



# ABENGOA

Innovative technology solutions for sustainability

## Annual Report 2014

**01** Activities



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**01**  
Glossary

**Operating terms**

A	Ampere
bar	Bar
bsh	Bushel
BTU	British thermal unit
CO <sub>2</sub>	Carbon dioxide
DGS	Distilled Grains and Solubles
EPC	Engineering, Procurement and Construction
ETBE	Ethyl Tertiary Butyl Ether
g	Gram
gal	Gallon
GHG	Greenhouse Gas
h	Hour
ha	Hectare
Hz	Hertz
ISCC	Integrated Solar Combined Cycle
J	Joule
km/h	Kilometer per hour
L	Liter
m	Meter
m/s	Meter per second
m <sup>2</sup>	Square meter
m <sup>3</sup>	Cubic meter
N	Newton
Pa	Pascal
ppm	Parts-per-million
s	Second
t	Metric ton
V	Volt
VA	Volt-ampere
VAr	Volt-ampere reactive
W	Watt
We	Electric watt
Wh	Watt hour
Wth	Thermal watt

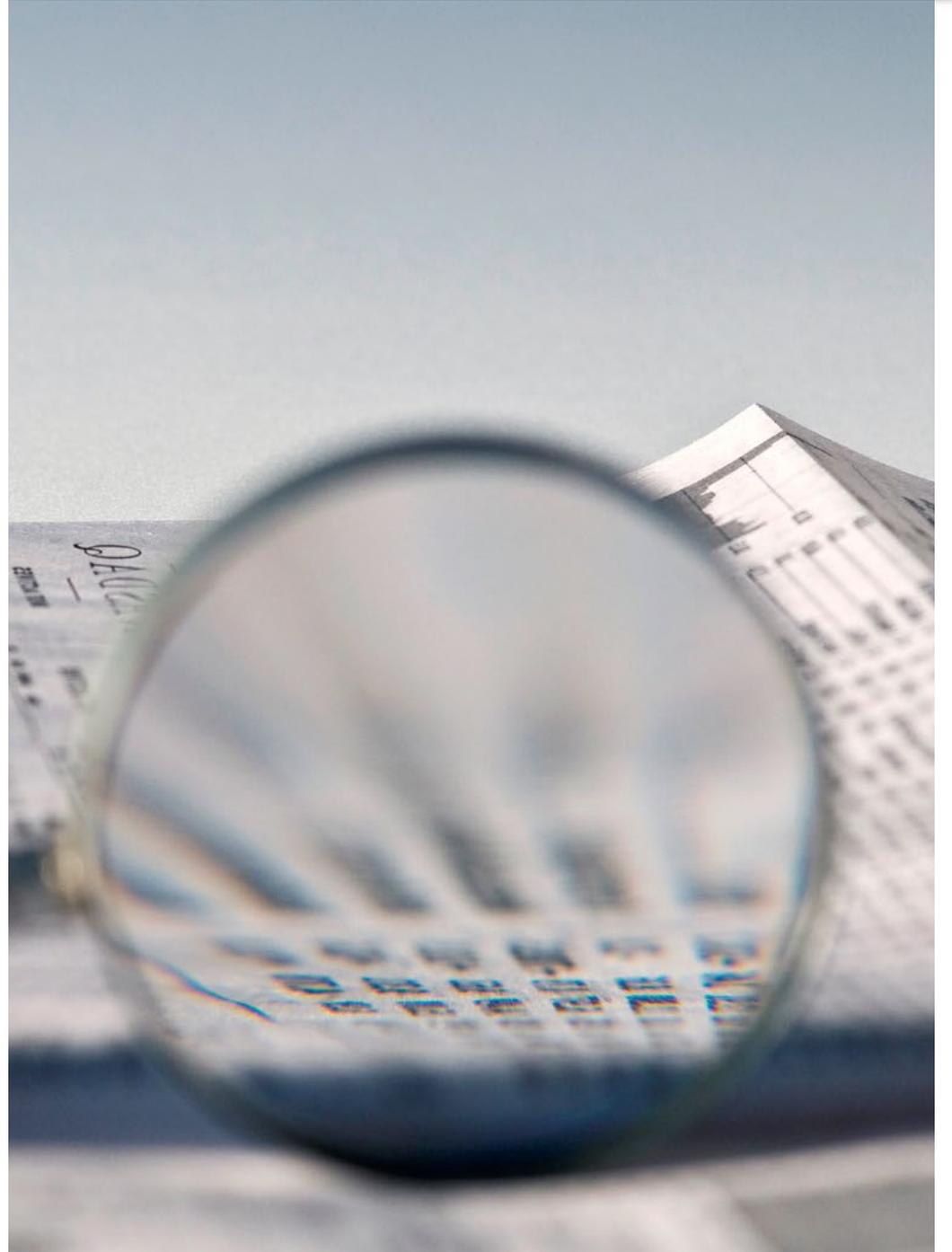
**Financial terms**

€	Euro
\$	US Dollar
BRL	Brazilian Real
CAGR	Compound Annual Growth Rate
EBITDA	Earnings Before Interest, Tax, Depreciation and Amortization
GDP	Gross Domestic Product
PCAOB	Public Company Accounting Oversight Board
ROE	Return On Equity
SOX	Sarbanes Oxley Act

**Prefixes according to the International Metric System**

m	Mili	10 <sup>-3</sup>
c	Centi	10 <sup>-2</sup>
d	Deci	10 <sup>-1</sup>
h	Hecto	10 <sup>2</sup>
k	Kilo	10 <sup>3</sup>
M	Mega	10 <sup>6</sup>
G	Giga	10 <sup>9</sup>
T	Tera	10 <sup>12</sup>

# 02 Main figures



## Main figures

During the period 2004-2014 Abengoa's revenues have grown at a compound annual rate of 15.1 %, the ebitda by 22.8 % and net income by 9.1 %.

	2014	% Var 2013-14	2013	2004	% CAGR <sup>(1)</sup> (2004-14)
<b>Income statement (€M)</b>					
Revenues	7,151	(1.3)	7,245	1,746	15.1
Ebitda <sup>(2)</sup>	1,408	11.1	1,267	180	22.8
Net income	125	23.5	101	52	9.1
<b>Balance sheet (€M)</b>					
Total assets	25,247	19.4	21,153	2,491	26.1
Shareholders' equity	2,646	39.8	1,893	413	20.4
Net corporate debt	2,353	10.8	2,124	28	55.8
<b>Significant ratios (%)</b>					
Operating margin (Ebitda / Revenues)	19.7	–	17.5	10.3	–
ROE (Return on Equity) <sup>(3)</sup>	4.6	–	5.8	14.6	–
<b>Data per share (€)</b>					
Earnings per share	0.15	(14.4)	0.17	0.12	2.3
Dividend per share	0.113	1.8	0.111	0.028	15.0
Last quotation (B shares)	1.83	(15.8)	2.18	–	–
Last quotation (ADS's B shares)	\$ 10.88	–	\$ 15.08	–	–
Capitalization (Share A+B) (€M)	1,563	(14.0)	1,817	658	9.0
Daily avge. trading volume (€M)	46.4	420.6	8.9	0.9	48.1

(1) CAGR: Compound Annual Growth Rate.

(2) Earnings before interest, tax, depreciation and amortization.

(3) Net Income / Shareholders' equity.

## Types of activities & geographies

Evolution 2014-2004 (%)	2014		2004	
	Revenues	Ebitda	Revenues	Ebitda
Engineering and construction	63.1	57.2	59.2	43.2
Concession-type infrastructures	7.0	23.5	4.9	17.6
Industrial production	29.9	19.3	35.9	39.2
<b>Consolidated total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

Revenues by geography (%)	2014	2004
Spain	12.4	59.8
Brazil	12.2	5.6
North America	31.5	21.2
Europe (ex. Spain)	12.5	6.9
South America (ex. Brazil)	18.3	3.0
Asia & Oceania	4.6	1.6
Africa	8.5	1.9
<b>Consolidated total</b>	<b>100</b>	<b>100</b>

**03**  
Our  
commitment





## Our commitment

At Abengoa, we believe that the world needs solutions to pave the way for more sustainable development. Scientists tell us that **climate change** is a reality and at Abengoa we believe that now is the time to seek out solutions and put them into practice.

Over ten years ago, Abengoa made the strategic decision to focus its growth on the creation of new technologies geared towards **sustainable development**:

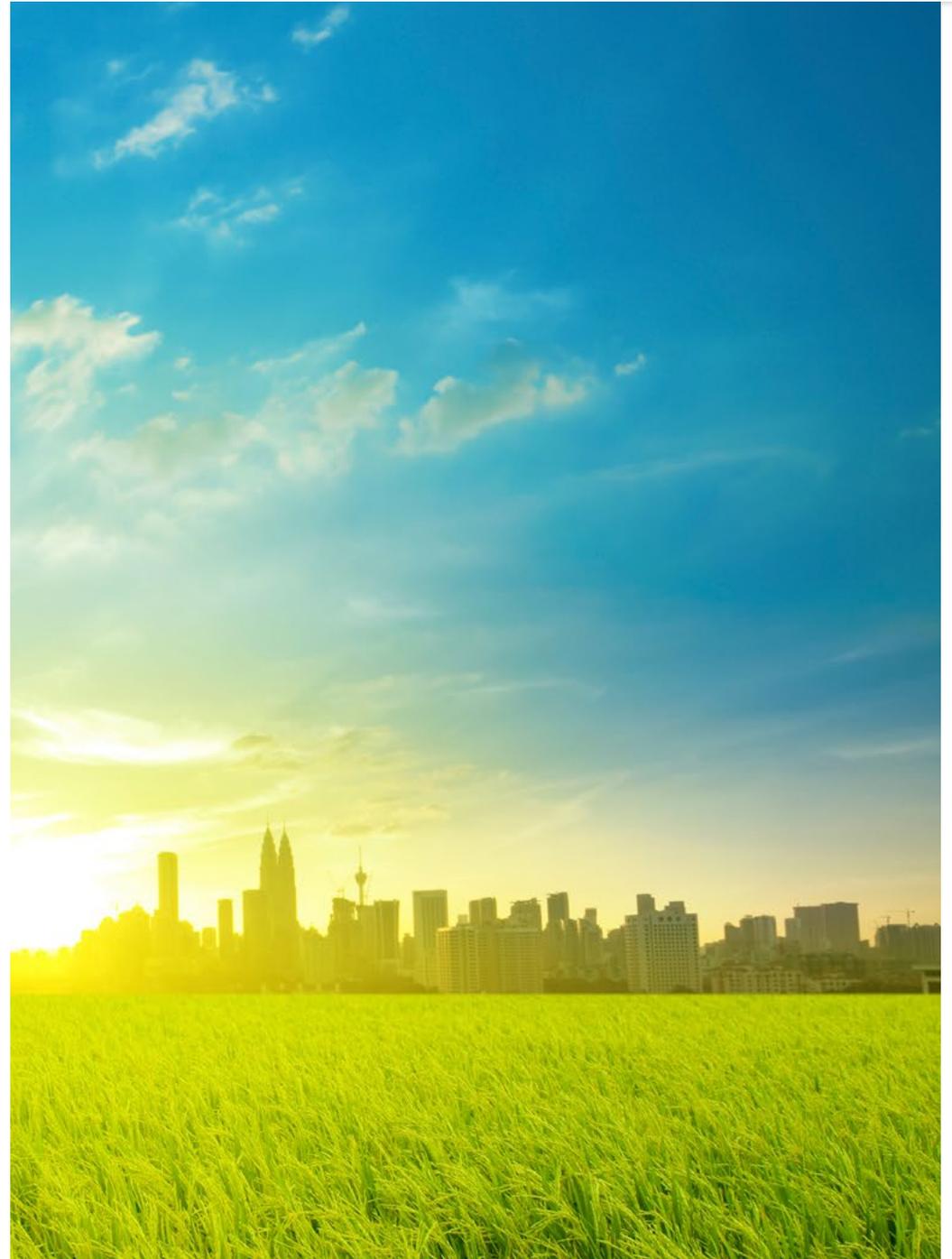
- › Generating **energy** from renewable resources.
- › Managing **water** treatment, desalination and reuse.
- › Creating **infrastructures** that eliminate the need for new investments in assets that generate emissions.
- › Creating **new horizons** for development and innovation.

To this end, we invest in Research, Development and Innovation, R&D&Innovation, **globally** expand those technologies with the greatest potential, and attract and develop the necessary **talent**.

In a similar vein, we channel human and financial resources into the **Focus-Abengoa Foundation** to promote social action policies that champion social and human progress.

By following this approach, we create **long-term value** for our shareholders, ensure the growth of the companies through which we operate and help to make the world a better and more sustainable place for future generations.

