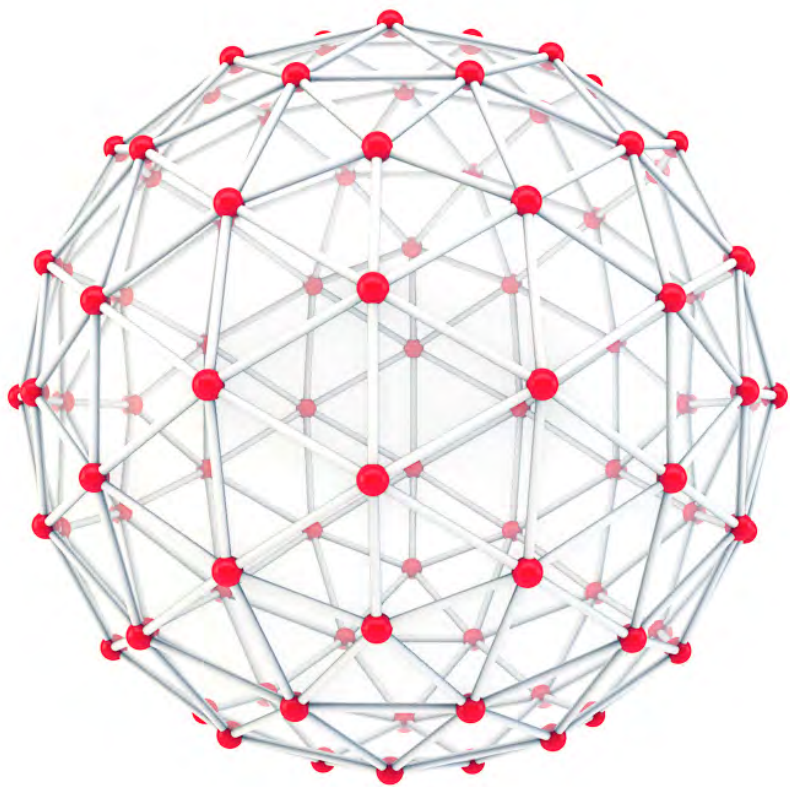


SPANISH NUCLEAR INDUSTRY 2020



With the support of:





THANK YOU

To all the companies that make
this catalogue real.



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IGNACIO ARALUCE

PRESIDENT OF SPANISH NUCLEAR INDUSTRY FORUM

In generating wealth and employment, the Spanish nuclear industry has leading edge capabilities and exports products, services and high technology to more than 40 countries. Recognised at an international level and with a firm commitment to human factors, as well as research and development, it intervenes in the whole chain of nuclear value. As indicated in this publication, it develops the initial studies, the conceptual design, the construction of reactors, the manufacturing of fuel, engineering for operation and maintenance, the supply of equipment and components, training, the management of waste, dismantling of installations, descontamination or provides support to production.

The recognition and prestige of the Spanish nuclear sector is also reflected in the perfect maintenance and updating of the Spanish nuclear reactors, which operate with maximum guarantees of safety and excellent performance indicators.

It is also the technology that most helps curb climate change by generating more than 35% of emission-free electricity annually.

The capacities, experience and state of the art technology of the sector, applied to the services and products that it provides to the Spanish nuclear power plants, lead to load factors, operation or availability of more than 90%. Year after year, this figure makes nuclear energy the source that produces the most electricity and operates the most hours.

In Spain, the nuclear power plants are leaders in production. They generate more than 20% of the electricity that we consume and help to decrease contaminating emissions to the atmosphere. Guarantee of supply and no CO₂ emissions are two of the reasons why many countries seek to maintain and develop this technology and in doing this, join forces with the Spanish nuclear sector.

Nuclear energy still has a big pull worldwide. Currently there is 447 reactors in a position to operate and 52 units in construction around the world, according to the United Nations' International Atomic Energy Agency. Together with the hundreds of planned reactors these data push the companies in the Spanish nuclear sector to expand internationally and to open new markets. Foro Nuclear is involved in this task of promoting the nuclear business and showcasing the capacities of the Spanish nuclear industry by supporting the presence of our industry on the exterior by participating in congresses, business missions, exhibitions and meetings in collaboration with Spanish and international institutions.

This publication, available in Spanish and English, and issued since 2008 in collaboration with ICAEX, and updated annually, includes the capacities and services that the Spanish nuclear companies offer, their business objectives and activities and references. A show of how well our sector is doing at the technological forefront with an ever-growing consolidated international presence.



THE SPANISH NUCLEAR SECTOR

In Spain, nuclear energy has represented approximately 20% of the total production of electricity in recent years. On a world scale, nuclear generation represents almost 11% with 447 reactors in a position to operate in 31 countries and 52 new reactors in construction in 20 countries.

These data have meant that a large number of Spanish companies have focused their activity in the nuclear sector, based on the experience and thanks of their participation in the development of the Spanish nuclear programme since its beginnings and are present in the whole chain of value.

All of this industrial structure has evolved with the circumstances of each moment, incorporating new technologies adapted to current needs and requisites and making it possible that Spanish companies are present today in nuclear projects in more than 40 countries, in four of the five continents.

The Spanish nuclear industry also participates in international research and development projects for advanced nuclear reactors, in programmes based on nuclear fusion, such as the ITER International Project and in programmes related to high energy physics.

The companies that work in the nuclear sector are grouped in this catalogue according to the activity that they carry out.

The electrical companies focus their main activity on the production, transportation, distribution and commercialisation of electricity. The objective of these companies is to work permanently towards excellence in the management of nuclear power plants, with a commitment to continue to produce in a safe and reliable way and promoting growth in their areas of influence both from the social, economic and environmental point of view.

Since the construction of the first nuclear power plant they have extended their actions to the study of the optimization of the performance, maintenance, management of improvements in equipment and procedures, management of the fuel cycle and the development of new reactors.

The Spanish electrical companies are capable of participating in an efficient manner in international markets undergoing a process of growing integration, globalisation and increase in competition.

The international suppliers of nuclear systems provided the first "key in hand" nuclear power plants in Spain and the steam generation systems for the nuclear power plants that were built after that. This was due to the fact that, at the beginning of the Spanish nuclear programme, the decision was made not to constitute a company of systems linked by license to a foreign supplier, which would have meant having to choose a single type of reactor.



The suppliers of electrical systems currently provide support services to nuclear sites in operation and maintenance in more than 20 countries, such as for example, Germany, Belgium, Brazil, Bulgaria, China, Slovakia, Slovenia, United States, Finland, France, India, Japan, Mexico, United Kingdom, South Africa, Sweden, Taiwan, etc.

These companies work through agreements with Spanish companies with which they have developed strong technological links. This has led to as framework of mutual benefit, through which the Spanish industry has been able to participate in the development of nuclear projects all over the world.

The design, manufacture and supply of fuel to Spanish and international nuclear power plants is made by the public capital company ENUSA Industrias Avanzadas and is responsible for the supply of raw materials and their processing right through to the final elaboration of the product. It is the owner and operator of the fuel elements factory in Juzbado (Salamanca), one of the most innovative in Europe which, since the start of its operation in 1985, has manufactured more than 24,400 fuel elements for both Spanish and foreign nuclear power plants. Last year, around 50% of its production going overseas.

The manufacture of capital equipment is made by Spanish companies who cover the production of main equipment to turbine alternators, valves, cranes, piping, boilers or equipment for handling the storage

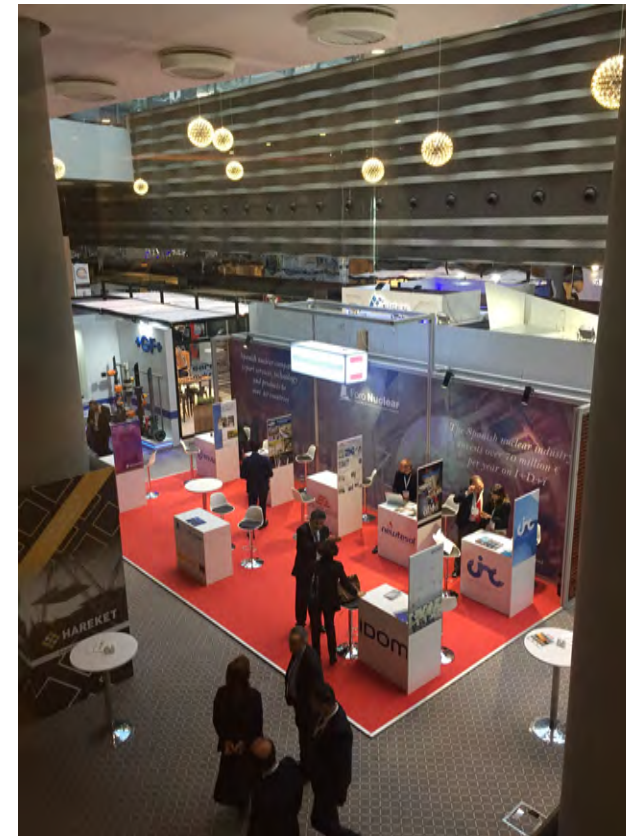
of fuel for both Spanish and foreign nuclear power plants, with a recognized level of quality. At present more than 80% of their annual production is exported.

At present, the whole portfolio of orders for the supply of large components as well as a high percentage of the rest of components of this group of companies is for exports.

The Spanish engineering and services companies have created an important engineering capacity for nuclear power plants, providing support in the management of the construction of new plants and in the operation and maintenance of the plants in operation, with a very diversified activity in which they export more than 60% of their annual production and in some cases up to 100%.

These companies have developed very specialised services such as the supply of simulators, training programmes for operators, in service inspection and the development of support and improvement systems in production. Their clients include all of the Spanish nuclear companies and a large number of foreign entities.

Some of these companies have laboratories for radiological analysis which offer an integral service that responds to all the needs of the sector and which are focused on the efficient and sustainable management of their activities.



Radwaste management in Spain is carried out by the National Radwaste Company, ENRESA. It is a public company and is an important international reference and example as its activities are studied and monitored by more than 15 countries around the world who have visited our site.

Very low, low and medium activity radwaste from nuclear sites, hospitals research centres and industry is managed in the Storage Centre in El Cabril, located in the province of Cordoba.

The fuel used in the nuclear power plants is kept in the onsite pools or in some cases, such as Trillo, Ascó, Almaraz or José Cabrera, in the Individual Temporary Storage Facilities, located onsite, until the future of the Centralised Temporary Storage (ATC) is clarified.

Among its activities it is also responsible for decommissioning nuclear and radioactive sites and was a pioneer in the decommissioning of the nuclear power plants of Vandellós I and José Cabrera.

Spanish Nuclear Industry Forum (Foro Nuclear) is a non-profit association which defends the Spanish nuclear sector and the continuity of the nuclear power plants and covers all of these companies and supports them in all the activities that they require.

Through their four phases of action, Support to the Industry, Technical Support, Communication and Education and Training it attends to the needs of the companies in the Spanish nuclear sector, at both a national and an international level.

In the area of Support to the Industry, Foro Nuclear coordinates the activities of the industry in different scenes, such as the participation in exhibitions with grouped pavilions, the organisation of business meetings among companies from different countries, the coordination of technical workshops in events of interest, etc.

For all of these activities it has the support of both national and international entities and institutions which gives it a greater diffusion and the possibility of reaching other companies that are not members of the Association.

Thanks to a collaboration agreement signed with ICEX Spain, Trade and Investment, Foro Nuclear is recognised as an agent responsible for providing services, in the name and representation of the entity, for the internationalisation of the nuclear sector companies, in the area of the management of aid relating to the promotion of internationalisation.

Through specific agreements with the commercial offices in Spain of those countries that are of interest for the companies in the nuclear sector, Foro Nuclear organises bilateral business meetings which make it possible to know the capacities of the participating companies and open up the possibility for collaboration among them, both in the countries that organise the meeting and in third countries.

Since 2014, Foro Nuclear and its associated companies have become part of "Brand Spain", a recognition and prestige for the numerous companies in the nuclear sector which have extensive activities beyond our frontiers.

The figures of the activity of our nuclear industry and the degree of internationalisation of their companies are the best proof of the competitiveness of the sector and the capacity of our professionals. At present the nuclear sector is a consolidated, prestigious industry that generates wealth and employment.

The aim of the catalogue of the Spanish nuclear industry is to reflect the reality of an open and dynamic sector in a growing international market.





ELECTRICITY UTILITIES

—
EDP
ENDESA, S.A.
IBERDROLA, S.A.
NATURGY

12-19

—
The Spanish electric utilities constanly work towards excellence in the management of nuclear power plants with a strong commitment to enabling long term production in a safe way.



EDP

Headquarters
Plaza del Fresno, 2
33007 Oviedo (Asturias)
Tel.: +34 902 830 100

C/ Serrano Galvache, 56
Edificio Encin
Centro empresarial Parque Norte, 2º
28033 Madrid
Tel.: +34 902 830 100



C/ General Concha, 20
48010 Bilbao (Vizcaya)
Tel.: +34 944 035 700

In Spain, EDP is a group of companies that produce and distribute electricity, natural gas and energy services.

It is part of the EDP energy group, a world leader and one of the main operators on the Iberian Peninsula. The Group is present in 14 countries, has an installed capacity of 26.7 GW, 73% of which is renewable. It is the fourth major wind power operator worldwide.

The EDP Group has over 11 million customers and 12,000 employees representing 44 different nationalities.

It is a sustainable company that reinvests in society, creating value, committed to the environment and innovation, with a strong focus on social action through its Foundation.



ELECTRICITY GENERATION

EDP has diversified generation facilities in Spain that are noted for their efficiency, high availability and operating flexibility, underpinned by an ongoing commitment to investment. The stake in the Trillo Nuclear Power Plant is providing EDP with a first-rate nuclear experience.

Data 2019	Production (GWh)	Power (MW)
Hydraulic	880	426
Classic Thermal	3,129	1,250
Combined Cycle	4,346	1,698
Nuclear	1,223	156
Special thermal regime	107	25
	9,685	3,555



Economic Data 2019 (million €)	EDP in Spain	EDP Renewables	EDP Group
Turnover	3,106	1,824	14,333
Gross Production Result (EBITDA)	346	1,648	3,706
Net Profit (BDI)	64	475	512
Number of employees	1,227	1,566	11,660

ELECTRICITY DISTRIBUTION

E-Redes Distribución Eléctrica posted the best electricity supply quality in Spain, with an all-time record on the TIEPI (Equivalent interruption time of installed power) index. Apart from Asturias, where it is the benchmark operator, it has consolidated electrical distribution networks in Madrid, Valencia, Alicante, Barcelona, Huesca and Zaragoza.



Electrical distribution 2019

Points of electrical supply	668,494
Distributed electrical energy (GWh)	8,262
TIEPI (min)	26
Intelligent counters	666,000

MARKETING

EDP leads the dual marketing segment with 1,2 million electricity-gas customers throughout Spain, with a turnover exceeding 12,362 GWh of electricity and 15,394 GWh of natural gas, with commercial offices in different cities.



RENEWABLES

EDP Renovables is one of the leading wind power operators worldwide and is based in Spain, where its installed power is 1,974 MW. It operates in 14 countries and generated 30,041 GWh in 2019, 5,298 GWh of which were in Spain. It maintains its leadership position of the sector with a use factor of 28% and which reflects the quality of its wind farms.

SERVICES

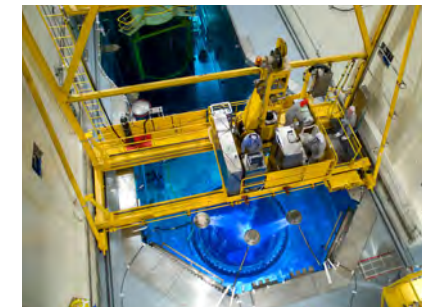
The marketing of electricity and gas is complemented with a varied set of energy services for the different sectors. Special mention should be made of the "Funciona" maintenance service for the residential segment. As regards companies and industry, there are energy efficiency and consumption optimization services, along with electricity mobility and solar self-consumption services.





ENDESA, S.A.

C/ Ribera del Loira, 60 (Campo de las Naciones)
28042 Madrid
Tel.: +34 912 131 000



Endesa, founded in 1944, is the leading company in the Spanish electricity sector and the second biggest operator in the Portuguese electricity market. The company, which belongs to the multinational energy group Enel, has around10,000 employees and serves 10.6 million clients.

Endesa's main business is the generation, distribution and sale of electricity. The company is also an important operator in the natural gas sector and provides other services related to energy.



COMMITMENT TO DECARBONISATION

Endesa, conscious of its role as a leading agent in the energy sector in Spain and its ability to contribute to achieving a low-carbon economy, places among its priorities the progressive reduction of greenhouse gas (GHG) emissions associated with the generation of electricity. It does this by giving a greater role to renewable energy and optimising the management of traditional technologies. Proof of this is the new update of the 2020-2022 Strategic Plan, with the company announcing a 70% reduction of specific emissions by 2030 and a complete decarbonisation of the energy mix by 2050. By 2019, 59% of its production was already free of CO₂ emissions.

This is a plan that bets on a sustainable, dynamic, efficient business model aligned with the strategic vision in which Endesa leads the energy transformation of society.

The 2020-2022 Plan is organised around decarbonisation and the necessary process of electrification of demand, creating infrastructures to facilitate these processes and ecosystems and platforms to support them, such as the commitment to electric mobility. To this end, Endesa has also set

itself the target of increasing installed renewables capacity by more than 38% by 2022, with an associated investment of €3.8 billion. Furthermore, as part of this commitment to decarbonisation, the 2020-2022 Plan includes the cessation of coal activity in the Iberian peninsular by 2022 and the total abandonment of coal activity by 2030, with a commitment to the long-term operation of the existing nuclear facilities.

SERVICES, PRODUCTS AND TECHNOLOGY AVAILABLE

Endesa carries out its activities in the electricity and gas business mainly in the Spanish, Portuguese and Moroccan markets. To a lesser extent, it markets electricity and gas in other European markets as well as other value-added products and services (VAPS) related to its core business.

In the **generation** activity, Endesa has a diversified energy mix. Nuclear energy is the main technology with an output of 26,276 GWh measured at the plant busbars, out of a total annual output of 61,402 GWh in 2019.

Endesa's installed capacity in Spain amounted to 24,231 MW in December 2019, compared to 23,766 MW the previous year, mainly due to the growth in the development of renewable energy sources (wind and solar) through the construction and connection to the network of new facilities. Thus, Endesa's generation plants, located in Spain, Portugal and Morocco, represent an installed capacity of 7,452 MW of renewable energy (hydro, solar and wind), 7,659 MW of traditional thermal power, 5,677 MW of combined cycles and 3,443 MW of nuclear origin.

Capacity (MW)	24,431
Production (GWh)	61,402
Sales (GWh)	89,441
Nº of customers	10,635,000
Revenue	20,158 million €
Gross operating profit (EBITDA)	3,841 million €
Operating Profit (EBIT)	388 million €
Net Profit	171 million €
Workforce	9,952 employees
Distributed energy (GWh)	116,611

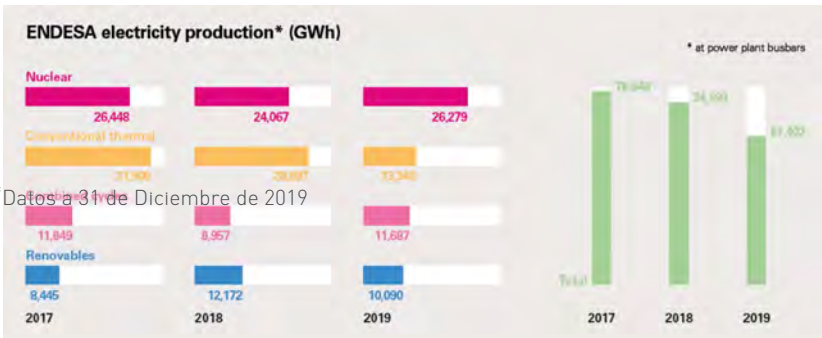
*Figures at 31 December 2019

• In the **Distribution** activity, Endesa distributes electricity in 27 Spanish provinces in 10 autonomous communities: Catalonia, Andalusia, the Balearic Islands, the Canary Islands, Aragon, Extremadura, Castile and León, Navarre, the Valencian Community and Galicia. With a total area of 195,500 km2 and a population close to 21 million inhabitants.

The number of customers with an access contract to Endesa's distribution networks exceeded 12 million on that date and the total energy distributed by the company's networks, measured at the plant busbars, reached 116,611 GWh in 2019.

• Regarding the **Marketing** of electricity, gas and value-added products and services (VAPS), in 2019, net electricity sales amounted to 89,441 GWh and, as at 31 December 2019, the customer portfolio in the Electricity market consisted of 10.6 million supply points. The total volume of gas sold in 2019 amounted to 79,784 GWh and at 31 December 2019 the customer portfolio in the conventional natural gas market consisted of 1.6 million supply points.

Nuclear Power Plants		% ENDESA	Participation ENDESA (MW)
Ascó I	1,033	100	1,033
Ascó II	1,027	85	873
Vandellós II	1,087	72	783
Almaraz I	1,049	36	378
Almaraz II	1,044	36	376
Trillo	1,066	1	10.7
Cofrentes	1,092	0	0
Total Nuclear	7,399	47	3,453

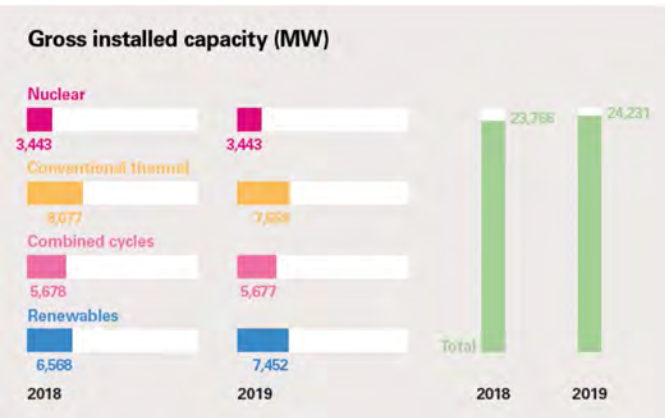


ENDESA AND NUCLEAR PRODUCTION

Endesa is the largest producer of nuclear energy in Spain, with 47 percent of the installed nuclear power through its shareholding in various plants, which amounts to 3,453 MW.

Endesa constantly strives for excellence in the management of its nuclear power plants and in 2019, their efficiency was 35.3%, in

line with 2018 values. The company is committed to the long-term operation of nuclear assets in a safe and reliable way, as set out in its nuclear policy approved in February 2011. This commitment also extends to the environment in which the plants are located, both from a social and environmental point of view, promoting economic growth.





IBERDROLA, S.A.

Headquarters
Plaza Euskadi, 5
48009 Bilbao (Vizcaya)
Tel.: +34 944 151 411

Iberdrola Generación Nuclear
C/ Tomás Redondo, 1
28033 Madrid
Tel.: +34 915 776 500



Iberdrola is a private global company with experience forged over the span of more than hundred seventy years of history at the service of energy development, supply guarantee, quality and innovation

Iberdrola owns a balanced, efficient and well diversified grid, guaranteeing its response capacity in any energy related matter.

BUSINESS OBJECTIVE

The company has taken a decisive and pioneer bet to use cleaner generation technologies, fight against climate change and respect towards the environment, becoming world wide leader in wind power. After last quarter of 2019, renewable business has got 31,939 MW of installed capacity around the world.

Fighting against climate change and in favor of sustainable development is one of the strongest commitments of Iberdrola, establishing as environmental objective to reduce the CO₂ emissions below 150 gr per kWh in 2030, that is, 50% below the specific emissions released by the company in 2007 and be carbon neutral by 2050.

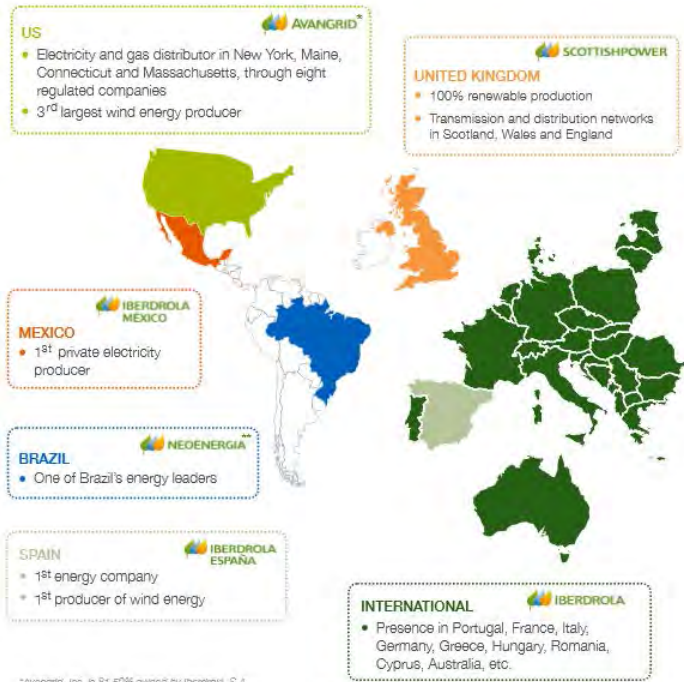


SERVICES, PRODUCTS AND TECHNOLOGY AVAILABLE

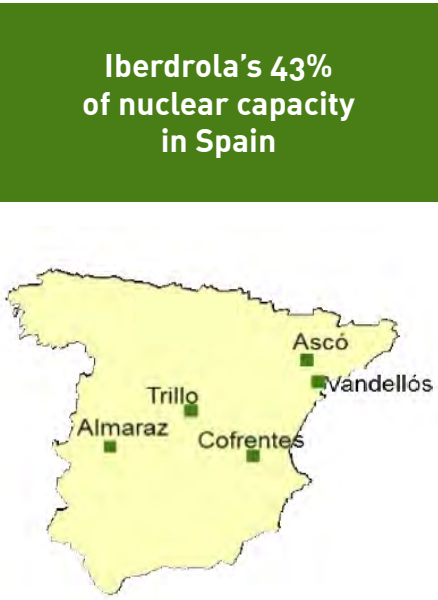
Main activities of Iberdrola consist of electricity production through renewable and conventional sources, trade in electricity and gas in wholesale markets, transmission and distribution of electricity, marketing of electricity and other activities mostly connected to the energy sector.

