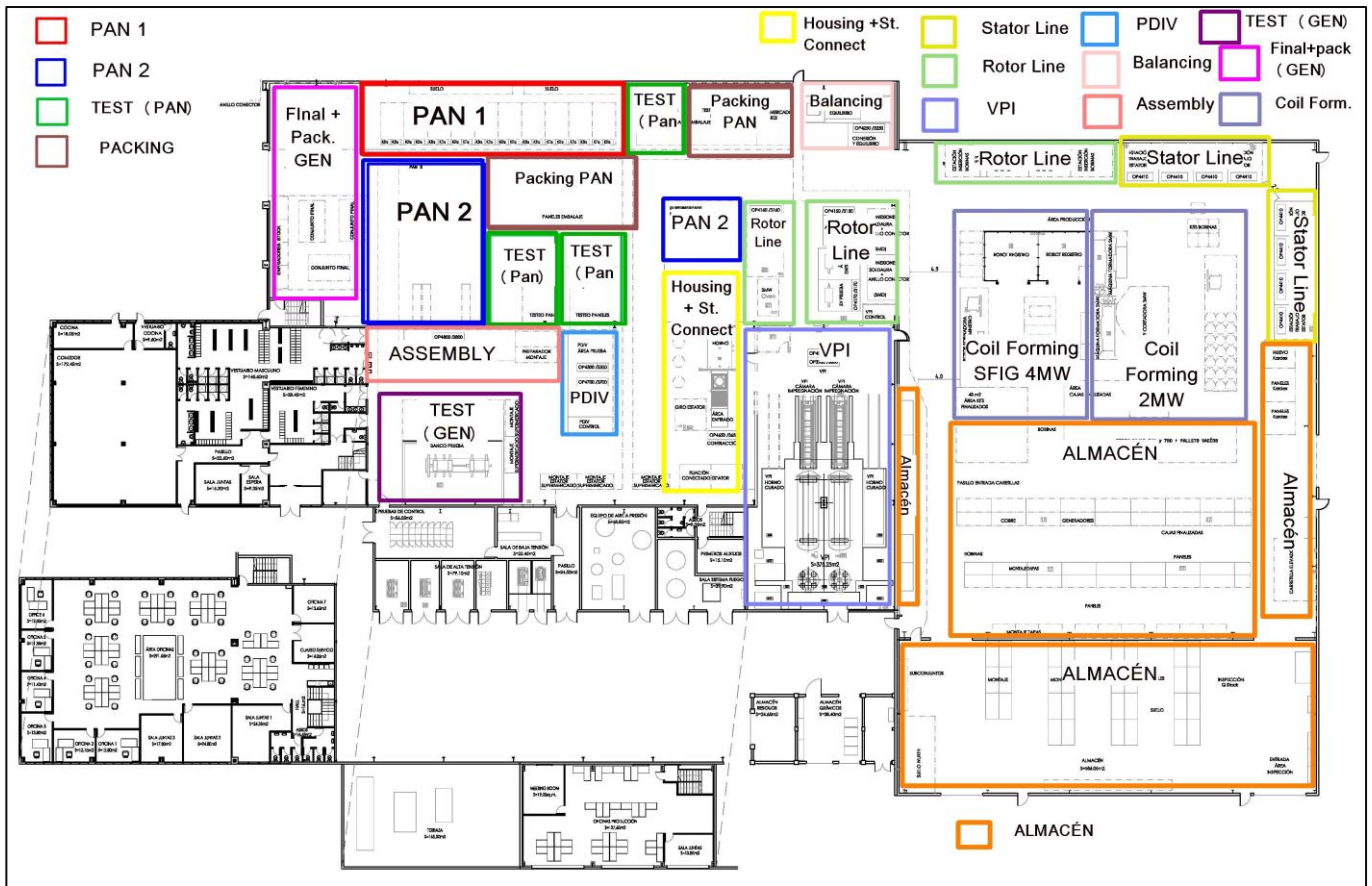


Detail section D-D



Detail section E-E

Below image shows Factory Layout and different production lines and warehouse.



Factory layout, Production lines and warehouse areas.

MACHINERY AND INSTALLATIONS:

The **Main Building** and the offices area are provided with all needed installations for the production processes and current plant activities.

It has, among others, electrical installations (including transformation centres), water supply, compressed air installation, fire fighting system (including water tank storage and pumping system, and also special foam system for specific áreas), camera surveillance system (CCTV), alarm, sistema de Videovigilancia (CCTV), alarma, aerothermal climatic system (Production/warehouse and office area heat pumps, climatic machines and fan coils), additionally there're specific cooling systems for some process equipment, IT installations (including servers, VOIP telephony, optical fiber wiring and net, and also WIFI coverage in all áreas including the exterior), etc.