**04**  
A message  
from our  
chairman



In 2015, environmental concerns will continue to be at the center of attention worldwide in a climate of progressive recovery from the economic and financial crisis. This will contribute to continued growth of Abengoa's potential markets and opportunities. According to the International Energy Agency, the global demand for energy will rise by 37 % to 2040, and this year's global energy supply will come in equal proportions from oil, gas, coal and low-carbon sources. In the midst of serious tensions affecting the international energy system as the result of conflicts in the Middle East, Russia and the Ukraine, the electrical power generation sector will lead the transformation of the world energy map, where renewables will prove the drivers of change. Renewable energy sources will represent nearly half of the increase in electricity generation until 2040 and biofuel use will triple. The water sector will continue to be characterized by shortages and the need for major improvements in water infrastructure and management. The report published by Global Water Intelligence indicates an anticipated 3.9% increase per annum until 2018.

The environmental challenges facing the world today remain pressing. Putting the brakes on rising temperatures and cutting greenhouse gas emissions continue to be prevailing objectives, as described in the latest report from the IPCC (Intergovernmental Panel on Climate Change). This is a huge responsibility that is shared by all of the world's economies. At the Conference of the Parties (COP-20) held in Lima, a draft agreement was drawn up for signing in 2015 at the decisive Paris conference: an international gathering that will set out a new Kyoto Protocol, which should emerge as a momentous milestone in the struggle against climate change.

All of these trends are fully in concert with the Abengoa philosophy and facilitate the forward-looking prospects of the portfolio of opportunities which the company has been making the most of as the product of its commitment to technology and solid position in the markets.

Over the course of 2014, Abengoa succeeded in executing the envisaged strategic plan, and the company's technological advancements led to the completion of highly innovative projects such as the Solana solar plant

with energy storage capability located in the Arizona desert and the KaXu facility in South Africa, and new contracts that include the Atacama molten salt tower in Chile. At the same time, we have expanded the project map to include new regions like Costa Rica and Colombia, while maintaining our position of leadership in the U.S., Brazil, South Africa, Chile, Peru and Uruguay.

Providing fundamental support to Abengoa's momentum is the quality of its team of people and the ongoing efforts dedicated to the training they engage in to stay on the cutting edge of knowledge and in developing and implementing the most advanced technical resources. Proof of this can be found in Campus Palmas Altas, where the laboratories for research into materials, thermal and chemical processes, biotechnology and power systems are now running at full capacity.

Progress in executing projects and exploitation of new opportunities took place simultaneously with reinforcement of the company's financial structure and advancement in the commitments undertaken involving balance sheet deleveraging and appropriate transparency. In 2014, we carried out operations in the capital market with two bond issuances for a total of € 1,000 M and we successfully refinanced the syndicated loan in the amount of € 1,400 M.

Along these lines, worthy of special mention is the admittance to trading on the U.S. NASDAQ stock exchange of Abengoa Yield through a capital increase of € 611 M. In order to bolster our financial structure and boost Abengoa Yield's opportunities for growth, this operation was complemented by the commitments reached to reduce our stake in the company and the creation of a joint venture with a leading international fund in the energy and infrastructure sectors to invest in the construction of present and future concession-type projects. With the investment totaling more than € 8,000 M, this will facilitate the anticipated decrease of more than € 600 M of debt.

Although sales stabilized this year, with figures totaling € 7,151 M, EBITDA saw an increase of 11 % for a total of € 1,408 M. Corporate net debt as of year-end 2014 is 2.4 times the corporate EBITDA figure,

which totals € 964 M. We ended the year with liquid assets totaling more than € 3,100 M, which will help us to meet the investment and debt commitments foreseen in 2015.

### **Engineering and construction**

The project portfolio at end-year totals € 7,953 M. In the U.S., we inaugurated our second solar thermal power plant, one of the largest in the world, in the Mojave Desert, which now brings us to a total of 1,200 MW installed and under construction in conventional power generation, photovoltaic, solar thermal and Waste to Energy plants. Noteworthy among the projects awarded over the year is the contract for developing a unique water project, including the delivery system and a water treatment facility that is going to provide 168,970 m<sup>3</sup> of water per day to the city of San Antonio, Texas.

We were also selected to build wind power, cogeneration, combined-cycle and water projects in Mexico; power transmission lines in a variety of geographical regions; construction and management of singular buildings; and execution of the first solar thermal plant for direct production of electricity in Latin America, located in the Atacama Desert.

### **Asset operation and maintenance**

Abengoa has a wide-ranging portfolio of assets which the company is in charge of operating and maintaining. The portfolio is composed of concession-type assets, as well as free-market businesses that are highly technology-driven, such as biofuels.

In 2014, we generated more than 6,900 GWh of solar plants, wind farms, hybrid and cogeneration plants, and we brought new plants on line in the U.S. (Mojave), South Africa (KaXu Solar One) and in Uruguay (the Palmatir Wind Farm). We also produced 118 Mm<sup>3</sup> of desalinated water out of our desalination plants in Africa, Asia and Europe.

Total installed and under-construction capacity in the power plants we operate and maintain in the U.S., Abu Dhabi, South Africa, Algeria, Israel, Mexico, Brazil, Uruguay, Spain, India and Holland amounts to 4,474 MW.

We continue to operate more than 5,100 km of power transmission lines in Brazil, India, Peru and Chile.

In 2014, Abengoa continued to work on the Waste to Biofuels (W2B) project in Salamanca (Spain). And, joining the 14 existing plants, is a new facility that will produce cellulosic ethanol from agricultural waste on a commercial scale in the U.S. Furthermore, in Brazil efforts are focused on developing second-generation ethanol from sugar cane pulp and chaff.

### **Growth and diversification**

Our growth model is grounded in simultaneous management of businesses with different profiles and characteristics. Cash flow from our traditional activities is reinvested in the growth of emerging businesses. Noteworthy here are Abengoa Hydrogen and Abengoa Energy Crops, in conjunction with other technological options which Abengoa Research and the company's business units obtain through their research.

The company's international activity accounts for 88 % of overall sales, with prominent shares coming from the North America at 32 % and South America with 30 %.

### **Human capital and employment**

The essential role Abengoa attributes to the team of people who make up the company was recognized with the awarding of the +500 EFQM Gold Seal for European Excellence for our management of human resources. We obtained a score of over 600 points.

We know that the future depends on the creativity of the present, which in turn depends on the training and engagement of the people that are part of the company. Keenly aware of this, we carried out more than two million hours of training this year. Many of these training instruction hours took place in collaboration with some of the most prestigious universities in the world.

Constant concern for the safety and security of our teams and operations around the world is part of our corporate culture, which results in

a demanding system of quality and occupational risk control and prevention on all company levels.

### **Auditing and transparency**

In keeping with our commitment to transparency and rigor, the Annual Report incorporates seven components of independent verification. Some are groundbreakers and attest to our desire to be a point of reference in transparency and ensure the reliability of both financial and non-financial information. These components encompass the following areas: annual accounts, the internal control system for preparing financial information in accordance with U.S. SOX (Sarbanes-Oxley) requirements, the Corporate Social Responsibility Report, the Corporate Governance Report, design and application of the company's Risk Management System in line with ISO 31000 specifications, design and implementation of the compliance system for the prevention of corruption, regulations and fulfillment of the criteria for use of funds obtained through Green Bond issuance.

### **Corporate social responsibility and sustainability**

As a product of our commitment to responsible business management, we have drawn up a new Strategic Plan for Corporate Social Responsibility (CSR), with an outlook to 2020 and including impact reduction targets.

In relation to the struggle against climate change, this year we were one of the first twenty businesses to commit to setting an internal carbon price within the United Nations Caring for Climate framework with the aim of gearing company activity toward a low-carbon economy. In addition, through the Focus-Abengoa Foundation, we carried out the initiative of launching the Energy Transition and Climate Change Forum, a platform for observation, analysis and debate regarding the energy transition process within the context of combating climate change.

In 2014, we became a component of the London Benchmarking Group in order to continue to improve return on our social engagement efforts and increase the value generated in the communities where we operate. This year, our investment in social action totaled € 9.5 M.

Abengoa's CSR Report was prepared for the first time in accordance with the G4 guidelines of the Global Reporting Initiative and was verified by an independent third party to a reasonable level of assurance.

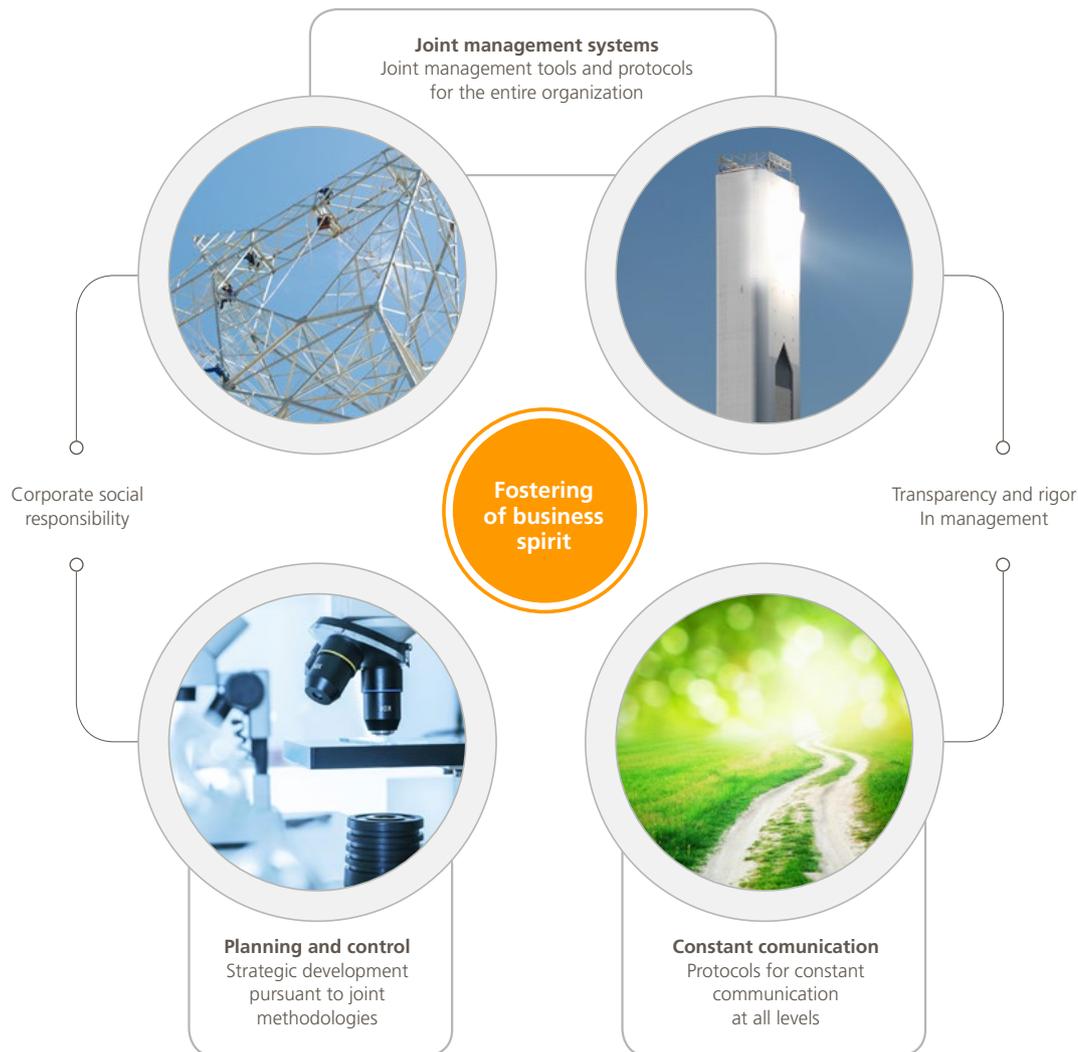
With these intentions, you will find the following at your disposal: the Corporate Social Responsibility mailbox ([rsc@abengoa.com](mailto:rsc@abengoa.com)), our website ([www.abengoa.com](http://www.abengoa.com)), the Energy Transition and Climate Change Forum website ([www.transicionenergeticaycc.org](http://www.transicionenergeticaycc.org)), our profile on Twitter, LinkedIn, Instagram, Facebook, Google +, Youtube, Pinterest and Slideshare and our corporate blog ([www.laenergiadelcambio.com](http://www.laenergiadelcambio.com)).

Felipe Benjumea Llorente



**05**  
Our  
management  
model





## Our management model

### Value chain

Growth at Abengoa is achieved through five strategic focal points:

- > Creating new lines of business that help combat climate change and push towards sustainable development.
- > Maintaining a highly competitive human team.
- > Permanent strategy of creating value by generating new options as we define current and future lines of business through a structured procedure.
- > Geographic diversification in markets offering the greatest potential.
- > Driving investment in research, development and innovation.

These focal points are targeted through a management model rooted in three key concepts:

- > Corporate social responsibility.
- > Transparent and exhaustive management.
- > Fostering a culture of enterprise.