After the last quarter of 2019, Iberdrola has 47,450 MW of installed capacity. Over 68% of it corresponds to greenhouse gases-free energy.

From the whole installed capacity, nearly 61% corresponds to renewable energies; 27% to combined-cycle gas plants; 7% to nuclear; 3% to cogeneration and the remaining 2% to coal.



Countries where it has activity	Around 40
Users	More than 13 millions
Staff	35,120 employees



NUCLEAR ENERGY IN IBERDROLA

From the whole electricity generated by Iberdrola in Spain, more than 40% comes from nuclear plants, with an installed capacity of 3,177 MW. For Iberdrola, the safety of its nuclear plants is the prime objective over other aspects as economics, production or compliance of schedule. Likewise, Iberdrola is committed to generate electricity from nuclear plants in a respectful way with environment, making rational use of natural resources, maintaining the best quality standards and excellence levels, and continuously carrying out the modernization of its plants according to the state of the art in this field

IBERDROLA SHARE IN THE SPANISH NPP'S

NPP	CAPACITY (MWe)	Share IBERDROLA	Capacity IBERDROLA (MWe)
Cofrentes	1092	100%	1092
Almaraz I y II	2094	53%	1103
Trillo	1067	49%	523
Vandellós II	1087	28%	304
Ascó II	1027	15%	154
			3177

OUTSTANDING NATIONAL AND INTERNATIONAL ACTIVITIES

Iberdrola has undergone a wide-ranging transformation over the last ten years which has enabled it to advance through the ranks to become the number one Spanish energy group, one of the Spanish main companies on the Ibex 35 by market capitalisation, the world leader in renewable energy, a pioneer in the deployment of smart grids and one of the world's top power companies.

Nowadays, Iberdrola is working in the construction of new wind farms and regulated generation plants, to achieve a total capacity of 7,790 MW in 2020.

In addition to consolidation in Spain, it has an international reference position, becoming one of the main operators of the United Kingdom, one of the largest producers of wind power and electricity

networks in the United States, the main generator private Mexico and has strengthened its leadership as a distributor of electricity with more customers from Brazil

Iberdrola is making a strong investment effort between 2018 and 2022, during which 34,000 million € will be invested in energetic projects and countries with an estable and predictable regulation.

Iberdrola accelerates the creation of value through five strategic pillars: profitable growth, operational excellence, customer focus, capital optimization and digitalization and innovation.

Headquarters
Avda. de San Luis, 77
28033 Madrid

Office in Barcelona
Plaça del Gas, 1
08003 Barcelona
Tel.: +34 934 025 100



Naturgy is an multinational energy group operating in 30 countries where it serves almost 18 million customers with a rated output of 16.9 GW. The basis of its business are in the regulated, liberalised gas and electricity markets.

The company is listed on the four Spanish stock exchanges via the continuous market and forms part of the select Ibex 35 index.

This Spanish multinational participates across the entire energy value chain, from generation and distribution to the commercialisation of natural gas and electricity. Its generation mix is

diversified and includes renewable sources, combined-cycles, hydraulics, coal and nuclear.

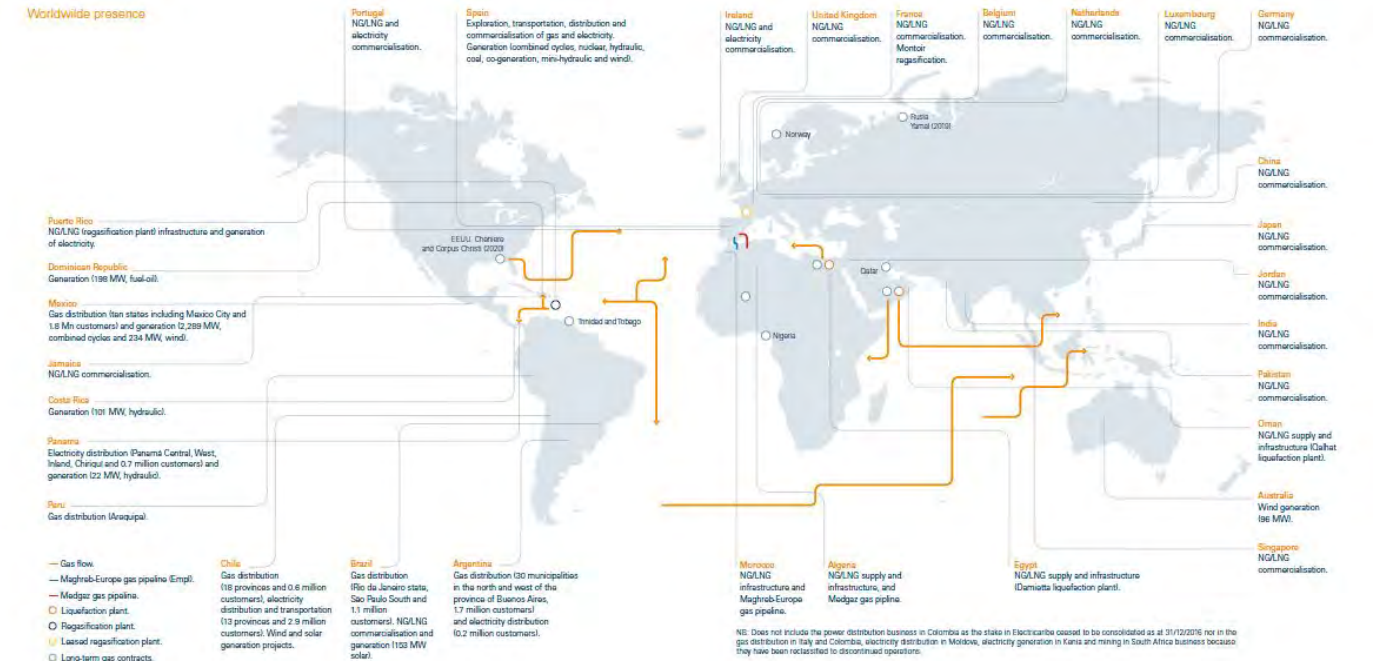
Internationally, Naturgy has a capacity of 3.2 GW distributed in 2.4 GW from combined cycle plants (Mexico), 0.2 GW from fuel (Dominican Republic), 0.1 GW from hydroelectric (Costa Rica and Panama) and 0.5 GW from renewable energy (Mexico, Australia and Brazil).

Naturgy is also the leading operator in the Atlantic and Mediterranean basins, managing an LNG supply portfolio of approximately 30 bcm.



Data 2019

Net turnover	23,035 million €
Net profit	1,432 million €
Consolidated EBITDA	4,668 million €
Workforce	11,847 employees



OUTSTANDING NATIONAL AND INTERNATIONAL ACTIVITIES

Naturgy promotes best practices in energy infrastructure management, aligning its activities with its concern for the environment, the development of low-emission economies and sustainability. Moreover, as an energy operator, it seeks to achieve progress in the use of increasingly efficient and less polluting energies and is committed to attaining enhanced air quality for our urban environments.

In the electricity generation business, the group's strategy focuses on having a balanced, competitive and environment-friendly generation mix, in keeping with the objectives and commitments of the COP 21 with regard to global warming and

consolidation of its presence as one of the chief operators of the Spanish electricity sector.

Naturgy's electricity generation capacity in Spain stands at 13.7 GW and is based on a balanced, competitive and environmentally-friendly generation mix with significant contributions from five technologies: 7.4 GW from combined cycle power plants, 2 GW from hydropower, 1.7 GW from coal, 2 GW from renewables and 0.6 GW from nuclear.

Regarding nuclear power generation, the company participates in the Almaraz (I and II) and Trillo nuclear power plants, with a percentage of 11.3% and 34.5%, respectively.

The group's generation business outside Spain is managed by its subsidiary Global Power Generation (GPG), which groups together all the assets and holdings in international generation with a rated output that is currently 3,100 MW and projects awarded for 543 MW.





NUCLEAR SYSTEMS SUPPLIERS

—

GE-Hitachi
Westinghouse Electric Spain

22-25

—

Nuclear systems suppliers provide support and maintenance services to nuclear sites in operation across more than 20 countries.



GE-HITACHI

C/ Gobelas, 35-37
28023 Madrid
Tel.: +34 916 632 500



GEH is a world-leading provider of advanced reactors and nuclear services. Established in June 2007, GEH is a global nuclear alliance created by GE and Hitachi to serve the global nuclear industry. The nuclear alliance executes a single, strategic vision to create a broader portfolio of solutions, expanding its capabilities for new reactor and service opportunities. The alliance offers customers around the world the technological leadership required to effectively enhance reactor performance, power output and safety.

BUSINESS OBJECTIVE

GEH offers customers innovative solutions that take nuclear energy the smart choice for a cleaner and more secure energy future. GEH is committed to serving the needs of customers, communities and the environment with a balanced portfolio of advanced technologies, trusted services and global energy experience for the world’s growing energy needs.

SERVICES, PRODUCTS AND TECHNOLOGIES AVAILABLE

The GE and Hitachi alliance is recognized as the world’s foremost developer of boiling water reactors, robust fuel cycle products and highly valued nuclear plant services. Beginning in the 1950s, GE developed breakthrough light water technology with the Boiling Water Reactor (BWR). Since that time, GE has developed nine evolutions of BWR technology including the ABWR and the ESBWR, as well as PRISM and BWRX-300, within the segment of Modular reactors.

NUCLEAR PLANT PROJECTS
Advanced Boiling Water Reactor (ABWR)

The ABWR is the world’s first and only Generation III nuclear plant design in operation today, providing the benefit of a combined 25 reactor-years of operational experience. GEH’s first ABWR began commercial operation at Kashiwazaki-Kariwa in Japan, in 1996. The ABWR is licensed in the U.S., Japan, UK and Taiwan.

Economic and Simplified Boiling Water Reactor (ESBWR)

The ESBWR is a GEH-designed Gen III+ reactor currently in the U.S. Design Certification process. This simplified design provides improved safety, excellent economics, better plant security, a broad seismic design envelope and operational flexibility that increase plant availability. ESBWR employs passive safety design features. The reactor can cool itself for more than seven days with no on-site or off-site AC power or operator action, uses approximately 25 percent fewer pumps and mechanical drives than reactors with active safety systems and offers the lowest projected operating, maintenance and staffing costs in the nuclear industry on a per-kilowatt basis.

Power Reactor Innovative Small Modular (PRISM) and Versatile Test Reactor (VTR)

The PRISM design is a sodium-cooled modular rapid reactor that is designed to recycle used nuclear fuel, generating low-carbon electricity. It is an inherently safe design that could help to close the nuclear fuel cycle, decrease the amount of waste and reduce the time that waste has to be stored in a repository to a few hundred years. It is based on proven sodium reactor technology, developed and tested over 30 years in the US. In 2018, DOE selected an adaptation of PRISM for its VTR (Versatile Test Reactor) program developed by Idaho National Laboratory. The first phase through 2020, will include the conceptual design, cost/schedule estimate and safety framework activities for a test reactor focused on the development of innovative nuclear fuels, materials, instrumentation and sensors.

BWRX-300

BWRX-300 is an evolution of the ESBWR design at reduced scale which saves 90% in volume with the goal of offering a major source of power generation able to complete with any other source in Capital Costs.

GLOBAL NUCLEAR FUEL (GNF)

GNF is a world-leading supplier of boiling water reactor fuel, including uranium dioxide and MOX fuel and fuel-related engineering services. GNF operates primarily through Global Nuclear Fuel-Americas, LLC in Wilmington, N.C., and Global Nuclear Fuel-Japan Co. Ltd. in Kurihama, Japan. GNF continues to strategically expand the nuclear fuel cycle by offering customers an extensive portfolio, including fuel for PWR reactors.

GE Hitachi Nuclear Energy (GEH) President and CEO	Wilmington, NC, USA Jay Wileman
Global Nuclear Fuel (GNF) President and CEO	Wilmington, NC, USA Jay Wileman
Other USA office locations	San Jose, CA; Vallecitos, CA; Morris, IL and Filadelfia, PA.
Other European office locations Staff	Madrid, Zurich, Stockholm 3,000 Employees

NUCLEAR PLANT SERVICES

As nuclear plants get older and worldwide demand for cleaner energy increases, GEH offers a wide range of valuable services that can improve performance, increase power output and extend plant life. GEH provides the technical leadership and experience for all operational and expansion requirements for BWR and PWR reactors.

PERFORMANCE ENHANCEMENT PROGRAMS

Advanced products and services improving performance and safety, such as Plant Uprating and Optimization Programs, Lifetime Management, New Instrumentation and Control Platforms and Digital Solutions.

DECOMMISSIONING AND DISMANTLING (D&D)

On the D&D segment, GEH offers solutions in the field of emerging cutting tools, advanced imagery technologies, the latest radiation detection devices and brilliant machines such as autonomous & sorting robots to assess what is possible. Solutions that deliver significant improvement to resolve the biggest issues identified in the market: schedule uncertainty and cost risk.

ACTIVITIES AND REFERENCES

Although GEH has no production centers in Spain, GE has based its strategy on alliances with national partners with whom it has developed strong technology links. This has led to a framework of mutual benefits through which the Spanish industry has been able to participate with GEH many projects throughout the world. The alliances with the following companies are particularly noteworthy:

Empresarios Agrupados has collaborated with GEH in proposals and projects for new plants in several countries, with a wide range of scopes and has been the main project engineering firm for the Cofrentes and Valdecaballeros plants. They also participated in the certification efforts for the new ABWR and ESBWR designs.

As regard nuclear fuel, links with ENUSA date back to 1974 and since that time some 10,000 GEH design fuel assemblies have been manufactured for 13 BWR reactors in Europe. Since 1996, GEH has been commercializing fuel and associated services for Europe through the Spanish company GENUSA, held jointly by GNFA and ENUSA.

In the area of Reactor Components, ENSA has supplied several different items of equipment for the Lungmen ABWR project and in the near future will supply reactor vessels and fuel racks for the new ESBWR designs. It has also manufactured replacement components for delivery to operating plants.

Since 1992, GE has had a Cooperation Agreement with Tecnatom, through which the two companies have jointly developed non-destructive testing equipment and have participated in Inspection Services in more than 25 nuclear plants worldwide and in the design of Man-Machine interfaces for certain new reactor designs.

This high degree of participation by the national nuclear industry at world level should be valued especially in view of the fact that GE has access to a wide range of partners and suppliers on the five continents. This is clear indication of the capacities and competitiveness of the sector, which will be strengthened in future projects for new reactors across the world, some already underway.





WESTINGHOUSE ELECTRIC SPAIN

C/ Estébanez Calderón, 3-5. 1º
28020 Madrid
Tel.: +34 912 106 410



Westinghouse Electric Company is the world’s leading supplier of safe and innovative nuclear technology. We provide our utility customers around the world with the most reliable, dependable nuclear power plants, nuclear fuel, plant automation and operating plant products and services. We are driven by our powerful history and experience, ground-breaking ideas, focus on safety and sustainability, and our strong team of approximately 8,765 employees around the world.

Westinghouse’s presence in Spain began in the mid-sixties with the supply, under a turnkey contract, of the José Cabrera Nuclear Power Plant to the electric company Unión Eléctrica Madrileña. Already in 1972 Westinghouse had its own office in Madrid, and since then its presence has been permanent and active by offering services to the Spanish nuclear power plants.

In 2001, Westinghouse acquired Initec’s nuclear division, thus expanding its business in the country. Nowadays, Westinghouse has 244 employees in Spain across three locations: Madrid, Vandellós and Hospitalet del Infante (Tarragona).

Several Spanish companies have purchased Westinghouse’s technology while at the same time becoming its associates both in Spain and in other European countries. Among them are ENUSA, ENSA and TECNATOM.

ORGANIZATION

Westinghouse is worldly organized through Business Units: Plant Solutions: NPP (New Power Plants), D&D Solutions and Government Services. Operating Plant Services: NFEP (Nuclear Fuel, Engineering and Parts) and OMS (Outage and Maintenance Services) and Global Operations Services. Westinghouse is divided in three regions (America, EMEA (Europe/Middle-East and Africa) and Asia). This way it fulfills its vision of developing locally applied global solutions.



SERVICES, PRODUCTS AND TECHNOLOGY AVAILABLE

Westinghouse’s product lines are as follows:

ENGINEERING SERVICES

Westinghouse provides different types of solutions and services to practically all reactors in operation. It offers a compromise of safe and efficient operation of nuclear power plants throughout the world.

Some of the services it provides are:

- Reactor-related engineering, such as support to systems operation, safety evaluations, accident analysis or power uprates.
- BOP engineering.

MANUFACTURING & COMPONENTS

Westinghouse’s factories and spare parts supplies have been consolidated in a single business unit in order to cover the following processes:

- Design, supply and replacement of nuclear components.
- Supply of spare parts.

Turnover in Spain	62 million €
% had a direct or industrial relationship with exports	50%
% of the volume of sales comes of the nuclear sector	100%
Countries of activity	12
Nuclear power plants that Westinghouse Corporate gives service	20-30 South > 300 worldwide
Westinghouse Corporate staff	8,765 employees

FUEL

Westinghouse provides nuclear fuel and all the engineering services related to operating nuclear power plants. From its factories in the United States, Sweden, United Kingdom and Japan, and its agreement with ENUSA, Westinghouse is capable of providing fuel to power plants of all commercial technologies in any country.

Furthermore, Westinghouse carries out all the necessary fuel inspection and repair services for their operation.

FIELD SERVICES & MODIFICATIONS

Regarding Outage & Maintenance services, such as reactor services, Fuel Handling or inspection, all of them are done locally in Spain. For very specialized services, our local team is supported by European or American organizations.

Also, this business unit has been unified with plant modifications including Design Modifications and its associated engineering.

INSTRUMENTATION & CONTROL

Westinghouse owns technology and instrumentation and control products for both protection and plant reactor control systems. Additionally, Westinghouse designs, supplies and installs instrumentation and control systems for the rest of the plant. The effort currently being made by plants towards digitalization of control systems is especially significant. In this respect, Westinghouse stands out as a pioneer with its Ovation platform.

DECOMMISSIONING & DECONTAMINATION (D&D)

Based on the successful experience of Westinghouse Electric Spain in Decommissioning Plans; Main Engineering; Site Remediation; Waste Storage Design: High, Medium and Low level; along with engineering support and Vessel and Internal segmentation capabilities, Westinghouse provides solutions for a wide range of Decommissioning, Dismantling, Remediation and Waste Management Projects.

More than 30 years of national and international experience endorsed the new D&D business unit being remarkable: El Cabril and Radiana Waste Repository Design, Zorita and Barsebäck Internal and Vessel segmentation, as well as Vandellós I, Oskarshamn,Chin-Shan and JEN-1 Decommissioning Plans. Currently Westinghouse is working for ENRESA as part of the main engineering for the dismantling of Garoña and Zorita Projects.

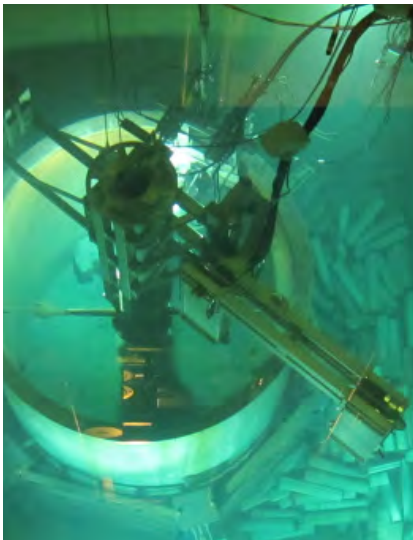


Photo courtesy of ENRESA

NEW PLANTS

Leveraging the accumulated experience gained by Initec in building Spanish plants, Westinghouse’s office in Madrid actively supports the detail engineering of the AP1000 reactor in USA.





NUCLEAR POWER PLANTS

ANAV

ANAV, Ascó & Vandellós II Nuclear Power Plants

CNAT, Almaraz I & II Nuclear Power Plants

CNAT, Trillo Nuclear Power Plant

Iberdrola, Cofrentes Nuclear Power Plant

Nuclenor, Santa María de Garoña Nuclear Power Plant

28-39

Spanish nuclear power plants operate in a continuous, reliable, safe and clean way, diving growth in their zones of influence.

Headquarters
Apartado de Correos, 48
43890 L'Hospitalet de l'Infant (Tarragona)
Tel.: +34 977 818 800
E-mail: comunicacio@anacnv.com



In 1998, as a result of a merger between the companies that independently managed the Ascó and Vandellós II nuclear power plants, an economic interest group known as Asociación Nuclear Ascó-Vandellós II (ANAV) was born. The rather similar technologies of both plants, and their relatively close locations, led their owner utilities to integrate them into a common management company.

This commitment is embodied both in the Group's investments on the Plants to guarantee their safe and long-term operation, and in direct actions on the

territory, with activities that foster economic, social and cultural development of the towns in the areas of influence of both Plants.

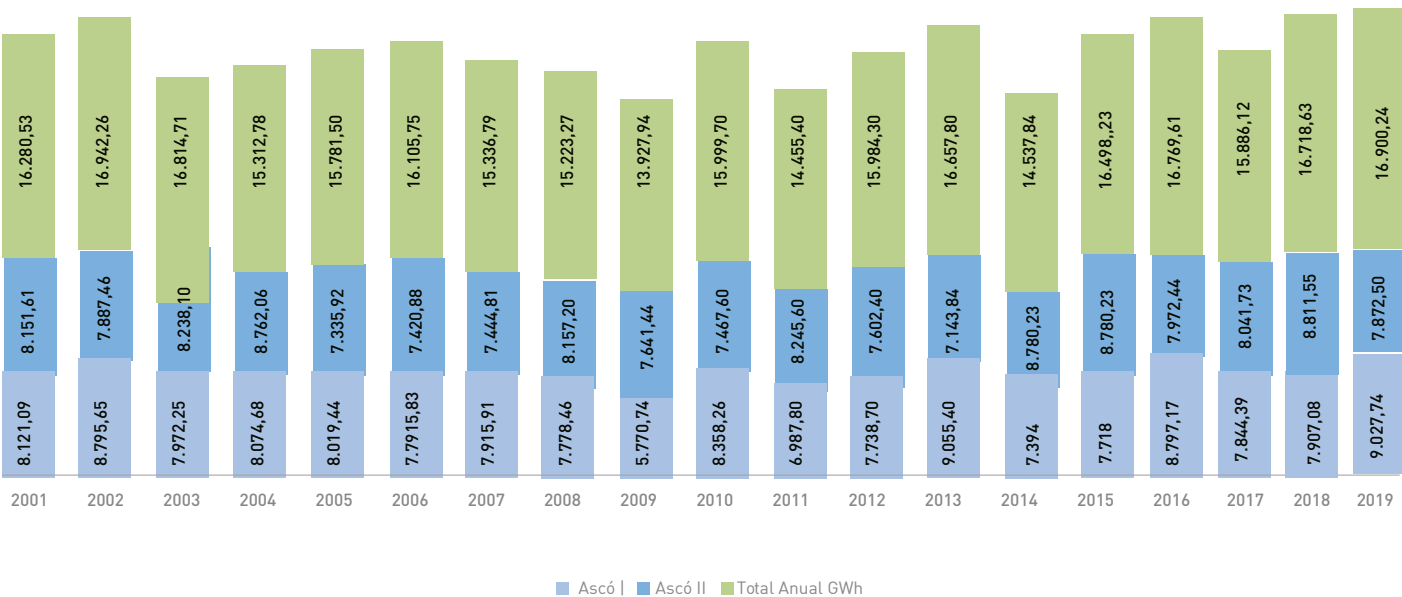
Through its day-to-day business, the staff at Ascó and Vandellós II NPPs have a fundamental role employing a total of 2,179 workers at the end of 2019 between the staff of ANAV and the stable contractor companies, which are one of the fundamental cornerstones for the safe operation of these plants. ANAV in this sense is an economic reference both in the province of Tarragona and in the whole of Catalonia.

One of the strategic communication tools that ANAV has is the Information Center. Since 2011, it has been hosting visits with the aim of giving response and, at the same time, generating new queries among all those who come with the curiosity of knowing what a nuclear power plant is and how it works. This project responds to the multiple objectives of ANAV to contribute to the approach of energy and the operation of the nuclear power plants, to generate an added value that complements the offer of the Ribera d'Ebre to attract visitors to the region and meet the existing demand to the nuclear power plant.

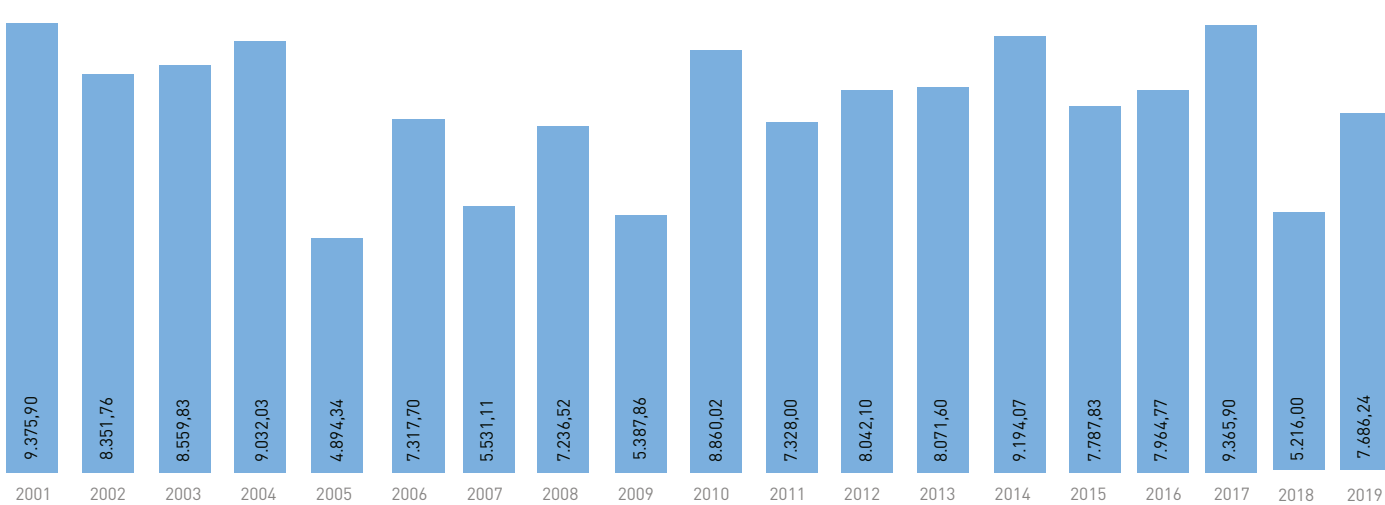
At the end of 2019, the ANAV Information Center incorporated a total of 14 elements from the visitor's center of the Santa María de Garoña nuclear power plant, including modules, information panels and other materials, with the aim of maintaining, and even improving, a fluent speech throughout the entire visit.



