

# 04.2

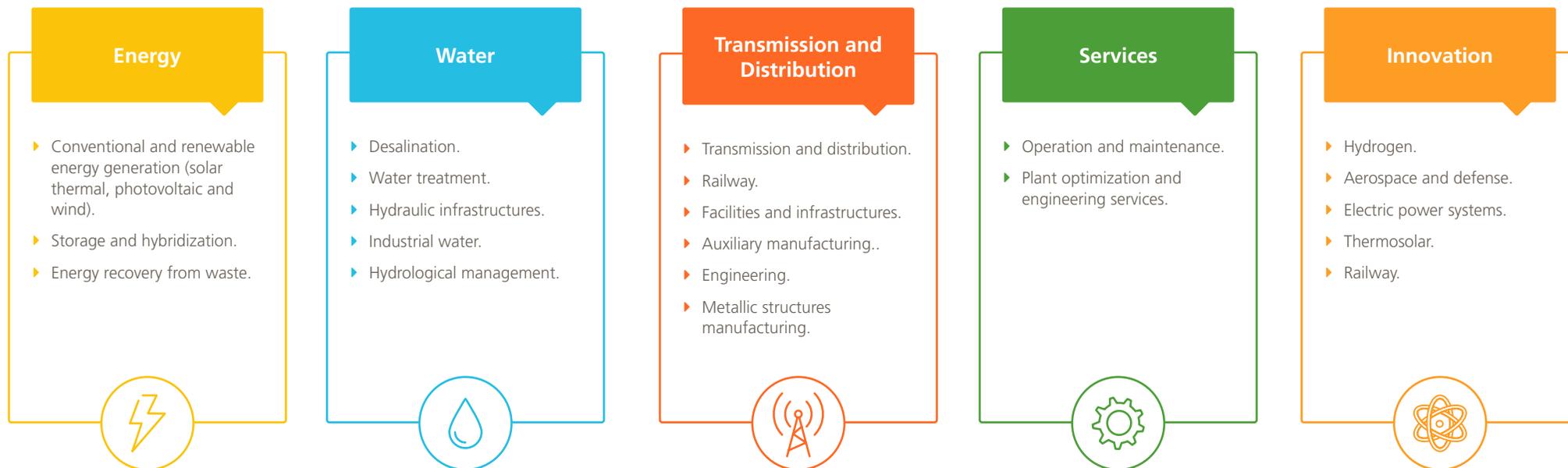
## Industrial contribution



04. Performance and sustainability contribution / 04.2. Industrial contribution

## Projects in which the company works

Abengoa began operating in 1941 focused on projects and technical studies, as well as electrical assemblies. Since then, 80 years later, the company has developed its main activity around engineering and construction projects in four fundamental areas: water, energy, transmission and infrastructures and services. All this, with R&D as a distinguishing driving force.



04. Performance and sustainability contribution / 04.2. Industrial contribution

Following an international expansion which started in the 1960s, Abengoa has a stable presence in the following geographical areas, which are of a strategic importance for the company: These are South America (Argentina, Brazil, Chile, Peru and Uruguay), North America (United States and Mexico), Europe (Belgium, Denmark, France and the United Kingdom), Africa (Algeria, Ghana, Kenya, Morocco and South Africa) and the Middle East (Saudi Arabia, United Arab Emirates, Oman and Qatar).



04. Performance and sustainability contribution / 04.2. Industrial contribution

## Projects by areas of activity

By areas of activity, these are the main milestones achieved by the company in 2020.

### 1 Desalination



In 2020 Abengoa was awarded numerous international desalination awards and continued to lead the world rankings in this industry. The Jubail 3A desalination plant in Saudi Arabia was likewise awarded, which will have a production capacity of 600,000 m<sup>3</sup>/day. At the end of this same year, it reached 80 % progress in the execution of the desalination plant of Rabigh III, also of 600,000 m<sup>3</sup>/day, in Saudi Arabia, and began the tests of operation and the production of water in the Salah desalination plant, in Oman, from 113,500 m<sup>3</sup>/day. Additionally, it continued with the construction of the Taweelah desalination plants (909,000 m<sup>3</sup>/day) in the United Arab Emirates, Agadir (275,000 m<sup>3</sup>/day) in Morocco, and Sousse (50.000 m<sup>3</sup>/day) in Tunisia.

### 2 Water treatment



Thanks to its wide experience in both water purification and urban wastewater treatment and reuse, Abengoa leads the way in the "Top International Contractor 2020" ranking from ENR Engineering News-Record (ENR), the reference platform in the construction industry, in the Treatment and Desalination category.

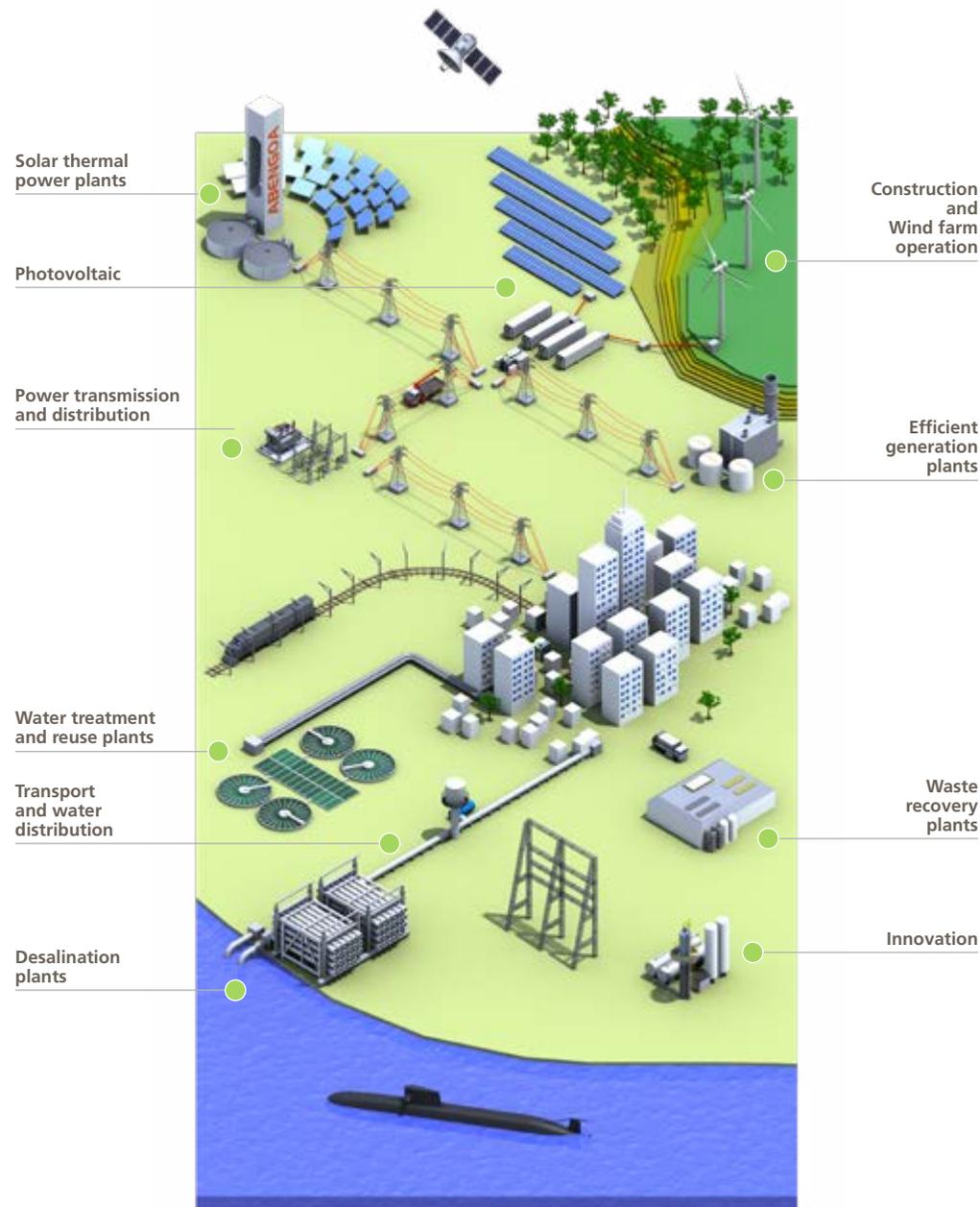
In 2020, the company continued with the construction of two purification projects in India, Nasrullaganj and Maheshwar, which will improve sanitation for nearly 55,000 inhabitants.

### 3 Water infrastructure



In its 75-plus years of experience, Abengoa has developed more than 40 pumping stations, more than 1,100 km of large pipelines for water regulation, transport and distribution has irrigated or modernized more than 500,000 ha and has installed more than 400 MW in built, upgraded or modernised hydroelectric plants.

In 2020, Abengoa Started to work on the irrigation network corresponding to the desalination project in Agadir (Morocco), which will ensure the irrigation of 15,000 ha in the plain of Chtouka using desalinated seawater. This project includes the construction of a desalination plant, considered the largest for the combined use of drinking water and irrigation.



04. Performance and sustainability contribution / 04.2. Industrial contribution

4 Industrial water



Abengoa has more than 35 years of experience in the treatment of process and wastewater, reuse and Zero Liquid Discharge (ZLD), in industrial sectors such as power generation, steel production,

paper industry, leachate, oil and gas, petrochemical, pharmaceutical, mining and food, among others, exceeding 650,000 m<sup>3</sup>/day of global treatment capacity. In 2020, it has continued the construction of the reverse osmosis desalination plant at the industrial complex of Emirates Global Aluminum in Jebel Ali, which will have the capacity to produce more than 47,750 m<sup>3</sup>/day of drinking water and water for the industrial use of the complex.

5 Solar thermal



Abengoa is an international leader in solar thermal energy, with a total capacity of 1.9 GW in plants developed, designed, built and/or operated on four continents, representing approximately 30 % of the total

world capacity. This fact has made Abengoa rank fourth in the Top International Contractor 2020 ranking, in the solar sector, published by the prestigious magazine Engineering News-Record. In 2020 Abengoa carried out the receiver hoisting and the melting of more than 46,000 tons of salts in the first solar thermal tower plant in Latin America, 110 MW solar thermal tower plant being built for EIG Global Energy Partners on the Cerro Dominador platform in Chile. It likewise completed the first solar field of the three parabolic trough plants of 200 MW each corresponding to the Noor Energy I project, which is being developed in Dubai for phase IV of the Mohammed bin Rashid Al Maktoum Solar Park, the largest solar complex in the world.

6 Conventional generation



Abengoa ranks third among the main cogeneration contractors in the Top International Contractor 2020 ranking of the Engineering News-Record magazine since it has an installed capacity of more than 9 GW in simple and combined cycles, simple to combined cycles conversion, engineer plants and cogeneration. In 2020 construction work continued on the combined cycle

of what will be the largest solar-gas hybrid plant in the world,, the Waad Al Shamal plant, which will produce a total of 1,440 MW of energy.

7 Wind



Abengoa has been involved in projects related to the wind energy industry for more than 35 years, accumulating experience with more than 480 MW worldwide. It provides services for the entire life cycle of the project, from resource study, optimization and selection of turbines, through detailed engineering, logistics, construction and operation of the wind farm.

8 Photovoltaic



With more than 500 MWp installed in photovoltaic solar energy and close to 30 years of experience in this sector, Abengoa was granted in 2020 important awards in Spain for Iberdrola, in consortium with FCC

Industrial, which together amount to 339 Mw.

9 Waste to energy and biomass



Abengoa designs, builds and operates innovative facilities to produce renewable and sustainable energy in the form of heat, cold, electricity or fuels from all types of waste and biomass. In 2020, it has continued with the construction work of the Sierra Biorefinery, the first plant

to produce biofuels for transportation from municipal solid waste in the US.