## Financing model

Abengoa relies on various sources of corporate financing, the main ones being the **capital markets and loans from banks**, as well as **long-term non-recourse financing associated with concession-based ventures**. At present, the capital markets account for more than 50 % of Abengoa's corporate financing, with the company offering seven high-yield bonds, two convertible bonds and a short-term commercial paper facility. On the subject of loans with banks, the main source of corporate financing is a five-year syndicated loan secured from a pool of banks, plus a number of loans and credit facilities with institutional bodies such as the Spanish Instituto de Crédito Oficial and various export credit agencies. The company also relies on non-recourse loans to finance its assets under concession. Non-recourse financing is generally used for the construction and/or acquisition of an asset. In these cases, the only collateral is the assets and cash flows of the company or group of companies engaged in the business for which the asset in question is to be used.

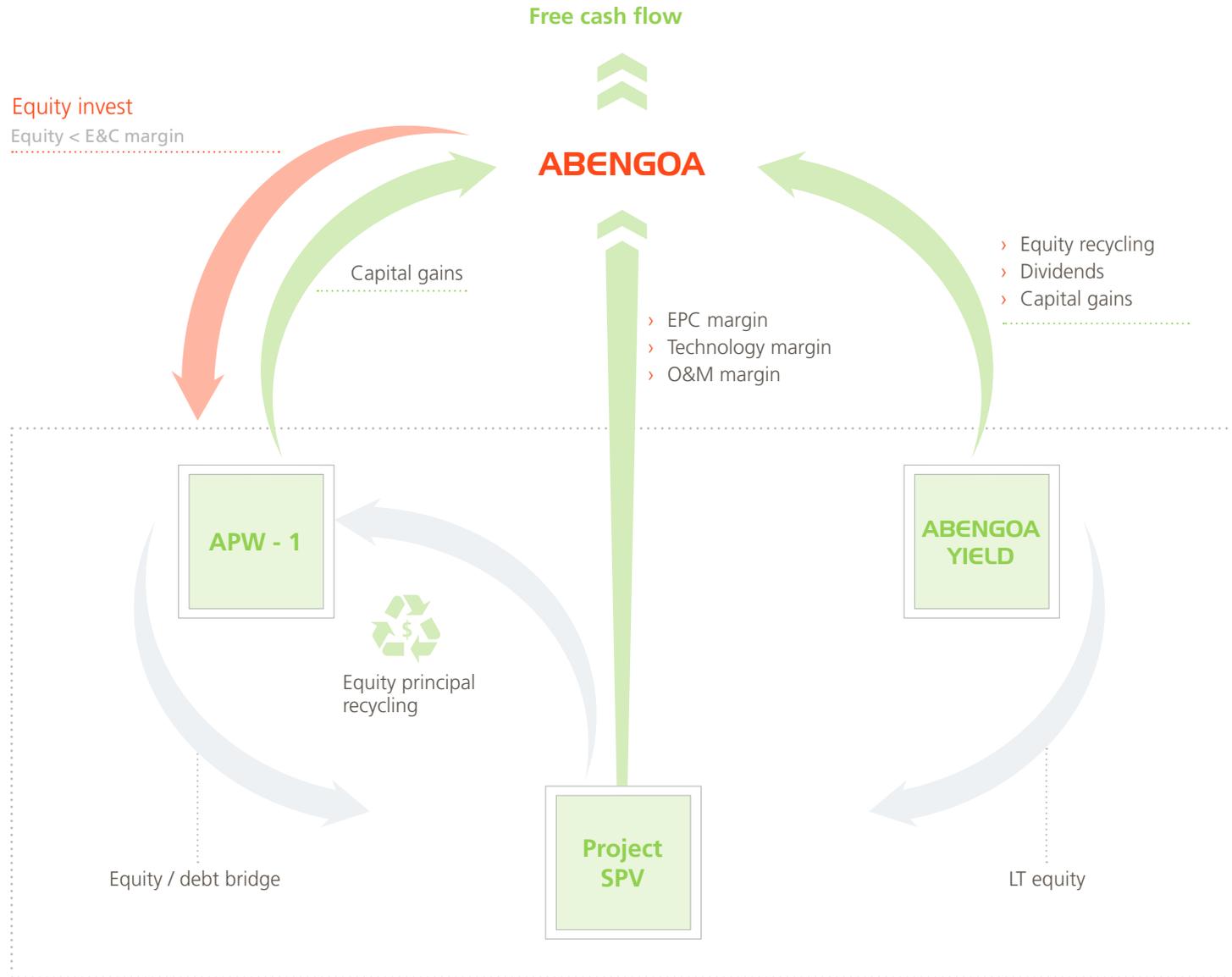
### › Abengoa Yield

Abengoa Yield is a Nasdaq-listed vehicle that has its own sources of financing unrelated to Abengoa's. Abengoa Yield **invests, manages and acquires assets** in the fields of renewable energies, conventional power generation, power transmission lines and other assets under concession. It currently owns and manages **13 concession-based assets** and holds a pre-emptive right to acquire certain other assets from Abengoa. Abengoa Yield has long-term non-recourse financing for all its assets under concession. Moreover, Abengoa Yield has additional debt capacity in its corporate area due to the available cash it retains from its concession-based assets after dividend pay-outs. Abengoa Yield has access to the capital markets and to bank financing.

### › Abengoa Projects Warehouse 1

Abengoa Projects Warehouse 1 is a new company which, along with the investor in energy infrastructures EIG Global Energy Partners (EIG), is set to acquire a portfolio of Abengoa projects under construction, including both renewable and conventional power generation facilities, and power transmission and water management assets in different regions, including the United States, Mexico, Brazil and Chile. The aim is to raise funds to obtain sufficient permanent capital to finance the construction of the new concession-based projects awarded to Abengoa. Abengoa Projects Warehouse 1 will make the company's business and financing model more efficient as it seeks to lower the cost of project financing and bring the construction phase forward, effectively meaning that the assets can be brought online and start generating revenue that much sooner.

> A business model poised to generate positive free-cash-flow.



**H1 Cash Generation**

- › Conventional power plants
- › Electricity transmission systems
- › Solar thermal power plants with mature technologies (power tower and parabolic trough)
- › Photovoltaic plants
- › Bioenergy (1G and 2G)
- › Water desalination and reuse
- › Other renewable energies: wind and waste to energy

**H2 Growth**

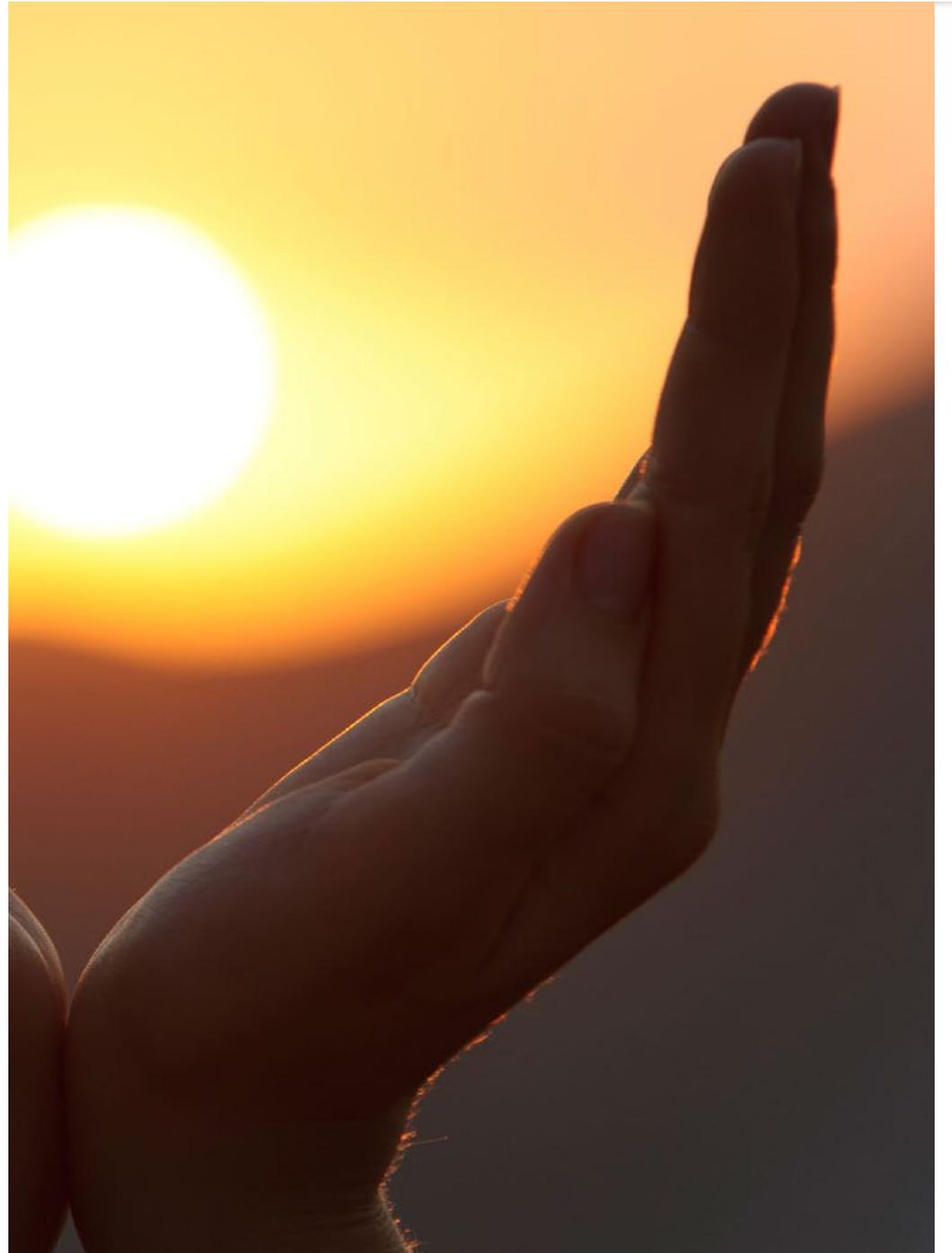
- › Engineering and construction of new products and in new regions
- › Electricity transmission systems in new regions
- › Rail transport infrastructures
- › First-of-a-kind solar thermal power plants (power tower and parabolic trough)
- › High concentration photovoltaic plants (HCPV)
- › Energy storage for electricity systems (molten salts and batteries)
- › Waste to biofuels
- › Bioethanol processing system for submarines
- › Pellets plant
- › Water reuse and treatment for industry

**H3 Future Options**

- › Engineering and construction in new sectors
- › Hydrogen: other applications
- › Marine energy
- › Solar thermal power plants featuring new technologies and in new regions
- › New photovoltaic technologies
- › Biorefining (new bioproducts)
- › Energy crops
- › New membrane technologies

06

# Activities



## 06.1

# R&D at Abengoa

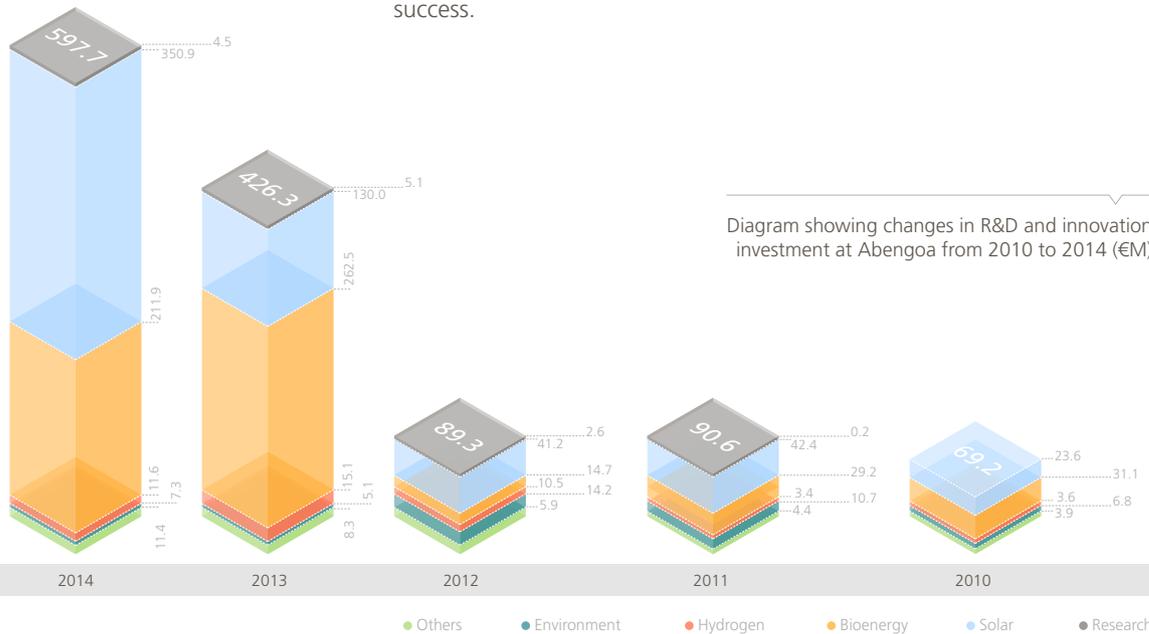
Achieving sustainable growth poses a number of major technological challenges that Abengoa has been successfully tackling with R&D-based solutions in the fields of energy and the environment.