ASCÓ NPP GROSS ELECTRIC POWER PRODUCTION (GWh)



VANDELLÓS II NPP GROSS ELECTRIC POWER PRODUCTION (GWh)



ASCÓ NUCLEAR POWER PLANT

Ascó Nuclear Power Plant
Avda. de la Centrales, s/n
43791 Ascó (Tarragona)
Tel.: +34 977 415 000



VANDELLÓS II NUCLEAR POWER PLANT

Vandellós II Nuclear Power Plant
Apartado de correos, 27
43890 L'Hospitalet de l'Infant (Tarragona)
Tel.: +34 977 818 700



ASCÓ NUCLEAR POWER PLANT

The Ascó Nuclear Power Plant is located on the right bank of the Ebro River in the district of Ribera d'Ebre, in the municipal area of Ascó in the province of Tarragona. Its construction began in 1972 and 81% of the construction and equipment assembly work was carried out by Spanish companies.

The Ascó Nuclear Power Plant has two pressurised water reactors (PWR), the cooling water for the two units is provided by the Ebro River.

Unit I of the Plant, with a thermal power of 2,940.6 MWt and an electric output of 1,032.5 MWe, belongs to ENDESA and it initiated its commercial operation on December 10th, 1984.

Unit II, with a thermal power of 2,940.6 MWt and an electrical output of 1,027.2 MWe, is jointly owned by ENDESA (85%) and IBERDROLA (15%), and it initiated its commercial operation on March 30th, 1986.

The Ascó Nuclear Power Plant employs 4,989 people, of which approximately half are university graduates. In addition, the Plant has over 649 staff members from stable contractor companies and that during refueling periods there is an addition 900 to 1,200 workers.

ANAV has dedicated 84,381 employee hours to the training of Ascó NPP personnel with a total of 2,479 courses and 17,361 students, representing 5.2% of the hours worked.

After 34 years of operation in July 2018, Ascó reached 500,000 GWh of electricity production, a milestone achieved thanks to the professional performance of an outstanding human team.



VANDELLÓS II NUCLEAR POWER PLANT

The Vandellós II Nuclear Power Plant is located on the Mediterranean coast in the province of Tarragona, in the municipal area of Vandellòs i l'Hospitalet de l'Infant, being the only Spanish Plant that extracts the cooling water necessary for its operation from the sea.

National participation in the construction and supply of equipment for this Plant amounted to more than 89% of the total, the highest percentage achieved in Spain for this type of project.

The Plant has a Pressurized Water Reactor (PWR) with a thermal power of 2,940.6 MWt and an electrical power of 1,087.1 MWe, and is jointly owned by ENDESA (72%) and IBERDROLA (28%). The Plant launched its commercial operation on March 8th, 1988.

The Vandellós II Nuclear Power Plant houses ANAV's corporate headquarters. Between the Plant and the corporate services, the site has a workforce of

1,041 people, of which 482 are ANAV employees and 559 come from stable contractor companies. During refueling periods there is an addition 900 to 1,200 workers from around 65 local companies.

ANAV has dedicated 61,953 employee hours to the training of Vandellós II NPP personnel with a total of 2,282 courses and 14,359 students, representing 5.2% of the hours worked.

Currently, the Vandellós II Nuclear Power Plant does not have an information center on site and all visitors are sent to the ANAV Information Center at the Ascó Nuclear Power Plant, except technical or institutional visitors to the Plant.

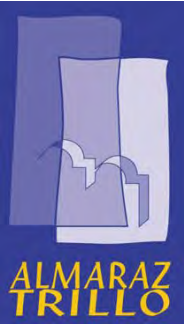
One of the challenges for next year is focused on the storage pool restructuring project, in order to expand its capacity.

Ascó Nuclear Power Plant

Reactor type	Pressurised Water Reactor (PWR)
Supplier	Westinghouse
Thermal power	2,940.6 MWt (both units)
Fuel	Enriched Uranium Dioxide (UO ₂)
Nº of fuel elements	157
Gross electrical power	1,032.5 MWe (Unit I) and 1,027.2 MWe (Unit II)
Refrigeration	Open circuit, Ebro River
Start of commercial exploitation	December 1984 (Unit I) and March 1986 (Unit II)
Date of current operating permit	02/10/2011 for a 10-year period
Duration of cycle	18 months (both units)

Vandellós II Nuclear Power Plant

Reactor type	Pressurised Water Reactor (PWR)
Supplier	Westinghouse
Thermal power	2,940.6 MWt
Fuel	Enriched Uranium Dioxide (UO ₂)
Nº of fuel elements	157
Gross electrical power	1,087.1 MWe
Refrigeration	Open circuit Mediterranean Sea
Start of commercial exploitation	March 8th 1988
Date of current operating permit	July 26th 2010
Duration of cycle	18 months



CENTRALES NUCLEARES ALMARAZ-TRILLO, A.I.E.

Headquarters
Avda. de Manoteras, 46-bis
Edificio Delta Norte 3, 5º
28050 Madrid
Tel.: +34 915 559 111



Almaraz Nuclear Power Plant
Apartado de Correos, 74
10300 Navalmoral de la Mata (Cáceres)
Tel.: +34 927 545 090



In November 1999, the companies that owned the Nuclear Power Plants of Almaraz and Trillo constituted the Economic Interest Group Almaraz-Trillo Nuclear Power Plants (**CNAT**) for the operation, management and integrated administration of the two plants, without changing their participations in the property of each one of them.

With this decision, the owner companies (Iberdrola Generacion Nuclear, Endesa Generacion, Gas Natural Fenosa Generación, Iberenergia and Nuclenor) reinforced their commitment to the safe and reliable operation of the two plants and their confidence in nuclear energy, in a diversified and environmentally free sector.

The Group has a staff over 850 employees, distributed in the headquarters in Madrid with more than 90 employees. Around 400 in CNA and around 345 in CNT.



ALMARAZ NUCLEAR POWER PLANT

The Almaraz Nuclear Power Plant is located in the village of Almaraz (province of Cáceres). The land on which the plant stands occupies a surface of 1,683 hectares. It belongs to Iberdrola Generacion Nuclear (53%), Endesa Generacion (36%) and Gas Natural Fenosa Generación (11%). Construction started in 1972 and 81% of all the construction and assembly work was carried out by Spanish companies.

The Almaraz nuclear power plant has two pressurised light water reactors (PWR) with a thermal power of 2,947 MWt each, and an electrical power of 1,049.43 MWe in Unit I and 1,044.45 MWe in Unit II.

Each reactor has a cooling circuit comprising three loops. Each loop in turn has a cooling pump and a steam generator. Both cooling circuits are contained in their respective containment areas in each reactor building.

Type of reactor	Pressurised Water Reactor (PWR)
Supplier	Westinghouse
Thermal power	2,947 MWt (U-I) - 2,947 MWt (U-II)
Fuel	Enriched Uranium Dioxide (UO ₂)
Nº of Fuel elements	157
Gross electrical power	1,049.43 MWe (U-I)-1,044.45 MWe (U-II)
Net electrical power	1,011.30 MWe (U-I)-1,005.83 MWe (U-II)
Cooling	Arrocampo dam open circuit
Start of commercial operation	September 1, 1983 (U-I). July 1, 1984 (U-II)
Date of current operating license	8/06/2010 for a period of 10 years
Duration of cycle	18 months (both units)



The steam from the generators is taken to the turbine buildings which houses the two turbogroups, in the same room, but separated. The cooling system (common for the two sites) is an open circuit from the cold spot which is the Arrocampo dam, constructed for this purpose.

Unit I started its commercial service on 1st September 1983 and Unit II did so on 1st July 1984. It is conceived to operate as a base plant, that is, with uninterrupted operation, and it is capable of guaranteeing an average annual supply of 16,000 million kWh.

The Almaraz Nuclear Power Plant provides around 7% of the national production of electrical energy. During its years of operation, the two plant units have obtained excellent results in their performance with load factor, operation and availability of more than 90% and have accumulated until december 2018 a production of 528,670 GWh. These results put the Almaraz Nuclear Power Plant among the best in the world park of nuclear power plants.

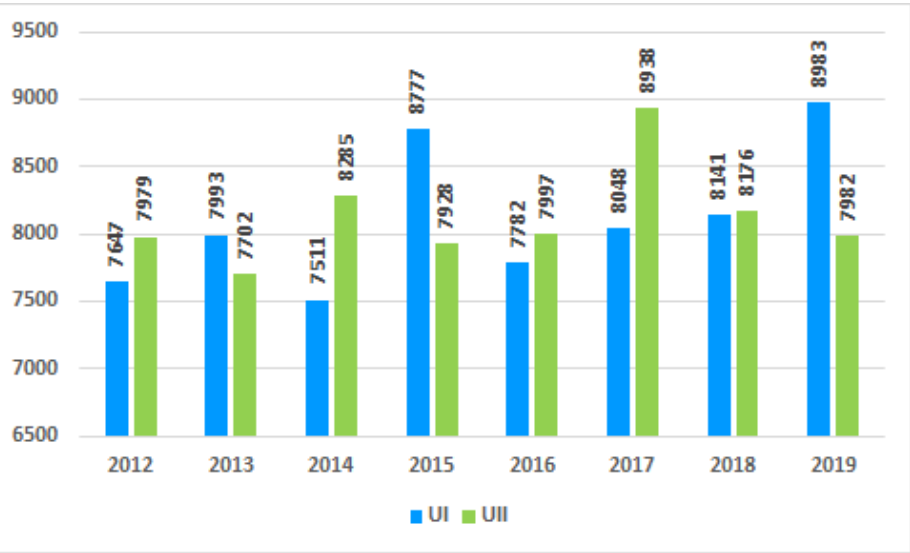
The Almaraz Nuclear Power Plant has a staff around than 400 people, of which 48% have a university degree, plus the collaboration of highly qualified personnel from contracting companies. Training is a key factor for the constant improvement of safety, quality, efficiency and competitiveness.

In order to let the public know about the reality of its activity, it has an Information Centre which started to receive visits in

February 1977, years before the plant started its operation, allowing visitors to have a more direct knowledge of what a nuclear power plant is and how it works

Since its opening the Information Centre has received more than 650,000 visitors. Most of them are students from institutes, schools and universities and mainly from the community of Extremadura.

GROSS ELECTRIC ENERGY PRODUCTION UI+UII (GWh)





CENTRALES NUCLEARES ALMARAZ-TRILLO, A.I.E.

Headquarters
Avda. de Manoteras, 46-bis
Edificio Delta Norte 3, 5º
28050 Madrid
Tel.: +34 915 559 111



Trillo Nuclear Power Plant
Apartado de Correos, 2
19450 Trillo (Guadalajara)
Tel.: +34 949 817 900

Type of reactor	Pressurised Water Reactor (PWR)
Supplier	KWU
Thermal power	3,010 MWt
Fuel	Enriched Uranium Dioxide (UO ₂)
Nº of fuel elements	177
Gross electrical power	1,066 MWe
Net electrical power	1,003 MWe
Cooling	Natural Draught Towers (River Tagus)
Start of commercial operation	August 1988
Date of current operating license	17/11/2004 for a period of 10 years
Duration of cycle	12 months



TRILLO NUCLEAR POWER PLANT

The Trillo Nuclear Power Plant is located in the village of Trillo (province of Guadalajara). The land on which the plant is built occupies a surface of 545 hectares. It is the property of the following Spanish electrical companies: Iberdrola Generación Nuclear with a participation of 48%; Gas Natural Fenosa Generación, 34.5%; Iberenergía 15.5% and Nuclenor, 2%. Construction started in 1979 and 85% of the investment made is from Spanish origin. National engineering and equipment exceeded 80% and such important areas as civil engineering and assembly were all national.

The Trillo Nuclear Power Plant has a pressurised light water reactor (PWR) with a thermal power of 3,010 MWt and an electrical power of 1,066 MWe with a cooling circuit with three loops. Each loop in turn houses a cooling pump and a steam generator. This circuit is contained in the containment area of the reactor building. The steam from the generators is taken to the turbine building. The cooling system is a closed circuit with two natural draught towers.

It started its commercial operation on 6th August 1988. It is conceived to operate as a base plant, with uninterrupted operation and guarantees an average annual supply of 8,000 million kWh and is the most modern plant in the Spanish nuclear park.



The Trillo Nuclear Power Plant has a temporary dry warehouse which stores part of the spent fuel inside metal containers which are totally hermetic and shielded. With a surface of 2,280 square meters, this warehouse is designed to house 80 containers.

During its years of operation, the plant has obtained excellent results in its operation, with load factors, operation and availability of more than 90%. It is worth mentioning that in 2003 the plant reached 9,304,908 MWh (maximum production in a cycle).

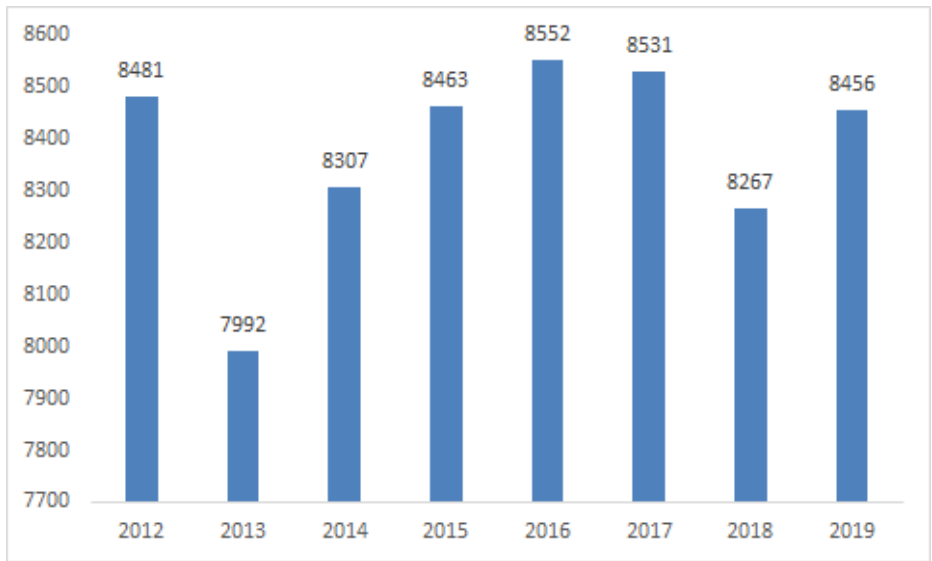
The Trillo Nuclear Power Plant has a staff of 345 people, of which more than 48% have a university degree, plus the collaboration of highly qualified personnel from contracting companies.

Training is a key factor for the constant improvement of the levels of safety, quality, efficiency and competitiveness.

The Trillo Nuclear Power Plant has an Information Centre which started to receive visits in November 1981, years before the plant started to operate, allowing the visitors to have a more direct knowledge of what a nuclear power plant is and how it works

Since it was opened the Information Centre has received 360,000 people. Most of them are students from institutes, colleges and universities, mainly from the Autonomous Communities of Madrid and Castilla La Mancha.

GROSS ELECTRIC ENERGY PRODUCTION (GWh)





COFRENTES NUCLEAR POWER PLANT

Iberdrola Nuclear Generation
C/ Tomás Redondo, 1
28033 Madrid
Tel.: +34 915 776 500



Nuclear Power Plant
46625 Cofrentes (Valencia)
Tel.: +34 961 894 300
E-mail: cncofrentes@iberdrola.es

Cofrentes nuclear power plant is owned by the utility Iberdrola Generación Nuclear, S.A.U.

Cofrentes NPP is located in the municipality of Cofrentes (province of Valencia), upstream of the former Embarcaderos reservoir, on the right bank of the Júcar River.

The plant has a nuclear system for steam generation comprised of a light-water boiling water reactor (type BWR/6) supplied by the USA corporation General Electric Company, with a thermal power of 3,237 MWt and an electric power of 1,092 MWe. Plant cooling is ensured by a closed-loop circuit, including two natural-draught cooling towers.

The operating cycle is as follows:

The construction permit was granted in 1975, being connected for the first time to the grid in October 1984. In 2019, the station had operated for 35 years, with an accumulated generation since commissioning until December 31, 2019 of 280,048 million kWh.

Cofrentes nuclear power plant is currently one of the main power generation facilities in Spain, contributing in 2019 some 3.2% of power within the regular energy production framework. In the Valencia Region, where the station is located, it supplies 34% of all power demand.

In addition to being a key power generation center in the country, Cofrentes is actively committed to the development of its social environment. In this regard, it is important to note that an average of 5,000 visitors yearly, including training centers and various associations, have passed through the Station's Information Center.

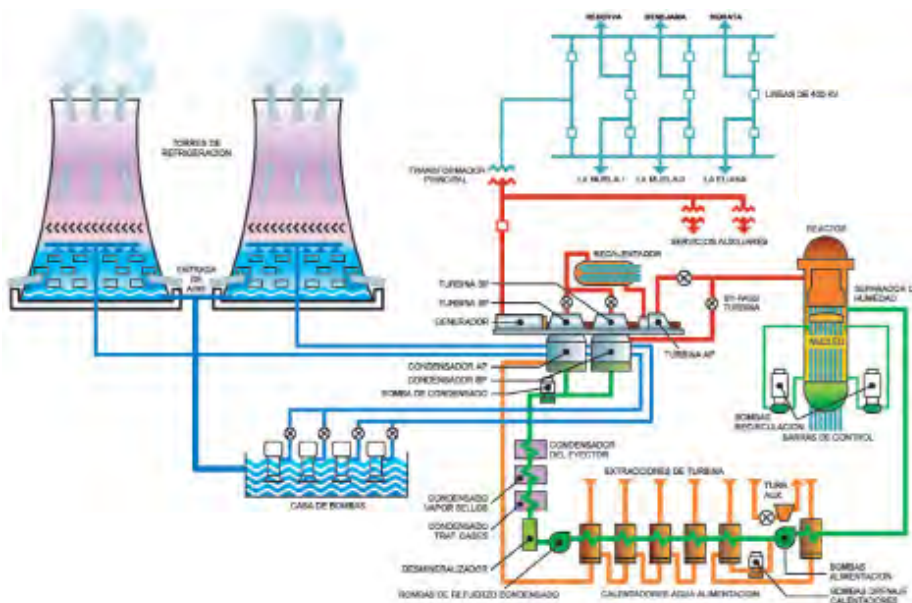
In terms of environmental contribution, the ongoing operation of Cofrentes nuclear power plant throughout the year saves the country the need to import some 14 million oil barrels annually and prevents the release of about 6.5 million Tn of CO₂ into the atmosphere.

In 2019, Cofrentes nuclear power plant generated a total of 8,387GWh, with the electrical generator coupled to the grid for 7,854 hours out of a possible 8,760 in the year, achieving an availability factor of 96.3%.

As a highlighted fact, note that in 2019 the 22nd scheduled refueling was carried out, between November 3 and December 6, with a final duration of 34 days in which more than 11,000 scheduled jobs and 40 design modifications were completed. At the work level, the refueling meant the incorporation of 1,200 people temporarily, added to the nearly 800 who work permanently at the plant.

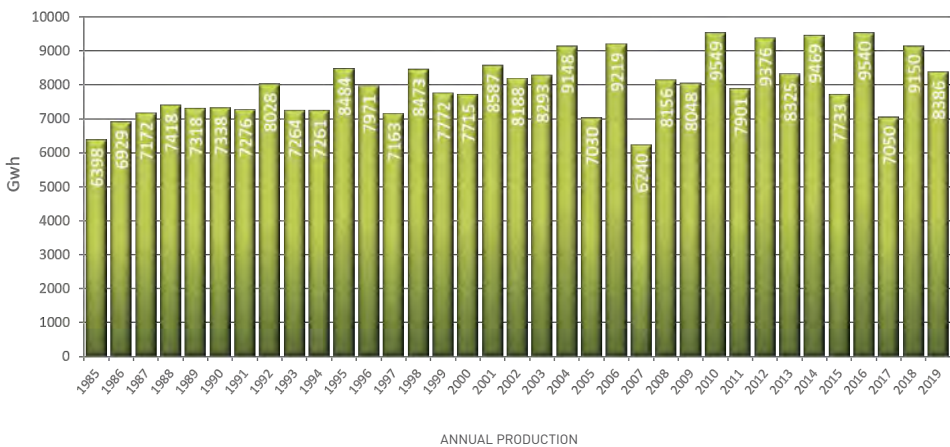
Furthermore, in late 2019 Cofrentes NPP had accumulated a period of over 10 years with no automatic scram, positioning itself as a top operational reliability station.

The existing Station Management Plan, in place until 2024, is intended to facilitate action implementation, especially in vital plant performance areas.



Reactor type	Boiling Water Reactor (BWR)
Vendor	General Electric
Thermal power	3,237 MWt
Fuel	Enriched Uranium Dioxide (UO ₂)
Number of fuel assemblies	624
Electric power	1,092 MWe
Cooling	Closed-loop circuit with natural-draught cooling towers
First electrical network connection	October 1984
Start of commercial operation	March 1985
Date of last Operating Permit	Since 19th March 2011 for a period of 10 years
Cycle duration	24 months

GROSS ELECTRIC ENERGY PRODUCTION (GWh)



This Plan currently includes 69 projects allocated to the areas of excellence and operational safety; technological update and reliability; radiation protection; major emergency management; organizational development and human resources; evaluation and ongoing improvement; and communication.

In short, all actions resulting from the Management Plan are aimed at reaching effectiveness and efficiency, prioritizing safety as an overriding priority in all business activities to ensure protection of both people and the Environment.

The key elements comprising the Management Plan are people, the organization and the facilities. Their constant interaction is paramount to reach the set objectives.

The station currently has an Alternative Emergency Management Center (Spanish acronym: CAGE); a Safe Seismic Storage Area for portable equipment; Passive Autocatalytic Recombiners (PAR) in the Containment and Drywell; a new seismic fire protection system and the filtered containment ventilation system.



Filtered containment ventilation at Cofrentes NPP.



Photo provided by Cofrentes NPP.

SANTA MARÍA DE GAROÑA NUCLEAR POWER PLANT

Nuclear Power Plant
09212 Santa María de Garoña (Burgos)
Tel.: +34 947 349 400
E-mail: secre.cnsg@nuculenor.es



The **Santa Maria de Garoña Nuclear Power Plant** is located in the province of Burgos, on the right-hand bank of a curve in the river Ebro near the village of the same name in the Tobalina Valley at the upstream end of the Sobrón reservoir. It is owned and run by NUCLENOR, S.A. (50% Iberdrola and 50% Endesa). Founded in 1957, it was pioneer in Spain in the use of nuclear energy for the generation of electricity. The plant has not produced electricity since 16th December 2012.

As a result of the decisions reached by Ministry for Industry, Energy and Tourism (IET) Order/1302/2013, of July 5, which stipulates the definitive cessation of operation of the Santa María de Garoña Nuclear Power Plant, and Ministry for Energy, Tourism and Digital Agenda (ETU) Order/754/2017, of August 1, which rejects the Operating Licence Renewal Request (SRAE), on August 3, 2017, and under the management of Spain’s National Radioactive Waste Management Company (ENRESA), the Santa María de Garoña Nuclear Power Plant began its phase of transition or pre-dismantling period, which saw it implement activities in preparation for its eventual decommissioning.

According to the projections of the 4th General Radioactive Waste Plan, and as per that established in article 28.2 of the Regulations Governing Nuclear and Radioactive Installations (RINR), the Plant’s activities during this period are focused on the transfer of ownership to ENRESA in a safe and efficient manner.

The singular nature of the closure of the Santa María de Garoña Nuclear Power Plant has led to ENRESA proposing a decommissioning process to be carried out over two phases, thereby ensuring its efficiency and enabling the experience of the Plant’s workforce to be put to optimum use. Phase 1 will last for as long as it takes to remove the fuel rods stored in the spent fuel pool and move them to the Temporary Individualised Store (ATI) and to disassemble the equipment housed in the turbine building. Once the spent fuel pool has been emptied and all the fuel stored in the containers located in the ATI, phase 2 will consist of the entire dismantlement of the plant.



Reactor type	Boiling Water Reactor (BWR)
Supplier	General Electric
Thermal power	1,381 MWt
Fuel	Enriched Uranium Dioxide (UO ₂)
Nº of fuel elements	400
Electrical power	466 MWe
Cooling	Open circuit, Ebro river
Start of comercial operation	March 1971
Duration of cycle	24 months



During 2019, the plant kept all the fuel stored in the reactor building pool, where it will be maintained in safe conditions until it is transferred to the ATI.

Nuculenor’s main priority in this phase of transition to decommissioning has been the safe operation and maintenance of the spent fuel and radwaste without operating incidents or industrial accidents and rigorous compliance with the standards and requisites established by the Spanish Regulator (CSN). Especially important in this phase is the dedication to the training and maintenance of the organisational capacities required for the new situation of the plant.