Also there're some life saving attachment lines for height operations in the building and overhead cranes. Currently there're several cranes with different capacities depending on the area and the operations to be performed (1x 32Ton crane, 2x de 12.6 Ton (2 x 6.3Ton) cranes, 4x 6.4 Ton (2 x 3,2 Ton) cranes, and also small cranes with 250Kg capacity).

The **Urbanized Area** has exterior lightning, WIFI coverage, 2 parking lots, and also 3 small constructions apart from the main one, 1 maintenance workshop or tools storage, and 2 storage tents, which are included in the above graphic descriptions, and also their size.

The **offices** have all needed installations as printer systems, meeting rooms, videoconference systems, etc. In the same building there's also a canteen, changing rooms, etc

In relation to the **Process machinery**, it has been explained in the above chapter within “Production Process Description”..

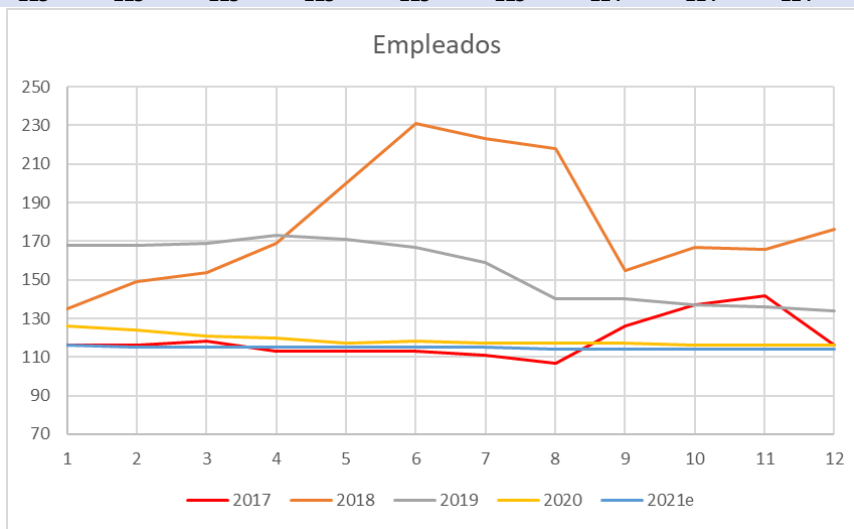
NUMBER OF EMPLOYEES:

The number of employees varies from current 114 to approx. 230 depending on the demand and workload in the last 5 years. Note that 2021 data is estimated.

Año	Mes	1	2	3	4	5	6	7	8	9	10	11	12
2017	Ofic+adm	19	19	19	19	19	19	19	19	19	19	21	21
	Operat.	97	97	99	94	94	94	92	88	107	118	121	95
	TOTAL	116	116	118	113	113	113	111	107	126	137	142	116
2018	Ofic+adm	22	22	22	22	22	22	22	22	22	22	22	22
	Operat.	113	127	132	147	178	209	201	196	133	145	144	154
	TOTAL	135	149	154	169	200	231	223	218	155	167	166	176
2019	Ofic+adm	19	19	20	20	20	20	20	19	19	19	18	16
	Operat.	149	149	149	153	151	147	139	121	121	118	118	118
	TOTAL	168	168	169	173	171	167	159	140	140	137	136	134
2020	Ofic+adm	13	13	14	15	15	16	16	16	16	16	16	16
	Operat.	113	111	107	105	102	102	101	101	101	100	100	100
	TOTAL	126	124	121	120	117	118	117	117	117	116	116	116
2021e	Ofic+adm	16	16	16	16	16	16	16	15	15	15	15	15
	Operat.	100	99	99	99	99	99	99	99	99	99	99	99
	TOTAL	116	115	115	115	115	115	115	114	114	114	114	114

Employment development. Annual/monthly detail on the Office+Admin area and Operatiosn (production, warehouse, quality, maintenance)

Año	1	2	3	4	5	6	7	8	9	10	11	12
2017	116	116	118	113	113	113	111	107	126	137	142	116
2018	135	149	154	169	200	231	223	218	155	167	166	176
2019	168	168	169	173	171	167	159	140	140	137	136	134
2020	126	124	121	120	117	118	117	117	117	116	116	116
2021	116	115	115	115	115	115	115	114	114	114	114	114



Total Employment Development (*)

(*) The above data comes from the monthly factory report. It might be some minor differences compared with Human Resources Database because of specific assignation area of the employees. But in any case they are not significant and can be only minor variations between monts or areas.

4.- SUPPLIERS.

The factory get the material from a Global Supply Chain, which also supply other company factories.

The current supply chain is mainly based in Asia and Europe.

5.- NEEDED RAW MATERIAL.