Key figures	2012	2013	2014	Chg. 14-13 (%)
Patents applied for (aggregate)	200	261	312	19.5
Number of Doctors	49	85	92	8.2

## R&D as a growth driver for Abengoa

Technological development has historically been the main driver of social and economic progress and this has become even more so in recent times. Large companies that have remained at the top of their game over the years have proprietary technology based on R&D to thank for their success.



At Abengoa, R&D is geared towards generating technology solutions that champion sustainable development in the fields in which the company operates: energy and the environment. R&D is therefore key to ensuring the company remains a leader in generating new products, processes and methodologies aimed at providing innovative and environmentally-friendly solutions that generate long-term value.

In a bid to enhance its R&D structure and embed it further across the entire company, Abengoa remodeled its internal R&D management and development structure over the course of 2014. R&D activity is now centralized in Abengoa Research; a new model that fosters technological and business leadership and actively drives the company towards this goal.

These recent changes underscore Abengoa’s commitment to becoming an international benchmark in R&D and in generating knowledge and applying it to energy and sustainable development as a driver of the company’s technological strategy.

Abengoa researches and develops projects in the following areas:

- > Solar thermal electricity
- > Photovoltaic energy
- > Chemical processes
- > Biotechnology and bioproducts
- > Power systems
- > Hydrogen
- > Water desalination, treatment and reuse.
- > Energy crops

Abengoa’s R&D and innovation investment for 2014 stood at € 597.7 M, 40 % up year on year and accounting for roughly 8.1 % of sales revenue.

Abengoa successfully set up a number of **new research laboratories at the company's Campus Palmas Altas headquarters** in 2014. Research at the new laboratories is focused on new materials, power systems, chemical and heat processes and biotechnology. The facilities span an impressive 2,150 m<sup>2</sup> and also feature a high-performance simulation and computing center, and cutting-edge software and equipment.

## Key projects in 2014

Described below are the main research projects being undertaken in the different areas:

### Solar thermal electricity

#### Thermal and thermochemical storage

Abengoa strives to develop technologies and new lines of research that help reduce costs, boost efficiency and improve the way its solar power plants are managed. In relation to plant management, the company has developed numerous market-ready thermal storage technologies that allow electrical power to be fed into the grid day and night. These include:

- › **Indirect storage based on molten salts** (Solana plant): the system employs a heat exchanger to transfer the heat energy from the thermal fluid that absorbs the concentrated solar radiation (hot oil) to the molten salts.
- › **Direct storage based on molten salts** (Atacama 1 plant): the molten salts absorb the concentrated solar radiation directly.
- › **Steam accumulator** (PS10, PS20 and Khi Solar One plants): a thermally insulated pressure tank containing hot water and steam under pressure.

Work is ongoing to improve these storage systems and apply them to other areas:

- › **Thermochemical storage:** solar energy is stored as chemical energy through a reversible chemical process, to be subsequently released on demand by reversing the chemical reaction. Examples of research lines on which the company is currently working include partially reduced oxides, hydrogen absorption/desorption and solar fuel synthesis.
- › **Thermal storage:** both as latent heat at constant temperature (also known as phase transition heat) and as sensible heat at variable temperatures without changes occurring in the physical state. In both cases, research focuses on new materials and fluids that will enable us to enhance existing technologies by storing and releasing energy at higher temperatures and/or increasing energy density per cubic meter of storage system.
- › **Energy grid storage services:** Abengoa harnesses all its knowledge in researching direct grid storage services, thus helping to meet power demands at peak times while bringing power generation in line with the demand curve. This allows us to valorize and safely integrate excess electrical power coming from renewable energies within the grid, among other sources.

## Photovoltaic energy

### Perovskite solar cells

Abengoa is working to optimize materials and to improve our understanding of the kinetics of devices that will enable us to improve our energy conversion efficiency even further. To this end, it is working closely with institutions and universities such as the Swiss Federal Institute of Technology in Lausanne, the Max Planck Institute for Polymer Research and the University of Castilla-La Mancha.

The company has also been focusing its efforts on developing perovskite solar cells since the technology first emerged in 2012. Perovskites are **materials with extraordinary properties and are currently taking the photovoltaics sector by storm**. Their light to power conversion efficiency currently exceeds 20 %, making them hugely competitive when compared with other existing photovoltaic technologies. The total thickness of the device is less than 1 micron. This keeps material usage to a minimum and provides an excellent price-efficiency trade-off.

Perovskite has fast become a very popular choice as a semiconductor in the production of photovoltaic devices thanks to its impressive light absorption properties. Another attractive application is to make multi-layer devices featuring other available photovoltaic technologies.

It is therefore a highly promising technology with great potential to reduce costs and raise efficiency; one that might well revolutionize the photovoltaics market due to its efficiency and scope of application.



1



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1. Material optimization in the production of perovskite solar cells
2. Solar simulator for measuring photovoltaic cells

## Chemical processes and water treatment

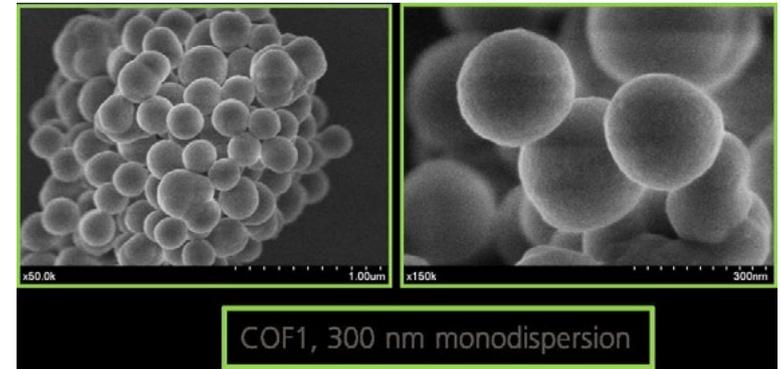
### Nanotechnology applied to water treatment processes

Scientific advances in nanotechnology are creating huge opportunities to develop efficient, cheap and environmentally sustainable water treatment and desalination processes.

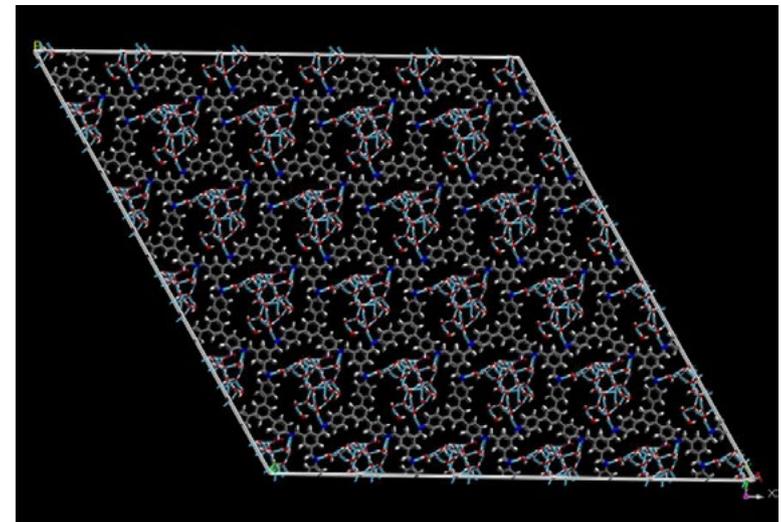
Nanomaterials offer **massive potential for resolving or at least working towards many of the existing problems associated with water quality**, with examples including nanoabsorbers, nanocatalysts, bioactive nanoparticles, and nanostructured catalytic membranes, among others.

The Nano4water project brings together a team of researchers in material physics and organic chemistry along with chemical process and water engineers from both Abengoa and collaborating entities, all working jointly to develop and offer new nanomaterials for water treatment applications.

For example, the company is working with Imdea Nanociencia and the Autonomous University of Madrid on a new family of materials known as porous covalent organic framework (COF). These can easily be rendered useful in a variety of different forms, yielding a wide and interesting range of different properties such as magnetism and hydrophilicity.



COF 1 sphere, monodispersed at 300 nm



Ab initio calculations of the interaction between a two-dimensional (2D) sheet of Covalent Organic Framework 1 (COF1) and H<sub>2</sub>O molecules. The hydrophobicity of the COF can be observed, while the pores (2.1 nm in diameter) present a more hydrophilic response given the interaction with the amino groups of the COF

## Biotechnology and bioproducts

Enzymes for generating biofuels from municipal solid waste (waste to biofuels, W2B) and from agricultural residue or biomass (2G)

The acronym “Cambios” comes from Combined Approaches Based on Metagenomics for Biofuel Synthesis, a metagenomic project being spearheaded by Abengoa’s Biotechnology Division.

Metagenomics is the scientific study of all the genomes present in a given environment recovered directly from environmental sampling without the need to isolate or grow the organisms present in the environment.

The project aims to explore the biodiversity of the ungrowable microbial world **in search of enzymes that could prove useful in biofuel synthesis**. To focus the search, the Biotechnology Division flags those niches that could play host to the desired enzymatic activities. From there, it can seek out enzymes capable of degrading lignocellulosic material (bottleneck in the production of second-generation bioethanol) by exploring the existing biodiversity present in goat rumen.

The project also encompasses a number of tasks aimed at overcoming the intrinsic difficulties posed by metagenomics, such as detecting elusive enzymatic activities or designing a versatile microorganism with which to scrutinize these enzymatic activities.

With this project, Abengoa is bidding to develop a raft of powerful molecular tools to continue leading the second-generation biofuels sector and transform municipal waste into liquid fuels.

## Power systems

### Smart Solar Plant (SSP)

Abengoa is working to develop smart solar power plants that combine **photovoltaic and solar thermal technologies with thermal and electrochemical storage to ensure the best possible integration within the electric power system**. In addition to generating clean energy at a cheaper tariff, these plants will be able to provide power grid support services to help optimize their position in competitive electricity markets.

The SSP project embraces the design and implementation of a smart distributed control system that pursues three key objectives:

- › Increasing automation in the control of integrated power generation plants.
- › Providing the SSP with advanced functionalities when interacting with the power grid to improve grid performance.
- › Extending the intelligence of the SSP control system towards the modern energy and services markets.

The project also involves developing equipment, such as the virtually synchronous power converters, along with other facets concerning information analysis (big data), control algorithms and distributed control system architectures. It also analyzes the impact this new kind of plant will have on a number of key locations, such as California, Chile, South Africa and Germany.

## Hydrogen

### Electrocatalysis

Redox reactions cover a multitude of processes occurring daily in nature that involve chemical reactions generating an exchange of electrons between different species.

These electrons can be exchanged in a controlled environment using an electrochemical cell operating at well-established intensities and voltages. An electrocatalytic reaction occurs when the electrode not only transports the electrons but also has a catalytic function. Electrocatalysis has acquired enormous importance in the race to develop fields such as organic electrosynthesis, sensors, fuel cells and batteries.

Abengoa has developed and patented its own proprietary electrocatalytic technology in collaboration with the University of Castilla-La Mancha with the aim of:

- › **Producing hydrogen and syngas simultaneously**, with a suitable  $H_2/CO$  ratio to improve and optimize the final application of the product (fuels, chemical products, and so on).
- › **Valorizing  $CO_2$**  to improve the cost efficiency of plants that generate this greenhouse gas and thus transform it into useful products (methane, methanol, etc.) by using the  $H^+$  generated from the water electrolysis as a hydrogen source.
- › Causing the electrooxidation of organic molecules **to generate high purity hydrogen**.

## Energy crops

### Biomass for biofuels

Energy crops are used to generate biomass for conversion into power. The aim is to ensure that the plants are highly adaptable in a production sense, generating low costs for both growth and harvesting.

Abengoa's research focuses on **maximizing biomass production** in as short a time as possible. To this end, various lines of research have been rolled out **to increase plant energy potential through agronomic and biotechnological techniques**.

The key objectives here are to establish the conditions in which the best tree growth rate can be achieved - a biological parameter that changes depending on species, age and growing conditions (soil, crop density, hours of light and available water, among others) - along with the maximum possible planting density, and to define the ideal conditions for ensuring the best possible energy return on energy invested. The company is also exploring the best growing conditions so as to improve the growth of trees while avoiding any negative impact on soil quality.