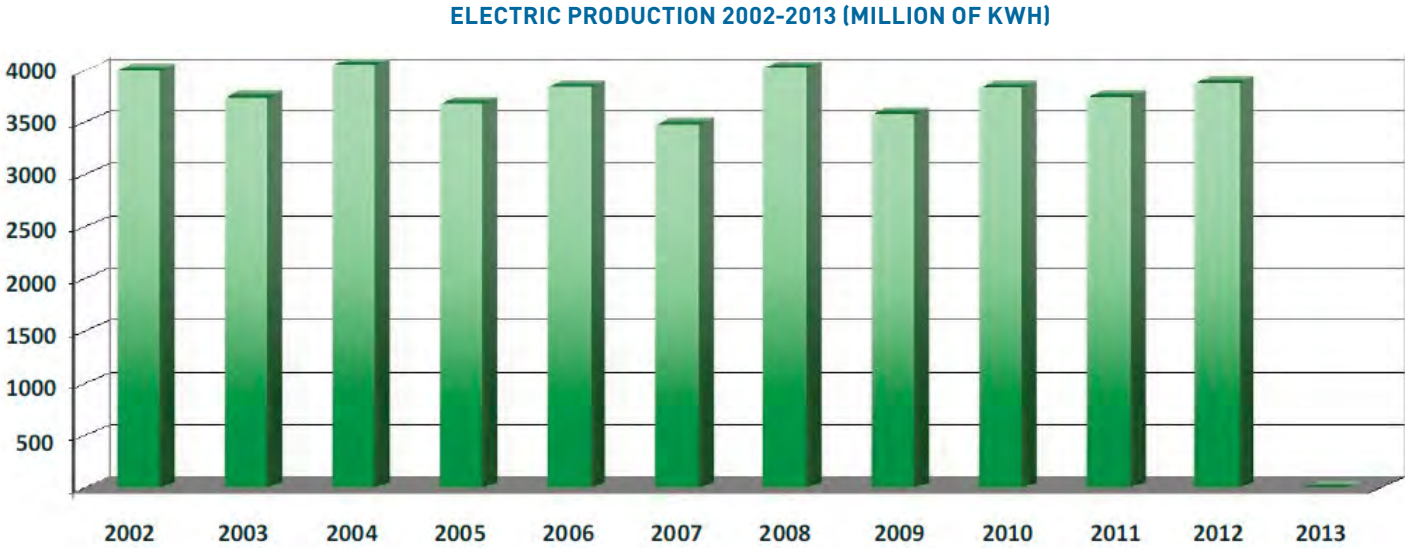
2019 saw the plant’s workforce involved in certain projects implemented in accordance with the new transition phase, always in close collaboration with ENRESA:

- The conditioning of the medium and low activity operational waste, which was completed in April 2019, and processing the last residual materials pending, both typified and non-typified. By said date, all the operational waste had either been conditioned or the associated management method had been defined together with ENRESA.
- The reconfiguration of the spent fuel pool cooling systems, the objective of which is the global optimisation of the Plant’s systems after more than 6 years cooling the irradiated fuel by maintaining the required safety functions with the following objectives: focusing monitoring on the important safety systems, reducing risks, facilitating the pre-decommissioning activities and adapting the Plant to international standards. In 2019 the CSN continued with its assessment of the modification proposals contained in the Official Stoppage Documents (DOPs) of this project.
- Management of the spent fuel, preparing the Temporary Individualised Store (ATI) in which the containers to be supplied by ENRESA will be housed to await the removal of all the fuel elements stored in the spent fuel pool, and preparing the refuelling floor and the spent fuel pool for the loading and moving of the containers when they arrive at the Plant. During the year, the Plant worked with ENRESA on the drafting of the Spent Fuel Management Plan (PGCG) Rev2 of December 2019, which defines the main aspects of the Plant’s fuel management procedure.

- Collaborating in the drafting of the Decommissioning Authorisation Application for phase 1, which was initiated by ENRESA in June 2019.

- Radiological characterisation of the turbine building. An activity requested by ENRESA for developing the safety studies for phase 1 of decommissioning. This involves evaluating the radiological impact of the works to be undertaken in this building (waste, dose to which the workforce is exposed, etc.). In 2019 the Plant worked with ENRESA on defining the scope of these activities, which involved the taking of measurements and samples in the field and sending these to the corresponding laboratories for analysis.
- Preparation for the decommissioning of the Plant, which involves collaborating with ENRESA in the specification, planning and development of other activities such as the physical inventory of structures, systems and components to be removed during decommissioning, the development of 3D models, the removal and disposal of all pipework and equipment that might contain asbestos, the preparation of warehouses for storing the waste generated by the decommissioning process, and the decontamination of equipment and systems to reduce the dose to which those involved in the works are exposed.

The site renewed its environmental certification (UNE-EN-ISO 14001:2015) in 2019.





FUEL

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ENUSA Industrias Avanzadas, S.A., S.M.E.

42-43

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A Spanish company is responsible for all stages of the nuclear fuel production process, from the delivery of raw materials, through to their processing and manufacturing.



ENUSA INDUSTRIAS AVANZADAS S.A., S.M.E.

Headquarters
C/ Santiago Rusiñol, 12
28040 Madrid
Tel.: +34 913 474 200
E-mail: relin@enusa.es

Juzbado Fuel Assembly Factory
Road Salamanca-Ledesma, km 26
37115 Juzbado (Salamanca)



Saelices el Chico Center
Crt.a. Ciudad Rodrigo a Lumbrales, km 7
37592 Saelices el Chico (Salamanca)

ENUSA Industrias Avanzadas, S.A., S.M.E. (ENUSA) was founded in 1972 as the National Uranium Company. It was part of an initiative that intended to strengthen the importance of the nuclear component in Spain's energy development. Today ENUSA is a public Enterprise 60% owned by the Sociedad Estatal de Participaciones Industriales (SEPI), and the remaining 40% by the Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (CIEMAT). **ENUSA is the parent company of the ENUSA Group, jointly with Express Truck, S.A.U., S.M.E. (ETSA) and Residuos Industriales S.A., S.M.E., M.P. (Emgisa),** focuses its activities in the nuclear fuel cycle and develops environmental services.

BUSINESS OBJECTIVE

ENUSA's business goal is to endeavor to improve its competitiveness, maintain the safety and quality of current production as well as the received recognition from regulators, institutions and clients, and contribute to the socioeconomic development of the communities where it operates.

ACTIVITIES AND REFERENCES

The nuclear business focuses on activities of the nuclear fuel cycle that are marketed both nationally and internationally and which services consists of:

- Management of the enriched uranium supply to the Spanish nuclear power plants under the criteria of security and flexibility.
- Engineering in all technical aspects of the lifetime of the nuclear fuel, from design and operation in the nuclear power plant up to his tenure as irradiated fuel for transport and dry storage.



- Manufacturing and fuel assemblies to national and foreign nuclear power plants for:

- Pressurized water reactors (PWR), under Westinghouse license.
- Boiling water reactors (BWR) under General Electric license.
- Pressurized water reactors (VVER), in collaboration with Westinghouse.

- Coordination the handling, inspection and repair campaigns that take place during the refueling programs, providing fresh fuel reception and irradiated fuel handling services and supervising the process during the reload (inspection, repair, characterization and cleaning)

- Transport of nuclear and radioactive materials through the subsidiary ETSA.

As part of the nuclear activities, we also develop technological capabilities for the second stage of the fuel cycle and the sale of fresh and irradiated fuel manufacturing and inspection equipment. The subsidiary Emgrisa is environmental Brand of the ENUSA Group and offers a wide range of services aimed at preserving the environment and ensuring an efficient use of energy.

- **Waste treat and management all kinds of (waste):**

- **Hazardous and non-hazardous industrial waste.** Collection, transport and management of hazardous and non-hazardous industrial waste, prioritizing waste reuse and recovery.

- **Municipal Solid Waste.** Design, construction and operation of MSW recovery facilities with biodrying and accelerated oxidation technology using airflow. Odour free system and no contact with the waste.

- **Agricultural, Livestock and Agro-industrial Waste.** Plants design for agronomic valorization of digestate and energy (biogas).

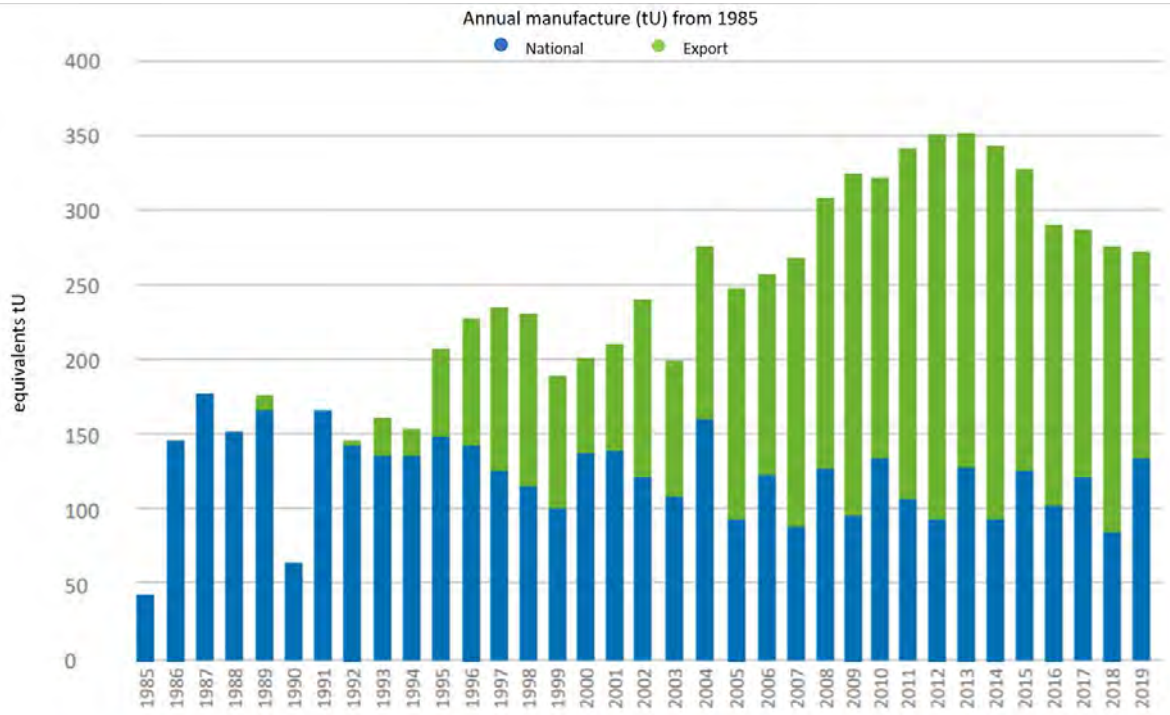
- **Characterization and treatment of contaminated soils and groundwater.** Performance of all kinds of environmental site assessment on soil and groundwater contamination.

- **Radiological studies**

- **Engineering and environmental consultancy.**

Turnover	291 million €
% from fuel sales that go to R&D projects	5% (7 million €)
Staff number average	646 employees

Manufacturing cumulative form 1985 to 2018	PWR	BWR	TOTAL		
	Total	Total	National	Exportation	Total
tU	6,004	1,909	4,150	3,763	7,913
EECC (units)	13,125	10,701	11,629	12,197	23,826



As a complement to these activities, the environmental area supervises the reclamation of former uranium mining facilities in Saelices el Chico and La Haba, the purpose of which is to try to restore the affected natural space to its original state, with environmental and radiological conditions as similar as possible to those existing before the mining operations.

Currently ENUSA has three work centers. Two of them are industrial sites: a fuel assembly factory in Juzbado, and a center in Saelices el Chico (Ciudad Rodrigo). Both of these are in the province of Salamanca. The corporate headquarters are in Madrid. ENUSA also manages a biogas plant in Juzbado and a solid urban waste plant in Cervera del Maestre (Castellon).

Since 1985, the Juzbado factory manufactures uranium pellets, assembles fuel elements and develops equipment for the manufacture and inspection of elements for PWR and BWR.

In 2019, ENUSA Industrias Avanzadas, S.A. supplied a total of 273.69 tonnes of uranium (tU) at different enrichment levels to the Spanish nuclear power plants Trillo, Almaraz I, Ascó I y Ascó II, and Cofrentes, which is equivalent to 1,851 tonnes of uranium concentrates (U₃O₈), 1,562 tonnes of natural uranium as UF₆, and 1,313 thousand TSU (technical separation units, measure of the energy consumed in the separation of uranium in two parts, one enriched

and one impoverished in the fissile isotope uranium-235. The number of UTS is proportional to the level of enrichment required).

The fuel assembly factory manufactured 276.35 tU, 51% of which were exported to France, Belgium and Finland.

In all, 615 fuel assemblies were assembled, 505 for PWR and 110 for BWR.





EQUIPMENT GOODS

Equipos Nucleares, S.A., S.M.E.
Ringo Válvulas, S.L.

46-49

Equipment goods manufacturing companies
export more than 80% of their output.



EQUIPOS NUCLEARES, S.A., S.M.E. (Ensa)

Avda. Juan Carlos I, 8
39600 Maliaño (Cantabria)
Tel.: +34 942 200 101
E-mail: direcc.general@ensa.es



Equipos Nucleares, S.A, S.M.E. **(Ensa)** was established on 10th July 1973 with the immediate purpose of meeting the demands of the Spanish civil nuclear manufacturing of large components. The construction of the facility, located in Maliaño (Cantabria), south of the bay of Santander and very close to the city, was performed during 1975 and 1976, when the manufacturing operations of the first equipment for the Spanish market started.

Especially conceived and designed for the civil nuclear industry, Ensa got its first ASME nuclear certification in 1978 delivering the first component, the reactor vessel for Valdecaballeros Nuclear Power Plant, in 1981.



In 1980, after the creation of the Business Development & Field Services department, Ensa started performing works at the nuclear power plants such as installation, commissioning, fuel management, plant maintenance, decontamination and dismantling. Since 1986 Ensa has a majority ownership of ENWESA, a company mainly dedicated to provide services at nuclear power plants.

Since its beginning, Ensa has had the appropriate infrastructure, technology and human resources necessary to meet the highest standards in the areas of engineering, design, procurement, quality assurance, manufacturing, inspection and services. Ensa facility includes a workshop capable of manufacturing the biggest nuclear components and an Advanced Technology Centre for the development and qualification of innovative manufacturing and inspection techniques, which include accredited laboratories that can supply services both to Ensa and to external customers.

Known in the nuclear industry as a preferred manufacturer for the high quality of its products and the high technology of its manufacturing processes, Ensa fabrication specializes in components such as reactor vessels including internals, supports and cover heads, steam generators, primary circuit pipings, pressurizers, heat exchangers, fuel elements bundle heads, used fuel casks for storage and transport and fuel racks for both new and used fuel and components for the ITER project (International Thermonuclear Experimental Reactor).

Since its inception, Ensa has provided, following recognized international standards and meeting the most

equipment operating with the required security in nuclear plants of multiple and varied designs located throughout the world. This has made Ensa a distinguished multisystem capable manufacturer, able to successfully provide the most demanding nuclear components based on continuous research and development of new and competitive manufacturing technologies for each of the different nuclear designs in the market.

The company has its operations center and its headquarters in Maliaño, Cantabria. It belongs to the SEPI Group, a business holding that owns directly or in majority a total of 15 public companies, with more than 74,000 professionals. It also has a tutelage public foundation and direct minority shareholdings in other nine companies and indirect in more than one hundred societies.

ENSA’S INTERNATIONALIZATION

With the technology and quality as the main pillars of the company, the successful orientation to the international market started in the late eighties and now accounts for over 90% of the manufacturing equipment and over 25% of the service provided to plants. Ensa is involved in demanding markets such as French, U.S., Belgium, Japan, Chinese, Taiwan, Slovakia, English, etc. Currently, all major equipment portfolio and equipment being manufactured in Ensa have a destination for the international market.

Focusing only on the NSSS (Nuclear Steam Supply System) components, only three of the thirty-seven major components manufactured by Ensa until 1986 were made for the international market, a percentage lower than 10%. However, this situation changed significantly in the late

Turnover (2019)	73.27 million €
Exports	57% of sales
Average Staff (2019)	445 employees Ensa + 240 employees Enwesa
Specialized operators	48% and 49% engineers and technicians
Average age	43 years (Ensa + Enwesa)



eighties beginning a rapid increase in exports. Twenty-six large equipment were exported between 1988 and 1995. Although the Spanish market demand, a priority for Ensa, restarted in the mid-nineties due to the need of replacement of components in power plants in operation, only three components of a total of eighty-eight have been provided to this market since 1997. This means that the internationalization has represented about 96% of the portfolio of Ensa since 1997.

Within the line of Fuel Management, Ensa has also provided transport and storage casks for fresh and used fuel to countries like China, Japan and the U.S.A. as well as storage racks for fuel pools in Korea, Germany, South Africa, Taiwan, Finland and China. For both casks and racks the enterprise offers competitive designs in which have been incorporated lessons learned as an experienced manufacturer and operator of this equipment such as the ENUN 32P, ENUN 52B y ENUN 24P.

Ensa has maintained a constant activity in other areas such as design and services which have had also a strong internationalization. Examples of this internationalization include the outstanding participation of Ensa in the South African project PBMR (Pebble Bed Modular

Reactor), participation in IRIS (International Reactor Innovative and Secure), ITER project and provision of services in NPPs in countries such as China, Bulgaria, France and Finland.

Another important market line is the dismantling of national and international nuclear power plants. It’s important to highlight the works carried out at José Cabrera (Guadalajara), Kozloduy (Bulgaria) plants.

Throughout its history, the nuclear activity in Ensa has also been reconciled with the manufacture of components for research institutes (CERN, UKAEA, EPRI, Max Plank etc.) and institutions (ITER, NASA, EURATOM), and the manufacture of offshore oil platforms, support services to other firms and the manufacture of pressure components for the chemical and petrochemical industry.

HUMAN TEAM AND COMPANY KEY FIGURES

Ensa holds ASME accreditations (N, NPT, NA, N3 and NS, S, U, U2 y U3 stamps), ISO 9001, ISO14001, ISO/IEC 27001, UNE 166002 and OSHAS 18001, TÜV DIN, TÜV AD 2000-Merkblatt. Ensa holds as well ENAC ISO / IEC accreditations for its metrology’s laboratory and its destructive test located in the Advanced Technology Centre.

Ensa’s competitiveness is based on its highly qualified and competent staff and their culture and passion for improvement, safety, quality, innovation and research and technological development.

The current order includes the supply of equipment and services to countries like France, USA, Finland, China, South Korea, United Kingdom, Brazil and Spain.





RINGO VÁLVULAS, S.L.

Polígono Industrial Empresarium
C/ Romero, 6
50720 Zaragoza
Tel.: +34 976 454 940
E-mail: ringo@ringospain.com



Ringo Válvulas S.L (RV) was founded in 2000 with the aim of manufacturing high performance valves of all types along with operational spares for use in the nuclear industry. Thanks to a team of persons with over 35 years of experience in valve manufacturing for the nuclear industry, RV currently has over 90% market share for the Spanish nuclear power plants, along with numerous contracts to supply to more than 45 plants in 20 different countries: Spain, Sweden, Finland, Switzerland, Belgium, United Kingdom, Russia, Belarus, Bulgaria, Slovakia, Slovenia, Ukraine, Rumania, South Africa, China, India, Mexico, Argentina, Brazil and Canada.

BUSINESS OBJECTIVE

The business objective of RV has, and continues to be, to cover the demand of the Spanish nuclear industry for valves and spares, guaranteeing equipment supply and providing high levels of quality and reliability. RV is equipped with modern facilities adapted to the manufacturing needs of the Spanish nuclear market, and is capable offering a rapid and satisfactory response to its clients' demands.



Thanks to good supply experience and excellent technical references, RV has been able to access the nuclear valve export market, this having increased its backing and commitment to the nuclear sector and leading the company to consolidate a professional team with wide experience on the nuclear market.

The RV plant is a modern facility with the latest technology available for all manufacturing activities. Plant is located in the Empresarium industrial estate in Zaragoza's most modern and logistically best located industrial zone. Production facility has a manufacturing area of 12,000 m² and office space of 2,500 m².

SERVICES, PRODUCTS AND TECHNOLOGY AVAILABLE

RV manufactures all types of valves for the nuclear industry, both nuclear and non-nuclear class. Applicable design codes are ASME III, NB, NC and ND, AD-Mekblatter and RCC-M.

Ringo portfolio includes:

- Gate valves: both manual, motor-operated and pneumatic.
- Globe valves for on/off services and regulation.
- Control valves.
- Check valves, including testable and assisted valves.
- Butterfly valves for applications such as containment and control room isolation.
- Diaphragm valves.
- Bellow seal type zero leakage valves.
- Ball valves, including top entry and in-line removable types.

RV also supplies operational spares for maintenance activities during refueling outages. One of the company's most significant services offered to the NPPs is the performance of special calculations and tests for the qualification of designs, in collaboration with TECNATOM, S.A., and the dedication of conventional valves for use at nuclear power plants.

RV has a Quality system in accordance with ISO-9001-2015 and it is homologated in accordance with the European Pressure Vessels Directive 2014/ 68/ UE for the manufacturing of valves and related spares. On the other hand, RV is a company qualified as ASME III N & NPT stamps holder, that allows RV to supply nuclear valves for the plants in USA and even has been recently approved by ASME as Material Organization.

Besides the main target of assuring the quality of its products, RV is fully committed to the environment, safety and corporate responsibility so, in order to fulfill all these aims, RV has an environmental program certified according to ISO 14001, a safety system qualified to the OSHAS 18001 and a corporate responsibility program certified as per SA8000.



Turnover average	46 million €
% of sales related to nuclear products	32%
% of sales related to nuclear products in the Spanish market	45%
Staff	120 employees
Graduates and highly qualified technical staff	60%
Specialist operators	25%
Administrative personnel	15%



RV is approved for some of the most relevant plant designers such as Westinghouse, Siemens, Areva, GE Hitachi, KHNP-Kepco, NIAEP-JSC Atomenergoproekt or NIAEP-JSC Atomenergoyexport. On the other hand, RV is also approved by the following end users: Grupo de Propietarios de Centrales Nucleares Españolas, Comisión Federal de Electricidad (Méjico), NASA (Argentina), Electrobras (Brasil), Grupo de Propietarios de Centrales Nucleares Suecas, NOK (Suiza), Electrabel (Belgica), Fortum (Finlandia), Comision Nuclear de Rumania, Rosenergoatom (Rusia), RUE Belarrussian (Bielorrusia), TAEK (Turquía), NPC (India), CNNC (China) and KHNP in South Korea.

RV has the most advanced design software in both 2D and 3D, allowing calculation in all areas, mechanical, fluid and dynamic noise, ensuring the adequacy of the valves. This is very important, especially in control valve applications for critical services.

ACTIVITIES AND REFERENCES

Through 2019, Ringo Válvulas has consolidated its position in the Spanish Nuclear Market, completing the supply of all kind of valves and spare parts to all the active Spanish nuclear plants to keep the level of sales of the previous years.

Concerning the international market, Ringo Válvulas has kept its presence in the markets where has been already succeeding during the last years such as Belgium (with supplies to Doel NPP and Thiange NPP) and the Nordic countries (Forsmark, Ringhals and Oskarshamn in Sweden as well as Olkiluoto in Finland). On the other hand, Ringo has continued its expansion to new markets: for instance, RV has supplied a contract for Energoatom in Ukraine, for the plants of Khmel'nitskaya and Rivne III as well as another important order of butterfly and check valves for the MPC cooling system for the Sizewell NPP in United Kingdom.

Furthermore, RV is currently holding a contract for the manufacturing of N-stamp bellow sealed globe valves according to ASME III for the Pickering NPP in Canada.

Once again, one of the key market in terms of volume during 2019 has been the Russian one (Rosatom), where Ringo continues consolidating its sales with new contracts in Rusia, for instance for Kursk NPP, but also in third countries such as India where RV has successfully completed the supply of several contracts including manual and fast acting gate valves, globe control and balls valves for Kudamkulam NPP, in Bangladesh (Roopur NPP) or Turkey (Akuyu NPP), as RV is manufacturing several relevant contracts for these two plants.

All the achievements stated above are based on the Ringo philosophy, absolutely oriented to the design and manufacturing of the products in fully accordance with the requirements of codes and client specifications of each particular project. For that purpose, Ringo Válvulas has specific training programs for its staff, with special focus on nuclear safety culture, where the proper working procedures are established and personnel is motivated to be totally committed to that culture.





ENGINEERING AND SERVICES

Amphos 21
CEN Solutions
Centro Tecnológico CTC
Coapsa Control S.L.
Empresarios Agrupados
Enwesa
Equimodal
GD Energy Services
Geotecnia y Cimientos, S.A.
Grupo Eulen
IDOM Consulting, Engineering, Architecture, S.A.U.
Newtesol, S.L.U.
Nusim, S.A.
Proinsa, S.A.U.
Taim Weser, S.A.
Tecnatom, S.A.
VIRLAB, Expertise in Vibrations and shocks. Testing Laboratory

52-85

The Spanish engineering and services companies have and continue to be engaged in nuclear projects across more than 40 countries.

Amphos 21 Consulting S.L.
C/ Venezuela, 103, 2º
E-08019 Barcelona
Tel.: + 34 935 830 500
E-mail: amphos21@amphos21.com

Amphos 21 Consulting S.L.
Paseo de la Castellama, 40, 8º
28046 Madrid
Tel.: + 34 620 634 729



Amphos 21 is a group offering an environmental consulting scientific, technical and strategic consulting services in 5 main activity areas:

- Nuclear
- Mining
- Water
- Sustainability
- Oil and Gas

We develop nuclear activities since our inception in 1994. Our team is recognised at an international level in radioactive waste management. From our headquarters, we work for clients in the entire world, mainly for agencies implementers and regulators of radioactive waste issues, the European Commission, as well as for private clients needing assessment on issues related with the uranium cycle, such as legacy wastes and soils affected by the presence of radioactive materials.

Our activities are organized around three main axis:

- Consulting
- R+D+i
- Advanced modelling solutions

Which we apply to provide the best solutions to the following issues:

- High, Intermediate and Low level radioactive wastes.
- Radioactive waste repository performance assessment and siting.
- Environmental and radiological impact of radioactive waste storage and disposal facilities.
- Water, sites and soils affected by the presence of radioactivity.

Our distinctive trends as organization are based on:

- A highly qualified team, used to face complex technical and scientific challenges to help our clients find the best solutions.