10 Storage and technology hybridisation



Abengoa is an integral supplier in energy storage, as it not only has the largest thermal energy storage portfolio in the world, with more than 6,000 MWht of capacity installed, but also has solutions based on lithium-ion batteries.

11 Innovation



One more year, Abengoa continues to further develop the technologies to maintain its competitive differences in the demanding markets of renewable energies, aerospace and defence. In this sense,

it is worth mentioning, among others, several innovation projects in supercritical CO<sub>2</sub> (CSP), in frequency and voltage regulation of the grid (batteries), AIP system of the S80 submarine (defence) and external habitability (aerospace), which will be described at greater length in later sections.

12 Power Transmission & Distribution



Abengoa has more than 70 years of experience in industrial and infrastructure engineering, construction and maintenance in the energy, industry, environment, transport and development of

electrical transmission and distribution lines, railway electrification, facilities and infrastructure of all kinds of plants and buildings, as well as auxiliary electrical, electronic and metallic structure manufacturing.

04. Performance and sustainability contribution / 04.2. Industrial contribution

 Energy



▶ Abengoa has a portfolio of conventional and renewable energy projects exceeding 13 GW installed and under construction.

In recent years, the energy generation industry has undergone a considerable evolution towards a greater use of renewable energies and important improvements in the field of storage. In this regard, Abengoa, throughout its history, has developed large projects based not only on the use of conventional generation technologies, such as combined cycles and cogeneration, but also on the use of renewable energies, through solar thermal and photovoltaic plants, wind farms and waste and biomass energy recovery plants, exceeding in total 13 GW installed and under construction.

Its extensive, specialised and competitive know how of this industry, and its proven experience in benchmark projects place Abengoa at the forefront in hybridisation of technologies and in storage, ensuring the provision of clean, manageable energy as well as decarbonisation responses to its customers.

In this regard, the company offers turnkey solutions, ranging from development, engineering, purchasing, construction and commissioning, to plant operation and maintenance.

▶ Renewable energies, storage and hybridisation



▶ Abengoa ranks fourth in the international ranking of contractors in the solar sector, according to ENR magazine.

Abengoa is an international leader in solar thermal energy, due to its own technology and a total capacity of 1.9 GW in plants developed, designed, built and/or operated on four continents. This capacity, representing approximately 30 % of the world total, has ranked the Company fourth in the Top International Contractor 2020 ranking in the solar industry, annually prepared and published by the prestigious Engineering News-Record (ENR) magazine.

Specifically, in terms of solar thermal tower technology, Abengoa pioneers the construction of plants for commercial operation, with more than 130 MW in operation and 110 MW under construction. This technology is based on the concentration of solar energy, captured by a field of heliostats, in a receiver located at the top of a tower.

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Likewise, it has extensive experience in solar thermal technology with parabolic trough collectors, with plants exceeding 1,600 MW in operation and 650 MW under construction. In this case, the energy is captured through a collector which heats a heat transfer fluid to use heat in a conventional thermal cycle.

Its commitment to decarbonisation has led Abengoa to develop its own solar heat technology for high-temperature heavy industrial processes, based on the use of parabolic trough solar thermal energy with integrated thermal storage, thus meeting the needs of strategic industries which require reliable technologies.



► Abengoa's portfolio of photovoltaic projects is around 800MWp.



► Abengoa and FCC are building the largest photovoltaic project in Europe in Cáceres (Spain).

In terms of photovoltaic solar energy, and with almost 30 years of experience, Abengoa is considered a benchmark due to the construction of plants around the world, totaling more than 500 MWp installed and which will reach close to 800 MWp once the portfolio under execution is completed.

In 2020, Abengoa achieved significant successes in the photovoltaic industry, and was awarded three projects in Spain, in consortium with FCC Industrial, for Iberdrola: the 50 MWp Barcience plant in Toledo; the Puertollano plant, in Ciudad Real, with 100 MWp; and the Francisco Pizarro project, in Cáceres, where Abengoa is participating in the construction of 189 MWp which will be the largest photovoltaic project in Europe.

In terms of energy storage, Abengoa has consolidated as a comprehensive supplier with the largest installed portfolio of thermal energy storage in the world, with more than 6,000 MWh of capacity, using molten salts, apart from lithium-ion batteries for rapid response management.

In terms of its ongoing projects, in 2020 Abengoa continued with the construction, in consortium with Acciona, for EIG Global Energy Partners, of the first solar thermal tower plant in all Latin America, in Chile, part of the Cerro Dominador platform, with 110 MW, and in which two very important milestones were reached. The first one, the hoisting of the receiver, which has become the first manoeuvre carried out in the world in this type of project. Taking into account the weight of the receiver (2,300 tons), it was built at the foot of the plant and later taken to the top of the tower, 250 meters high.

The second milestone was the fusion of more than 46,000 tons of salt from the Atacama desert, which will allow the energy captured throughout the day to be stored for up to 17.5 extra hours, which will allow the plant to generate clean energy in a manageable way, 24 hours a day.

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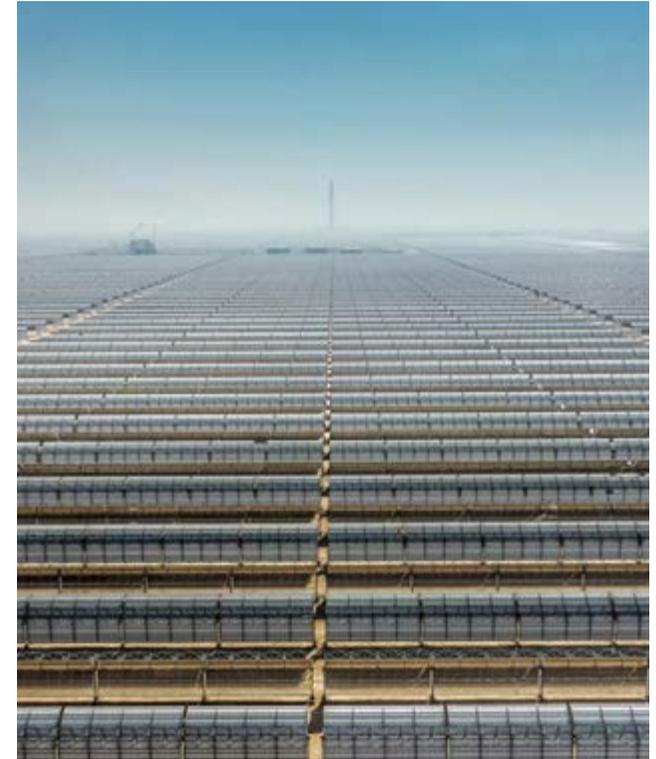


► Hoisting the receiver of the Cerro Dominador solar thermal plant.

This solar thermal plant, together with the 100 MW photovoltaic plant built and commercially operated by Abengoa in 2017, and a 4 MWh battery storage system, will constitute the first renewable energy complex in the world combining the three technologies which will have a total capacity of 210 MW.

In Dubai, in the Noor Energy I project, Abengoa completed the first solar field of the three parabolic trough plants of 200 MW each, which it is developing for phase IV of the Mohammed bin Rashid Al Maktoum Solar Park which will be the largest solar

complex in the world. The collectors installed in these plants, the so-called Spacetube 8.2++, are part of a new generation of large-opening parabolic trough collectors developed by Abengoa and previously used by the company in plants such as Xina Solar One, in South Africa. It is the commercial collector with the largest opening on the market and whose innovative design has resulted in significant improvements in its optical performance and assembly optimisation, as well as reducing manufacturing and installation costs.



► Abengoa has completed the construction of a parabolic trough solar field for the largest solar complex in the world, in Dubai.

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► Conventional generation

Internationally acclaimed for its capabilities in conventional energy generation technologies, Abengoa ranks third among the main cogeneration contractors in the above mentioned Top International Contractor 2020 ranking, from ENR magazine. In this area, Abengoa has an installed capacity of more than 9 GW in simple and combined cycles, conversion from simple to combined cycles, engine plants and cogeneration plants. Of the 9 GW, 1.4 GW are under construction and are fully part of the Waad Al Shamal plant in Saudi Arabia, a combined cycle which will be part of what will be the largest hybrid solar and gas power plant in the world. Additionally, this plant has a 50 MW parabolic trough collector solar field.

► Waste to energy and biomass



► Sierra Biofuels will be the first plant in the United States to produce biofuels for transportation from municipal solid waste.

For Abengoa energy recovery represents its commitment to eliminating waste and to reducing the use of fossil fuels. Therefore, it designs, builds and operates innovative facilities to produce renewable and sustainable energy in the form of heat, cold, electricity or fuel from all types of waste and biomass.

and approximately 42 million litres of synthetic crude will be produced.

📄 More information about this plant on [page 112](#)

In 2020, Abengoa continued with the construction works of the Sierra biorefinery. This will be the first plant to produce biofuels for transportation from municipal solid waste in the United States. 175,000 tons of waste will be annually processed

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 Water



▶ Abengoa has received a special recognition as “Desalination Company of the Year” at the Global Water Awards (GWA).

Abengoa is a global technological operator in the water industry, an international leader, due to the development of large desalination projects, urban and industrial purification, purification and hydraulic infrastructures, for public institutions, private and industrial clients. These projects integrate development, engineering, supply, construction and start-up activities, as well as operation and maintenance services.

With more than 65 years of experience in this industry, Abengoa has a highly qualified team applying the most innovative and efficient designs, offering its clients solutions tailored to their needs and with the lowest investment and operating costs, being positioned as one of the main companies in the industry in terms of portfolio, engineering and technology.

▶ **Desalination**

Reverse osmosis desalination is an increasingly competitive and effective technology to obtain drinking water from sea or brackish water in regions in which water resources scarcity poses a great challenge to life and to the normal development of the communities inhabiting there. Abengoa is a leader in the desalination industry with the capacity to produce a total of 1.8 million m<sup>3</sup>/day of desalinated water, which will be increased to 4.3 million m<sup>3</sup>/day when completing the portfolio of ongoing projects. This is endorsed by the international recognitions received in 2020:

- Special Highly Commended recognition as “Desalination Company of the Year”, in the Global Water Awards (GWA), promoted by the prestigious publication of the water industry, Global Water Intelligence (GWI). This recognition has been the result of Abengoa’s achievements during this year, not only for the desalination projects awarded, but also for

the optimal evolution of all under construction, as well as the plants in which it provides operation and maintenance services.

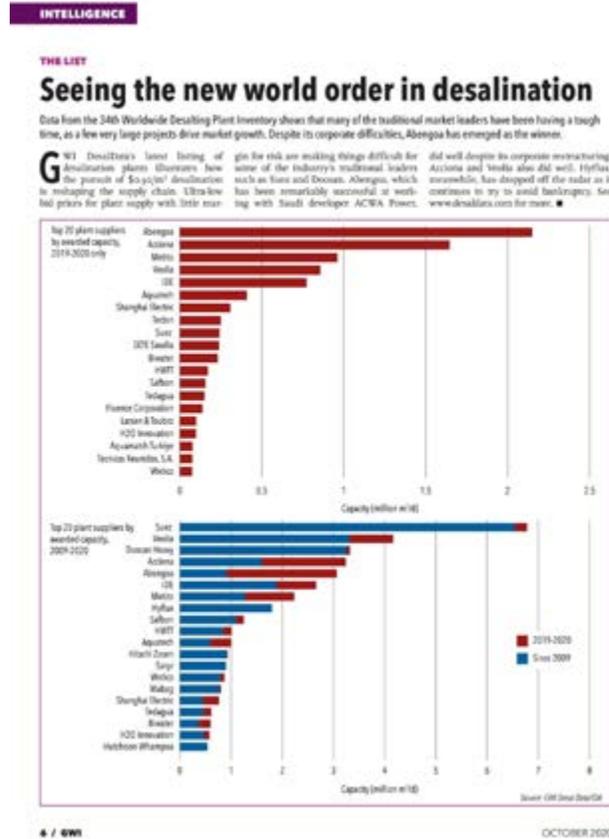
- The Shuaibah desalination plant in Saudi Arabia, with a capacity of 250,000 m<sup>3</sup>/day, has received recognition from several international institutions, such as the GWI, which has awarded the plant a GWA in the “Desalination Plant of the Year” category; or the Middle East market intelligence platform, MEED, which has awarded it as “GCC Water Project of the Year”. Inaugurated in July 2019, the Shuaibah desalination plant started to be commercially operational ahead of schedule, meeting the deadline committed by the construction consortium, after only 21 months from the start of construction, setting a new record for large reverse osmosis plants. In 2020 this plant celebrated its first year since its start-up, having supplied 87 million cubic metres of drinking water for human consumption to that date.