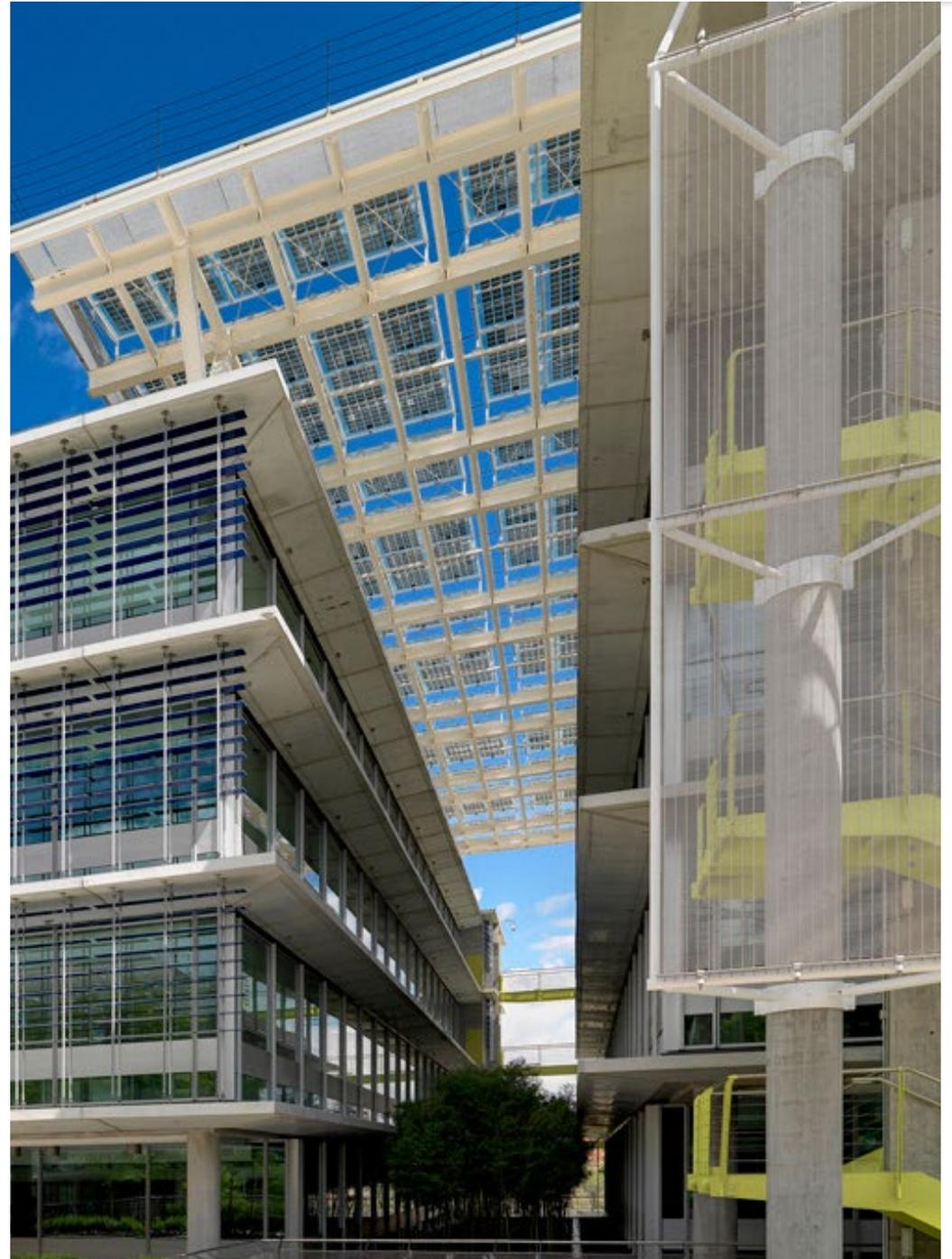


New laboratories of investigation  
in Campus Palmas Altas, Seville (Spain)



## 06.2 Business development

Abengoa, a global leader in projects involving solar energy and other sources of electric power, energy storage, transmission lines, water desalination, treatment and reuse, bioenergy, hydrogen, energy crops and custom-made buildings.





Abengoa intends to cement its leadership in the solar thermal power market by banking on its proven experience and track record in operating and maintaining these kinds of facilities, among other factors

## Solar energy

Two very different products can be obtained by harnessing the power of the sun: **solar thermal energy and photovoltaic energy**, both having different characteristics and features and, therefore, different markets. Abengoa is present in both through its solar energy business, operating in the markets that offer the right levels of solar radiation for each technology and stable regulatory frameworks that allow business to proceed with as little risk as possible.

Starting with the solar thermal market, there is currently 4.2 GW of installed capacity worldwide: Spain leads the market with 2.3 GW, followed by the United States, with 1.8 GW. Other markets with a significant presence of solar thermal technology include: South Africa, with 300 MW, Morocco, with 184 MW, Chile, with 110 MW, Abu Dhabi, with 100 MW, Algeria, with 25 MW and Egypt, with 20 MW.

All external analysts expect to see heavy growth, with 10 to 15 GW installed by the end of 2020. The main drivers of this growth are expected to be the United States, the Middle East, North Africa, South Africa and Chile, while other countries such as India, China and Australia also include solar thermal energy as part of their long-term energy plans, despite their cautious start. They are therefore expected to make their presence felt in the market in the medium term. Projected market growth beyond 2020 and through to 2030 looks very promising, with the solar thermal market showing greater growth ratios than in previous years, due largely to the technology-related cost savings that are expected to be achieved from 2020 onward in line with the envisaged cost reduction plan.

**Abengoa leads the solar thermal market with a share of 40 %** and intends to cement its position thanks, among other things, to its unrivalled technological prowess and experience in operation and maintenance.

It is expected that total combined capacity for the photovoltaic market will stand at around 580 GW by 2020. When you consider that the installed capacity in 2013 was 147 GW, you can begin to appreciate the enormous growth expected to occur within the photovoltaic market in the coming years. It is important to note that most of the new capacity - over 50 % - will come from distributed generation. In general, growth of the photovoltaics sector will be spearheaded by China and India, supported to a lesser extent by the United States, Japan and Chile, among others.

Within the photovoltaics sector we would underscore the efforts being made to roll out new technologies to help boost plant performance while lowering the associated costs. A key technology in this regard is high concentration photovoltaics, also known as HCPV. This technology requires similar levels of solar radiation to solar thermal technologies and is more efficient than conventional photovoltaics. There are a number of pilot plants currently showcasing this technology and the market is expected to reach approximately 2 GW by 2020. This fledgling market is currently been driven by China, the United States and Spain.

Abengoa is fully aware of the importance of the photovoltaics market. Given the synergies of this technology with solar thermal technology, coupled with the company's presence in regions offering high levels of solar radiation, Abengoa has committed itself to expanding its presence in the market, relying not only on conventional photovoltaic technology, but also new technologies being developed within the company.

The lines of activity associated with the solar energy business are:

- › Developing new solar technologies, embracing both solar thermal and photovoltaics.
- › Industrializing the new technologies and developing solar products, including both solar thermal and photovoltaics.
- › Developing solar power plants from these products.
- › Manufacturing and selling components for solar power plants.
- › Overseeing construction and managing the asset during the construction of the solar power plants.
- › Operation and maintenance (O&M) of solar power plants.
- › Ownership of solar power plants.



Thanks to thermal storage technologies, plants can be operated 24 hours a day



Abengoa has four power tower facilities in operation and under construction

A number of major milestones were reached in 2014 in the solar business, including the successful start-up of the **Mojave** and **KaXu Solar** One parabolic trough solar thermal power plants, the former a 280 MW facility located in the Mojave Desert, California. The latter a 100 MW plant, has 2.5 hours of thermal storage and is South Africa's first solar thermal power plant to enter service. The **Solana** plant, the world's largest parabolic trough facility, with 280 MW capacity and six hours of thermal storage, celebrated its first year of operation in September. Abengoa has also started construction of two ambitious solar thermal power facilities in Chile and South Africa, namely Atacama-1, a molten salt-based power tower plant with 110 MW of installed capacity and 17.5 hours of storage, and Xina Solar One, a 100 MW parabolic trough plant with up to five hours of thermal storage.

## Other sources of power generation

For as long as developing countries continue to become more industrialized, global demand for resources will rise exponentially due to the boom in the population (8.4 billion forecast for 2032) and the rise of the middle class, which in 2020 will be up 78 % on the same figure for 2010, according to a study conducted by an international consultancy firm. Abengoa wishes to play an active role in helping to ensure that the global population has access to essential resources.

Abengoa constructs renewable energy facilities, such as **wind farms**, **biomass plants** and **waste to energy (W2E) facilities**, as well as conventional generation facilities, such as **combined cycle plants**, **cogeneration plants** and other kinds of facilities. It does this in all corners of the world, working on groundbreaking projects tailored to the specific needs of the region in question and the client.

Abengoa promotes, designs, conducts site assessments, analyzes energy production, purchases supplies, constructs, fits out and commissions these kinds of plants. Moreover, the company handles the management of the facility, while marketing and selling the energy produced and

carrying out maintenance work. In other words, **it covers every single link in the value chain.**

The electricity sector shows considerable promise for the coming years. Installed capacity is expected to grow by roughly 2,121 GW, half of which will be generated in Asia, with China at the forefront, followed by India and Indonesia. By country, the United States is second only to China in terms of projected growth in installed capacity for the coming six years, with gains expected to reach 385 GW.

According to World Energy Outlook, the report published by the International Energy Agency (IEA), natural gas is set to become the second largest source of energy for installed capacity, with over 2 TW, and will experience the greatest overall growth during the period.



Abengoa has more than 9 GW of installed capacity in conventional generation

Abengoa has **more than 9 GW of installed capacity** in conventional generation, encompassing simple and combined cycles, conversion of simple cycle to combined cycle, internal combustion plants, cogeneration facilities and biomass plants. The company's experience in this sector and the fact it has already completed a number of groundbreaking projects have been key to cementing its status as the **second largest international construction** firm when it comes to cogeneration plants, according to the ranking prepared by the prestigious journal Engineering News-Record (ENR).

Abengoa started operating in the wind sector back in 1985, following construction of its first wind farm in Spain. Since then, the company has been involved in the construction of wind farms with a total installed capacity of over 340 MW. At present, the company has a capacity of 170 MW under construction and in operation in Latin America.

According to a report published by the Global Wind Energy Council, total wind power installed capacity amounted to 35 GW in 2013, down on same figure for 2012, which exceeded 45 GW. Mexico is a prime example of the sector's potential, with the country tapping only 3.2 % of its potential capacity to produce wind energy, according to estimates of the U.S. government. The country expects that the sector will receive investment of up to \$ 20,000 M to develop this potential in the coming years.



Abengoa has been involved in the construction of wind farms with a total installed capacity of over 340 MW



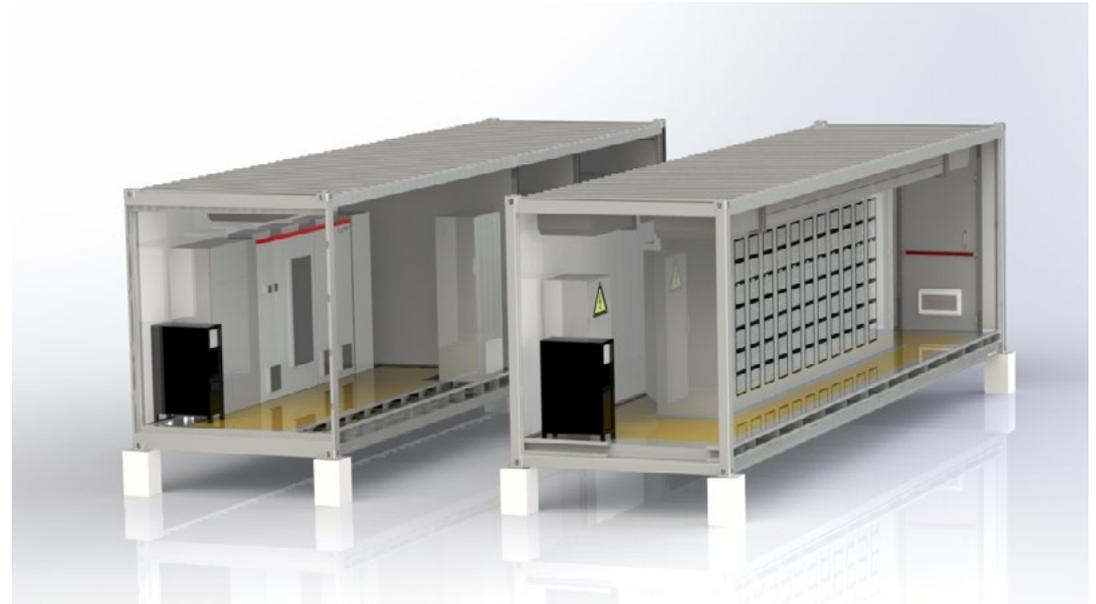
Molten salt energy storage

## Energy storage

There are currently a number of breaches in existing energy systems and Abengoa is able to bridge these by implementing energy storage systems at both renewable power plants and facilities linked up to the grid. The company relies on energy storage technologies, which may be thermal, electric, or thermochemical, to tackle and respond to the four major problems facing existing energy systems:

- › Integrating renewables: storage technologies improve management and flexibility at renewable power plants, responding swiftly to demand from the grid at any time of day.
- › Need for new transmission and distribution infrastructure: due to rising energy demands and an ageing infrastructure, energy storage systems help improve the functioning of the power grid, thus deferring the need to invest in new power transmission and distribution lines.
- › Need to regulate grid voltage and frequency: energy storage enables the grid to be operated more smartly and efficiently.
- › Need to meet peak demand: energy storage systems are the cheapest alternative for end consumers when covering periods of peak demand for electricity, without having to overload the power grid.