- Highly skilled in-house conceptual and numerical capabilities.
- Innovative solutions, which we present in international conferences and publish in international scientific and technical journals.
- Our imbrication with Universities and Research Institutions Worldwide, which puts us in a unique position to find and develop the best solutions for every case. There is a constant pool of Ph.D students and engineers advised by our senior staff.
- Our international character. Most of our activities in Nuclear are developed outside the Spanish borders (a 95% in 2016).

CERTIFICATIONS:

- Amphos 21 is certified according on international standards ISO9001 and ISO14001 and European Regulation EMAS.
- Amphos 21 is a company certified by the French Ministry of Education and Research (MENESR) as R+D developer (CIR).
- Amphos 21 is the 1st COMSOL certifie consulting in geosciences.

Founded in	1994
Annual revenue	11 million €
% of international activity	60% of international activity; 95% in nuclear sector
4 offices in 4 countries	Spain (1994); Chile (2009); Perú and France (2012)
Total staff	150 employees
% senior graduates	95%
% Ph.D. in science or engineering	30%

DEVELOPMENTS 2019

Throughout the year 2019, we have developed more than 100 projects. We provided services to our long-term clients, as well as, to the recently-incorporated clients by developing projects in Spain, Sweden, France, Finland, Belgium, Germany, the United Kingdom, Japan and South Korea. Below, we detail some of the activities of 2019 that we consider the most remarkable given their innovative contribution within the nuclear sector.

Within the framework program that we signed with the Swedish radioactive waste management agency (SKB), we have carried out numerous activities for the future repository of long-lived low and intermediate radioactive waste (SFL repository). We can highlight our studies on the robustness of the underground repository structure, which were informed by performing advanced numerical modelling exercises. We calculated the geochemical stability of the engineered barriers, simulated underground water flow, developed a multiphase flow to evaluate the impact of hydrogen gas formation and transport within the repository. The geochemical models were set up to predict the transport of radionuclides and chemical degradation of materials. Amphos21 assisted SKB in issues associated with the license application for the final repository for short-lived radioactive waste (SFR repository). In 2018, SKB received different queries from the Swedish regulatory authorities and Amphos21 is helping to adequately tackle concerns that are critical for the sustainability of the country's energy industry.

Within our framework agreement with ANDRA, the French radioactive waste management agency, the activities have continued as planned, through the development of both, experimental studies and numerical simulations. The projects have addressed problems related to the migration of radionuclides, the geochemical activity of saline media, chemical stability of engineered and natural barriers at high temperatures, and chemical-mechanical interactions between repository materials. The results of these studies contribute to the repository design as a long-term safe facility.

Amphos21 maintains regular employee trainings to promote R&D activities and improve overall team performance. During 2019, employees attended multiple international trainings that helped them to earn specific knowledge and enhance already acquired skills. We have extensive

experience in supervising thesis programs. Currently, 3 doctoral dissertations are underway in Amphos21. By the end of 2019, our team produced 14 scientific manuscripts that were published in highly-ranked international journals.

Along with our continuous scientific development, we produce new software products and provide their quality assurance. We would like to highlight that in 2019 we significantly contributed to the development and maintenance of the radionuclide transport code (MARFA) within the framework of our collaboration with the Swedish (SKB) and Finnish radioactive waste management agencies (POSIVA).

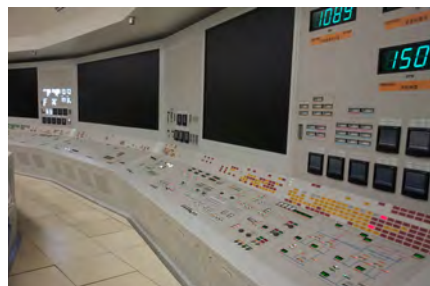
One remarkable fact in 2019 is that Amphos 21 won a multiyear contract to perform the hydrogeological modelling of groundwaters surrounding the NPP of Ascó and Vandellós, in Spain.



CEN Solutions develops its activity in the Energy, Oil & Gas, Industry and Transport sectors, in which it provides solutions in the field of equipment manufacturing and expert maintenance.



The design and manufacture of the equipment is carried out at the company's premises in the free zone of Seville, with a total area of 60,000 m².



To ensure good performance in terms of quality, environment and safety, CEN Solutions has management systems in accordance with the requirements of ISO 9001, ISO 14001, PECAL 2120, NQA-1: 1994, 10CRF50 Appendix B, UNE 73401: 1995, ANSI Standards and ASME Codes, which are periodically audited allowing the homologation and accreditation as a supplier of Nuclear Safety equipment (Class 1E) at national and international level.

We also have our own capacities for commercial dedication of electrical components, performed for the components of the products we manufacture or spare parts required by the different Nuclear Power Plants.

CEN Solutions maintains a highly specialized technical team and the qualifications required for the nuclear sector, which have allowed it to continue offering uninterrupted global solutions for the supply of safety and commercial equipment from the beginning of the industry.

The permanent contact with the most specialized companies in the nuclear field, makes CEN Solutions aware of the new technological advances and can be present in the nuclear power plants in Spain and abroad.

Among the most recent references for the nuclear sector are the following work and supplies:

NATIONAL NUCLEAR POWER PLANTS

- Supply of spare parts (Motor Control Center drawers, auxiliary material) (Almaraz NPP, Trillo NPP, Ascó NPP and Vandellós II NPP).
- Supply of 6.3 kV switchgears, transformation centers and MCC, train A, B and N for EJ project (Vandellós II NPP).
- Provision of labor for main site and control room works (Almaraz NPP).
- Supply of power centers and CCM for power increase (Almaraz NPP).
- Supply additional column CF 2B1A (Almaraz NPP).
- Design, manufacture and assembly of modular electric room for TC cooling towers system (Almaraz NPP).
- Design, manufacture and assembly of modular electric room for water treatment (Almaraz NPP).



Turnover [2018]	26,400,306
Export figure	85%
Staff	184 employees



- Supply of 20kV and 6.3kV switchgears, Teva project transformation center (Almaraz NPP).
- Execution of Alternative Shutdown Panels and Centralization Switchboards (Almaraz NPP).
- Execution of electrical design modifications of various systems (Trillo NPP).

INTERNATIONAL NUCLEAR POWER PLANTS

ABWR by GE Hitachi

- Main Control Room Panels and Remote Shutdown Panels (Simulator, Units 1 and 2).
- FMCRD relay logic panels and self-firing solenoid fuse panels (units 1 and 2).
- HCU self-test panels (units 1 and 2).
- Systems of sampling and analysis of liquids of secondary systems.
- Meteorological control panels.
- NUMAC panels: NMS panels, optical fiber panels, ATIP & MRBM panels, PRM panels, RTIF panels (units 1 and 2).
- Provision of labor for review in plant and control room.

China Nuclear Power Engineering & China
Techenergy Co. LTD.

- Main Control Room Panels and Remote Shutdown Panels for Fuqing NPP (Simulator, units 1 and 2).
- Main Control Room Panels and Remote Shutdown Panels for Fangjiashan NPP (Simulator, 1 and 2).
- Main Control Room Panels and Remote Shutdown Panels for Hainan NPP (Simulator, units 1 and 2).
- Provision of labor for supervision and modifications in the Fuqing and Fangjiashan NPPs.
- Instrumentation for the main control rooms for Hongyanhe NPP 5 & 6.



Nuclear Fusion Technology

Long-term projects in which the company participates

- Review of bars of 10 kV and low voltage and Metron switch replacement during recharges (2018-2022) for CN Trillo.
- Design and supply of the Safety Control System - Nuclear (SCS-N) for Iter.

C/ Isabel Torres,1
39011 Santander, Cantabria
Tel.: + 34 942 766 976
E-mail: info@centrotecnologicctc.com



The Technological Centre CTC is a private foundation which is recognized as a Technology Centre by the Ministry of Science, Innovation and Universities.

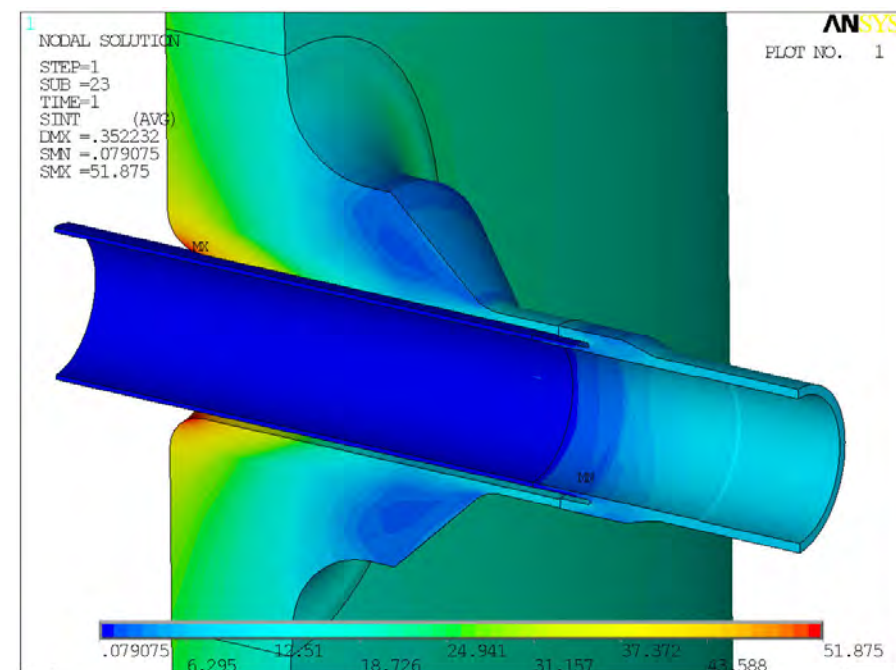
Its main objective is to bring value to companies through research, development and innovation projects, contributing to the enhancement of their competitiveness and sustainability, and becoming their technology partner, by being the meeting point between their needs and research activities.

Within the various fields of knowledge, the CTC is positioned in Experimental Sciences and Engineering, driving the R&D activity into the following technology solutions:

- Advanced engineering.
- Advanced materials and nanomaterials.
- Predictive maintenance.
- Robotic systems and autonomous vehicles.
- Navigation systems.
- Smart offshore structures.
- Industry 4.0.

CTC has its management system certified according to the "Quality Management System" UNE EN ISO 9001:2008 Standard and the "Environmental Management System" UNE EN-ISO 14001:2004 Standard.

The Centre has cooperation agreements with various institutions and companies. The purpose of these agreements is to



establish the basis for joint and coordinated development of R&D in different fields of activity and thereby promote the culture of innovation and the enhancement of the technological collaboration.

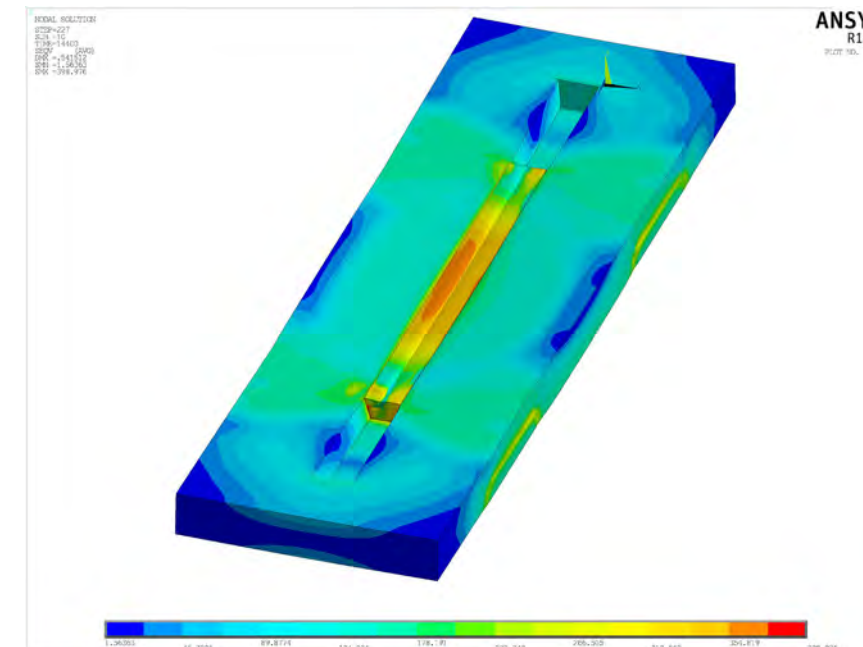
CTC is active partner of various platforms and associations. Among these associations' highlights:

- **Clúster de la Industria Nuclear de Cantabria (CINC).** The objectives of the cluster are to strengthen the field of nuclear energy in Cantabria and act as a reference for all players in the sector and thus represent the same interests as

partners in the nuclear industry to the government or other decision-making bodies; as well as to increase competitiveness and business opportunities of the companies or entities in the field of nuclear industry market, combining synergies that allow access to major projects both national and international.

- **CEIDEN.** It was formed in 2007 and it aims to coordinate the different national plans and programs of innovation in the field of nuclear fission technology, as well as participate in international programs, ensuring consistently guide the efforts of the entities involved.

Turnover	2.1 million €
% of the activity of contracts with companies	60%
% of european projects	25%
Staff	33 employees
% of university graduates	97%
% of doctors	26%



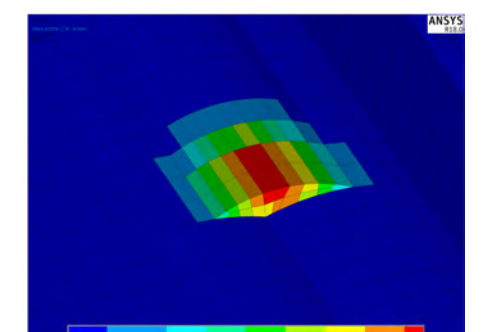
- Analyses of racks for new and spent fuel
- Analysis of tools for handling of fuel in nuclear power stations
- Thermo-hydraulic analysis of feed and recirculation pipes of a BWR reactor
- Thermo-hydraulic analysis of polls of spent fuel in nuclear power stations
- Seismic analysis of a fire-fighting pump a nuclear power station
- Thermal and structural analysis of heat interchangers
- Structural analysis of spent fuel storage casks

OUTSTANDING ACTIVITIES - INTERNATIONAL

CTC is a member of European Energy Research Alliance, EERA (<http://www.eera-set.eu/>) and the international association NUGENIA (<http://www.nugenia.org/>). Likewise, CTC regularly participates in the ITER BUSINESS FORUM. Finally, highlight the active participation in R&D proposals related to nuclear energy.

COUNTRIES IN WHICH THERE IS NUCLEAR ACTIVITY

Spain.



SERVICES, PRODUCTS AND TECHNOLOGY AVAILABLE

CTC is specialized in structural integrity analysis of last generation nuclear reactors under ASME design codes and design of components and tools for nuclear power stations according to ASME, RCC-M, Eurocode and FEM. Analyses consist of material resistance calculations and heat transfer calculations which require engineering expertise and strict compliance with the codes. Analyses have allowed the detailed design and the manufacturing on components for generation III+ and IV reactors and spare components for generation II reactors.

CTC performs the design of manipulation and test tools. The design consists of analysis, manufacturing drawings and definition of specifications

The specialization lines and technologies are:

- Simulation of welding processes
- Decontamination of water by graphene
- Thermal and structural simulations (ANSYS)
- Thermo hydraulic simulations by CFD codes (ANSYS CFX)
- Mechanical design and structural analysis

OUTSTANDING ACTIVITIES - NATIONAL

- Development of composite materials with barrier properties against radiation
- Research project about fatigue monitoring and the effects of the environmental effects on the fatigue of the nuclear reactors
- Definition of innovative manufacturing processes for ITER
- Research project about the application of the Master Curve on a nuclear reactor
- Analyses of reactors of generations III+ and IV: ABWR, ESBWR and PBMR



Coapsa is consolidated as a company of reference handling of heavy loads in the nuclear market.

The objective of Coapsa, which was set up in 1997, is to offer our clients the most complete service, addressing problems globally from design to turnkey delivery and even anticipating us to them.

Thanks to our team, the company has achieved continuous growth in the sectors in which we carry out our activity, among others in the fields of industrial automation, equipment goods and in the nuclear industry.

To achieve the growth that they have reached, they have based their work on three key principles:

- Offering quality and good service in every work we do.
- Counting on a professional and highly trained human team capable of offering quick solutions to any possible problems that may appear on the development of each project.
- Adapting to the new technologies that appear on the market, integrating them on the equipments supplied to our customers.

BUSINESS OBJECTIVE

Since our very beginning Coapsa has had the ability to carry out the design, assembly, installation and start-up, in addition to the compliance with all the applicable quality assurance requirements as regards the control and automation of industrial processes and systems.

From the very beginning, the orientation within the sector has traditionally been towards control systems for lifting and handling equipment of heavy and special loads, among others, high precision heavy duty gantry cranes: polar and turbine cranes... and for nuclear fuel handling systems: refueling machines, manipulators, gantry cranes for the handling of spent fuel casks, etc.

At present we have experience in the qualification of the Single Fault Criterion applied to gantry cranes (Nureg-0554 and Nureg-0612) and in the design, manufacturing and assembly of equipment with environmental seismic qualification 1E.

In addition, we have consolidated experience on the port and harbor machinery markets, for the handling of containers and merchandise, as well as

on the equipment for other industrial processes in general: MDD’s Low Voltage Distribution Centers, control systems and monitoring of industrial processes, remote control systems for the handling of devices on underground rail networks, etc.

Coapsa’s objective is to extend and improve the services we offer on our consolidated market, for which we are improving and extending all our human and material resources in order to bring them into line at all times with the quality and service required by the type of work we perform.

SERVICES, PRODUCTS AND TECHNOLOGY AVAILABLE

ENGINEERING

We offer a complete integrated service adjusted to the client needs, supported by our qualified personnel and our experience.

- Wide experience in the design of conceptual, basic and in detail engineering.
- The use of the principal technologies makes us to be able to give the best solution and assure the total integration of our client’s facilities.
- Economical and technical viability studies.
- Planning and monitoring.
- Comprehensive automation projects of industrial processes.
- Automation and improvement of existing processes.
- Migration of control systems, PLC’s and industrial communication from the main manufacturers.
- SCADA systems programming including prescriptions, reports, control charts, etc.
- Electronic design using the most avant-grade tools from the market (E-plan, Autocad, etc.).

Estimated turnover at the end of 2019	3.6 million €
% volume of sales that comes from the nuclear sector	79%
Staff	30 employees
Bachelor’s degree	12
Specialised operators	16
Other personnel	2

MANUFACTURING

We are manufacturers of electrical equipment, low voltage distribution equipment, regulation equipment, Motor Control Centers, etc. applying the latest technologies existing on the market.

- Distribution and Power equipment.
- Automation and Control equipment.
- Motor Control Center with fixed and removable execution.
- Intelligent Motor Control Center. We offer solutions to any kind of industrial installation, adapting to any requirement of the sector and client.
- Supervision and Control Systems (SCADA) and Distributed Control Systems (DCS).
- Desks, consoles and conventional control ergo seat and by radio-control.
- Supply and installation of weighing systems for cranes.
- HVAC systems.

SERVICES ON PLANT

Our qualified technical team offers corrective maintenance service, preventive maintenance, repairs, start-up in the client facilities, adapting us to the client’s needs and requirements.

We offer our clients all kind of services in plant:

- Supervision of the assembly in plant.
- Execution of SAT tests and put into service.
- Preventive, predictive and corrective maintenance works in equipments.
- Diagnosis and solution to breakdowns.
- Modification on existing equipments.
- Modernization of equipments (Retrofitting).
- Training for the maintenance personnel.
- Post sales service.

ACTIVITIES AND REFERENCES

Coapsa has become an essential reference in the nuclear field, that is why most of Spain’s power plants and their service companies trust Coapsa as a provider of goods and services.

Works on nuclear field

- Trillo NPP: Completely remodelling the 404TN gantry crane in the turbine hall and undertaking a series of improvements to the polar crane. There is constant support work throughout the year, especially during recharge times.
- José Cabrera NPP: Complete reformation of the Omega gantry crane in the containment building in order to meet the requirements established for the handling of the spent fuel casks.
- Vandellós NPP: Manufacturing of the local command cabinets for the new essential services water cold source. Continuous maintenance and enhancement work on the plant gantry and fuel handling cranes at the plant.
- Ascó NPP: Installation of two new 115TN carriages and integral reformation of the bridge cranes at the fuel buildings in order to reach compliance to the Nureg-0554 regulation for spent fuel cask handling. Installation of a radio control system for polar crane handling. Continuous maintenance and support work.
- Almaraz NPP: Adaptation to the Nureg-0554 and Nureg-0612 Appencix C standards of the two bridge cranes located at the fuel handling building.
- Cofrentes NPP: Adaptation of the 15TN gantry crane in the fuel building to the Single Fault criterion.

- Laguna Verde NPP (Mexico): Manufacturing and installation of a new 7,5TN Radioactive waste crane.
- Santa Maria de Garoña NPP: Amedment of the bridge crane from the reactor building adapting it to the Nureg-0554 and Nureg-0612 Appendix C standards, “Heavy Loads Control” and “Single Failure Proof Crane”.
- Equipment control system design for the manipulator machine “Second Skip Handler Machine”





Empresarios Agrupados (EA) is a leading international engineering and construction management company with headquarters in Madrid (Spain). Founded in 1971, EA has a permanent multidisciplinary staff of over 900 persons, 80% of whom are university graduates.

EA's main focus as an engineering and construction management company is to provide a full range of engineering services for nuclear, conventional, renewable energy and biomass power plant projects.

In the Nuclear field, EA areas of activity are:

- New build nuclear power plant projects.
- Engineering support services to nuclear plants in operation.
- Decommissioning and radioactive waste management projects, including design of low and intermediate level waste and spent fuel storage facilities.
- Research reactors and GEN IV projects.
- Fusion technology (ITER project).



EA has carried out the engineering for electric power generating plants with a combined installed power of more than 52,000 MWe, with projects in Spain and in over 50 other countries. EA is ranked among the Top 225 International Design Firms by the US magazine "Engineering News Record" (ENR).

EA is an independent engineering company, with quality services recognised by the market. Our clients include electric utilities, IPPs, reactor vendors, government agencies, EPC contractors, main equipment suppliers and numerous international organisations such as IAEA, EBRD, European Commission, ITER Organization, Fusion for Energy, etc.

EA holds the ISO 9001:2015, ISO 14001:2015 and OHSAS 18001:2007 certificates.

SERVICES, PRODUCTS AND TECHNOLOGY AVAILABLE

Services and products provided by EA include: consulting, project management, engineering and design, licensing and permitting, procurement services, construction management, commissioning management, engineering support to plants in operation and quality management.

OUTSTANDING ACTIVITIES-NATIONAL

The main references and experience developed in Spain in the nuclear field are:

EA has been the sole or main engineering company for six (6) 1,100 MWe nuclear units in Spain, (PWRs and BWRs), being responsible for a full range of engineering, procurement, construction, plant testing and commissioning services.

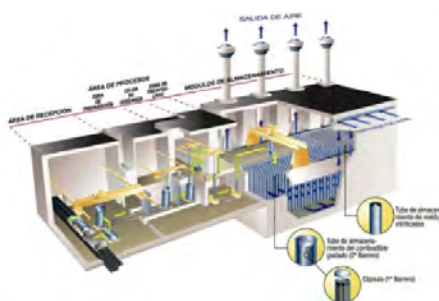
EA also provides a complete range of engineering support services to all seven nuclear units (PWR and BWR type) currently in operation in Spain, as well as to other nuclear plants in operation around the world, with a variety of scopes and responsibilities. EA is also involved in modernization, design modifications due to new licensing requirements, power uprating, life extension and post-Fukushima backfitting programs for these plants.



- Supply, on and EPC contract basis, of three (3) complete Filtered Containment Venting Systems (FCVS), one for each of the following PWR units: Almaraz NPP Units 1 and 2 and Trillo NPP.
- Engineering services for the temporary spent fuel storage facilities (ATI) at plant site for the Trillo NPP (PWR, Framatome, 1066 MWe), Ascó 1&2 NPPs (PWR, Westinghouse, 2 x 1000 MWe), Almaraz 1 y 2 NPP (PWR, Westinghouse, 2 x1049 MWe) and Cofrentes NPP (BWR 5 Mark III Containment, GE 1100 MWe).
- Engineering and design of the Centralized Interim Storage Facility ("Almacén Temporal Centralizado", ATC) for the spent

fuel produced at all the nuclear units operated in Spain (Client: ENRESA).

- Engineering services for the decommissioning of J. Cabrera NPP (PWR, Westinghouse, 165 MWe) (Client: ENRESA).



- Power Uprating Engineering for Almaraz NPP Units 1 and 2 (PWR, Westinghouse, 2 x 1049 MWe).
- Probabilistic Safety Analysis (PSA) for majority of the Spanish nuclear power plants.
- Engineering support services to the operation and refuelling outage services for Almaraz 1 & 2, Trillo and Cofrentes NPPs.

OUTSTANDING ACTIVITIES-INTERNATIONAL

New Build Nuclear Power Plant projects:

Over the years EA has taken part in a number of international projects aimed at developing, licensing and implementing Generation III and III+ advanced nuclear reactors. This includes an active participation in projects using different technologies such as Westinghouse PWRs (SPWR, AP-600, EPP and AP 1000), GE-Hitachi BWRs (ABWR, SBWR and ESBWR), Framatome PWRs (EPR), Rosatom VVERs (VVER 440, VVER- 1000, VVER 1200), Mitsubishi PWRs (APWR), etc.

- EA has been providing consulting and Owner Engineer services for plant preconstruction activities, preparation of feasibility studies, preparation of Bid Invitation Specifications (BIS) and evaluation of Bids for the new build NPPs in the majority of new build projects in Europe: e.g., Hanhikivi NPP project, in Finland (Client: Fennovoima), Temelin Units 3 & 4 NPP, in the Czech Republic (Client: CEZ),

Staff
University graduates

Over 1,000 employees
75%

Next NPP at the Beznau site in Switzerland (Client: RESUN), Olkiluoto 3 NPP and Olkiluoto 4 NPP, in Finland (Client: TVO), Dukovany NPP site in the Czech Republic (Client: CEZ), New NPP project in Jaslovské Bohunice Site in Slovakia (Client: JESS) and AKKUYU 1,2,3 & 4 NPP (4 x 1200 MWe VVER Type) in Turkey (Client: ASE-NIAEP), etc.