▶ Shuaibah, “Desalination Plant of the Year” 2020 at the Global Water Awards.

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- Abengoa likewise ranks first among the main companies in the industry for its contracted desalination capacity in 2019 and 2020, and fifth since 2009, according to the IDA Water Security Handbook 2020-2021 and the GWI.



- Abengoa ranks first in the international desalination plant contracting ranking 2019-2020 (IDA Water Security Handbook).

Of note among its main achievements in 2020 was the award of the Jubail 3A desalination plant in Saudi Arabia. This plant, which will guarantee the supply of drinking water to the Eastern, Riyadh and Qassim provinces throughout the year, will have a capacity of 600,000 m<sup>3</sup>/day and includes the construction of a photovoltaic solar field allowing it to sustainably reduce the energy consumption of the desalination plant network.

By the end of 2020, Abengoa was building plants with a total production capacity of 2.5 million m<sup>3</sup>/day of desalinated water. The Rabigh III desalination plant, which, with 600,000 m<sup>3</sup>/day capacity once completed will be the largest in the country with reverse osmosis technology, reached 80 % completion by the end of 2020. Additionally, its projects currently in progress include some milestones in the international industry, such as the world's largest reverse osmosis desalination plant, located in the Taweelah power and water generation complex in the United Arab Emirates, with a production capacity of 909.000 m<sup>3</sup>/day.



- Abengoa continues to make progress in the construction of Rabigh III, which will be the largest desalination plant in Saudi Arabia.

Other projects to continue under construction during 2020 were the Agadir desalination plant, with 275,000 m<sup>3</sup>/day in Morocco and the Sousse plant, with 50,000 m<sup>3</sup>/day, in Tunisia.

At the end of 2020, the Salah desalination plant started operating tests and water production. This plant, with a capacity of 113,500 m<sup>3</sup>/day, will boost the supply of drinking water to the southern region of Oman and has been a major challenge for the company from the point of view of its design and construction, as it is able to adapt to the changing climate conditions in the area and, specifically, to the worsening seawater quality.



- The Salah desalination plant has been a major technological challenge for the company.

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► In 2018, Abengoa received the final acceptance for the Barka desalination plant (Oman)

Abengoa develops sustainable solutions for water treatment, both in water purification, with the capacity to supply more than 11 million people around the world, and in urban wastewater treatment and reuse, serving more than 6.5 million people. It has ranked first in the “Top International Contractor 2020” ranking of ENR, a benchmark platform in the construction industry, in the Treatment and Desalination category.

In central India, Abengoa continued in 2020 with the construction of two purification projects, Nasrullaganj and Maheshwar. Both include treatment plants and sanitation networks that in total will have the capacity to treat 10.000 m<sup>3</sup> of wastewater a day. These plants will reduce the discharge of untreated wastewater into natural channels, thus improving the sanitation of nearly 55,000 inhabitants.

► Cerrato hydroelectric plant

Abengoa is a specialist in hydraulic engineering and has more than 75 years of experience in which it has developed more than 40 pumping stations, more than 1,100 km of large pipelines for water regulation, transportation and distribution, has irrigated or modernised more than 500,000 ha and has installed more than 400 MW in built, improved or modernized hydroelectric plants.

In 2020, Abengoa started working on the irrigation network for the desalination project in Agadir (Morocco), a milestone that included the visit of King Mohammed VI. This project includes the construction of a desalination plant, considered the largest for the combined use of drinking water and irrigation, with a capacity to produce 275,000 m<sup>3</sup> of desalinated water a day. The irrigation network will consist of 22 km of general pipeline, five pumping stations, two ponds regulating 10,000 m<sup>3</sup>, a pipeline distribution network of 487 km and a connection network of

300 km, which will serve 1,300 irrigation terminals. This network will ensure the irrigation of 15,000 ha in the Chtouka plain using desalinated seawater, which will avoid the existing problems due to overexploitation of groundwater in the area and will benefit the economic development of the region.



► Abengoa has started working on the irrigation network for the Agadir desalination plant.

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► Industrial water



► Abengoa has more than 35 years of experience in industrial water treatment.

Abengoa has more than 35 years of experience in industrial water treatment, throughout which it has specialised in different industries, such as power generation, steel production, paper industry, leachate, oil and gas, petrochemical, pharmaceutical, mining and food, among others. Abengoa is highly specialised in the treatment of process and waste water, reuse and Zero Liquid Discharge (ZLD), reaching a global capacity of more than 650,000 m<sup>3</sup>/day.

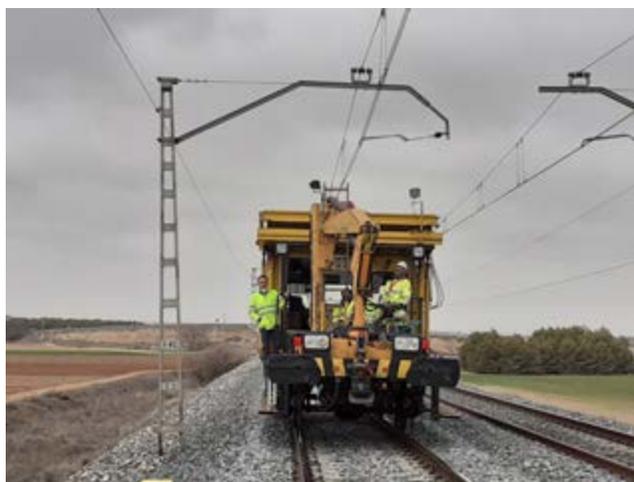
In 2020, Abengoa continued to work on the construction of the reverse osmosis desalination plant at the Emirates Global Aluminum industrial complex in Jebel Ali. This plant will have the capacity to produce more than 47,750 m<sup>3</sup>/day of drinking water and water for industrial use in the complex.

On the other hand, the process water treatment and wastewater treatment plants being built by Abengoa at the Norte III combined cycle power plant in Mexico passed the start-up and operational testing phase. These plants, which have an overall treatment capacity of 1,700 m<sup>3</sup>/day, supply the different uses of the power plant, treating the discharges to an almost "Zero Liquid Discharge".

Abengoa likewise developed throughout 2020 the evaluation and determination of operational improvements of the Hornillos de Eresma slurry treatment plant for Naturgy, in Valladolid (Spain).



## Transmission and Infrastructure (T&I)



► Abengoa celebrates eight decades dedicated to developing transmission and infrastructure work.

From its Transmission and Infrastructure (T&I) area, Abengoa has spent 80 years dedicated to engineering, construction and maintenance of facilities and infrastructure in the energy, industry, environment, rail and telecommunications industries. This vertical, which dates back to the 1940s and represents the company's original activity, has been operating for eight decades. Its activities currently cover all products in the electrical transmission and distribution industry, electrification and conventional and high-speed rail installations and infrastructures for all types of industrial plants and buildings, as well as the auxiliary manufacture of electronics and metal structures.

### ► Transmission and Distribution (T&D)



► Abengoa is an international leader in transmission and distribution with more than 27,000 km of lines and more than 330 substations built in the last 15 years.

In 2020, work was successfully completed in Spain with the transmission electrical grid operator, Red Eléctrica España (REE), on the Güeñes-La Jara and Belesar-Lomba lines, both 220 kV, and also for the 400 kV Itxaso-Güeñes line. Likewise, work began on the 400 kV Baza-Caparecena line.

A very significant milestone was the award of the multi-year framework contract to increase capacity and lay fiber optics, also for REE.

In France, work continues steadily and relentlessly for transmission electrical grid operator (Réseau de Transport d'Électricité, RTE), which includes the engineering and construction, assembly and dismantling of overhead and subway

high-voltage lines, as well as substations, under the high-voltage framework contract which has been regularly renewed for more than 20 years.

In Belgium, a first homologation test has been completed to start working with ELIA, the transmission grid operator.

In Ukraine, the 750 kV Zaporizhzhia-Kakhovska high-voltage line has been successfully energized.

In the Emirates, several sites in the northeast and west coastal areas of Abu Dhabi have been covered for the high-voltage network operator, Transco.



► Abengoa is working on several transmission and distribution projects for the Abu Dhabi high-voltage operator, Transco.

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► **Railways**

In Spain, Adif continued with the maintenance of the high-speed lines Antequera-Granada, Madrid-Zaragoza-Barcelona-French border, Madrid-Alicante, Madrid-Córdoba-Málaga-Seville, Madrid-Toledo and Madrid-Valladolid. The maintenance of conventional railway lines and substations in the central (Madrid-based) and northeastern (Barcelona-based) areas has likewise been contracted and work has begun in both areas.

Work continues on the electrification of the Madrid-Levante high-speed line on the section to Murcia, a highlight being the starting-up of a first phase to Orihuela. The installation and maintenance of the protection, safety and telecommunications systems in the Pajares tunnel are still in progress.



► Abengoa is an international leader in catenary, substation, communications and auxiliary installation activities.

In the United Kingdom, and within the framework agreement of the company in the Anglian region, the design and assembly of the Bulls containerized substation has been successfully completed. Lodge feeder station. Likewise, Abengoa has been awarded a new contract to install harmonic filters in the above mentioned substation, providing first hand support to the customer in a technology being implemented for the first time in these substations.

In France, work has resumed on traction substations for the French railway operator.



► Abengoa is working on a railway electrification project in Lithuania to connect the country from east to west.

In Lithuania, the company has started the electrification project for the Vilnius-Klaipeda rail corridor, comprising more than 730 km, six traction substations and eight intermediate auto-transformer centres (ATCs). This project connects the country from east to west, allowing electric trains to run from the border with Belarus to the port of Klaipeda, which is one of the main freight movement axes of the Baltic countries and a key strategic objective to develop the railway industry in Lithuania. The socio-economic benefits expected from reducing pollution by eliminating the current diesel locomotives will be tremendous.

In Saudi Arabia, the Mecca-Medina high-speed train is already operational, under restricted operation, and Abengoa has contributed to its electrification as one of the members of the Spanish consortium that has implemented this emblematic project, having started the pre-commercial operation and maintenance works.

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► Facilities and Infrastructure (F&I)



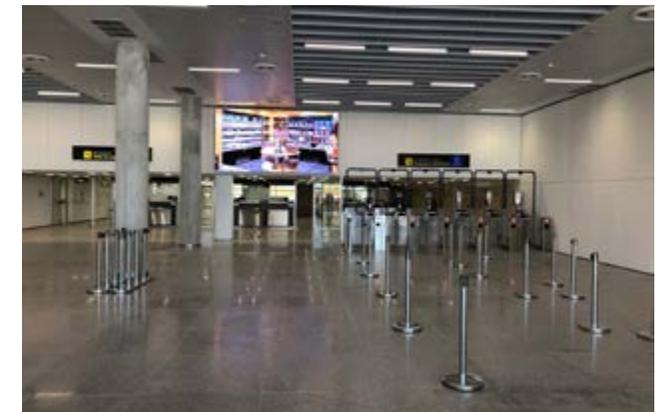
► Abengoa is responsible for the integral maintenance of the electromechanical installations of the Lagoh shopping and family leisure centre (Seville).