Energy storage systems can provide a range of different grid support services, from mitigating power fluctuations and boosting power transmission capacity to improving frequency stability within the electrical grid. They also allow renewable energies to be fed into the grid, a solution Abengoa has already applied at existing solar thermal plants such as Solana and which it also intends to apply through combined thermal heat and electricity systems at the Atacama-1 solar power facility currently under construction in Chile.



Infographic of a modular energy storage system featuring lithium batteries built into 40-foot containers

Energy storage is the most efficient means of responding to the advances in the electrical grid by supplying capacity at peak times and rendering the grid more stable, while also helping to feed sources of renewable power into the grid. Abengoa is therefore committed to developing a full range of energy storage technologies, making it a benchmark company when it comes to services to improve the functioning of electrical grids. These innovative systems can also be used to construct renewable power plants capable of providing a rapid response to grid power demand day or night.

The company currently has sufficient technological capacity to provide both operators of the electrical system and utilities with a spectrum of energy storage solutions tailored to their individual needs, thus offering the best possible solution in each case:

- › Molten salt tanks with electrical resistors and a steam turbine (new turbines or existing ones from obsolete plants, such as coal power stations).
- › Electric battery systems.
- › S3 Smart Storage System, which includes molten salt tanks, electric batteries and system control and management.

Abengoa is also working on alternative storage systems to enable adaptation to other needs as they arise:

- › Hydrogen-based energy storage systems.
- › Thermochemical storage systems.



Transmission line in Argentina, where Abengoa built its first transmission line outside Spain

## Power transmission lines

Here Abengoa is the undisputed leader on the international stage. According to Engineering News-Record (ENR), it is the **world's largest construction firm when it comes to power transmission and distribution**. The company has been awarded over 25,000 km of transmission lines and 284 substations across the world over the last ten years.

The electricity sector shows considerable promise for the coming years. According to figures published in the latest Global Electricity Transmission Report, it is estimated that one million km of high voltage line will be erected. Asia will be the continent to see the greatest growth, with China and India leading the way. In turn, Latin America, North America, the Middle East and Africa will all experience similar growth of around 6 %.

Abengoa's first ventured into the field of power transmission and distribution back in 1944, with the installation of a 15 kV line and a transformer station in Spain. Twenty-two years down the line, Abengoa would develop its first transmission line outside Spain, a 500 kV line in Argentina. As it currently stands the company has installed transmission lines and constructed electrical substations in over 30 countries worldwide.

Transmission lines allow electricity to be transported efficiently from wherever it is generated (meaning wherever production is optimal) to demand centers. Abengoa offers safe and efficient electrical storage systems in any electrical substation or renewable energy plant.

Abengoa is one of the leading private concessionaire companies in Latin America, with a total of 12,000 km of active transmission lines in Peru, Chile and, above all, Brazil, where it has demonstrated its unrivalled expertise in direct current systems with the construction and start-up of South America's largest extra high voltage system (HVDC).

The year also saw the company secure its first power line concession in India.

The wide range of technical solutions that Abengoa offers in the field of transmission and distribution includes lines and electrical substations of all shapes and sizes: alternating current and direct current; all levels of voltage (low, medium, high and very high); overhead, underground and underwater lines; substations insulated with air, oil, gas and hybrid solutions; as well as power upgrading work to boost the power transportation capacity of existing lines.



Abengoa has built 284 substations in the last 10 years

Abengoa covers the entire value chain in this area, from engineering to operation and maintenance, with key services including plant verification and start-up, monitoring, system oversight and control 24 hours a day, seven days a week, planning of maintenance engineering and maintenance work on live lines.

The company also offers a range of other services, including financial structuring of large-scale projects, for which it has its own specialist team.

## Water desalination, treatment and reuse

Water is an essential natural resource, being vital for all life and our very existence. We need it to drink, to keep ourselves clean and to produce the food we eat. We also require water to produce the energy we use and to fuel the economy.

If we truly understand the water cycle, we know full well that to solve the existing problems in water management, we need not only generate drinking water from natural resources, but also manage this key resource efficiently and purify and regenerate the wastewater produced by human activity so that it can be reintegrated safely and sustainably into the cycle, whether through responsible disposal or regeneration for other economically viable uses.

Aware of this need, Abengoa wishes to push its message that it is a company fully committed to sustainable development, relying on its know-how and expertise in **water resource management and purification, and regeneration of wastewater** (municipal and industrial), and also on its reputation as a benchmark company in **water purification and desalination**.



Desalination plant, Cartagena, Spain, with an installed capacity of 65,000 m<sup>3</sup>/day

According to the GWM<sup>1</sup> 2014 report, the global water market was worth \$556,800 M in 2013, with estimated annual growth of 3.9 % through to 2018. This figure encompasses all investment in capital and in operation and maintenance on a global scale in both the industrial and municipal sectors.

Although water-related problems tend to be limited geographically speaking and heavily influenced by society's acute awareness of the issue, there are currently numerous global factors (economic, social and political) behind the forecast growth for the sector in the years to come. These factors can be summed up as follows:

- › Increasing problems of water scarcity and contamination.
- › Increased regulation of water management and greater oversight of compliance with applicable law.
- › Need for improved water purification infrastructure in cities experiencing heavy growth.
- › Pressure to optimize the management of water resources.
- › Need to enhance the management of industrial wastewater and the close relationship between water and energy.
- › Growing concern about the impact of climate change on the water cycle.

These factors, among others, have led to the widespread growth of the water market and of the sub-sectors where the greatest growth is expected to be seen. For example, capital investment in desalination through to 2018 is estimated to witness annual growth of 19.8 % on its way to reaching a market value of \$15,188 M. The water reuse market, on the other hand, is likely to see 20 % growth to reach a market value of \$7,683 M by 2018.

By operating within the water business, Abengoa is driving towards sustainable development, providing innovative cross-the-board technological solutions in the field of water treatment, purification, regeneration and management for both municipal and industrial clients. It strives to become a truly global technological company and a benchmark figure in the promotion, construction, development and management of technologically innovative infrastructures in the water sector, serving both municipal and industrial clients.

<sup>1</sup> Global Water Intelligence (2014)

To this end, the company is involved in various lines of business in the water sector:

- › Promotion, development, construction and operation of integral projects in the following sectors:
  - Desalination of seawater and brackish water
  - Water purification and transportation
  - Purification and regeneration of municipal wastewater and associated sludge management
- › Design, construction and advisory services in relation to infrastructures for treating process water and wastewater for industrial clients.
- › Management of drainage basins and delegated management services.
- › Research, development and innovation in the field of water



Desalination plant at Cartagena, Spain, with an installed capacity of 65,000 m<sup>3</sup>/day and featuring reverse osmosis technology

## Bioenergy

We have witnessed a number of major changes in the biofuels market in recent years, requiring us to act and adapt swiftly and innovatively in response. Oil consumption and oil prices continue to fluctuate based on market performance. This fact, along with various other factors, has begun to change the profile of the biofuels industry and its role in mitigating problems relating to safety, the impact on the economic landscape and its ongoing contribution to the sustainability of the environment in which we all live.

The last decade has been crucial in helping us understand the future potential of biofuels as the main alternative in reducing oil dependence at a global level. It has also been a period marked by research, specifically in the development of biofuels from new feedstocks, such as lignocellulosic materials and municipal solid waste. These advances have led to a range of new opportunities in the market.

Despite the current economic and political landscape, Abengoa continues to be positioned as a biotechnology leader who is expanding its activities and diversifying its bio-product creation and production. Proprietary technology is the focus for the creation of new products and bio-products that result in diversifying and expanding our portfolio.

While the weakened biofuels market in Europe has lost momentum and the less than favourable political support for the biofuels sector has only perpetuated this current landscape, Abengoa finished 2014 with a **strong presence and proven success in the United States and Brazilian bioenergy sectors**. In the United States, the bioenergy business has shown positive, solid returns thanks to the development and promotion of advanced biofuels.



Biomass bale for the production of cellulosic ethanol

Abengoa’s corporate mission for its bioenergy business is to develop and expand the following lines of business so as to provide the best possible results for its stakeholders, the industry and society as a whole.

- › **Fostering the sustainable development of the biofuel** for transportation market while developing biochemical products through the use of renewable raw materials and environmentally friendly technologies that help curb GHG (greenhouse gas) emissions and cushion environmental impact.
- › **Developing innovative technological** solutions through continuous investment in R&D, leading to more efficient production processes, diversification of raw materials and the manufacture of new products.



Facilities of Biocarburantes de Castilla y León at Babilafuente (Salamanca, Spain)

Following this approach, Abengoa's objective is as follows:

- › To become an international leader in the **production and sale of biofuels and chemical bioproducts produced from renewable inputs**.
- › To be recognized as a global leader in research and development, widely-known for **its technological innovation in converting biomass** into fermentable sugars, bioethanol, biodiesel, aviation fuel, chemical bioproducts, and in upgrading first-generation assets so as to diversify its product portfolio.
- › In the biofuels market, Abengoa is **Europe's leading producer and one of the main producers in the United States and Brazil**, with a grand total of **3,175 ML of installed production capacity** distributed between **14 different plants operating in five different countries across two continents**. Abengoa has also ended the year with a new plant in operation: the first commercial facility to produce cellulosic ethanol (also known as second generation (2G) ethanol) from agricultural residues (waste).



Crop unloading at the Hugoton plant (Kansas, USA)

In addition to its first and second generation plants, Abengoa also produces biodiesel from vegetable oils, which, in contrast to oil-based diesel, help reduce emissions of air polluting gases. It is worth noting that the plants also yield a number of important coproducts. A prime example here would be DGS (distillers grains with solubles), which is used for animal fodder, or the crystal sugar obtained at Brazilian facilities for both export and sale within the domestic market.

These plants are also set up to generate steam and electricity to meet the plant's own power supply needs, while the surplus electricity produced is exported to the national grid. Bioethanol production through fermentation produces CO<sub>2</sub> (carbon dioxide) emissions. This CO<sub>2</sub> is captured and supplied to gas companies, thus leading to a reduction in greenhouse gas emissions from the production process.



Electricity cogeneration at Abengoa's plant in Sao Luiz (Pirassununga, Sao Paulo, Brazil)

With a view to diversifying the raw materials or inputs used to produce biofuels and bioproducts, the company focuses its attention on enzymatic hydrolysis and catalysis processes to obtain bioethanol from lignocellulosic raw materials, chiefly crop residue, which would have no value otherwise. A major milestone in 2014 was the fact that Abengoa started marketing its own enzymes with a proprietary technology successfully developed after various years of ongoing research and development.

Abengoa also offers a wide range of services, including technology licensing, project development, biomass supply and logistics, agricultural management of biomass (energy crops), construction management, management of operations and product marketing and coverage of raw materials and contribution margins.

## Hydrogen

The last 12 months have been a key period without doubt in the use of **hydrogen as an alternative fuel for transportation**. In addition to the tenders in California for 68 hydrogen service stations, we have the launch in Europe of the Directive on the deployment of alternative fuels, hydrogen being one of these, coupled with the commitments made by the main automobile manufacturers.

This has opened up a much larger market for hydrogen than that offered by traditional niche markets, such as captive fleets of forklift trucks, or the aerospace or defense sectors.

Abengoa aspires to become an international benchmark within the hydrogen economy, applying proprietary technology to offer solutions based on hydrogen and fuel cells, with the ultimate aim of championing an energy system that is sustainable for everyone.

In relation to hydrogen production, Abengoa provides plants based on both water electrolysis and biofuel reforming, focusing especially on those technologies compatible with renewable energy sources to offer renewable energy storage solutions.

In the field of electrical and thermal power production, the company designs and constructs plants that can operate with both fuel cells (polymer and molten carbonate) and hydrogen motors or microturbines, thus offering various solutions for distributed generation.

Abengoa reached a number of significant milestones in 2014 in developing its AIP (air-independent propulsion) system for the S-80 class submarines the Navantia shipyard is currently constructing for the Spanish Navy. It also completed development of the different modules that make up the MCFC (Molten Carbonates Fuel Cell) cogeneration plant to be assembled at Abengoa's headquarters in Torrecuellar, Seville.

## Energy crops

Biomass is a type of energy that has seen significant growth in recent years, providing both heat and electricity and accounting for roughly 10 % of the worldwide supply of primary energy. The leading biomass markets vary, depending on the type of fuel in question. Biomass is making a steadily increasing contribution to the energy demands of many countries and already represents a significant part of the total energy supplied in some of these countries, including the Nordic states in Europe, where biomass energy accounts for more than 25 % of the total energy consumed. Biomass markets have grown at different rates. Pellets and chips are now regularly sold internationally in large volumes, yet despite the growth, they remain relatively small markets; pellets account for just 1-2 % of the total global demand for solid biomass. 2014 saw the completion of numerous large-scale plants (over 750 MW) that use pellets as a fuel, especially in the UK. New producers have emerged in response to this demand, particularly in the Southeastern United States, with new facilities starting up in Florida, Virginia, South Carolina and Georgia. Global demand for the pellets market, in which Abengoa has a number of projects in advanced state of completion, is expected to grow significantly in the next ten years for both industrial and residential uses. The average consensus for 2022 is 36 million metric tons, although the greatest growth will be seen in the coming five years.