- EA has participated in the preparation of the European Utility Requirements (EUR) document for future nuclear power plants of evolutionary and passive designs in Europe.
- EA has also been delivering engineering and design services for the Lungmen NPP project (ABWR, GEH 2 x 1360 MWe), under construction in Taiwan, as a subcontractor of GE-Hitachi.



- Also as a Subcontractor to GE-Hitachi, EA has provided engineering support services for the design development and Design Certification by the US NRC of the ESBWR.
- For the Mochovce Units 3 & 4 NPP (VVER, 2 x 440 MWe), under construction in Slovakia (Client: SE/ENEL), EA has carried out the high energy pipe break analysis and protection against the consequences of pipe break in the Nuclear Island of both Units.
- Turbine Island design for Wylfa Newydd 1 & 2 NPP (ABWR, Hitachi-GE, 2 x 1360 MWe, UK including 3D model, general arrangement, mechanical systems design, piping and support design (Client, GE SPS).
- Turbine Building general arrangement design, piping and support design for Paks 5 & 6 NPP (VVER 2x1200 MWe) in Hungary (Client, GE SPS) and EL-Dabaa 1 & 2 NPP (VVER 2x1200 MWe) in Egypt (Client, GE SPS)
- Hanhikivi 1 NPP (VVER 1200), Finland. PSAR Preparation (Client: RAOS/Atomproekt).

Engineering Support to Plants in Operation:

- Design modification of the complete Class 1E Emergency Electrical Supply System for Krško NPP, (PWR, Westinghouse, 730 MWe) in operation in Slovenia, (post-Fukushima requirement).
- Establishment of a system for monitoring technical conditions of VVER NPP buildings and structures based on advanced methods and techniques in Ukraine (EU Project).
- Over the last 25 years, EA has been providing engineering and consultancy services for the implementation of plant upgrades and the safety improvement of Russian design VVER-440 and VVER-1000 plants in Russia, Ukraine, Bulgaria, Czech Republic, Slovakia and Armenia.

Research and GEN IV Reactor Projects:

- EA in Consortium with Technicatome and Ansaldo Nucleare has performed Front End Engineering and Design (FEED) services for the Myrrha research reactor complex at SCK Mol in Belgium (Client: SCK-CEN), an experimental accelerator driven reactor system.
- JHR (Jules Horowitz Reactor), France, experimental reactor, for materials research: design of the primary circuit heat exchangers.



- PBMR (Pebble Bed Modular Reactor) high temperature gas reactor project in South Africa: complete structural-mechanical engineering and design of the primary pressure boundary system and components.

Decommissioning and Waste Management Projects:

- Project management services for the decommissioning of Kozloduy Units 1 to 4 NPP (VVER 440) and for the construction of the National Disposal Facility for Low and Intermediate Radioactive Waste in Bulgaria (EBRD funding. Client: SERAW)

- Project management services for the decommissioning of the VVER 440 Bohunice 1 & 2 NPP in Slovakia (Client: JAVYS and EBRD funding).

- Radioactive Waste Management Project at the Vektor Industrial Complex in Chernobyl (Ukraine) – EU Project.
- Engineering support services for Decommissioning and Waste Management Program at the EU Joint Research Centre (JRC) at Ispra, Italy (Client: EC JRC).

Nuclear Fusion Technology Projects:

- 20 years involvement in Fusion technology (ITER, IFMIF, DEMO, etc).
- Architect-Engineer and Construction Management for all buildings and auxiliary systems of ITER Project (as part of Engage consortium) (Client: F4E)
- Nuclear Safety Control (SCS-N) System for ITER (IO): design manufacturing, qualification and installation (in consortium with Inabensa).
- ITER Project Final Design of the Connection Pipes for the Test Blanket System (TBS) (Client: IO).
- ITER Project, Thermo-Hydraulic Analyses for Process, and System Engineering of the TCWS (Client: IO).



COUNTRIES IN WHICH THERE IS NUCLEAR ACTIVITY

EA has carried out nuclear projects in: Spain, United States, Belgium, Bulgaria, Czech Republic, Canada, Slovakia, Italy, Hungary, Ukraine, Egypt, Turkey, Finland, France, United Kingdom, Russia, Japan, Mexico, Argentina, Brazil, Bolivia, Taiwan and Jordan.



ENWESA OPERACIONES, S.A.

Polígono Industrial Heras, nave 136
39792 Heras, Cantabria
Tel.: + 34 942 253 815
E-mail: comercial@enwesa.com

Polig. Industrial Les Tapies
C/ Gimbernat, 15
43890 Hospitalet del Infant, Tarragona
Tel.: + 34 977 172 702



ENWESA is a services company committed to the nuclear industry from its foundation.

It accumulates several decades of experience in the sector.

Its core business is specialized, high added value, maintenance and construction services for a range of industries.

Its main activity is nuclear power plant maintenance, specially PWR technology.

A deep knowledge of the energy business and the potential to adapt to increasingly demanding circumstances, are the key to achieve competitive project execution.



Founded in	1997
Turnover	30 million €
Payroll	250

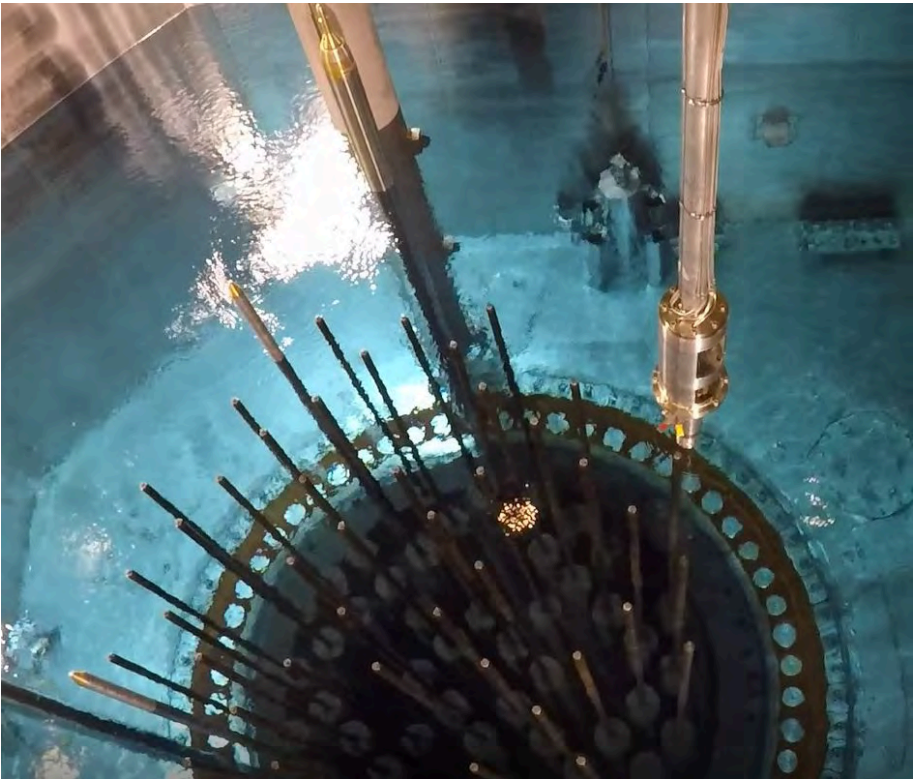
In the Spanish BWR Cofrentes, ENWESA routinely performs mechanical maintenance of valves, motors and pumps.

ENWESA also has an active role in the spent fuel casks loading in Spanish NPPs.

ENWESA's facilities are suitable for Nuclear components manufacturing, such as heat exchangers, tanks and spent fuel casks. This activity is often part of a bigger project that includes on-site installation along with component supply.

Other ongoing activities are:

- Maintenance of CCGTs
- Manufacturing and assembly projects for the shipbuilding industry (vessels and submarines)
- Robotics and process automation, specially in the automotive industry, providing turnkey projects that include engineering.



SERVICES, PRODUCTS AND TECHNOLOGY AVAILABLE

The company is organized in five areas that collaborate closely, enabling the integration of different expertise and perspectives to face complex projects:

These areas are:

- Nuclear services of NSSS components such as reactor, fuel, steam generators and reactor coolant pumps. It also includes decommissioning of nuclear facilities.
- Valves and actuators maintenance, mainly nuclear related.
- Mechanical maintenance of turbines, pumps, motors, heat exchangers and other mechanical equipment.
- Robotics and automation & control.
- Manufacturing of mechanical components, mainly for the nuclear and shipbuilding industries.

ENWESA is certified to ISO standards in Quality (ISO 9001) Environmental Management (ISO 14001) Welding (ISO 3834) Health and Safety (ISO 45001 and OHSAS 18001).

Several other certifications cover specific areas of the company.

OUTSTANDING ACTIVITIES - NATIONAL

As to PWR reactor services, (Almaraz, Ascó, Trillo and Vandellós II), ENWESA is involved in different activities, including:

- Mechanical maintenance (during plant cycle).
- Refueling outages NSSS components maintenance.
- Fuel handling, inspection and repair.
- Valves maintenance.



OUTSTANDING ACTIVITIES - INTERNATIONAL

ENWESA is growing into other countries.

The main international activity is valve maintenance in France, where ENWESA is well stablished and holds a continuous workload all year round, with recent projects in Golfech, Gravelines, Bugey; Belleville, Chinon; Paluel, Dampierre, Tricastin and St Alban.

Other international nuclear activities have been:

- Mechanical works, including manufacturing for the ITER project and the JHR reactor.
- Modification and upgrade projects in commercial nuclear power plants like KRSKO or Laguna Verde.

COUNTRIES IN WHICH THERE IS NUCLEAR ACTIVITY

The main international business area for ENWESA is France, where it has been growing throughout the last decade and currently has permanent resources.

Nowadays ENWESA is well known as a valve maintenance supplier in many of EDF's power plants.

ENWESA also works in Belgium, Finland, Brazil, Mexico and Slovenia.

Equimodal is a company that deals in the development and manufacturing of containers, swap bodies and containerised solutions.

Founded in 1992 and headed since then by Pedro Domínguez, Equimodal started out as a manufacturer of transport containers and subsequently, a specific Engineering department was created to offer permanent support for specific and customised projects for our client.



Photo courtesy of Siemens

In 2006, Equimodal obtained the ISO 17025 certificate as an ENAC accredited laboratory.



Equimodal has always invested in both technology and human capital. For this reason, we are the only laboratory in Spain with the possibility of carrying out design tests, developments and manufactured units, as well as their approval. In its continued commitment to offer a quality product, Equimodal has obtained the ISO 14001, ISO 3834 and OHSAS 18001 certificates and is the only container manufacturer in Europe with this level of Quality. Over 20 years and more than 22,000 units produced.

INDUSTRIAL PROJECTS

Our investment in I+D+I+H allows us to design, develop and produce the best quality containers and containerized solutions in Spain / Europe, for transport and industrial, energy or defense applications.

Development of sustainable solutions that improve the quality of life of all those who participate in the process and reduce the environmental impact.



Our flexibility also enables us to supply turnkey containers and products. We have the capacity to ensure the full integration of equipment and installations.



Thanks to the experience of its engineers, Equimodal adapts and generates innovative solutions at each stage of the process.

Working in collaboration with the Engineering Department of the clients, achieving amazing results of efficiency and quality, or develop projects alone.



DEFENSE PROJECTS

Our capacity to generate technical solutions enables us to provide our military clients with products designed by and for a certain mission.

The experience of our engineering team includes specific projects for:



- Transport (ammunition, explosives, weapons, camp material)
- Everyday systems (stoves, fridges, laundries, toilets)
- Medical systems (X-ray, sterilization, morgues)
- Integration of large installations (camps, workshops, hangars)

ENERGY PROJECTS

Equimodal works in the wind and solar power sectors containerizing power transformer units, inverters, and switchgear.



This technical solution offers a reduction in costs and risks compared to other types of solution based on the on-site construction of installations.



TRANSPORT PROJECTS

Equimodal is the largest manufacturer in Spain and one of the largest in Europe of containers and swap bodies for intermodal transport.



All our units are approved in line with current regulations, according to CSC, ISO, CEN or UIC.



QUALITY ASSURANCE

Equimodal acknowledges Quality, the Environment and Occupational Risk Prevention as the mainstay of its Business Management Policy and, therefore, is responsible for and committed to establishing and implementing a Comprehensive Management System.



LABORATORY

Equimodal has and ENAC accredited laboratory.

Our laboratory has accreditation number 545_L1224 for the performing of tests on containers and swap bodies according to standards ISO 1496, EN 283, CSC and UIC 592.

- CSC: International Convention for Safe Containers
- ISO: International Organization for Standardization
- CEN: European Committee for Standardization
- UIC: International Union of Railways



NUCLEAR ACTIVITY

We have manufactured containers to transport containers with radioactive waste of low industrial activity. All these containers have been approved according to ISO standards and are classified as industrial package type 2 in accordance with ADR for transport of material classifies as LAS-I.





GD ENERGY SERVICES

Headquarters
Ronda Auguste y Louis Lumière 15.
Parque Tecnológico de Valencia.
46980 Paterna (Valencia), Spain
Tel: +34 963540300

Madrid Delegation
C/ Aduana, 33, 3º
28013 Madrid
Tel.: +34 916 409 870
E-mail: info.es@gdes.com



GD Energy Services (GDES) is a Spanishbased business group with over 85 years of experience providing industrial services for a wide range of customer profile nuclear maintenance, surface treatments, decommissioning, services for the wind power industry, radiation protection services, radioactive waste management, logistics and emergency response.

Our broad diversification makes our group one of the most predominant and visible in the energy sector, giving the company a strong market presence. GDES currently employs a staff of over 1,500 professionals actively working in 9 countries. An eminently qualified team, fully oriented toward our customers, providing high added-value solutions adapted to the specific requirements of each project.

BUSINESS OBJECTIVE

In recent years, the new challenges of an increasingly globalized industry and the high-growth strategy of the company have acted to greatly increase its international presence in global markets, with overseas business making up an increasingly important part of GDES' business activity and revenue. Currently, the Group is active in Spain, France, the United Kingdom, Portugal, Italy, Mexico, Panama, Brazil, and the United States, with projects in these and other potential markets gaining in importance.

MAIN BUSINESS UNITS FOR THE GROUP

NUCLEAR SERVICES, SURFACE TREATMENT, DECOMMISSIONING, WIND, LOGISTICS, EMERGENCY RESPONSE

NUCLEAR SERVICES

O&M support

- Maintenance services
- Waste management
- Fuel movement support
- Support for refueling services
- Radiological emergencies
- Decontamination
- Hydrostatic testing
- Sludge treatment
- Biological disinfection

Thermal protection

- Passive fire protection
- Penetration seals (electrical and mechanical)
- Thermal insulation that is both reflective (with an option for radiation shielding) as well as Conventional
- Signage and identification of systems
- Design, calculation and assembly of scaffolding and permanent access ways
- BIM modelling

Radiological protection

- Radiological Protection Services
- Radiactive waste management radiological characterisation of installations
- Official and on-demand dosimetry readings
- Official and ad hoc courses for radiation facilities according to the customer type
- Support for refuelling services
- Radiation facilities supervision
- Detection of radioactive and nuclear material
- Legalisation of facilities
- Radiological and Encapsulated
- Source Hermetic Sealing Verifications
- Radiological Emergency Services
- Biological decontamination consulting

Long term operation

- Structural analysis of systems and components
- Root-cause evaluation of failures
- Thermohydraulic and functional validation
- Critical components residual lifespan evaluation, assessment and management
- Commercial components third-party dedication to nuclear / harsh environment
- Reverse engineering of legacy components no longer supported by their OEMs

Revenues (FY 2019 aggregated)
Workforce

102.5 million €
1,500 employees

SURFACES TREATMENTS

- Surface preparation:
 - Abrasive blatin
 - Shot blasting
 - High-pressure water
- Surface Treatment by Sponge-Jet
- Corrosion protection:
 - Maintenance
 - Primers, paints and coatings
- Concrete treatments:
 - Repairs
 - Structural reinforcements
- Passive fire protection
- Aplication of pavements
- Metallisation

DECOMMISSIONING

- Dismantling of radioactive and nuclear facilities:
 - .- Power Plants
 - .- Experimental reactors
 - .- Equipment and components (Globe boxes, hot cells, etc)
 - .- Radioactive installations
- Technical Support
- Feasibility Studies
- Radiological Protection
- Waste Characterisation
- Decontamination services

LOGISTICS

- **Warehouse management:**
 - Reception and forwarding
 - Loading docks
 - Picking, labeling, handling
 - Internal transport
- **Integrated "in-house" logistic management:**
 - Handling of internal flows
 - Provisioning
 - Internal distribution
 - Manual finishing and packaging
 - Packing
 - Equipment optimization

WIND

- Maintenance (preventive and corrective) in factory and field
- Retrofitting
- Technical assessment
- Periodic inspection (thermography and ultrasound)
- Technical consultancy
- Rotor balancing and vibration dampening
- Long-term operation

EMERGENCY RESPONSE

- Professional fire brigades
- Training of fire and emergency personnel
- Maintenance of fire suppression systems
- Consulting
- Emergency response plans and self-protection manuals
- Patient transportation (urgent or scheduled)

PAST WORK AND REFERENCES

DECONTAMINATION, CLEANING AND MAINTENANCE SERVICES IN:

- Spain: Almaraz NPP, Asco NPP, Cofrentes NPP, Santa Maria de Garoña NPP (recharge), Trillo NPP, Vandellós II NPP, Vandellós I NPP, El Cabril, CIEMAT
- France: Fessenheim NPP, Bugey NPP, Civaux NPP, Golfech NPP, Chooz NPP, Chinon NPP, Blayais NPP, Iter, St Laurent NPP, Nogent NPP, Tricastin NPP, Belleville NPP, Gravelines NPP, Cruas NPP.
- Mexico: Laguna Verde NPP.

DECOMMISSIONING

- Andujar Uranium Factory (FUA)
- Ciemat facilities (PIMIC)
- Vandellós I Nuclear Power Plant
- Arbi Experimental Reactor
- Jose Cabrera Nuclear Power Plant
- Galileo Galilei Reactor, CISAM (Pisa, Italy)
- Dounreay, Winfrith and Springfields NPPs (UK)
- CEA Marcoule (France)

Support for Radiological Protection at the JRC in Ispra (Italy), hospital and industrial facilities (Spain)

Chemical Cleaning Secondary side of Steam Generators for EDF in Dampierre 1 & 2NPPs (France).

Treatment of effluents from chemical cleaning of Dampierre 1 (France).

Application of special coating (EXTRADOS) in Cattenom 3 and Flamanville 1 & 2 NPPs, Blayais NPP and ITER (France).

Cross Under Metallization for the Laguna Verde NPP (Mexico), Vandellós II NPP and Cofrentes NPP (Spain), Dampierre NPP and Blayais NPP-U2 (France)

Metallization of GSS water boxes: Civaux NPP (France), Belleville NPP (France), Bugey NPP (France) and Nogent NPP (France).

Passive fire protection Vandellós II NPP, Almaraz NPP and Cofrentes NPP (Spain).





GEOTECNIA Y CIMENTOS, S.A.

C/ Los Llanos de Jerez, 10-12
28823 Coslada, Madrid
Nuclear Area
Tel.: +34 916 603 066
E-mail: enavarron@geocisa.com

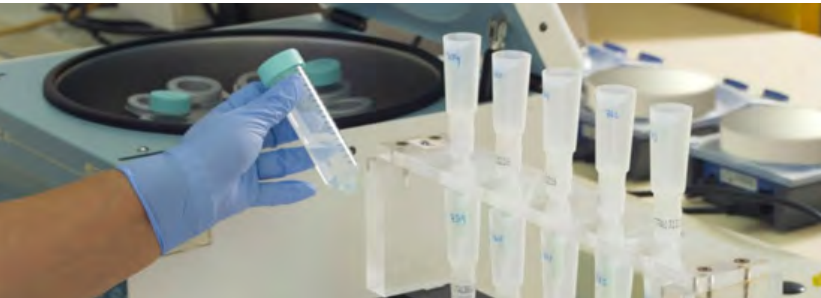


GEOCISA is a highly skilled company with expertise across a range of technical projects: Geology and Geotechnics, Instrumentation and Monitoring, Soil Investigation and Ground Treatments, Deep Foundations, Laboratories, Infrastructure Management and Highway Maintenance, Restoration and Rehabilitation of Monuments, Bridges and Singular Buildings and Environmental Protection. GEOCISA is a sister Company of DRAGADOS, an international contractor established in 1941 that specializes in major infrastructure projects worldwide. DRAGADOS is the construction arm of ACS Group, which is one of the leading infrastructure developers in the world with a presence in more than 40 countries.

In the nuclear field and involved in the conservation and protection of our environment, GEOCISA founded over 35 years ago, Environmental Testing Laboratory as a demonstration of environmental commitment, performing both chemical and radiochemical measurements in different matrices.

The experience gained over the years attached to both human and technological multidisciplinary team makes GEOCISA part, from the beginning, in the first decommissioning of a Spanish nuclear power plant, Vandellós I. Characterized by the constant pursuit of innovation and effort in research and development it means that, with the arrival of new phases in the life cycles of facilities, new challenges are taken: new matrices and test new isotopes not previously determined.

Our participation in Preoperational and Operational Programs for Nuclear Power Plants, Operational Program of the Center



for Disposal of Radioactive Waste Cabril Surveillance Program Uranium mining, positions us as a specialized laboratory with extensive knowledge both artificial and natural radioactivity, amply able to tackle any type of monitoring program in all types of sites.

Quality is a constant reference in the pursuit of our activities so GEOCISA has an accredited system according to ISO-9001, ISO-14001 and OHSAS-18001 standards, and is also approved Evaluation Group Suppliers of the Spanish nuclear power plants.

SERVICES, PRODUCTS AND TECHNOLOGY AVAILABLE

Environmental Radiation Monitoring Programmes

Since its creation in 1978, the laboratory GEOCISA is positioned as a reference for the realization of Environmental Radiation Monitoring Programmes in the Spanish nuclear power plants. Experience allows us to manage all phases of the programs:

- Program Design, implementation of the land census.
- Run field: in situ measurements, sampling, storage and transportation to the laboratory.
- Implementation in the laboratory sample

receipt and acceptance, processing, analysis and radiation measurement.

- Data and report management, analysis of results.

Technical support personnel to nuclear facilities

This is the case GEOCISA participation, since 1992, in Central Radioactive Waste Storage Medium and Low Activity El Cabril (Córdoba), where we have developed new methods and procedures for the set-up of Quality Verification of packages Laboratory.

RPTU Scope: Decommissioning nuclear facilities

Although the beginnings of the Radiological Protection Technical Units were in the hospital setting, GEOCISA broadens the scope to nuclear area adapting to the activities in which the laboratory has been involving in the field of decommissioning projects of nuclear facilities.

The other two main priorities of the RPTU are:

- Monitoring programs impacted sites: composed of measures in depth (radiological borehole) with radiation measuring equipment prototype developed by GEOCISA and radiochemical sampling for laboratory analysis.

Founded in	1968
Turnover [annual]	3 million €
Total workforce (Nuclear Area)	37 employees
% of university graduates	24%

- Site Release Programs: composed of measures in land surface by applying MARSSIM methodology, measuring equipment prototype developed by GEOCISA radiological and radiochemical samples for laboratory analysis.

Bioanalysis : Dosimetry by bioelimination

In 2007, the process of tuning up Bioanalysis Laboratory, specializing in measurement of body radioactivity in urine and feces lab starts.

In 2010 the Nuclear Safety Council issued the authorization of Internal Personal Dosimetry Service Tecnatom, being GEOCISA laboratory responsible for carrying out the measures of body radioactivity bioelimination.

The determinations made in this laboratory are:

- Determination of americium, uranium isotope, curium and plutonium in urine samples.
- Determination of strontium and tritium in urine samples.
- Determination of creatinine in urine samples.
- Determination of americium isotopes of uranium, plutonium in faecal samples.

NORM Studies

Since the publication of Royal Decree 1439/2010, the Regulation on Health Protection against Ionizing Radiation and the 11.2 Safety Guide on “Control of exposure to natural sources of radiation” of Nuclear Safety Council which recommended that these studies are conducted by the Radiological Protection Technical Units or laboratories with expertise in radiation protection as natural radioactivity, the Radiochemistry laboratory

and RPTU of GEOCISA and incorporating such studies in its activities.

Determination and chemical tests

Taking as guarantee various accreditations, GEOCISA performs chemical analysis of multiple parameters in a variety of matrices by highly sensitive equipment and techniques [HS / GC / MS, GC / FID, ICP - AES, ICP - MS] .

His fields of activity a e:

- Quality control and inland water consumption.
- Characterization of industrial wastes.
- Environmental monitoring programs.
- Characterization of waste landfill
- Chemical characterization of soils and building materials.

OUTSTANDING ACTIVITIES- NATIONAL

- Environmental Radiation Surveillance Programs (ERSP), pre-Operational Stage at the Centralised Storage Facility (“ATC” in Spanish) as principal laboratory.
- Environmental Radiation Surveillance Programs (José Cabrera, Asco, Vandellós I and II and El Cabril).
- Internal Personal Dosimetry Service by bioelimination for the dismantling of the NPP Jose Cabrera.
- Radiological Protection Service for the proposed decommissioning and dismantling of the NPP Jose Cabrera.
- Radiological analysis of samples related to the CRI-9.
- Instrumentation and radiological measures PIMIC-CIEMAT project.
- Exploitation of the laboratory of Central Radioactive Waste Storage Medium and Low Activity El Cabril.
- Site release in the NPP Vandellós I.
- Characterization of land and buildings screeds NPPJose Cabrera.