The Generator an Control Panels production require components that can be grouped in the follow cathegories:

- Electric components.
- Electronic Components.
- Casting and machining components.
- Electrical cabinets estructures.
- Iron lamination.
- Copper.
- Small metal work components.
- Insulation and glass fiber components.
- Consumables.
- Chemical components (resin, paint)
- Packing Components (Plastics, wood, etc.)
- Etc.

6.- COST ESTRUCTURE.

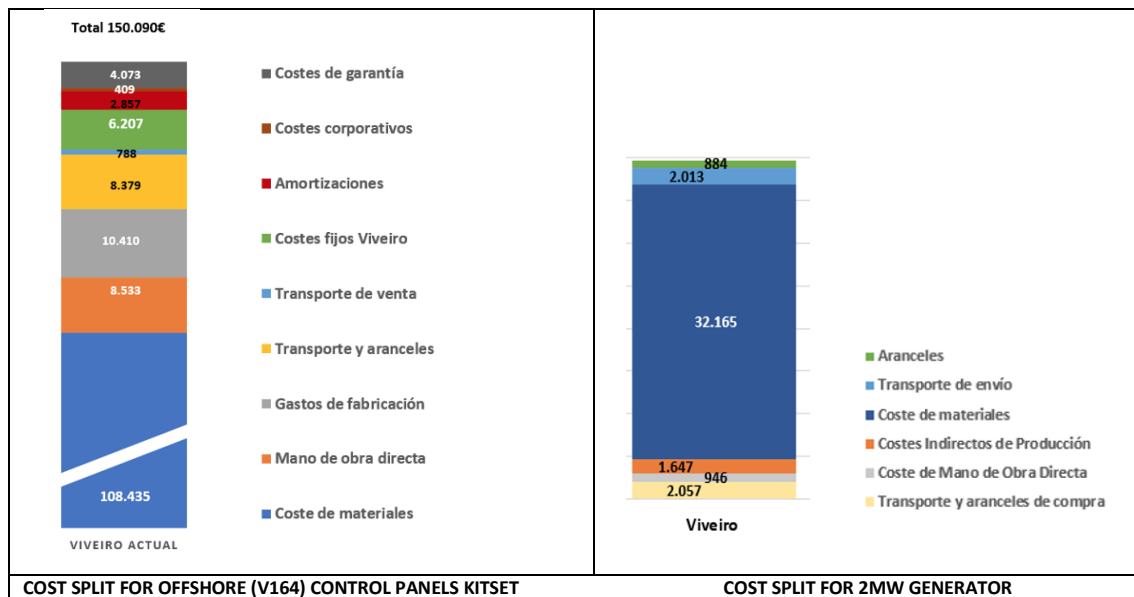
Below there's a Split of the Factory Cost Estructure, in relation to the Net Fix capacity Cost, Net Indirect Production Cost and Manufacturing IPC allocation (deducted cost from indirect activities in relation to direct costs associated to product and quality). The rest of the costs not included in the below table are related to product (direct cost, transport, etc.). but there's a specific product cost Split in some some graphs below.

Concept	Net FCC		Man Net IPC		Man OH Allocation	
	budget	FY	budget	FY	budget	FY
2017	1.312	1.305	2.123	1.963	-2.624	-2.358
2018	1.398	1.396	2.160	2.649	2.160	-2.391
2019	1.255	1.150	2.204	2.073	-2.204	-2.596
2020	1.121	687 (*)	2.357	2.064	-2.157	-2.060
2021e	1.127	987 (*)	2.310	1.963	-1.228	-1.501

All data in K€. Data from 2021 based on Budget and August Full year Forecast.

(*) Total cost reduction due to re invoicing to R&D projects.

COST SPLIT FOR EACH PRODUCT PRODUCED IN VIVEIRO IN 2021.



7.- SALES AND MARKET DEVELOPMENT

Following table shows market development and sales from Viveiro Factory to the different export destinations (100% of the production has had an international destination, no market in Spain since 2018).

PRODUCTO/Destino	AÑO				
	2017	2018	2019	2020	2021e
2MW GENERATOR					
USA	102	3	1344	1023	291
INDIA	--	122	165	--	76
DENMARK	19	24	11	6	--
SPAIN	172	136	--	--	--
3MW GENERATOR					
SPAIN	47	133	--	--	--
DENMARK	48	32	--	--	--
KIT PANELES V164					
DENMARK	--	109	150	120	144e

Note: In the 2MW units there're included both complete and kitset generators.

8.- FINANCE DATA

Desc	2018	2019	2020
Revenue	34.353.107,14	91.945.422,46	61.079.302,54
Sales	34.349.694,64	91.848.301,46	60.743.739,39
EBITDA	917.930,55	4.130.875,59	4.870.841,39