Wood chips for energy use

Abengoa has become a market leader in Uruguay in the field of forestry services, developing **groundbreaking solutions for the biomass value chain as a raw material for both industry and energy generation.**

It aims to become a global leader in technology and in the development and supply of biomass as an efficient source of energy through innovation and sustainability.

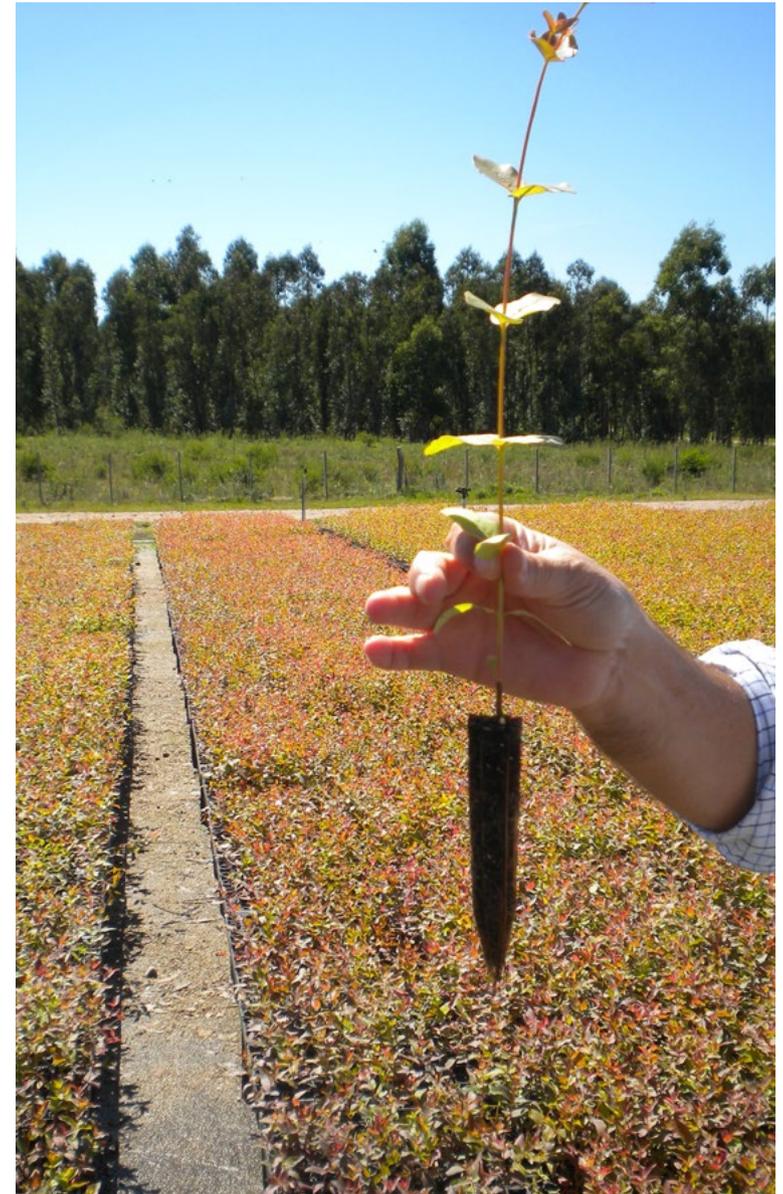
With this goal in mind, Abengoa is currently working on three main fronts, with its market divided into the following key regions: United States, Uruguay and the rest of the world (RoW), in which it carries out the following **lines of business**:

- › Promotion: **energy crop plantations.**
- › Logistics services for: harvesting, biomass transportation, forestry and operation of biomass deposits.
- › Biomass trading to power industries (Wood chip, refrigeration, etc.).
- › R&D and innovation to develop genetic material for combustion processes, focusing on temperate zones.

Abengoa similarly has a wide range of activities and projects in the United States related to the energy crop business:

- › Promotion: **pellet plants, chip plants and energy crop plantations.**
- › Logistics services for: Harvesting, biomass transportation and forestry.
- › Biomass trading to power industries (wood chip, wood pellets, etc.)
- › Infrastructure management of pellet and chip mills (operation, maintenance and Management).
- › R&D and innovation to develop genetic material for combustion processes and biofuels, focusing on temperate zones of the northern hemisphere.

The company is also seeking out new markets and opportunities and developing new lines of business in the rest of the world.



Eucalyptus seedlings at a forestry nursery



Abengoa has secured its first project in Denmark

## Custom-made buildings

Another facet of Abengoa's business is the construction and management of custom-made buildings such as **hospitals, administrative complexes, courthouses, cultural centers and correctional institutions**, among others.

The company's involvement in the sector typically takes the form of **public-private partnerships** (PPPs), which offer huge benefits for both parties. On the one hand, the public sector can benefit from the know-how and expertise of the private sector, while in return, the private sector obtains a regular source of low-risk, long-term income.

According to figures published by Standard & Poor's, the public-private partnership market will grow significantly in the coming years, and close to 60 % will relate to custom-made buildings. Abengoa will share in this growth as a key player in the world's main markets.

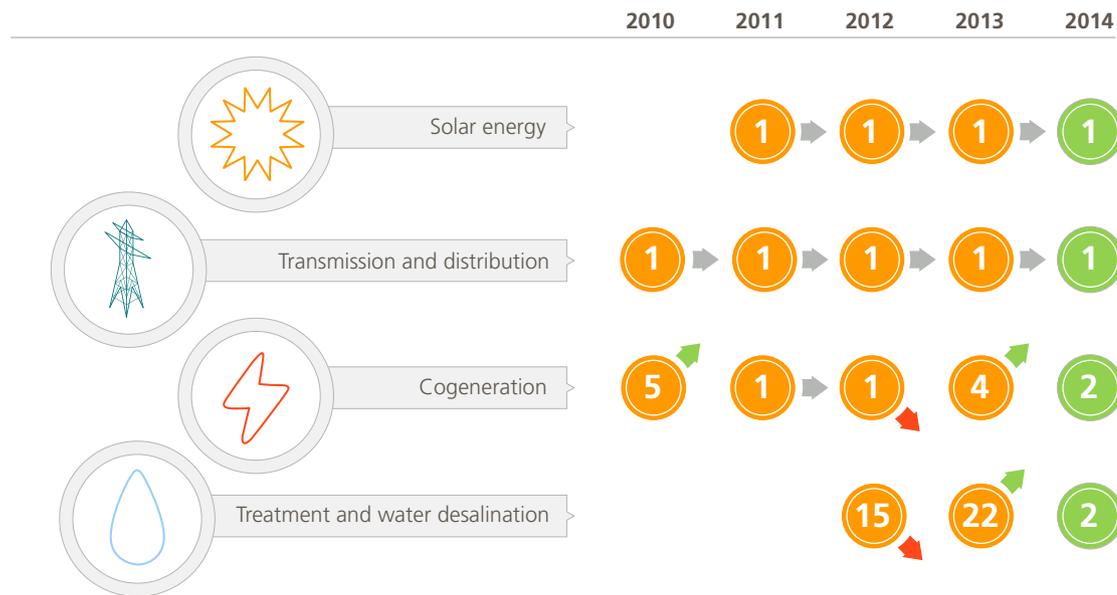
Abengoa's business in this sector embraces the entire value chain, from development, financing and civil engineering, including electrical and mechanical installation work, through to ventilation and air conditioning systems, communications systems, fire protection, and so on. The company **manages assets in this sector** in a number of different countries, including Brazil, Spain, Uruguay and Mexico.

## 06.3

# Engineering and construction

With over seventy years of experience in the energy and water engineering and construction business, Abengoa is a renowned expert in offering groundbreaking turnkey technology solutions across the world: solar powers plants, integrated solar-gas plants, conventional power plants and biofuel plants, hydro infrastructures, including large-scale desalination plants, rail electrification systems, wind farms and sprawling electrical power transmission systems, among others.





Abengoa cements its position in the international market according to the table published by ENR

Key financial figures	2012	2013	2014	Chg. 14-13 (%)
Revenue (€M)	3,789	4,832	4,515	(7) %
EBITDA (€M)	624	806	806	-
EBITDA margin (%)	16	17	18	6%

## Engineering and construction

Abengoa ranks **among the twenty largest international construction firms** according to the table published by ENR, the prestigious international journal of the construction sector. By region, Abengoa ranks fifth in Latin America and seventh in the United States. Moreover, the company has retained its position as international leader in electrical infrastructure for the second straight year and has now made it four years as the leading international contractor in solar energy. A further highlight for this year's report is Abengoa's climb up the cogeneration market to second place, a feat it has managed to replicate in the water treatment and desalination sector.

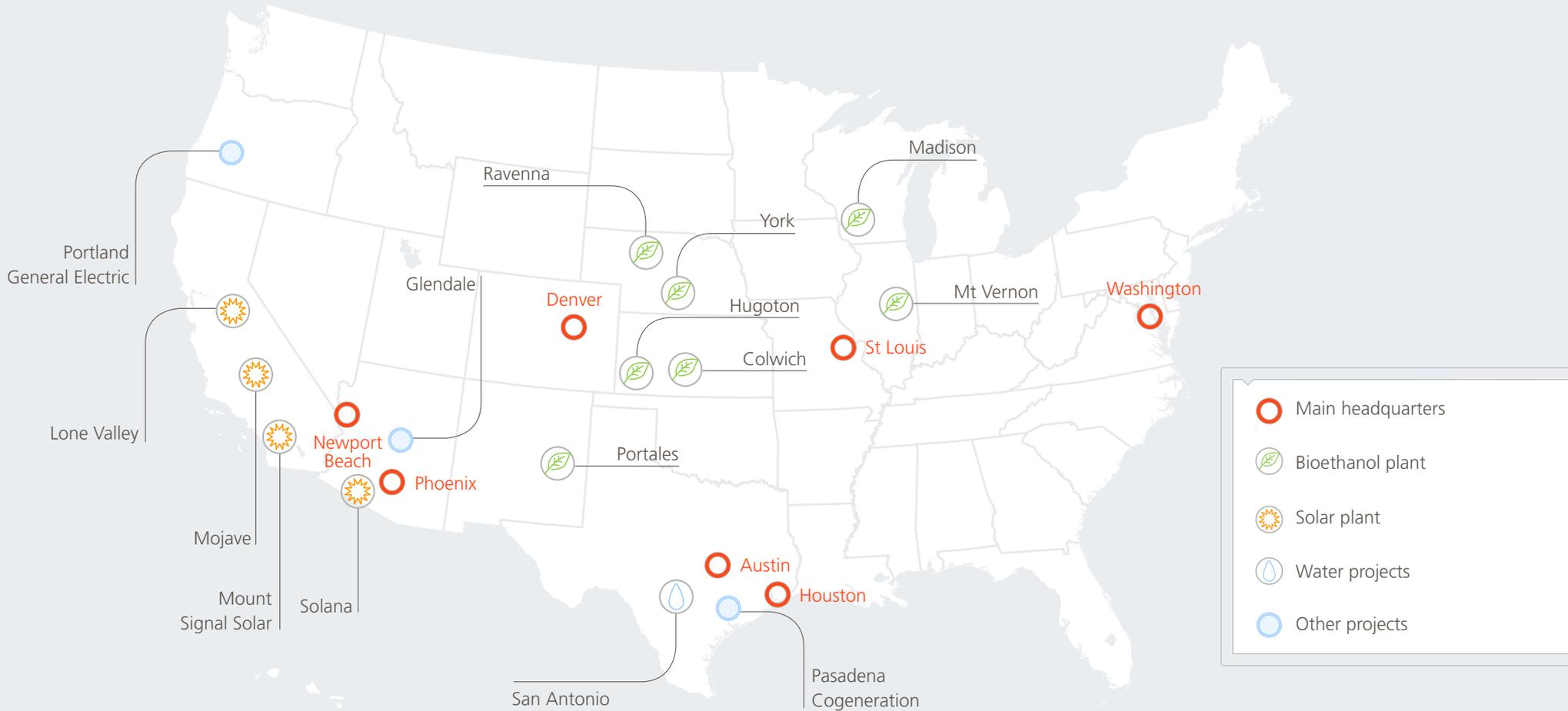
The company's main projects in engineering and construction by region are as follows:

### America

#### United States

Abengoa has swiftly consolidated its position in the United States, where it is already the **seventh largest international contractor** in terms of sales revenues. The company rolled out projects across all its sectors of activity, with key areas being renewable energy generation projects to champion the development of renewable infrastructures within the United States, which is strongly committed to the sector.

Abengoa has more than **1,200 MW of capacity either installed or under construction in the United States**. This power is generated by a mix of conventional power generation, photovoltaic and solar thermal power plants and waste-to-energy plants, all serving and powering 350,000 households. The company operates across 12 states and has projects and offices in 22 cities, providing employment to over 1,800 people.