- Monitoring of groundwater and contaminated land area SROA.
- Emergency Analysis Laboratory and radiological analysis of samples RPTU.
- Quality Control Process declassification of materials and surfaces characterization and decontamination workshop on NPP Jose Cabrera.
- Quality Control Process declassification of materials Montecillo (PIMIC Phase III).
- Analysis of samples of production process control, mining water, drinking water and disposal of sewage water (Justesa, Geodeser, Berlimed, Gate Gourmet, Sepiolsa, Toyota).
- Waste characterization tests (Diviconfe, Terragua engineers).
- Testing in building materials, flooring steel, minerals (Icinco, Fertiberia, Eptisa, Controlex Canary, Alexpa).

OUTSTANDING ACTIVITIES- INTERNATIONAL

Project technical advice and training of NPP Kozloduy (Bulgaria) for physico-chemical solid and liquid samples within the Project Decommissioning of the facility characterization.





EULEN GROUP

C/ Gobelás, 29
28023 Madrid
Tel.: +34 916 310 800
E-mail: dcomercial@eulen.com



GRUPO EULEN was founded in 1962, becoming a pioneer in the industry by offering the market a professional cleaning service for the very first time. The company's extensive experience and the training undertaken by its professionals means Grupo EULEN now specializes in a range of sectors, including nuclear, automotive, steel, industry, petrochemicals, pharmaceuticals, department stores, hospitals, agriculture and food, transportation and office buildings.



With its range of specialist companies, Grupo EULEN offers the following services to the Nuclear sector:

- Specialist technical cleaning
- Decontamination
- Security (EULEN SEGURIDAD)
- Radiation protection (PROINSA)
- Declassification of material
- Radioactive waste management
- Maintenance
- Environment and Gardening
- Radiation and environmental measures (ENVIRONMENTAL MEASURES)
- Conventional cleaning

The company has certificates that guarantee the quality of the services we undertake:

- ISO 9001:2008 quality standard
- UNE 73401:1995 quality standard
- ISO 14001:2004 environmental management standard
- OSHAS 18001:2007 risk prevention

SERVICES, PRODUCTS AND TECHNOLOGY AVAILABLE

Grupo EULEN has extensive presence and experience in providing all kinds of services to nuclear power stations and radioactive facilities:

- Technical cleaning and radioactive decontamination services
- Cleaning and decontamination of buildings, facilities and equipment in controlled areas
- Cleaning and decontamination of parts, tools, equipment, etc.
- Cleaning of vessel studs and nuts for the Rx and SGs

- Decontamination of material and scrap metal
- Classification and management of contaminated material
- Waste conditioning and containment
- Support (staff and equipment) during refueling and outages
- Installation and conditioning of SAS
- Filtration of refueling cavity water
- Establishing and logistics of transit points
- Hydrodynamic cleaning with pressure washing
- Cryogenic cleaning with CO₂
- Cleaning of heat exchangers, condensers, water boxes, pumps, tanks, intakes and supplies, pools, cooling towers, etc.
- Scaffolding, logistics and industrial support
- Decontamination interventions in incidents with radioactive sources (recovery units, steel plants)
- Fire fighting services



Turnover (2018)	1,587.59 million €
% International sales	23%
Global staff	85,450 employees
Staff in Spain	48,554 employees
Countries in which the company operates	14



EQUIPMENT

The company has access to the following wide range of equipment for services provided in the nuclear sector:

- Combined extraction and induction equipment
- Vacuum trucks
- High pressure hydrodynamic equipment (2000kg/cm²)
- Specific equipment for cleaning air pipes
- Cryogenic cleaning equipment
- Specific equipment for cleaning vessel studs and bearings, SG studs
- Etc.



ACTIVITIES AND REFERENCES

Grupo EULEN has been involved in the nuclear industry for more than 35 years, working for the following Nuclear Power Plants:

- Santa María de Garoña
- Ascó I & II
- Vandellós
- Almaraz
- Trillo
- José Cabrera
- Cofrentes

At some of these facilities, Grupo EULEN has worked on the construction stage, as well as on operations and refueling.



Grupo EULEN has also undertaken activities relating to the nuclear sector at the following facilities:

- Enresa
- Enusa
- Radioactive decontamination work in the Scrap Metal Recovery sector and at Steel Plants, in collaboration with PROINSA (radioactivity monitoring).

Headquarters
Avda. Zarandoa, 23
48015 Bilbao (Vizcaya)
Tel.: +34 944 797 600
E-mail: nuclear@idom.com

Avda. Monasterio de El Escorial, 4
28049 Madrid
Tel.: +34 914 441 150



Avda, de la Fama, 11-15. Edificio Arce
08940 Cornellá de Llobregat (Barcelona)
Tel.: +34 934 092 222

No.1 St Ann Street
Manchester M2 7LR. Manchester. UK
Tel: +44 161 302 0950



The professional services offered by IDOM Consulting, Engineering, Architecture, S.A.U. (IDOM) cover most of the industrial and technological activities carried out in a nuclear installation, both in the fields of fission and fusion and nuclear fuel cycle. The organizational structure of the company allows us to offer a wide range of technical solutions, assistance and management services.

IDOM distinguishes itself as a company that has the capacity to integrate the expertise and experience of the nuclear division and draw on the support of all the professionals of the Group, responding efficiently and effectively to the requirements of each project and the needs of each client.

The integrated approach of IDOM involves multidisciplinary teams with expertise from the different technical areas of the Group: Consulting and Systems, Industry and Energy, Architecture and Building, Infrastructure and Nuclear Services. All these disciplines are coordinated using project management practices that guarantee the correct technical and economic outcomes of the projects.

Specifically in the field of Nuclear Services (NS), IDOM is an approved supplier of the quality assurance group of Spanish NPP's, ENRESA, UNESA, FRAMATOME, NA-SA, Rolls Royce and F4E (ITER), and possesses certifications

from ROSATOM's contractors (TITAN2). In addition, IDOM has in place, a nuclear quality assurance system audited according to the standards NQA-1, ISO-9001, UNE-73401 and KTA 1401. Moreover, IDOM has successfully implemented the OHSAS 18001 Certification requirements (Health and Safety on working sites) as well as the Environmental Management System of UNE-EN-ISO 14001

SERVICES, PRODUCTS AND TECHNOLOGY AVAILABLE

PROJECT SERVICES

Integral Solutions from conceptual design to full integration into operation of nuclear facilities, both power and research. Those services can be provided individually or as an integrated package assuming the full responsibility, as per the specific client needs, covering all areas of engineering, project management, procurement and logistics, construction management, commissioning and start-up support, operational support and decommissioning. IDOM can participate as:

- EPCM
- Project Management (PMC)
- Owners' Engineering
- Technical Assistance
- Design & Engineering (D&E)
- Advanced Analyses Studies
- Nuclear Consulting

And for some specific projects, assuming EPCM / EPC contracts.

NUCLEAR CONSULTANCY

IDOM independence, together with more than 40 years of nuclear expertise, provides us a global vision to support our clients on strategic, financial and technical nuclear industry challenges:

- Nuclear Strategic Consulting (Nuclear Programs, National Plans, Business Plans)
- Engineering of Safety-Cost-Benefit Solutions (Optioneering)
- Engineering of Digital Technologies and Industry 4.0 (Configuration Management, ILCM)
- Support to the client in front of the regulator
- Safety and Licensing
- Asset management

DESIGN & ENGINEERING

Taking into consideration the unique requirements of each project, applicable regulations and the requirements of the Nuclear Regulator of each country, IDOM performs engineering in the fields of

- Systems Conceptual, Basic and Detailed Design Engineering.
- Specifications and Design Modification
- Components, Structures and Systems (SSCs) Analysis and Seismic Qualification
- Radiological Protection and Shielding.
- Back-end engineering (spent fuel storage, radioactive waste management, decommissioning).
- Support Engineering and Maintenance (Plant Engineering).

IDOM carries out all the above activities in National and International Projects and in different nuclear technology applications such as power generation, health, environment, industry, defense or research.

Founded in	1957
Turnover (2019)	330 million €
International Activity	90%
Projects developed in over 125 countries	45 offices
Staff	3,800 employees
Superior degree holder employees	90%

In addition to the traditional Engineering services, IDOM NS has developed a multitude of special products related to safety and licensing:

- Lifetime Management.
- IPEEE and Stress Test.
- Fire Protection and Explosions.
- Ionizing Radiation Technology.
- Safety and Licensing.

ADVANCED ANALYSIS STUDIES

To develop the special analyses that are required for NPPs or nuclear fusion plants, IDOM offers the following activities:

- Fire simulations with FDS.
- Ionizing radiation calculations
- Design Analysis of Nuclear Class SSCs and non-linear calculations.
- Gas Performance, mechanical and fluid dynamics simulations, CFD calculations.
- Thermo-hydraulic Analyses (MAAP, RELAP, MELCOR, GOTHIC).
- Advance mechanical calculations
- Software development (manipulation of radiation maps, scripts for the mapping of neutronic deposition, code coupling, mesh manipulation scripts).

OUTSTANDING ACTIVITIES - NATIONAL

- Lifetime Management in Spanish NPPs.
- Individual Spent Fuel Storage Installation (ISFSI) at Santa M^a de Garoña NPP.
- Engineering services for Garoña NPP Decommissioning.
- Technical Assistance in Periodical Safety Review. ANAV.
- Plant View. ANAV.
- Consulting Services for Business positioning. Spain.
- Detailed Engineering for the upgrade of the HVAC and Fire Protection (extinction, detection and dampers) in several NPPs.
- Stress Tests and Design Modifications for safety enhancement in numerous NPPs (Post Fukushima Requirements), based on detected vulnerabilities as a result of the

Seismic analyses, flooding, and other external events (Alternative Emergency Management Centre, Heliport, Improvement of Drainage Systems and implementation of Large Flow Drainage Systems, Structural Reinforcement as well as improvement of equipment and systems, Containment Filtered Venting System (CFVS)).

- Cask Maintenance Workshop (TMC) for the CSFSF of ENRESA.
- EJ System: Substitution of Ultimate Heat Sink at Vandellós II NPP. "Turnkey Project".
- Radiological Impact Study associated with the Long Term Operation of Almaraz I-II NPPs.
- Re-Racking spent fuel pool at Vandellós II NPPs.
- Support for IFMIF-DONES in safety analyses

OUTSTANDING ACTIVITIES - INTERNATIONAL

- Front-End Engineering (FEED) Services for Nuclear Health Centre GMP Production Building. Netherlands.
- Primary & Secondary Containment Barrier Thermohydraulic Calculation for Laguna Verde NPP. Mexico.
- Breeder Blanket Design STEP Project. UKAEA.
- Conceptual Design for Hot Cells. ITER.
- Owner Engineering Support to ITER, France.
- Dynamic Analyses (Framework contract) in ITER, France.
- Advanced Mechanical Analyses (Test Blanket Modules) in ITER, France.
- Neutronics Analysis, thermo-hydraulic and fluid dynamics (Framework contract) analyses in ITER, France.
- Diagnostic Ports and Remote Handling in ITER, France.
- Nuclear Heating Impact on ITER of Vacuum Vessel, France.
- Decommissioning-related activities in Sellafield NPP, UK.
- Design of a collimator and a robotic arm for the Jules Horowitz Reactor, France.

- Emergency Control Room at Krsko NPP, Slovenia, in consortium with Tecnatom.
- Improvement of national personnel training system in the field of radioactive wastes, decommissioning and remediation in Ukraine for the European Commission.
- Design and Analysis of main equipment for Hinkley Point C NPP, UK.
- Commissioning support and supervision at Taishan I NPP, China.
- Engineering associated to the Individual Spent Fuel Storage Facility (ISFSI) In Atucha I NPP, Argentina.
- RAW management for operation and decommissioning of Kozloduy NPP, Bulgaria.
- Strategic evaluation of the Chilean nuclear program, Chile.
- Strategic Consultancy Services for the implementation of R&D nuclear centre, Bolivia.
- Technical expert services for the sensitivity study of seismic hazard prediction, for Finland NPPs.
- Neutronic Studies (Framework contract) for IRSN, France.
- Moltex Engineering services for SMR development in Canada.
- Heat Exchange design for Sizewell B NPP, UK.,
- Installation and Commissioning of alternative refrigeration equipment at Krsko NPP, Slovenia
- Engineering support on piping under RCC-M code for French NPP

COUNTRIES WHERE HAS NUCLEAR ACTIVITY

- | | |
|-------------|---------------|
| • Argentina | • France |
| • Belgium | • Lithuania |
| • Bolivia | • Mexico |
| • Brazil | • Netherlands |
| • Bulgaria | • Slovakia |
| • Canada | • Slovenia |
| • Chile | • Spain |
| • China | • Turkey |
| • Colombia | • UK |
| • Finland | • Ukraine |



OUR ORIGIN COMES FROM THE CIVIL NUCLEAR INDUSTRY

Newtesol offers unrivalled quality and professional welding and weld overlay to clients WORLDWIDE from our main facilities and head quarter in Santander (Northern of Spain), where the company was born as a spin off from civil nuclear industry located in the region.

AFTER DECADES OF WELDING OUR KNOW-HOW IS HUGE

More than forty years of EXPERIENCE and the ability to solve all welding technical demands of the customers. Our close contact with them is the main source of knowledge on how pieces and equipment behaves along their working life. Thus, when your company faces an unusual need, you can rely on Newtesol as the best possible advisor.



As a result of this history, Newtesol is able to manufacture any kind of weld overlayed pieces, even extremely difficult ones. We have been using for decades low dilution processes, getting excellent corrosion and erosion resistant results

OUR TECHNOLOGY

In 2001, Borja and Roberto Saiz faced a problem to solve. Why nuclear claddings and built up welding seemed to have always so bad quality that requiring a lot of repairs? Since then on they decide to study all the welding processes available to clad and weld with a clear goal: Quality has to be perfect while keeping the process competitive. Newtesol was born!



As a first analysis, the answer regarding poor quality of cladding processes was due to the size and relevancy of the parts to be cladded. Cladding was not part of the pressure boundaries in nuclear components so quality requirements were not the top priority, competitiveness was and tripe SAW process was the preferred solution.

They wondered what would happen if Automated GTAW welding process offering high-quality results could be economically competitive. At the time, this process had low deposit rates and was not the best one for competitiveness. Newtesol had to push it to its extreme technical limits to make it competitive.

We have the latest technology for Weld Overlay and are keeping to DEVELOP this continuously in house as well as in

association not only with the most known weld machine manufacturers, but also with University and related research institutes.

The automation of the processes optimized for each new challenge, together with our civil nuclear back ground mindset, allows us to design and implement zero-defect weld overlay systems.

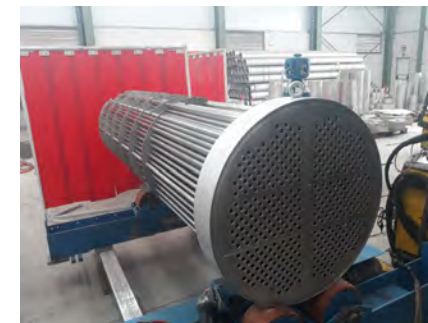


OBSESSED BY QUALITY TO MAKE DURABLE PRODUCTS

In Newtesol we like our customers to rely in our accuracy when referred to the high standards we achieve in each of our jobs. Even though we are ISO 9001:2008 & ISO 14001 certified, our quality system complies with much more demanding NQA-1, 10CFR50 App. B and 10CFR21, whereas zero-defect mindset is tightly pursued, project documentation is issued in parallel with the manufacturing and tiny problems become a promising opportunity to improve in a never ending learning discipline, assuring always that the approved IPPs are the road map to excellency and that traceability is completely guaranteed.

This quality system enables us to make the highest quality products under the ASME U & U2 stamp, ISO 3834-2 certificate, corrosion resistant pipes under the API-5LD monogram and pieces and equipment under ASME III stamp.

Turnover (2019)	9 million €
Exports	84% of sales
Staff	54 employees
Specialized operators	100% (30% engineers)
Average	36 years



We are also the only manufacturer in the clad market worldwide holding the NPT nuclear stamp.

In spite of our Cladding, built-up and weld overlay expertise we also manufacturing all kind of nuclear components up to 100T

- Steam generator internals
- Fuel rack components
- Casks components
- Pressure vessels
- Tanks,
- Heat exchangers
- Many other components

WELL TRAINED STAFF AND FULLY AUTOMATED MACHINES TO ENSURE FLEXIBILITY

Newtesol is fully aware of the increasing need to react quickly on the demanding schedule of the O&G, PowerGen, industrial or maritime & offshore projects nowadays and thus search the highest efficiency through fully AUTOMISED production along with continuous training of our staff on modern plant management and maintenance systems.

Multipurpose of both programmable state of art machines and committed work force, makes Newtesol able to adapt its production planning to the changing needs of the customers so that required lead time is achieved.

PROJECT MANAGEMENT FOR ACCURACY, COMMITMENT AND COMMUNICATION

Each order is managed by a dedicated Project Manager, who is in charge of the communication with the customer, assuring also internal coordination among design, procurement, quality control, production, documentation, expedition and financial department through the tightest attention in detail.

That way lead times are optimized and delivery of the pieces are placed in time, and what's equally important: DOCUMENTATION is made along with the project due to our nuclear-based quality system, avoiding any inconvenient delay after the completion of the manufacture.

THE FUTURE OF NUCLEAR INDUSTRY IS CLAIMING NEWTESOL TECHNOLOGY

Our competitiveness is becoming well-known in all the main component design companies. Main project for the use of this technology is for design-to-cost programs and there are two 2 principal innovative business lines:

Forging cost reduction is the first one. Complicated geometries of forgings can be avoided. Complex shapes and protuberance can be removed from the forging phases improving forging costs and be replaced by build-up welding and machining.

Materials cost reductions.

Replace Inconel or stainless-steel forging, plates or fittings by carbon steel with Inconel or stainless-steel cladding is also cost effective.



Headquarters
Aravaca, 6-8. 3rd
28040 Madrid
Tel.: +34 915 359 640
E-mail: nusim@nusim.com

Balbino Marrón 8, 6^o
Viapol Building
41018 Seville
Tel.: +34 954 932 447
E-mail: ingenieria@nusim.com



Concret injection device for drums block in NORM treatment plant (Abu Dhabi)

NUSIM, S.A., was founded in 1980 to provide technological solutions for different application fields, such as Nuclear, Health Care, Research, Construction and Prevention.

Nowadays, NUSIM, S.A. consists of four divisions: Radioactive Waste Treatment, Radiation Protection, Health and Safety Instrumentation, and Automation, all supported by their corresponding Maintenance Areas.

These divisions provide high quality products and services to a wide range of clients including Nuclear Power Plants, Official Organizations (ENRESA, CIEMAT), Hospitals, Universities, National Laboratories, and other specialized industries.

NUSIM, S.A. has a Quality Assurance system in accordance with the requirements of the UNE 73401:95, ISO 9001:2015, 14001:2015, and radioactive national nuclear industry certifications GES and regulator certification ENRESA.

SERVICES, PRODUCTS AND TECHNOLOGY AVAILABLE

RADWASTE TREATMENT DIVISION

The Radioactive Waste Division, with over 35 years of experience working with all the Nuclear Power Plants in Spain, carrying out the Engineering, Manufacturing, Commissioning, Operation and Maintenance of equipment for treatment, handling and transport of Radioactive Waste.

NUSIM has developed a significant number of equipment that are being used today in all the Spanish Nuclear Power Plants in operation or decommissioning and in the Official Spanish Agencies and disposal, like ENRESA (El Cabril) or research centers like CIEMAT.

NUSIM is also internationally present with equipment in main nuclear sites like Laguna Verde NPP (Mexico), Kozloduy NPP (Bulgaria), Karachi NPP (Pakistan), Chernobyl NPP (Ukraine), Atucha NPP (Argentina) or the NORM waste treatment plant (Abu Dhabi).

All the equipment developed by the Division are manufactured on the basis of own technology. The proposed solutions have been developed to meet the most demanding requirements, giving reliability and robustness, which is highly valued within the Nuclear Sector.

The products range covers the hole cycle of the Radwaste from cradle to grave.

Equipment catalogue features:

Handling Devices of Drums, HICs, Containers and special Handling with filling, capping, or nesting process.

Inspection Equipment

- X-Ray Drums Inspection.
- Sampling systems.
- Latency reactor Inspection equipment.

Radiological Characterization for radwaste packages (drums or containers) with accessories for capping, surface contamination test etc.

Processing Equipment for recovery and reconditioning Plant for Historical Wastes.

Volume Reduction Equipment

- Drying systems for sludge or miscellaneous waste by microwave or resistances.
- Pre-compacting equipment.
- HEPA filters Compactor

Grouting and cementation systems

- In situ Mixing System or premixed systems.
- Modular Blocking System, skid or ISO container mounted systems.
- Continuous or batching Mixers with cleaning system.
- Secondary waste recovery systems.

Cleaning and Decontamination Equipment for drums or containers in fully enclosed cabinet, on conveying line or in glove box.

Transport Equipment ADR (American Depositary Receipt) Vehicles and packaging ADR for radwaste land/air transportation.

Decommissioning equipment and Systems. Cutting, confining handling, water treatment, processing.

Waste recovery. Extraction cut and decontamination of tubular bundles of heat exchangers.

NORM radwaste facilities with integral solution for processing, drum filling capping, nesting, cementation and grouting.

RADIOLOGICAL PROTECTION DIVISION

Since its creation, NUSIM is the exclusively distributor in Spain of equipment for contamination measuring, spectrometry systems, dosimetry systems and equipment, and electronic components

Founded in	1980
International activity	70%
Sales that comes from the nuclear and radwaste sector	90%
Master Degree Engineers	80%

for the detection and measurements of the Ionizing Radiation from the main Companies: Mirion – Camberra and ORTEC among others.

This Division is not only in charge of distribution, but also of assembly and onsite commissioning to products for Nuclear Power Plants, Research Centers, Universities, etc. undertaking the subsequent maintenance to ensure proper functioning.

The catalogue features the following equipment:

- Radiation Dosimeters.
- Spectrometry Alfa and Gamma.
- Contamination Monitors equipment/ clothing.
- Personal Contamination Monitors.
- Radiometer/ Radiation Meters.
- Portal monitors for trucks/vehicles.
- NaI y LaBr3 detectors.

AUTOMATION DIVISION

Carries out the study, the planning and the integrated global solutions for the automation systems covering the design, development, assembly and commissioning in all type of industry installations.

NUSIM carries out the PLC's and SCADAS programming of the main manufacturers in the market. NUSIM is recognized integrator of Rockwell Automation even though also have tools and knowledge of the software of the main brand in remaining market shares such as Siemens, Schneider, Omron, ABB, etc.

NUSIM integrates complete automatic systems, both hardware and/or software from different manufacturers, interconnecting business systems (ERPs, Information Servers, etc.) with the manufacturing (Solutions MES).

OUTSTANDING NATIONAL AND INTERNATIONAL ACTIVITIES

RADWASTE TREATMENT DIVISION

Between main references, the major projects are the following:

- Container handling, nesting and capping equipment for the New Safe Confinemen in the Chernobyl NPP, Ukraine (TAIM WESER).
- Stabilization and Solidification plant for NORM ashes. ADNOC Abu Dhabi National Oil Company (TAKREER).
- ISO container SAS confinement with control room for the José Cabrera NPP reactor vessel lid cutting.
- Drums and HIC handling and compaction equipment for Laguna Verde NPP (Mexico).
- Reprocessing Plant for Historical Waste, for the Santa María de Garoña NPP.
- In drum Microwave Drying Facility, for Ascó and Cofrentes NPP.
- Equipment for Casting Collection and Cooling for a Plasma Oven Facility for Kozloduy NPP (Bulgaria).
- Miscellaneous drum drying facility by heating resistors for Asian NPP.
- In addition, drum and container handling devices, waste solidification plants, package radiological characterization systems, compactors, etc, are in operation in all the Spanish nuclear emplacements.
- NUSIM has developed new equipments for tilting of drums, automatic manipulators for forklifts, in-drum precompaction with recoverable sleeve, radiological inspection system of roads all with the new technology of augmented reality.

RADIOLOGICAL PROTECTION DIVISION

Main supplies during recent years:

- Body Count Contamination Monitors: Mirion Technologies and RADOS with proportional and scintillation detectors for Trillo, Almaraz, Ascó, Vandellós II and Cofrentes and Santa María de Garoña NPPs and El Cabril.

- Handfoot RADOS contamination with proportional and scintillation monitors for Almaraz, Trillo and Ascó NPP and El Cabril.
- Laundry RADOS monitor for NPPs: Ascó, Almaraz, Vandellós II and Santa María de Garoña and for tools for Vandellós II.
- TLD RADOS dosimetry systems: Almaraz, and Trillo NPPs and Dosymetry center.
- Gamma Spectrometry Systems ORTEC with germanium detectors and Alpha Spectrometry Systems ORTEC for Polytechnic Universities of Valencia, Cáceres, Basque country, Barcelona; Catalanian Government, CIEMAT and CSIC.

- Portable Gamma Spectrometry Equipment ORTEC for ENRESA, Customs Algeciras and Catalanian Government.
- BrLa y NaI detectors for environmental network of the Catalanian Government.
- Integral radiological protection equipment for the NORM waste treatment plant. Takreer, Abu Dhabi.



Handling Equipment for Drums, El Cabril (ENRESA)



SERVICES, PRODUCTS AND TECHNOLOGY AVAILABLE

PROINSA is authorised by the Spanish Nuclear Safety Council as a Radiological Protection Technical Unit against ionising radiation.

This permit has allowed it over the years to become specialised in offering radiological protection and environmental services, which can be classified as follows:

Radiological protection in nuclear power plants.

- Services in normal production.
- Services in refuelling outages.
- Services during decommissioning.

Control and radiological protection of radioactive sites.

- Radiological control.
- Elaboration and processing of documentation.
- Advice and management with respect to public entities.

Training in radiological protection.

- Supervisors and operators of radioactive installations.
- Directing and operating medical and/or dental radiodiagnosis.
- Other specific radiological protection courses.

Protection services against exposure to natural radiation in NORM Industries.

Management of radioactive materials in operation and decommissioning.

Nuclear and radiological emergencies.

Environmental radiological surveillance services.

Environmental studies and projects.