In Spain:

- Start of construction work on a new operational technical building in Torrejón de Ardoz, Madrid, for Enaire.
- Electromechanical assembly and civil engineering works for the Barciencia, Puertollano and Pizarro photovoltaic plants of Iberdrola were contracted and started.
- Work started on the auxiliary systems at the Morón de la Frontera Base, in Seville.
- The fibre optic piping project for the Bizkaia Transport Consortium was contracted.

- The integral maintenance of the electromechanical systems of the Lagoh shopping and family leisure centre in Seville was renewed for another one-year term (renewed for the second time).
- Maintenance work on the mechanical systems of Universidad Loyola de Andalucía, in Seville.
- Renovation and extension work continues on the San Pablo Airport Terminal building in Seville.
- Work has continued with Airbus on low-voltage installations at the Puerto Real factory in Cádiz.

- Work continues on voice and data installations for new stores, renovation of existing stores and logistics centres at the largest supermarket chain in Spain.
- Electrical maintenance and instrumentation work continues at the power generation plants of Almaraz (Cáceres) and Trillo (Guadalajara).
- Electrical maintenance work continues at the Sabic factory in Cartagena.
- Work with telecommunications operators in Navarra continues to progress at a good pace, as well as the deployment of mobile telephony, radio and fibre optics, installations of telecommunications structures and GSM-R.
- And work continues on the construction of the new building for the Mutua Universal Assistance and Administrative Centre in Malaga.



► Abengoa continues with the refurbishment and extension of the San Pablo Airport Terminal building in Seville (Spain).

In France, in the town of Cadarache, Abengoa is participating once again in the design and installation of two 400/22 kV substations within the ITER complex (International Thermonuclear Experimental Reactor).

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► Engineering

Important Milestones achieved in 2020:

- T&D Projects:
  - › Engineering work continues on the 220 kV Belesar-Lomba high-voltage power line.
  - › Development of 132 kV overhead-underground high voltage 132 kV Pinar del Rey junction line (Cádiz).
  - › Constructive engineering supervision of a 132 kV high voltage line at Belectric (Ciudad Real).



► Engineering works for the Vilnius-Klaipeda railway electrification project in Lithuania.

- Railway projects:
  - › Design engineering for the construction of six substations, eight auto-transformer stations and associated high-voltage lines for the Vilnius-Klaipeda project in Lithuania.
  - › Continued engineering work on catenary and substations for the electrification of the Mecca-Medina high-speed line.
  - › Catenary engineering for the electrification of the Monforte del Cid high-speed line is still progressing. – Murcia de Adif.
  - › Telecommunications system engineering for the Adif La Robla project.
  - › Electric traction simulation project for the Meca-Medina project (Haramain ASC) carried out with theALISproprietary simulation software.
  - › Simulation project Pantograph-Catenary studies for the Wales & Borders (Open Route Uplift).
  - › Design engineering for 1500 Vdc railway traction substations for SNCF Gerland and Egly substations.
  - › Catenary engineering in the United Kingdom for the Wales & Borders project, in which the following activities are being carried out:
    - Electrification Project. Route Section R2P.
    - Electrification Project. Route Section RS2THT. Treherbert to Trehafod.
    - Electrification Project. Route Section RS0CTL. Ninian Park to Radyr.
    - Electrification Project. Route Section RS1ABD Aberdare to Pontypridd.
  - › Engineering to design a harmonics system for the Beaulieu railway traction substation in the United Kingdom for Network Rail.

- Photovoltaic projects:



► Abengoa is developing the construction engineering for a photovoltaic plant in Barciencia (Toledo).

- › Photovoltaic engineering, substations and lines to develop a technical-administrative project for the Las Gabias 220 kV node (Granada).
- › Photovoltaic engineering, substations and lines to develop different technical-administrative projects for the Alhaurín 220 kV (Málaga), Pinar del Rey 220 kV (Cádiz), Nueva Casares 220 kV (Cádiz) and Cañuelo 220 kV (Cádiz).
- › Constructive engineering for the photovoltaic generation project for the Barciencia (Toledo) and Puertollano (Ciudad Real) plants.

04. Performance and sustainability contribution / 04.2. Industrial contribution

► **Manufacture of metal structures**



► Telecommunications towers for Los Belos transmission line (Teruel - Zaragoza), produced at the metallic structures factory, Eucomsa.

Abengoa manufactures meta frames at its Eucomsa centre, located in Utrera (Seville). It designs, manufactures and tests lattice towers for overhead lines and telecommunications, as well as structures for electrical substations and solar energy generation (parabolic trough collectors and heliostats). The resistance of these structures is likewise checked at the test station available at the factory. The milestones achieved in 2020 are as follows:

In Spain:

- The manufacturing of 66 kV towers for the Riocaya – Frontera Portugal line (Badajoz) and screeds for the Quel – La Serna and Aragón – Mequinenza lines (Zaragoza) has been completed
- Eucomsa's own design towers have been manufactured for the following lines:
  - Límite Baza 220 kV (Granada).
  - Las Majas VII – Las Majas VIID de 220 kV (Zaragoza).
  - Hilada Honda – Las Majas VIID de 30 kV (Zaragoza).
  - Los Belos 220 kV (Teruel y Zaragoza).

- REE towers have been manufactured for the line:
  - Lousame (A Coruña) – 400 kV tube (Pontevedra).
- Ongoing work on the current framework agreements in force with electric companies, under which supports have been manufactured for REE (220 kV and 400 kV) and Iberdrola (30 kV, 45 kV, 66 kV and 132 kV).
- The three-year framework contract for avifauna crossarms with Iberdrola is enforced. Crossarms arising from this framework contract are being manufactured.
- Work has continued on the manufacture of telecommunication towers for the following customers:
  - Adif (GSM-R system).
  - Telxius for mobile telephone operators.



► Manufacturing of telecommunications tower for mobile telephony in Spain.

04. Performance and sustainability contribution / 04.2. Industrial contribution

In Germany:

- The manufacturing of the 380 kV Altheim line has been completed. – St. Peter for Tennet.
- The manufacturing of the 330 kV line of the Ostbayernring project, section C (Redwith – Mechlenreuth) lot 2 for Tennet has been procured and started.

In Ireland:

- The manufacturing of 38 kV, 63 kV and 132 kV supports and cross heads continues to progress at a good pace, pursuant to the framework contracts in force with the electricity company operating in the country, the Electricity Supply Board (ESB). In addition, the seven-year framework agreement entered into with this entity for the design, testing and manufacturing of substation frames is in force. The design phase has begun.

In Sweden:

- The supports for the 130 kV Storskalsjon - Jenasen line have been manufactured.

In Chile:

- The supports for the 220 kV evacuation line of the Tchamma wind farm have been manufactured.



► Work on the evacuation line of a wind farm in Chile.

In Kenya:

- The design, testing and manufacturing of supports for the 132 kV Rabai – Kilifi and Voi – Taveta lines have been procured. The engineering has been performed, prototypes manufactured and tests carried out.

In Cameroon:

- The testing and manufacturing of supports for the 90 kV Bertoua line has been procured. Prototypes have been manufactured and tests have been carried out.

In Emirates:

- The supply of support structures for the parabolic trough collectors of the Mohammed Bin Rashid Al Maktoum plant (phase IV) continue.

South Africa:

- Spare parts for the parabolic trough collectors of the Xina Solar One plant have been manufactured



► Eucomsa has manufactured spare parts for the parabolic trough collectors of the Xina Solar One solar plant in South Africa.

► **Auxiliary electric and electronic manufacturing**

The outstanding milestones achieved in 2020 are as follows:

- Upgrading of Power Distribution Boxes (PDBs) and manufacturing of control electronics and protection modules for UK armoured defence vehicles. These works include wiring modifications, electronic components assembly, testing and functional trials.
- Continued manufacturing of urban traffic control regulating equipment for the domestic and international market.
- Continued manufacturing of access control machines and associated electronics for Metro Madrid and Euskotren.
- Manufacturing of ticket cancellation machines for Tuvisa.
- Manufacturing of control monitors.
- Manufacturing of inclinometers for heliostat positioning control at the Cerro Dominador and Mohammed Bin Rashid Al Maktoum solar thermal plants (phase IV).
- Continued work on the manufacturing of the harness for the central channel of the high-speed motors and on-board AC cabinets for the Talgo project F070.
- Manufacturing of AC, DC cabinets and on-board connection blocks for the Talgo project F073 (Egypt). In 2019, the pre-series and First Article Inspection (FAI) units were developed, and in 2020 the execution of the series has been undertaken.
- Manufacturing of control cabinets at Valvidriera.

04. Performance and sustainability contribution / 04.2. Industrial contribution



## Services



▶ Abengoa has been providing operation and maintenance services in the energy, water and environment industries for more than 20 years.

Abengoa, with more than 20 years of experience in this field, carries out predictive, preventive and corrective operation and maintenance (O&M), using Computerized Maintenance Management System (CMMS) tools, in electric and thermal energy production plants (renewable and conventional), water and waste treatment plants and in hydraulic and environmental infrastructures. Operation and maintenance ensure that the assets function correctly throughout their life cycle. Additionally, Abengoa is responsible for the maintenance and operation of machinery and equipment to ensure maximum productivity, profitability and safety.

In this regard, the company has been internationally recognized for its leadership in this field, ranking sixth among the world's leading operators and constructors according to the "Internacional Contractor 2020" ranking, annually prepared and published by the prestigious ENR magazine.

Furthermore, Abengoa is positioned as leader in solar plant O&M due to the complete portfolio of tools developed by its R&D teams to provide the highest quality service, both in plant operation and in research centers. Thus, Abengoa, by becoming more actively involved in all phases of plant operation, achieves a higher level of vertical integration.

Designing and building with an operator's vision is a competitive advantage for Abengoa. O&M personnel, who are responsible for making continuous improvements in all plants by unifying and improving operating standards, work very closely with the centralized engineering department, enabling the plants operated by the company to achieve high levels of production and availability.



▶ Abengoa is the sixth company in the "Internacional Contractor 2020" ranking, prepared by the ENR magazine.

**04. Performance and sustainability contribution / 04.2. Industrial contribution**

In 2020, the global health crisis scenario due to the coronavirus pandemic and Spain being under a state of alarm, resulted in the Services vertical applying a series of preventive, training, informative and awareness-raising measures, which are still being applied today. A coronavirus prevention protocol has been drawn up, as well as specific contingency plans for each work center and plant. All this has allowed us to continue with the O&M work of the energy and water plants which, due to their essential nature, were required to remain active and in operation, always complying with the regulations and restrictions imposed in each individual country.

Specifically, this includes the six seawater desalination plants operated and maintained by Abengoa in Spain, Algeria and Ghana, which together produce more than 675,000 m<sup>3</sup>/day. Likewise, it has continued its activities in 15 solar thermal plants in Spain, Chile and South Africa; two solar-gas hybrid plants in Morocco and Algeria; a cogeneration plant in Mexico and a photovoltaic plant in Chile (part of the Cerro Dominador project), exceeding 2.30 GW in total.

In this regard, the Services company has more than eleven years of experience in the implementation and monitoring of maintenance management solutions in power plants with IBM Maximo Asset Management.

Additionally during 2020, Abengoa entered into a new five-year extension of the O&M contract for the 472 MW solar-gas plant (Ain Beni Mathar) with the Moroccan National Office of Electricity and Potable Water (ONEE). The plant has been under Abengoa's management since the beginning of its operation in 2010. ONEE's recurrent confidence in Abengoa is an endorsement of the company's track record in the industry. Moreover, the smooth performance of the plant consolidates its position in the international market.



► In 2020 Abengoa has entered into, with ONEE, a new extension of the O&M contract for the 472 MW solar-gas hybrid plant, Ain Beni Mathar (Morocco).

The company has likewise carried out maintenance work on the steam turbine both in Ain Beni Mathar and in Solaben 1 parabolic trough solar thermal plant (Spain). These operations were successful in terms of safety (no occupational accidents were recorded) and execution times, as well.

On the other hand, the company has supplied its customer Masdar for the Shams solar thermal plant with different services allowing improved performance of its operations.

04. Performance and sustainability contribution / 04.2. Industrial contribution

## Abengoa's presence

Abengoa's activity during 2020 was carried out mainly in the following geographical regions.

### Argentina



► The 345 kV Altiplano switching station, with AIS and GIS technology and specific designs due to its location at 4,000 meters above sea level, became operational in 2020.

Operating in Argentina for more than 50 years, Abengoa is a benchmark in the transmission and distribution industry in the country, having built more than 1,500 km of lines and more than 25 substations.

The global health crisis, aggravated by the extended economic and financial crisis in the country, has caused further delays in major electricity transmission works during 2020, as was already the case in 2019.

Taking into account this stand-by, the company's search for new contracts in Argentina focused on private clients. In this context, Abengoa has signed four new contracts during 2020, including assemblies and laying on 500 kV and medium voltage lines.



► Maintenance work on an existing 550 kV line.

In this way, Abengoa's subsidiary in Argentina has carried out, for the first time in its more than half a century of history, maintenance works on an existing 500 kV line, operated by third parties.

Likewise, during 2020, progress was made in the execution of ongoing projects: the 500 kV 25 de Mayo transformer station, the 500 kV Vivoratá interconnection, and the medium voltage works for the lithium projects in northern Argentina. Moreover, the 345 kV Altiplano disconnecting station project was completed.

By 2021, the company estimates that the reactivation of major electric transmission works will be gradual, so it will continue to manage opportunities for both the public and private sectors.



► Placing spacers on 500 kV line laying, in the province of San Juan.

04. Performance and sustainability contribution / 04.2. Industrial contribution

Brazil



► Abengoa has created a live line maintenance area (energized).

Abengoa has been present for over 20 years in Brazil, where it has a vast experience in the development of projects in transmission lines and electrical infrastructures, having built over 1,800 km of power lines and 30 substations.

2020 was set to be the first year of robust growth after successfully completing its restructuring process in 2019.

Nonetheless, the COVID-19 scenario has halted this growth, making 2020 a complicated year due to the fact that, despite having re-executed projects in the Brazilian transmission system, the global pandemic has not been an ideal scenario.



► The company has been awarded the civil works and assembly of the 500 kV Miracema substation.

In terms of the activity carried out by the company in 2020, the following should be highlighted:

- The renewal of the maintenance contracts for a five year term in which Abengoa, through its subsidiary Omega, will continue to carry out the maintenance of 3,500 km of power lines and 20 substations located throughout ten Brazilian states.
- The creation of a live line maintenance area, i.e., on energized lines, through this subsidiary, enabling maintenance work and modifications to be carried out on electrical installations without interrupting the service voltage.
- The equipment rental activity growth and the completion of its logistics center, located in Barreiras, in the state of Bahia.
- The award of a new contract to carry out the civil works and electromechanical assembly of the 500 kV Miracema substation in the state of Tocantins.

In the next years, Abengoa will face significant challenges in the country due to the fact that, despite the pandemic, Brazil will remain an attractive market in which the energy industry plays an essential role with major infrastructure investments expected.

04. Performance and sustainability contribution / 04.2. Industrial contribution

Chile



► Abengoa's 220 kV line constructed for Arauco in its MAPA project.

During 2020 Abengoa had to face the outbreak of the COVID-19 pandemic in Chile, like across the rest of the world; therefore, in order to carry out the projects, all the necessary measures were taken to safeguard the health of all workers in each project. This has allowed us to continue with the activity in the country, having successfully completed the following projects:

- Change of 23 kV lines for Minera Escondida (BHP Billiton), enabling its expansion in mining operations. The project involved the relocation of four sections of transmission lines associated with the largest copper mining deposit in the world: La Escondida.
- Change of four 13.8 kV lines for AMSA Centinela - Tesoro Sur in phase 2. Specifically, the company was in charge of modifying the electrical infrastructure required for the exploitation of the Tesoro Sur mine for one of the main Chilean copper suppliers.
- Construction of two substations and a 220 kV line for Arauco, in its MAPA project. These works have allowed the client to increase its cellulose production and discharge surplus energy into Chile's national interconnected system.
- Works for the world's largest copper supplier, Corporación Nacional del Cobre de Chile (Codelco), for the supply lines for the Talabre wells in the Chuquicamata division and civil works on roads, electric fences, laying and replacement of

tailings transport pipes from the mine to the dam in the Andina division. In this same division, Abengoa has been selected to execute civil and piping works to facilitate the operation of the mining company.

- Construction of the 220 kV Malleco substation, owned by Transelec (the country's main electricity transmission company), which has enabled the improvement of Chile's energy distribution infrastructure; as well as the change of conductor on a 154 kV transmission line, approximately 20 km long, connecting the Maitencillo and Vallenar substations.



► During the last year, Abengoa completed the construction of the 220 kV Malleco substation.

Likewise, 2020 has enabled the company to consolidate its presence in the country thanks to new contracts such as those listed below:

- Construction of two new 33/220 and 110 kV lift substations to allow discharging the energy coming from the Mesamavida and Los Olmos wind farms, belonging to our client, AES Gener. Both projects are part of the client's plan to increase the number of renewable energy facilities to contribute to the sustainable growth of the region.
- Construction of the Nueva Chuquicamata substation for Engie, as well as the expansion of the Calama substation and the line connecting to the new substation (works carried out at 220 kV).

- Four new contracts for Transelec, highlighting Abengoa's excellent performance and the customer's trust in the company. They include the construction of the new Ancud substation, located in Ancud; the enlargement of the 220 kV Miraje substation, on which work began in 2020 and is scheduled for completion in 2021; the line that will connect the island of Chiloé with the mainland in Puerto Montt; and the construction of a new 220 kV switch substation in Los Ángeles area. The latter are scheduled to begin in 2021.



► Civil works on roads, electric fences, laying and replacement of transportation pipelines for Codelco in the Andina division.

All this has allowed Abengoa, for more than 30 years, to continue being a leader throughout Chile in the execution of projects, both for the large mining industry and for companies enabling the generation and distribution of energy and contributing to the development of the country. It is worth highlighting the importance of always applying the necessary measures to safeguard the health of all those who execute the projects on a daily basis. Therefore, the Chilean Chamber of Construction has awarded Abengoa in the Honor Roll in terms of Occupational Health and Safety, obtaining the highest category: six stars. This distinction recognizes those companies excelling in terms of occupational safety due to the fact that in the last three years, excellence has been achieved in accident rate indicators.

04. Performance and sustainability contribution / 04.2. Industrial contribution

United States



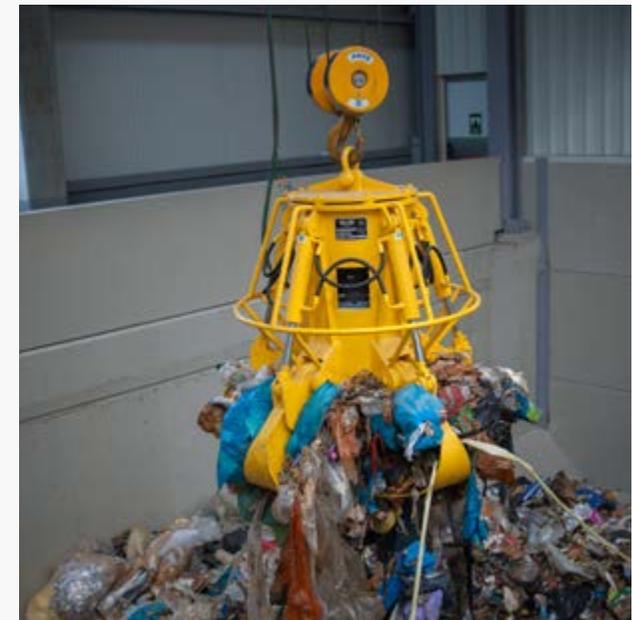
► Abengoa continued the construction of the Sierra Biofuels plant for Fulcrum during 2020.

2020 has been globally impacted by COVID-19 and, in this context, Abengoa's activity in North America has likewise been significantly impacted by this pandemic, as has been the case in most industries. Despite these circumstances, the engineering and construction activity has remained robust, especially in the works carried out by the company for the construction of the Sierra Biofuels plant in Fulcrum, located in the northern part of the state of Nevada.

This is a pioneering project as the plant will produce fuel from municipal solid waste (MSW), to be used in a more sustainable

aviation. Work carried out continue during 2021, with the plant expected to start commercial operation during this year.

Abengoa's participation in plants of this nature reinforces the company's strategic position in very demanding, high value-added projects, undertaking relevant technological and project management challenges. This experience will undoubtedly allow Abengoa to be a reference for future opportunities in the development of renewable biofuel plants, a growing market in the United States and with tremendous prospects for a short-term implementation in Europe.



► The Fulcrum plant will produce fuel from municipal solid waste.

At the same time, Abengoa has continued to collaborate with renewable energy project developers, especially in the solar energy industry. The portfolio of projects executed in the United States and worldwide consolidate the company as a major player in the industry in terms of engineering capabilities and execution of turnkey projects. A commercial development plan in the water industry has likewise been implemented in this market, aimed to strengthen the company's presence in this market. Therefore, the important contracts secured in areas such as the Middle East have been taken as a reference. It is expected that the activity developed during 2020 will pay off in the coming years, with new contracts to execute projects in the above mentioned industries.

04. Performance and sustainability contribution / 04.2. Industrial contribution

Mexico



► Abengoa has been in Mexico for 40 years, during which it has mainly focused on the power transmission and generation industries, among others.

2020 has been a year marked by the evolution of the COVID-19 pandemic. This situation led to Mexico recording its second largest historical GDP drop (8.5 %), which greatly affected construction in several industries, including energy and the environment.

Likewise, several legislative changes were implemented resulting in a significant reduction in investments, mainly in renewable energies.

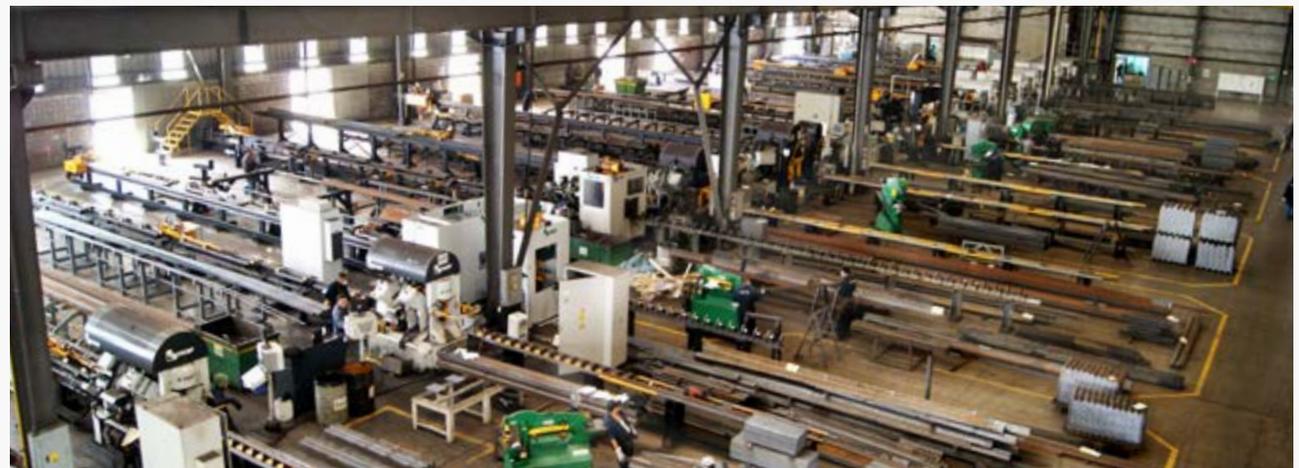
Nonetheless, last year, Abengoa in Mexico was able to complete the restructuring of its debt, after the approval of its Modifying Agreement to the Insolvency Agreement. Therefore, the company began a new stage in the country, in which it has been operating for 40 consecutive years, during which it has mainly focused on the transmission and generation of power, electromechanical installations, and water and environment industries.