Protocol and collaboration on the monitoring of metallic materials.

Firefighting squads and services.

Industrial waste management.



Turnover	7.4 million €
Volume of sales that comes from the nuclear sector	90%
Investment in R+D+i	Integrated in the Eulen Group
Staff	127 employees
Managers	4
Senior Engineers	25
Engineers	8
Technicians and administrative workers	90

All of the activities carried out are included in the Quality Management System, certified by Det Norske Veritas (D.N.V.) in accordance with ISO Standard ISO-9001:2015 and in the Environmental Management System, also certified by D.N.V. in accordance with ISO Standard ISO-14001:2015.

ACTIVITIES AND REFERENCES

Throughout its course, PROINSA has provided permanent support to the radiological protection services of the nuclear power plants of Asco I and II, Vandellós II and Santa Maria de Garoña, during their normal operation (closed radiological protection shifts, instrumentation, etc.) as well as support in radiological protection during refuelling outages in the same plants and in the nuclear power plants of Jose Cabrera, Cofrentes and Trillo.

It also provides several specific radiological protection services for other clients such as ENRESA, CIEMAT and AGENCIA TRIBUTARIA.

Since it was founded PROINSA has also provided services to both medical and non medical radioactive installations, offering the maximum scope and guidance in radiological protection. Clients include Siemens, Smurfit, Unión Española de Explosivos, etc.

PROINSA has also delivered courses related with radiological protection, including, official courses for personnel in radioactive installations, as well as other specific courses for nuclear power plants and courses on radiological protection for different official institutions. It is a leading company in services in nuclear and radiological emergencies since it was contracted by the CSN in 1998 until 2016. It has participated actively in all of the important incidents that have occurred in the country, before and after signing the protocol of collaboration on the monitoring of metallic materials, Clients include Egmasa, Siderúrgica Sevillana, Arcelor, Nervacero, etc.

It has collaborated with all the Spanish nuclear power plants in matters relating to environmental radiological surveillance plans and with Trillo nuclear power plant as well in monitoring the ecosystems surrounding it.

Services during Vandellós I Nuclear Power Plant dismantling and PIMIC Project have been carried out.

Services against natural sources of radiation have been carried out for GAS NATURAL FENOSA.

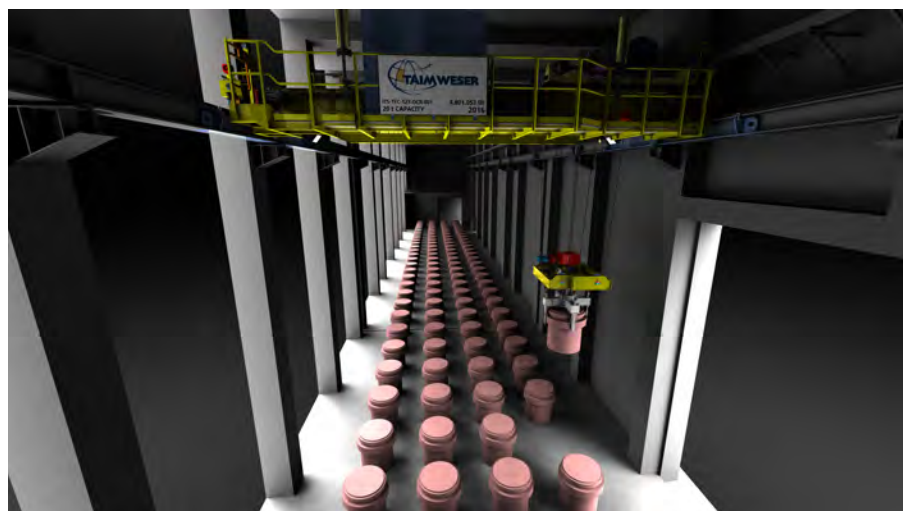
Management of radioactive material have been carried out for NUCLENOR and ENRESA.





TAIM WESER, S.A.

Carretera de Castellón km. 6,3
50013, Zaragoza
Tel.: + 34 976 500 006
E-mail: info@taimwesor.com



At **TAIM WESER** we have 120 years experience in the supply of tailor made EOT and gantry cranes as well as turnkey bulk materials handling installations for the main industrial sectors, according to the specific requirements demanded by our customers and always based on the principles of safety, high performance, precision of movements, low maintenance and operation costs and maximum availability of our products.

We are a major solutions provider for the nuclear industry supplying tailor made equipment for the handling of low and intermediate active nuclear waste and nuclear fuel in New Build as well as Decommissioning projects of Nuclear Plants.

In addition, we have also supplied high precision cranes to the most prestigious research experiments in the world, CERN and CELLS studying the relation between mass and energy.

We are qualified supplier of ENRESA, IHI, ELECTRABEL and SELLAFIELD among others and we are certified ISO 9001, ISO 14001 y OHSAS 18001.

SERVICES, PRODUCTS AND TECHNOLOGY AVAILABLE

Turnkey supply of cranes and bulk materials handling installations

We specialize in the supply high integrity in cell and out cell EOT cranes, gantry cranes and trolleys as well as single failure proof (SFP) equipment to perform critical load-lifting applications as the handling of low and intermediate active nuclear waste as well as nuclear fuel. In addition, we also supply high performance stockyard machinery and conveyor system for the handling of raw materials as uranium ore. For this purpose we have the most suitable resources and the most advanced techniques. Our scope of supply includes the whole project cycle, design, manufacturing, assembly and test at our facilities, final assembly at site and commissioning of the equipment.

All essential processes of design and fabrication are carried out and supervised in our installations and additionally all the cranes are assembled and tested in our factory, generally without load, or with load if required by the customer. This process leads us to the achievement of a high quality final product and an absolute assurance that no major unforeseen problems will happen during site's installation.

After sales and spare parts

Our after sales service provide our customers with its extensive experience and know-how in maintenance service, improvement and revamping of equipment and complete facilities.

Our high-qualified staff is able to provide the optimal solution to the client's requirements. For this purpose, we have the suitable resources and the most advanced techniques through our specialized team in engineering development, erection and commissioning.

On demand, our customers can hire us to enjoy a wide range of services, shaping up the pattern that fits best their needs. These services focus on different areas, as follows:

- Ad hoc maintenance and service works.
- Inspection of TAIM WESER or third parties equipment.
- NDT: Non Destructive Tests.
- Reverse engineering.
- Structural analysis.
- Customized solutions.
- Facilities revamping.
- Specific purpose training.
- SWP (Safe Working Period) and Exceptional Inspections, fulfilling the UNE 58144-5:2015 standard

In addition, besides supplying top quality commercial parts made by first class suppliers, we manufacture in house in our hi-tech facilities a wide range of components, thus ensuring the best product to our customers.

We secure all components interchangeability, according to client's strictest integration requirements.

Maintenance services and technical assistance

More than a service, we provide security, reliability and protection to our customer's assets. A well-managed, planned and executed maintenance is essential to optimize resources:

- Extension of equipment operation life.
- Reduction of down-times and their associated costs because of the non-production.
- General OPEX reduction.
- Improvement of equipment performance.
- Fulfilment of targets set in the operation plans.

Founded in	1899
Turnover 2019	46 million €
International Activity	98%
Offices and agents	Through 20 countries
Projects developed	In over 70 countries
Staff	350 employees
% of superior degree holder employees	60%



OUTSTANDING ACTIVITIES- NATIONAL

- Supply of EOT cranes to the first Nuclear Power Plant installed in Spain, José Cabrera NPP.
- Supply of EOT and gantry cranes to Vandellós I NPP.
- Supply of EOT and gantry cranes to Ascó I NPP.
- Supply of EOT cranes to Trillo NPP.
- Supply of EOT and gantry cranes to El Cabril low and intermediate active nuclear waste repository.

OUTSTANDING ACTIVITIES- INTERNATIONAL

- Supply of EOT crane to Atucha NPP, Argentina.
- Supply of EOT crane to HABOG repository for high-level nuclear fuel disposal, located in the Netherlands.
- Supply of EOT and gantry cranes for the assembly and lowering of the CERN's LHC particle accelerator in Switzerland.
- Supply of EOT crane to Berkeley NPP, UK

- Supply of EOT crane to Dounreay NPP, UK.
- Supply of EOT crane to Pilgrim NPP, UK.
- Supply of EOT crane to Sellafield NPP, UK.
- Supply of EOT crane to Rokkasho Aomori NPP, Japan.
- Supply of a SFP (Single Failure Proof) trolley to Tihange 2 NPP, Belgium.
- Supply of a bridge crane for handling of structure elements and RAW containers in the Technological Building (TEC) of the Chernobyl NPP New Safe Confinement (NSC) project.
- Executing a project for the supply of up to 24 out cell high integrity cranes for Sellafield Ltd.
- Executing other projects that include high technological lifting solutions for the nuclear sector; we cannot disclose more details due to confidentiality reasons.

COUNTRIES IN WHICH THERE IS NUCLEAR ACTIVITY

Technical assistance contracts in several countries in Europe and Asia and commercial activity in Europe, America and Asia.

OTHER DATA OF INTEREST

In addition to the nuclear sector, at TAIM WESER we have a wide experience in the global mining, ports and metallurgical industries as well as oil & gas and fertilizers sectors, where we provide customized integrated high-tech solutions for bulk solids handling and special lifting projects.



With more than 60 years of know-how, **Tecnatom** has made quality one of the main principles of its activity, competing with its experience and contributing with innovative solutions to the global nuclear challenge.

BUSINESS OBJECTIVE

Tecnatom was created in 1957 as a Spanish engineering company specialised in guaranteeing the operation and maintenance of nuclear power plants with the highest levels of security.

The main activities are focused on services to inspect components and structural integrity, the training of personnel in advanced training environments and support engineering to the operation of plants. Today it is a business group with subsidiaries in France, Brazil, China, United States of America, Mexico and United Arab Emirates, which carries out activities in several sectors, among them energy, petrochemicals, rail transport and aerospace.

The company offers services and develops products with a high technological content and its own technology, adapted to the needs and requirements of the different clients and markets and possessing mechanical, electronic and data processing resources in the state of the art of technological development.

Tecnatom develops projects in 40 countries worldwide and its methodology and equipment have been validated by clients and regulatory authorities at an international level.

The company is also deeply involved in future developments, consolidating its participation in advanced projects for nuclear energy plants, such as the construction of the new AP1000, ESBWR, ABWR, APR-1400 or PHWR plants around the world.

Tecnatom participates actively in fusion reactors and research reactors such as the great international ITER project in France, the International Facility of Material Irradiation (IFMIF) in Japan and the Jules Horowitz Research reactor (JHR) in France.

Tecnatom has provided advanced and sophisticated technology for the nuclear sector for almost six decades. Its role within the international nuclear projects in this period has allowed the company to adapt its technological capacities to a very demanding environment, providing innovative solutions to the global nuclear and technological challenge.

SERVICES, PRODUCTS AND TECHNOLOGY AVAILABLE

Tecnatom provides services and products with their own design and manufacture in order to continuously adapt to the needs and requisites of the different clients and markets, among which the following stand out:

A relevant part of Tecnatom's activity is devoted to the evaluation of the structural integrity of the main components of nuclear power plants and other industrial facilities. Tecnatom has achieved huge international experience and references.

Its inspection and testing services have been approved and certified by many organisations and international clients. Its basic capacities include:

- **Inspection services:** complete capacities to perform an automated inspection using NDT of all the areas of the reactor pressure vessel, fuel assemblies, steam generators, heat exchangers and other relevant components such as piping and turbines.

- **Testing services:** a wide range of advanced tests for the evaluation of the status of the different components of the site.

- **Engineering services:** in the areas of life management, codes and standards, implementation of inspection programmes, maintenance and reliability of equipment, management of parts and components with special emphasis on the support of plant asset management and the long term operating programmes.

Using the technological development and the application of its services, Tecnatom contributes to improving the training and efficiency of the personnel of the plants, as well as implementing the best resources to facilitate the operation of the sites, thus guaranteeing improvements in safety, availability and economic efficiency

- **Nuclear Training:** with more than 35 years of experience in the application of the most advanced training methodologies, Tecnatom has more than 160 specialised professional instructors in the different technologies of generation II, III and IV,

Turnover (2019)	104.6 million €
Volume of sales that comes from the nuclear sector	86%
Destinated to exports	33%
Investment in R&D	6.6 million €
Staff	845 employees
Management	18
Senior Engineers	496
Engineers	111
Technicians and admin. workers	220

which makes us the leader in training services for the Spanish nuclear industry sector and provides us with an important presence in countries with nuclear projects.

- **Emergencies and Operational Support:** operating procedures and severe accident procedures assistance in the field o nuclear emergencies, specialised services to support start up, operational experience, radiological protection and dosimetry.

- **Control Rooms and Simulation:** using in-house technology, Tecnatom provides the best solutions in the areas of training and engineering assisted by simulation in the design and supply of new control rooms, as well as their modernisation.

- **Safety Management:** providing high added value services that reinforce the management of the sites and the development of additional competences in matters of safety culture and leadership.

Tecnatom has developed its own technology of automated inspection systems and, as a result, has become a provider of high level technological services and products, with the support of the companies in the Tecnatom group to guarantee global and reliable solutions for any need.

- **NDT inspection systems:** Tecnatom designs and manufactures complete inspection systems for a wide range of applications tailored adapted to the specific requisites of the client.

COUNTRIES IN WHICH THERE IS NUCLEAR ACTIVITY

Argentina, Brasil, Mexico, The United States of America, United Kindom, Finland, Belgium, France, Switzerland, Slovenia, Romania, Russia, United Arab Emirates, China, Taiwan and South Korea.





VIRLAB, Expertise in Vibrations and shocks. Testing Laboratory

An Urbar Ingenieros Group Company
Polígono Industrial Asteasu. Zona B, Nº 44
20159 Asteasu (Guipúzcoa, España)
Tel.: +34 943 691 500
E-mail: laboratorio@virlab.es



Created in 1976, within URBAR Ingenieros, group of companies specialized in the industrial applications of vibration, **VIRLAB** develops its activity in the field of tests of vibration of all types of equipment, which is required continue fulfilling the purposes or are designed, in the case that they will be subjected to earthquakes or other types of vibrations.

VIRLAB has its own testing procedures, established in accordance with the requirements applicable to each case, international standards and depending on the customers’ particular requirements.

VIRLAB gives a comprehensive and tailored service to the needs of its customers, without them having to worry about nothing more than to get their equipment to its facilities and collect them after testing. More than 3,000 tests have been conducted at its facilities located in Asteasu (Guipúzcoa), between San Sebastian and Tolosa and just over one hour from Bilbao airport.

FACILITIES

- A shop of 11x18m that includes a Control room, of 4.3 x 8.4m.
- A bridge crane of 10m, with two hooks 10 and 3 tons load and maximum elevation 6 m.
- A hydraulic central driven 40 CV engines 2 and 4 engines 50 CV, capable of providing up to 250 bar (210 bar, nominal pressure) and flow rate up to 640 l/min.
- An auxiliary assembly room of about 1000m² with 2 bridges crane 16 and 20 T.

- A complete set of electrical, pneumatic, hydraulic facilities and power supplies that make that equipment can be tested under real conditions of operation.
- Equipment testing and data collection and monitoring instruments as indicated below.

TEST PLATFORMS

Biaxial oil hydraulic EDB 250

- 2500x2500mm.
- 2x150kN.
- ±125mm.
- 800mm/s.
- 6g.
- 0.1 a 200Hz.

Biaxial oil hydraulic EDB 120

- 1200x1200mm.
- 2x100 kN.
- ±125 mm.
- 1,000mm/s.
- 10g.
- 0.1 to 150Hz.

Monoaxial electrodynamic, LDS 824 LS

- 750x750mm.
- 27kN.
- ±19mm.
- 1.78mm/s.
- 60g.
- 1 a 3200Hz.

Monoaxial electrodynamic, LDS 824 LS

- 2.2 kN.
- ± 12.7mm.
- 1.54mm/s.
- 100g.
- 1 to 5000Hz.

INSTRUMENTATION

VIRLAB systems data and measure elements allow us to analyze all kinds of variables: accelerations, displacements, deformations, strains, etc. Then, the instruments available to the laboratory.

Vibration Controllers

- Sine, random and shock controller: Eight input channels and one output channel (3).
- Random, shock and SRS controller: Four input channels and two output channels (1).
- Sixteen input channels and two output (1).

Sensors of vibration

- 32 piezoelectric accelerometers.
- 6 four channel amplifiers.
- 8 single channel amplifiers.
- 2 laser sensors ± 1 and ± 50 mm.

Signal monitoring

- Discontinuity Detectors, 12 channels, (0.5-20 ms), (2).
- A data acquisition and processing system, 31 channels, 200 kHz (1).
- A data acquisition and processing system, 24 channels, 1 MHz (2).

Signal analyzers

- 16 channels.
- 8 channels.
- 4 channels.

Signal recorders

- 24 input channels and 24 output channels (1).
- 24 input channels and 12 output channels (1).

Turnover (2019)	1,800,000 €
% had a direct or indirect relationship with exportation	54%
Volume of sales that comes from the nuclear sector (2019)	57%
Staff	17 employees
Senior engineers (Engineers): Director, Lab Engineers & Sales Agent	8
Administrative staff / draftsmen	4
Other personnel	5



Others

- Accelerometer Calibration Set.
- Automatic accelerometer calibration system.
- 8.5-Digit Digital Multimeter.
- 6.5-Digit Digital Multimeter.
- 4.5-digit portable digital multimeter.
- Dc power supplies 1000W / 17A / 200V; 1500W / 10A / 150V; 1500W / 5A / 300V.

ACCREDITATIONS AND HOMOLOGATIONS

VIRLAB laboratory is accredited by the national (Spanish) accreditation entity (ENAC) according to the criteria laid down in the standard UNE-EN ISO / IEC 17025:2005. This accreditation is valid in all countries of the European Union, the rest of those represented in the European cooperation for Accreditation (EA) Organization and the signatories of the

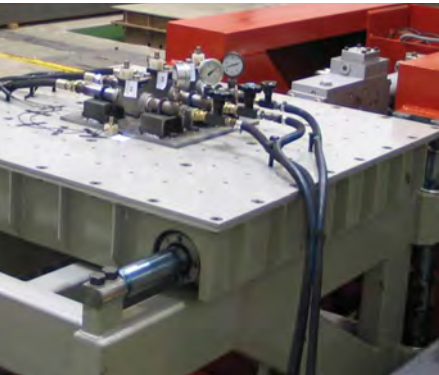


Organization International cooperation for accreditation of laboratories (ILAC). At the same time, **VIRLAB** laboratory is approved by the NPP Spanish group.

TESTING STANDARDS

- CEI/IEC 60980: Recommended practices for seismic qualification of electrical equipment of the safety for nuclear generating station.
- EN 60068-2-6: Environmental testing. Part 2-6: Tests. Test Fc: Vibration (sinusoidal).
- 60068-2-27: Environmental testing. Part 2-27: Tests. Test Ea and guidance: shock.
- EN 60068-2-64: Environmental testing. Part 2-64: Methods of test. Test Fh: Random vibration wide band and guide (random).
- EN 60068-2-57: Environmental testing. Part 2-57: Tests. Test Ff: vibration. Method of accelerograms.
- EN 60068-3-3: Environmental testing. Part 3: Guide. Methods of seismic tests applicable to the equipment.
- IEEE 344: IEEE Standard for Seismic Qualification of Equipment for Nuclear Power Generating Stations.
- CRT91.C.112.00: Tenue aux séismes des matériels. Dispositions génériques pour l'essai bi-axial par accélérographes de EDF.

- IEEE 382: IEEE Standard for Qualification of Safety-Related Actuators for Nuclear Power Generating Stations.
- KTA 2201.1: Design of Nuclear Power Plants against Seismic Events: Part 1: Principles.
- NT 100727 00 0111A: NOTE TECHNIQUE Projet ECS Méthodologie de Qualification sismique des équipements de Areva.
- STD7426E: METHODES D'ESSAIS SIS-MIOUES DES EQUIPEMENTS de Areva.





RADIOACTIVE WASTE MANAGEMENT AND DECOMMISSIONING

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Enresa

88-89

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Radioactive waste management and decommissioning of nuclear installations in Spain has acquired international prestige.

Headquarters
C/ Emilio Vargas, 7
28045, Madrid
Tel.: +34 915 668 100
E-mail: registro@enresa.es



The National Radwaste Company, ENRESA, is a public Company, created by Parliament in 1984 with state capital that plays an essential public service. Its mission is to collect, condition and store all the radwaste that is produced in Spain.



EL CABRIL STORAGE CENTRE

Ctra. A-447 Km 17,8 (dirección
Fuenteobejuna-Cazalla de la Sierra)
14740 Hornachuelos (Córdoba)
Tel.: +34 957 575 100 Fax.: +34 957 575 130

2019 data	
Total waste managed	2,674 m³
Low and medium activity waste:	826 m³
Very low activity waste	1,848 m³
From hospitals, research centres and industry	117 m³
From nuclear sites	2,557 m³
Number of expeditions	295
ENRESA staff	119 employees

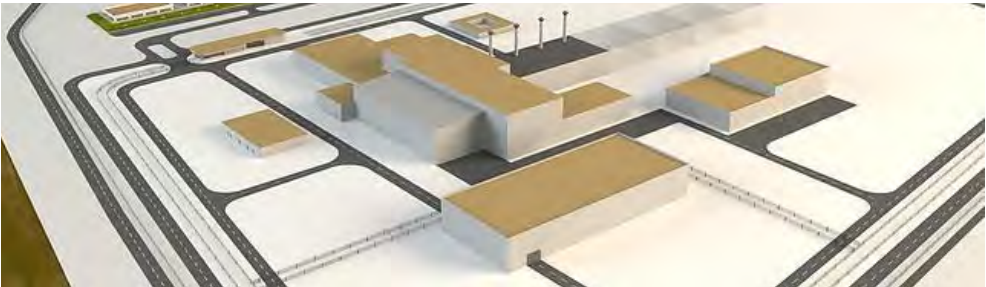
ENRESA is also in charge of dismantling the nuclear power plants whose activity has come to an end and of the environmental restoration of mines and uranium related installations, when so required by the authorities.

At present, ENRESA has a definitive radioactive waste storage sit for very low, low and average activity, in El Cabril located in the town of Hornachuelos in Cordoba.

The General Radioactive Waste Plan (PGRR) includes, as an objective for the management of Spent Fuel (CG) and High Level Waste (RAA), a Centralized Interim Storage Facility (ATC).

Regarding the dismantling projects, ENRESA is in charge of managing the Mestral Technological Centre, located in the old nuclear power plant of Vandellós I (Tarragona). Vandellós I is currently at the latent period, having completed its dismantling process to level 2. ENRESA is as well the Responsible Operator of the Jose Cabrera nuclear power plant in Guadalajara, during its dismantling process.

ENRESA is also involved, in coordination with Nuclenor, in the preliminary actions of the dismantling of Santa María de Garoña nuclear power plant, located in Burgos.



CENTRALISED TEMPORARY STORAGE SITE

Total waste that will be managed *	
Spent fuel	7,487 t
High activity vitrified waste	13 m³
Special waste	6,050 m³

* The total is included, also those generated in operation from the Centralized Interim Storage Facility (ATC) and Deep Geological Repository (AGP)



DISMANTLING

Nuclear Power Plant José Cabrera
19118 Almonacid de Zorita (Guadalajara)
Tel.: +34 625 661 452
E-mail: cevisic@enresa.es

Mestral Technological Centre
Ctra. N-340, Km 1123,7
43890 L'Hospitalet de L'Infant (Tarragona)
Tel.: +34 977 818 500 Fax.: +34 977 818 527
E-mail: cevisva@enresa.es

Total waste that will be managed	Vandellós I	José Cabrera
Type of reactor and power	Graphite-Natural Uranium. 480 MWe	PWR. 160 MWe
Reactor shutdown	1989	2006
Tears of operation	17	38
Total materials managed	96.630 Tn	34,700 t
Conventional materials	84.894 Tn	7,700 t
Declassified materials	9.973 Tn	18,300 t
Radwaste	1.763 Tn	8,700 t
Dismantling period	1998-2003	2010-2020
Current dismantling status	Latency	Execution of the Dismantling and Closure Project
Average workforce during dismantling	323 employees	250 employees
ENRESA workforce	7 employees	13 employees

WEB DIRECTORY

A

Almaraz I and II Nuclear Power Plant	www.cnat.es
Amphos 21	www.amphos21.com
Ascó Nuclear Power Plant	www.anav.es

C

CEN Solutions	www.censolutions.es
Centro Tecnológico CTC	www.centrotecnologiccoctc.com
Cofrentes Nuclear Power Plant	www.cncofrentes.es
Coapsa Control, S.L.	www.coapsa.com

E

EDP	https://es.edp.com/
Empresarios Agrupados	www.empresariosagrupados.es
Endesa	www.endesa.com
Enresa	www.enresa.es
ENUSA, Industrias Avanzadas S.A., S.M.E.	www.enwesa.com
Enwesa	www.equimodal.com
Equimodal	www.ensa.es
Equipos Nucleares, S.A., S.M.E.	

G

GD Energy Services	wwwwww.gdes.com
GE-Hitachi	www.ge-energy.com
Geotecnia y Cimientos	www.geocisa.com
Grupo Eulen	www.eulen.com

I

Iberdrola	www.iberdrola.es
IDOM Consulting, Engineering, Architecture, S.A.U.	www.idom.com

N

Naturgy	www.naturgy.com
Newtesol	www.newtesol.com
Nusim	www.nusim.com

P

Proinsa	www.proinsa.eulen.com
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R

Ringo Válvulas, S.L.	www.ringospain.com
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S

Santa Maria de Garoña Nuclear Power Plant	www.nuclenor.org
Spanish Nuclear Industry Forum	www.foronuclear.org

T

Taim Weser	www.taimweser.com
Tecnatom	www.tecnatom.es
Trillo Nuclear Power Plant	www.cnat.es

V

Vandellós II Nuclear Power Plant	www.cnat.es
VIRLAB, Expertise in Vibrations and shocks. Testing Laboratory	www.virlab.es

W

Westinghouse Electric Spain	www.westinghousenuclear.com
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