In order to effectively reactivate its activity in Mexico over the past year and despite the additional difficulties of COVID-19, the company has continued to offer its traditional customers (mainly the Federal Electricity Commission - CFE), as well as to different private companies, laying the foundations for the recovery of the activity, as many projects have been pending assignment for the financial year 2021. Thus, as a result

of the work carried out in the first quarter of 2020, during the first quarter of 2021, the company has announced the award of four new distribution projects for the CFE, which are likewise the first contracts following the approval of the debt restructuring last year, which represents a new milestone for Abengoa in the country.

It should likewise be highlighted that, in terms of health and safety, Abengoa Mexico has completed another year with a zero frequency index. Thus, 2021 will be a year to restart and consolidate Abengoa's activity recovery in the Aztec country and to keep accident indicators at minimum levels.

On the other hand, Comemsa, the company's metallic structures factory in Mexico, has continued working and supplying material to different projects, increasing its turnover by 20 % compared to the previous year. During 2021, the company will continue to actively seek to serve the strategic projects of Dos Bocas and Tren Maya, as well as opportunities in new countries throughout the continent.



► Mexico's metal structures factory increased its turnover by 20 % in 2020.

04. Performance and sustainability contribution / 04.2. Industrial contribution

Middle East



the 600,000 m<sup>3</sup>/day capacity reverse osmosis desalination plant being built in Rabigh, Saudi Arabia, where it is likewise responsible for the construction of the world's largest solar-gas hybrid plant, Waad Al Shamal.

Moreover, likewise in this country, during 2020 Abengoa has been awarded the 600,000 m<sup>3</sup>/day Jubail 3A desalination plant, in which it participates as technologist for Sepco III and ACWA Power.

In the United Arab Emirates, it continues to execute the 700 MW solar thermal phase IV of the Mohammed bin Rashid Al Maktoum Solar Park in Dubai, where it is likewise building the world's largest reverse osmosis desalination plant in Taweelah, with a capacity of 900,000 m<sup>3</sup>/day. Moreover, another desalination plant for drinking and industrial water use at the Emirates Global Aluminium (EGA) industrial complex in Dubai is expected to be completed in 2021.

In Oman, work continued progressing on the largest desalination plant in the Dhofar region, Salah III, which has become operational in the first quarter of 2021.

More information on the power and water projects on [pages 93](#) and [page 97](#) respectively.

► Among other projects, Abengoa has continued to work on what will be the largest desalination plant in the Dhofar region of Oman.

Abengoa has been operating in the Middle East for more than 15 years, in countries such as Saudi Arabia, Kuwait, United Arab Emirates, Oman, Qatar, Bahrain and Egypt.

Throughout last year, and despite the global pandemic, the company continued with its activity in this region, executing the projects granted in previous years, such as

04. Performance and sustainability contribution / 04.2. Industrial contribution

Peru



► During its 26 years of operations in Peru, Abengoa has focused its activity on the mining, energy, infrastructure and transmission industries.

Abengoa has been operating in Peru for more than 26 consecutive years, during which it has focused its activity on executing projects for the mining, energy and infrastructure industries. Likewise, through its subsidiary Omega Peru, high voltage transmission systems are operated and maintained for customers in the mining and energy industries.

Throughout 2020, and despite the COVID-19 pandemic, the company has been awarded new projects in these industries.

On one hand, in the mining industry, it has entered into a contract for the engineering, procurement, construction, assembly and starting-up of the relocation of the 69 kV electrical ring and complementary works to extend the Toquepala Mine of the Southern Peru Copper Corporation (SPCC). The project is located at a height of 3,500 masl (meters above sea level).

The company has likewise been awarded several electrical maintenance works in this area for Shougang Hierro Perú and Compañía Minera Antamina.

It has likewise been awarded the detailed engineering for Minera Poderosa for its Chapacrosas electrical project, consisting of a 14 km, 60 km power transmission line with metal towers, the extension of an existing substation and a new electrical substation in the La Libertad region.

On the other hand, in the energy industry, the company has entered into a new contract for the engineering, procurement, construction, assembly and commissioning of the 220 kV transmission line for the Lomitas wind power project of Engie Energía Perú. It is located on the Peruvian coast.



► Work on the distribution line of the Minas Justa de Marcobre mining project.

Finally, important works have been completed, such as:

- Starting-up the 46 km distribution line at 22.9 kV for the Minas Justa de Marcobre mining project, located in the Ica Region.
- The 30,000 m<sup>3</sup> capacity retention dam reservoir and wastewater management system for the Cuajone mine, located in the Moquegua region. These works were carried out at a height of 3,500 meters above sea level and have included excavations, fillings, compaction, surface preparation and concrete works (concreting) of the retention dam and embankment, as well as the hydraulic works of the water filtration collection system.
- The civil works package for the desalination plant of Petroperu's Talara refinery modernization project, located in the Piura Region.



► 30,000 m<sup>3</sup> capacity retention dam reservoir built by Abengoa for the Cuajone mine.

During 2021, the company aims to consolidate its position as a specialist in integrated solutions in the mining industry due to its experience in projects for Southern Perú, Minera Poderosa, Shougang Hierro Perú, Minsur, Antamina, Nexa and Volcan, among others, as well as to continue offering specialist services in electrical EPC projects for companies in the energy industry, such as Engie, Atlantica, ISA and Kallpa, among others. All of the above mentioned, under the premise of zero accidents.

04. Performance and sustainability contribution / 04.2. Industrial contribution

South Africa



▶ The KHI Solar One solar thermal plant, built by Abengoa, is fully operational.

Abengoa's main activity in South Africa in 2020 focused on continuing to execute the operation and maintenance (O&M) contracts for the three Kaxu, KHI and Xina Solar One solar thermal plants, which it has promoted and built in that country, within the framework of the Renewable Energy Independent Power Producer Program (REIPPP), launched in 2011 by the South African government. These plants constitute three of the most important solar thermal projects in South Africa, since each of them has unique pioneering characteristics.

Thus, Kaxu Solar One, with parabolic trough technology, 100 MW of power and 2.5 hours of thermal energy storage using molten salts, was the first solar thermal plant to be commercially operational in the country, thus marking an industrial and technological milestone.



▶ Kaxu Solar One solar steam generator.

In this plant, in February, a fire broke out in the electrical building, mainly affecting the equipment called variable frequency drives (VFD) feeding the water and thermal oil pumps (HTF). This incident, given the safety conditions of the facility, did not cause any personal injury and practically coincided with the beginning of the state of alarm due to COVID-19 and the consequent restrictions on the mobility of people and the transport of goods.

The company worked in a very effective and coordinated manner, both with the O&M team and with external suppliers in many of the plant's restoration activities, so that just over seven months after the fire, the plant was operational again. Taking into account the challenges of the pandemic and the magnitude of the work involved, including the provision of heavy, long-term manufacturing and transportation equipment, the plant's recovery time was reasonably satisfactory. Likewise, the occasion allowed the new equipment to be installed in a technically more operational and safer layout, based on the equivalent design of this subsystem of other solar thermal plants, such as the adjacent Xina Solar One plant.



▶ Containers for the new Kaxu Solar One variable frequency drives.

The second solar thermal project developed by Abengoa in South Africa was the KHI Solar One plant, with tower technology, 50 MW of power and steam thermal energy storage, which was the first and, for the moment, the only solar thermal plant built in South Africa with this technology. Moreover, in 2020, the result of the renegotiation of the construction contract with the financing banks and with the project company continued to be executed, which will allow optimizing the plant's performance by implementing certain improvements, some of which had not been included in the original design, thus potentially achieving the optimal performance of the facility.

Abengoa's third project in South Africa is Xina Solar One, with parabolic trough technology, 100 MW of power and 5.5 hours of thermal energy storage using molten salts. With similar characteristics and adjacent to Kaxu Solar One, Abengoa introduced an important innovation: a new type of large-opening parabolic trough collector designed to improve the optical efficiency of the solar field, while optimizing thermal losses and reducing both the number of collectors and the ratio of steel weight per reflective surface.

04. Performance and sustainability contribution / 04.2. Industrial contribution



► Partial view of the Xina Solar One solar field with a large-opening parabolic trough collector.

Thus, due to the execution of the O&M contracts for the three plants, with two different technologies, with a combined installed capacity of 250 MW and with energy storage in all three plants (two using molten salt and the third one using steam), Abengoa continues to be the outstanding leader in this activity in South Africa.

Moreover, the remaining obligations under the EPC construction contracts for the Khi and Xina Solar One plants have continued to be met, since both were still under guarantee at the beginning of 2020.

Regarding the plant's production, in terms of real versus guaranteed production ratios, very good results were achieved in all three cases, roughly repeating the excellent values previously achieved in 2019.



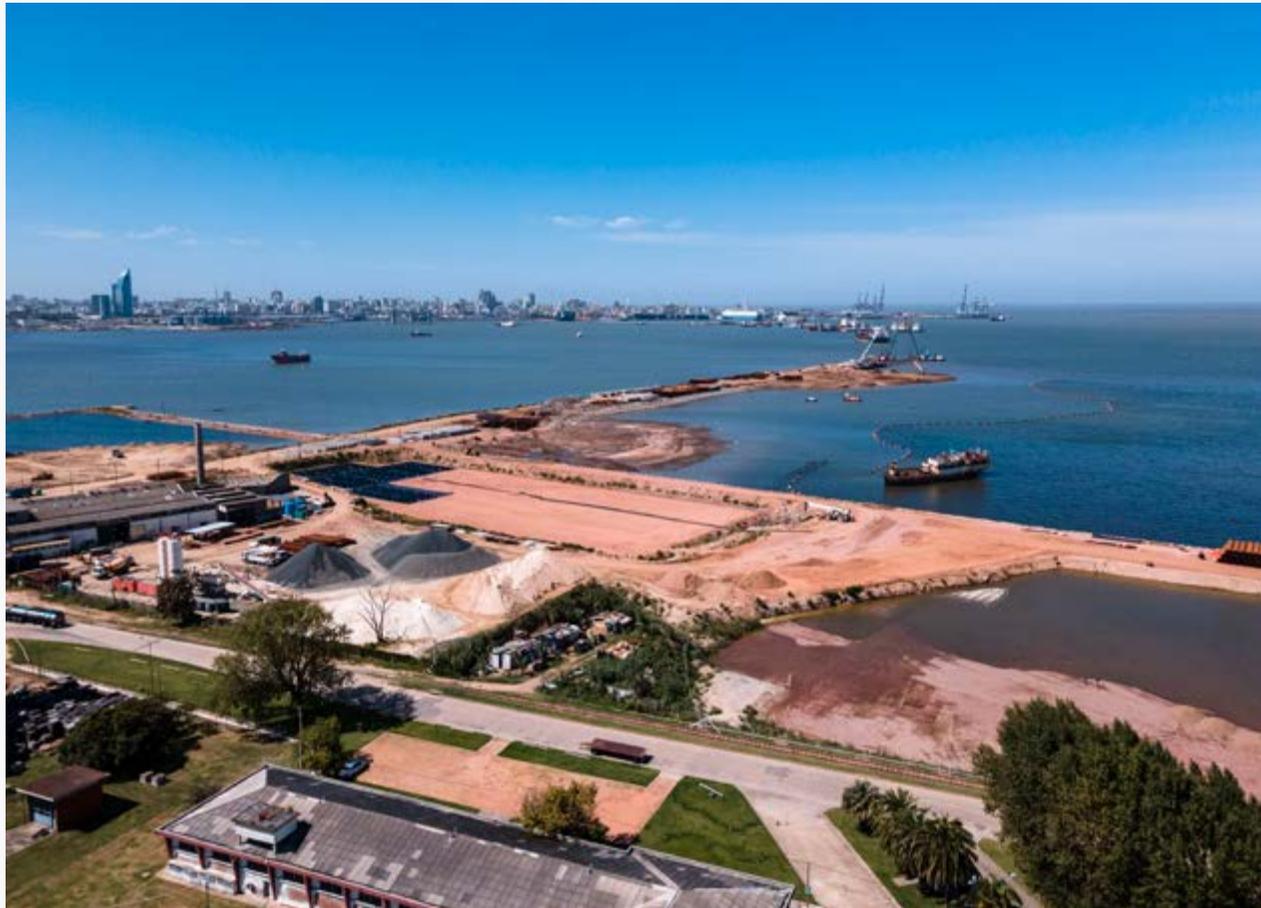
► View of the solar field from the Khi Solar One tower plant.

Nonetheless, in terms of gross generation, and due to the months in which the plant was shut down as a result of the fire, Kaxu Solar One did not reach the levels of that year. Those months are not counted to calculate the energy production ratio.

At Khi Solar One, 2020 was so far the year of highest gross energy production, exceeding the value of the previous best year by 12 %, as a result of the above-mentioned implementation of various technical improvements in the plant.

04. Performance and sustainability contribution / 04.2. Industrial contribution

Uruguay



► Abengoa works at Puerto Capurro Fishing Terminal.

In Uruguay, during 2020 and, despite the pandemic, the company continued executing its projects and managed to implement the necessary sanitary measures to ensure the personnel's safety.

In this context, work continued on the new Fishing Terminal in Capurro, among which, the concreting of the deck of the outer pier began by the end of the year. This deck is built on previously placed precast "Pi" type slabs, totalling more than

10,500 m<sup>3</sup> of concrete.

The work involves the executive project and construction of approximately 1,000 meters of dock for industrial fishing vessels, with the shelter, mooring and defense-related works. Furthermore, a 3.3 hectares backfill area, paving works, drainage, drinking water and fuel distribution, as well as the dredging of the corresponding dock and its final disposal in geo-containers, an innovative technology to be used for the first time in Uruguay, will be carried out.

Concreting of the hopper building of the Ancap cement plant in the city of Minas (Lavalleja) was completed. This building, approximately 14 meters high, was continuously concreted (at a rate of 10 cm/hour) using a slipform specially designed for this project.

This contract includes the preparation of the executive project, the execution of civil works for concrete structures and the assembly of metal structures, among other tasks.

At the end of the year, 23 % of the overall progress was achieved in the construction of the new forensic police building in the city of Montevideo, a contract being executed for the Ministry of the Interior of Uruguay.

This project involves the execution of the executive project and the turnkey construction of a building of approximately 3,000 m<sup>2</sup>, developed over six levels in which the departments of Forensic Ballistics, Road and Occupational Accidentology, Expert Inspection, Computer Forensics, Photography and Acoustics, Planimetry, Facial Identification and Jewellery, Computerized Criminal Identification, Decadactilar, Biological Laboratory, the Criminalistics School and the National Registry of DNA Fingerprints will be located.

04. Performance and sustainability contribution / 04.2. Industrial contribution



► In 2020, Abengoa completed the construction of a large parking lot in downtown Montevideo.

On the other hand, 2020 likewise marked the completion of major projects such as the construction of a parking lot in downtown Montevideo.

The works included the executive project and the construction of a parking lot with capacity for 95 cars and 19 spaces for bicycles, distributed on a semi-basement level, ground floor level, mezzanine level, eight upper levels and, finally, the deck level. The contract for laying OPGW (Optical Ground Wire) fiber optic cable on a 150 kV line between the Trinidad station and the Rodríguez station of UTE (Administración Nacional de Usinas y Trasmisiones Eléctricas) was likewise completed.

This contract involved the engineering, assembly, inspecting and testing of approximately 105 km of fibre optic cable.



► Last year, the company completed the laying of OPGW (Optical Ground Wire) fibre optic cable on a 150 kV line.

Regarding new awards, the execution of several civil works corresponding to different process areas of the pulp mill was contracted with the pulp company UPM, which will be located

near the city of Paso de los Toros, Tacuarembó, and likewise at the specialized terminal located in the port of Montevideo.

Completion work (masonry, carpentry, enclosures and installations) have begun on floors 4 and 5 of the new CASMU mutual insurance company's hospital building in the city of Montevideo, where 44 new top-notch rooms will be built, which will add 88 intermediate care beds, with their corresponding infirmaries, services and facilities.

And the work for UTE has begun, which involves the construction of a 150 kV high-voltage transmission station with GIS (Gas Insulated Switchgear) technology in the town of José Ignacio, department of Maldonado.

It will be based on SF6 insulated GIS cells, 170 kV class, self-supporting for indoors, and will have a 31.5 kV medium voltage installation based on air-insulated shielded cells, 36 kV class for indoors.

The company's operation and maintenance area in Uruguay began executing an O&M contract for six photovoltaic solar farms located in the departments of Río Negro, Paysandú and Salto. These parks have a total installed capacity of almost 84 MWp and generate approximately 112 GWh/year of renewable energy for the Uruguayan electricity grid.



► Abengoa was awarded new civil works in a pulp mill owned by UPM.

04. Performance and sustainability contribution / 04.2. Industrial contribution

# Innovation

## Goals set forth in the SSP 2019-2023

**7** AFFORDABLE AND CLEAN ENERGY



**9** INDUSTRY, INNOVATION AND INFRASTRUCTURE



**11** SUSTAINABLE CITIES AND COMMUNITIES



**17** PARTNERSHIPS FOR THE GOALS



Maintain and place value in the existing technological development of the company, and try to reach strategic agreements that allow us to opt for EPC and conventional projects, thanks to the knowledge and intellectual property acquired so far.

 100 %



Abengoa is committed to innovation as a driving force for technological development and value generation. This enables improved features of products and services, being provided with significant added value, while at the same time giving a competitive advantage in the international market.

### Main figures

	2020	2019	2018
Investment in R&D and innovation (€k)	629	1,597	1,420
			
Personnel	19	20	19
			
Cumulative patents granted since 2008	282	280	342
			

Abengoa is currently working on five lines of research: Hydrogen, Aerospace and defence, Electrical power systems, Solar thermal and Railway.

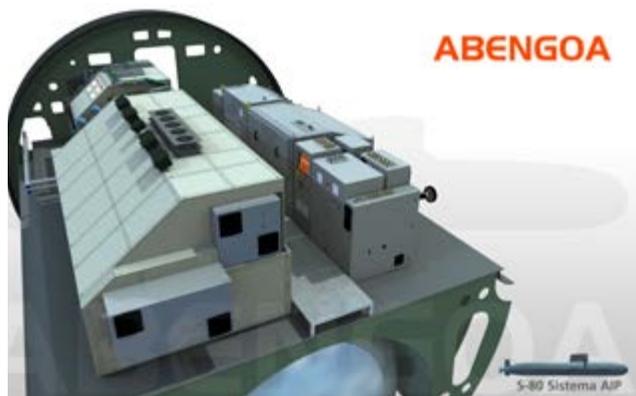
04. Performance and sustainability contribution / 04.2. Industrial contribution

► Hydrogen

Abengoa has more than 15 years of experience in hydrogen technologies, with a specialized department dedicated to the execution of both national and international projects, ranging from hydrogen production, through electrolysis and reforming, to its use in energy production through fuel cells, industrial uses, mobility and renewable gas production, among others.

This extensive experience enables Abengoa to offer highly innovative product solutions in specific industries of the hydrogen value chain, through strategic alliances with leading manufacturers and technologists. The main examples of Abengoa's current capabilities as a developer of complex systems with a high technological in-house component are: the S80 submarine and the European Grasshopper project. 2020 has been especially successful with these two projects.

S80 Submarine



► Abengoa will supply the AIP (Air Independent Propulsion) system for the S80 submarine, owned by Navantia.

In 2020, after more than 15 years developing the AIP (Air Independent Propulsion) system for the S80 submarine, Abengoa has entered into a contract as technologist and main supplier of this type of system with the Spanish public company, Navantia, a benchmark in the design and construction of high-tech ships. The AIP System is made up of several major components: Bioethanol Processor System (BPS), Fuel Cell System (SPC, for its acronym in Spanish), Power Adequacy System (SAP, for its acronym in Spanish), Removal System of CO2 (SECO2) and AIP Control System (SCAIP, for its acronym in Spanish). Abengoa is responsible for the design, manufacture and validation of several of these major elements (BPS, SAP and SCAIP), as well as the integration of the SPC and SECO2 to ensure the required performance, functionality and operability.

The experience gained by Abengoa in the S80 program positions the company as a technological leader in on-board systems, in which compactness, safety, reliability and compliance with strict military requirements are essential to be duly integrated into the final application. Therefore, in 2020 a much wider market has opened up for Abengoa in the maritime industry, not only limited to submarines, in which the requirement to reduce emissions is impending and, indeed, hydrogen and fuel cells play a key role as decarbonisation options.

Grasshopper

2020 has likewise been a year of major achievements for the European Grasshopper project (GA No. 779430), in which the construction of this 100 kW pilot power plant based on PEM (Proton Exchange Membrane) type fuel cells has been completed and testing has begun at Abengoa's Innovation vertical facilities in the Torrecuellar industrial estate, located within the free zone of the Port of Seville (Spain). The execution of the first testing phase at the port has given Grasshopper a certain reputation and recognition as a leader in innovation and technological capabilities of special interest for Andalusia and, specifically, for the city of Seville.



► Grasshopper, a new generation of fuel cell-based power plants from green hydrogen.

The Grasshopper project is part of a strategic line that will position Abengoa as a leader in the fuel cell-based power production market, both stationary and mobile (maritime and railway industries). Likewise, it has enabled the consolidation of strategic alliances with the manufacturer of the stacks which goes beyond this application and will contribute to greater market penetration.

2021 will be filled with significant challenges to successfully complete the Grasshopper project. First, testing of the pilot plant in Seville is expected to be completed, which will then be transferred to its final facility in the Netherlands, where its operation will be validated in a real industrial environment, leveraging the hydrogen by-product from a chlor-alkali plant. Finally, all lessons learned from the operation of the pilot plant will be translated into an optimized design on a larger MW scale to meet the cost per kW targets and to be the marketing starting point in 2022.

04. Performance and sustainability contribution / 04.2. Industrial contribution



► The Grasshopper project is transferred to the Port of Seville (Spain) to start the testing phase.

In addition to the major milestones achieved in specific products, 2020 has been crucial in defining Abengoa's strategy as an EPC leader and consultant in the hydrogen industry. The green hydrogen vector has been incorporated into the portfolio of hybrid solutions for decarbonization and energy transition offered by Abengoa's Energy vertical. A concrete example of this strategy is the work that has been carried out along with the biofuels division to incorporate the hydrogen produced by electrolysis into its waste to fuel processes to obtain Sustainable Aviation Fuel and other derivatives such as naphtha, methanol, synthetic natural gas, among others.

2021 will be decisive to consolidate this strategy and to position Abengoa as a strategic partner in hydrogen, starting with the Spanish market, which has already outlined the hydrogen roadmap in 2020 with ambitious goals for the following years, and which will receive a significant percentage of public and private funding.

► **Aerospace & Defense**

Abengoa continues to consolidate its presence in aerospace and defense, a high added value industry in which engineering and innovation are an essential part of the activity. Additionally, it has maintained its activity as a supplier of electronic sensing, monitoring and control and power distribution systems even in a year as complicated as 2020.



► Electronic system for satellite tracking developed by Abengoa.

Regarding Aerospace, this financial year the company has designed, manufactured and delivered a key electronic system to operate the satellite tracking antennas of the National Institute of Aerospace Technology (INTA, for its acronym in Spanish), one of the most important players in the industry in Spain. This system, entirely designed by Abengoa, monitors the status of the antenna elements and guarantees their correct operation when the satellites download the data to Earth, while triggering the appropriate alarms in case any problems are detected. The first system was installed at the Maspalomas antenna, in Gran Canaria (Spain), in June and, after its successful deployment, Abengoa has already entered into the contract to be deployed on the antennas at the Villafranca del Castillo station in Madrid.

In terms of Defense, Abengoa is consolidating its position with a portfolio of projects exceeding milestones in terms of time and performance. One of the major players in terms of defense in Spain, Navantia, has praised Abengoa for its execution, following the delivery of the first three units of the Millenium tower power supplies integrated in Avante 2200 corvettes for the Royal Saudi Navy.

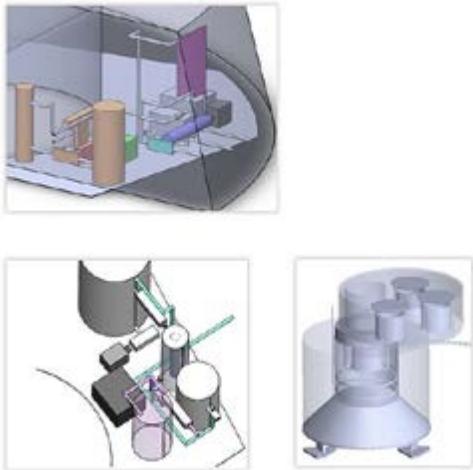
Moreover, Abengoa has started two strategic activities with the European Space Agency (ESA) in 2020: the first one is the development of the first flight product for the ESA. It is a Battery Management System (BMS) to be installed on a satellite developed by Abengoa. The project, which won a public tender, is funded by the ESA for future R&D projects. Likewise, it involves a very high technical complexity and requires significant knowledge of power systems and space. It has a two year duration, and having passed the design milestone, it now enters the production and testing phase. This phase will demonstrate the feasibility and benefits of the system to justify its adoption on future satellites.



► Abengoa works for the European Space Agency (ESA), within its In-Situ Resource Utilization (ISRU) program, to develop a payload for the Moon and Mars.

04. Performance and sustainability contribution / 04.2. Industrial contribution

The second is a new and promising area in which Abengoa was the first large Spanish company to operate. It is part of ESA's In-Situ Resource Utilization (ISRU) program, aimed to develop a payload (a set of instruments to allow achieving the objectives of the mission for which the satellite has been launched) to establish a habitable environment first, on the Moon and, later, on Mars. The requirements established by the ESA to develop this activity are consistent with Abengoa's core traditional business, from energy generation and storage, to the processes for the production, separation, purification and recycling of fluids necessary to produce fuels or for life support, such as oxygen or water.



► Abengoa is working to develop a habitable environment first on the Moon, and then on Mars.

In 2020, the first feasibility studies which were started in 2019 have been successfully completed. On the other hand, Abengoa has won a new contract with ESA for a ground-based demonstrator to test new concepts to extract and purify O2 from lunar regolith, designed for space. Moreover, it has presented two new offers for the following phase, which will design the first prototype of the payload that will go to the Moon.

► **Electrical power systems**

In order to improve the integration and manageability of renewable energies, Abengoa has a specific area within its Innovation department, focused on developing innovative control and energy storage technologies to improve the safety, quality and flexibility of the electrical system.

During 2020, progress has continued on the Flexitranstore R&D project, aimed at promoting the flexibility of the electricity system so that it can maintain a continuous service and

manage variations in demand or generation, which is typical of renewable energies. The manufacturing of the equipment and its installation on site at the Atheniou electrical substation in Cyprus has been completed. The battery storage system (BESS) is locally controlled through the dedicated management system, Abengoa Energy Management System (AEMS).



► The Flexitranstore project is designed to bring stability to the power supply using lithium ion batteries.

04. Performance and sustainability contribution / 04.2. Industrial contribution

► Solar thermal

Abengoa continues to develop solar technology as a strategic product in the energy market. The manageability that concentration technology allows, with thermal storage, places it as a key product among the renewable hybrid solutions that lead the company's energy portfolio.

**Renewable hybrid solutions**

Abengoa continues working on custom-designed hybrid products to allow the integration of low-cost renewable technologies, such as wind and photovoltaic, with concentration technology (and its thermal storage capacity), to ensure full manageability of the solution offered.

The energy market decarbonisation, both at the electricity production and process heat levels, requires a tailored-made hybrid solution. In order to optimize the hybrid configuration, Abengoa has continued to work in 2020 on the integration of emerging energy storage technologies with fully integrated electric batteries, optimized molten salt thermal storage systems and thermal batteries based on electric salt heaters.

Likewise, the company keeps developing modular and robust applications in order to use solar thermal technology in the field of process heat production, by designing solutions adapted to the needs of strategic industries such as mining and the chemical and petrochemical industries. Abengoa has likewise developed a solution adapted to the decarbonization strategy of traditional thermal plants to allow the use of their thermal cycles powered by renewable sources.

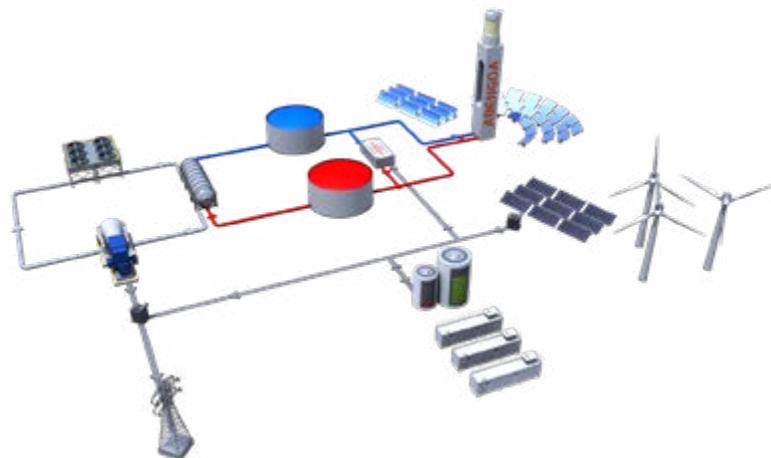
In 2020, Abengoa has continued to optimize the GEA platform, which enables tailor-made hybrid solution modeling. Therefore, by combining the production model of the solar thermal plant with the photovoltaic field one, it is possible to integrate auxiliary equipment, such as batteries and electric heaters, with thermal storage. This enables offering the current market-required different configurations and hybridizations.

**Component optimisation**

Abengoa continues working to reduce the costs of key components of solar thermal technology, based on the learning curve as a leader in the solar thermal market, with 30 % of the plants currently installed worldwide. In order to achieve this, it

operates the Solucar R&D platform, in which work is ongoing to validate and optimize the solar field components. The area has three locations for trials on a different scale:

- Pontones platform: for evaluation and testing of new heliostats with cutting-edge technology optimisation.
- Repow platform: for loop testing of parabolic trough collectors and their components and the optical validation of new designs.
- Solnova platform: for validation of parabolic trough collector modules.



► Tailor-made hybrid solutions fully developed by Abengoa.



► Detail of heliostats at the Pontones test platform.

**04. Performance and sustainability contribution / 04.2. Industrial contribution**

In 2020, tests continued to be conducted for the optical, structural and operational validation of the solar field components, both for new optimized designs, as well as for new supplies or equipment to be installed in commercial plants under construction (Cerro Dominador and DEWA).

Platform tests also allow the assembly and operational procedures to be optimised for field components in commercial plants, increasing their operational reliability.

Finally, the continuous optimization of the field start-up and field targeting operations are highlighted. In 2020, work has been carried out to implement optimized heliostat field control algorithms, flow map simulations and receiver tube surface temperature control in the Cerro Dominador project.



▶ Abengoa is engaged in the Scarabeus project on supercritical CO<sub>2</sub> to increase the efficiency of solar thermal plants.



▶ Collector testing at the Repow test platform.

A test loop for dynamic tests has likewise been set up at the University of Seville, where the molten salt receiver tubes are validated under flow, flow rate, temperature and transient operating conditions.

**Long-term strategic lines**

Finally, Abengoa continues to bet on solar thermal technology for high-temperature industrial heat and the production of renewable fuels as solutions for the future. In this line, the two H2020 projects that have been further developed this year should be highlighted: Scarabeus and SolarsCO2OL.

**Scarabeus Project**

During 2020, the H2020 Scarabeus project has begun to obtain its first promising results on potential gas mixtures for supercritical CO<sub>2</sub> cycles capable of increasing the efficiency of future solar thermal plants. Abengoa's participation in this phase has been particularly aimed at assessing the technology state of the art solar thermal and supercritical CO<sub>2</sub> cycles acting as a starting point for the developments being carried out and as a point of comparison to calculate the improvements to be obtained during the project, both from a technical and an environmental point of view. Likewise, due to the COVID-19 restrictions this year, Abengoa has jointly adjusted its outreach strategies with the consortium, transforming a series of conferences and round tables into a series of webinars in which Abengoa presented the major features of the solar field simulation systems for tower plants.

**SolarsCO2OL Project**

At the end of 2020, the SolarsCO2OL project kicked off. This project seeks to install the first demonstrator of a supercritical CO<sub>2</sub> cycle for a solar thermal installation in Europe, incorporating a molten salt electric heater to take full advantage of the possibilities of integrating different renewable technologies and adding manageability to the grid. Therefore, the consortium has sought Abengoa's extensive experience, both in solar thermal and in technology integration. During the short period of activity in 2020, Abengoa has analyzed the specific characteristics of the expected plant and has begun work on the conceptual engineering of the demonstration plant.



▶ Launch meeting of the SOLARsCO2OL project.

04. Performance and sustainability contribution / 04.2. Industrial contribution

► **Railways**

In 2020, Abengoa has successfully progressed in the development of the following innovation projects in the railway industry:

**The Railway Innovation Hub**

This railway cluster, based in Malaga (in the Andalusia Technological Park), is working to become a leader in national and international railway innovation. Among its more than 90 associates, including universities and leading partners such as Adif, Renfe, Metro de Madrid, Metro de Sevilla, Fundación Once or even the Junta de Andalucía and the Agencia IDEA itself (Innovation and Development of Andalusia), Abengoa should be mentioned, holding the vice presidency since 2016.

In 2020, the Railway Innovation Hub has continued to develop more than 20 innovative projects.

**Broken Track project**



► Rail break detection and location projects such as the projects developed by Abengoa are vital for the safety of individuals.

The company has continued to conduct tests and trials with the Carril roto (Broken Track) project, a system for detecting breaks in railway tracks operating in real time on high-speed lines, while negotiating its possible marketing with different managers.



► The Alis innovation project provides safety and efficiency to railway systems.

**Development of the BIM for railway environments**

Abengoa continues working to develop the BIM (Building Information Modelling) tool, for the automatic layout of catenaries and substations, as well as the modeling of systems in a way that can be fully integrated into a workflow. The result will be a 3D image of the project, among other valuable features. The software is expected to be ready in 2021.

**Alis project**

Abengoa continues developing simulations for the Alis project, such as the Pantograph-Catenary interaction for the Monforte del Cid - Murcia joint venture, or for customers such as NetworkRail, as well as traction and power demand simulations for the Meca-Medina project, or efficient running simulations, such as the simulations for Metro de Granada, among other works.

The Alis project, which enables the comprehensive simulation of electrification, safety and energy efficiency systems in railway systems, is still in the marketing phase and gives the company a significant competitive advantage in the international market.