Of the main projects awarded to the company in 2014, we would highlight the contract to develop a **unique water-related project requiring the supply of materials and a treatment plant capable of generating 168,970 m<sup>3</sup>/day of water every year for the city of San Antonio, Texas**. Abengoa has also been tasked with operating the facility over a 30-year term.

Abengoa completed various projects in the country in 2014. In addition to Mojave and Hugoton - two landmark projects for the company - it also completed work on the world's **largest single-tracker photovoltaic plant**, namely Mount Signal Solar in San Diego (California), with an impressive 206 MW of installed capacity. It also completed a **waste-to-energy (W2E) plant** at Glendale, Arizona, which is capable of generating 15 MW of electric power.



Moreover, the company is developing **two photovoltaic plants** with a combined capacity of 30 MW at San Bernardino, California; a 15 MW cogeneration plant in Pasadena (Texas) and a **440 MW combined cycle facility** to supply enough electricity for half the population of Portland (Oregon).

## Mexico

Abengoa is **one of the leading companies in the Mexican electricity and power generation sectors**, having been operating in the country for over 30 years. Vouching for the company's credentials in the country are its 3,900 MW in conventional power generation, upwards of 6,300 kilometers of power transmission lines, over 120 substations and a water treatment facility that will soon be able to process 328,000 m<sup>3</sup>/day of water.

The company has been chosen to **upgrade the Nuevo Pemex cogeneration plant** to 1,245 MW. The venture will guarantee 100 % usage of the steam generated by the Nuevo Pemex Gas Processing Complex, while generating clean energy, the result being improved availability and reliability for the national power grid.

In the water sector, highlights include the **Zapotillo aqueduct, one of the most impressive hydro projects on the international market**. The structure will provide a sustainable supply of drinking water to over one million inhabitants of the state of Guanajuato. The company will also operate the concession for 25 years.

Abengoa is continuing construction work on the Centro Morelos **combined cycle plant**. Operating at 640 MW, the facility will generate enough energy to power over 280,000 households. The Mexican Federal Electricity Commission has once again placed its trust in Abengoa by entrusting it to construct a **924 MW combined cycle plant** at Juárez. The company will also be responsible for the facility's operation and maintenance under a 25-year contract. The plant will generate enough electricity to power over 500,000 households each year.

Abengoa completed work on the world's largest single-tracker plant in California, with 206 MW of installed capacity



Abengoa is constructing Mexico's largest combined cycle plant

In the manufacturing business, Abengoa has commissioned to construct over **1,500 t of metallic tower structures** to reinstate the supply of electricity in Baja California in the wake of Hurricane Odile.

#### Costa Rica

Abengoa is currently working on **three electrical substations** and associated lines in the Central American country, which will help to improve the nation's existing energy infrastructure.

#### Colombia

Abengoa has secured its **first contract in Colombia** to engineer, design, construct and commission the compression and air drying system at the Cartagena de Indias plant of Ecopetrol.

#### Brazil

Abengoa is **one of the leaders in the development of large-scale transmission systems** in Brazil, where it has been operating for 15 years, with more than 13,000 km of lines either built or under contract.

The company is currently constructing a further **ten transmission lines to provide more than 7,200 km**, all in different stages of development. In order to construct the new lines, Abengoa will need to hire more than 10,000 workers at peak times. To maximize efficiency and help develop the country, the company intends to take the same approach as that taken in Peru, by training 2,500 Brazilians as line technicians. In addition to learning a valuable skill, they will also be hired over the duration of these projects.



Abengoa intends to train 2,500 young Brazilians as transmission line technicians

The company also constructs custom-made buildings in Brazil, where it is responsible for the construction and 20-year operation of the 30,000 m<sup>2</sup> **Manaus Hospital**, at which the first wing has already been opened.

### Peru

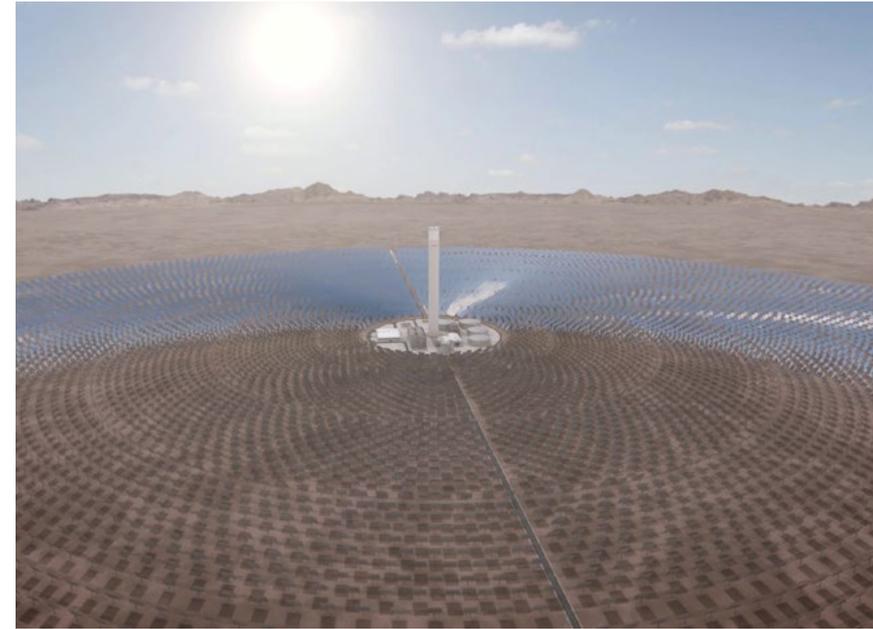
After 20 years in Peru, Abengoa has cemented its position as a leading company in the water, energy and power transmission and distribution sectors, **having constructed upwards of 4,400 km** of power transmission lines, of which 236 km have been awarded in the last year.

The company has also secured the country's biggest ever mining **project to upgrade Minera Shougang**, boosting the mine's production capacity of iron ore concentrate by 10 Mt a year.

Abengoa has also secured a contract to construct a **20 MW hydro power plant**, which enough capacity to supply clean energy to over 10,000 homes while helping cut yearly CO<sub>2</sub> emissions by 43,000 t.

### Chile

Abengoa is developing **Latin America's first solar thermal plant to be used for direct electricity generation**. Located in the Atacama Desert, which receives the highest amount of solar radiation anywhere on earth, the facility combines a 110 MW power tower plant with a 100 MW photovoltaic plant. The power tower plant features up to 17.5 hours of thermal heat storage based on molten salts, a pioneering storage system designed and developed by Abengoa that will enable the company to optimize production of solar energy while offering cost-competitive around-the-clock generation.



Abengoa is constructing Latin America's first plant capable of direct generation of electricity and has chosen Chile as the host country

In the rail sector, key projects include the award of the **electrical system for the two new metro lines in Santiago de Chile**, while in the water sector, the company has been selected to develop the country's **first desalination plant** and has finished construction of a **140 km aqueduct**. It has also been involved in various power transmission and distribution projects and electro-mechanical assembly work for the main mines operating in the country, including the **five new contracts secured at the end of the year**, a transmission line spanning 87 kilometers and upgrades to four substations.

## Argentina

Argentina was **where Abengoa first landed in South America** 46 years ago. Since then the company has worked on projects in numerous different sectors, highlights being the development of large-scale transmission systems, in which it continues to be one of the country's key players.

To provide a prime example, Abengoa was recently awarded **a contract to construct 176 km of transmission lines at 132 kV**, with the work to include the construction of a new transformer station and upgrades to various existing stations. The project will unfold in the province of Buenos Aires and falls within the Federal Electrical Transmission Plan of the country's Federal Board of Electrical Energy (Consejo Federal de Energía Eléctrica), for which Abengoa is currently working on another two projects in the provinces of Misiones and Santa Fe, for a further 195 km between them.

Moreover, the company closed out the year by securing **two new power transmission projects** involving the construction of 28 km of line, 40 km of fiber optic cabling, upgrades to two transformer stations and construction of a new transformer station.

## Uruguay

Abengoa is the **largest construction firm in Uruguay**, where it has been operating for the last 35 years and where it has earned its leading status by successfully completing a wide range of different projects. In 2014 the company won the Ibero-American Quality Award, making it the only company to receive this accolade on three different occasions. It was also awarded the **Excellent Track Record Award**, the highest distinction in Latin America for quality excellence.

In the last year the company was awarded a contract to construct the new **convention center** at Punta del Este and a correctional institution at Montevideo, marking the country's first ever **public-private partnership** (PPP).

It has completed construction of the bridge over the Santa Lucía River and successfully upgraded the Sanatorio Americano healthcare center and the Paysandú cement factory for the state-owned company Administración Nacional de Combustibles, Alcohol y Portland.

Abengoa has cemented its position as **the leading private constructor and operator of wind power in Uruguay**, with three wind farms for the state-owned electric utility, one in operation and one under construction for a combined total of 170 MW. The three together will supply renewable energy to over 200,000 homes, cutting yearly CO<sub>2</sub> emissions by over 300,000 t.

The company has unveiled a number of other projects in the country, such as the construction of the **70 ML bioethanol plant** in Paysandú for the state-owned company Alcoholes de Uruguay, and a cement plant.

## Europe

### Spain

Abengoa started out in Spain over 70 years ago. Since then, it has been an active participant in the drive to develop the country's electrical, rail, grid and civil infrastructure.

The company is involved in **all manner of different projects** for a loyal and diversified portfolio of clients, ranging from rail network and transmission line maintenance to construction and remodeling of buildings.

Highlights for 2014 include the **two contracts signed with Adif, the state-owned railway administrator in Spain**. Abengoa will be responsible for installing and maintaining the protection, safety and fixed telecommunications systems for a 51 km section of railroad between the provinces of León and Asturias. The company is also to supply and install an overhead contact line and associated systems for a 65 km stretch of the new high-speed Madrid-Murcia line.

### France

Abengoa has a **long-term contract in effect with the French public companies responsible for the electrical power transmission and rail transport systems**, carrying out a variety of different tasks relating to transmission lines, catenary systems and electrification.

### United Kingdom

Last year saw Abengoa secure two hugely important projects in the rail sector. One of these is the **electrification of 250 km of rail in the south of England**. Abengoa possesses some of the sector's most advanced machinery and equipment and is an international benchmark in developing turnkey projects for catenary systems, traction substations, communications and auxiliary installations.

### Belgium

Abengoa is set to commence work in Ghent on **the new construction world's largest commercial biomass plant**, which will be capable of generating 215 MW of electrical power from biomass.

### Denmark

Abengoa secured its **first project** in Denmark: the mechanical installations of the future Niels Bohr building at the University of Copenhagen. Abengoa will also be responsible for maintaining the electrical and mechanical installations for two years.

### Poland

Construction work is under way on **Poland's largest combined cycle plant** at 450 MW. The facility is located at Stalowa Wola, 200 km south-east of Warsaw. It will supply electricity, heating and hot water to approximately 10,000 homes.

### Ukraine

Abengoa is constructing a **758 kV transmission line spanning 187 km**, as part of the plan to develop and improve the country's power grid infrastructure. The project is being financed by the European Bank for Reconstruction and Development (EBRD).

## Africa

### Morocco

Having arrived 37 years ago, Abengoa has since consolidated its position in the country. It is one of the **main constructors of transmission lines** in Morocco, with over 800 km, plus a further 300 km awarded in 2014.



Abengoa has been awarded a new contract in 2014 to install 300 km of transmission lines in Morocco

The company has been chosen to construct **Morocco's largest desalination facility**, which will supply 100,000 m<sup>3</sup>/day of drinking water to the local population of Agadir, thus helping to overcome the water supply problems in one of the world's most drought-ridden regions.

Abengoa is also involved in other projects, such as the remodeling of the control rooms at Agadir's airport, the electrification and instrumentation of a phosphate plant and mobile telephony and fiber optic work for the country's main telecoms operators.

### Algeria

Construction continues on a **new desalination plant featuring reverse osmosis technology** at Tenes, with capacity to desalinate 200,000 m<sup>3</sup> of water a day, enough to supply a population of 800,000. Abengoa will also operate the plant for a 25-year term.

With the Tenes facility now completed, Abengoa has constructed a total of three water treatment plants in Algeria, where it treats a total of 500,000 m<sup>3</sup> of water every day to supply the local population.



With the new desalination plant at Tenes now completed, Abengoa has reached a total desalination capacity of 500,000 m<sup>3</sup> of water a day in Algeria

### Ghana

The company is working on its first project in Ghana; a **reverse osmosis desalination plant** capable of producing 60,000 m<sup>3</sup> of water a day and which will become the first desalination plant in West Africa.

### Kenya

Abengoa is constructing a **132 km transmission line and a substation** in the country. The project is being financed by the African Development Bank.

## Angola

The company has completed the Xangongo **water treatment plant**, which is able to generate 16.300 m<sup>3</sup>/day of treated water from the Cunene River.

## South Africa

Abengoa is **one of the leading developers of solar power plants in South Africa**, where it has three impressive facilities for a combined total of **250 MW** of installed capacity: KaXu Solar One, a 100 MW parabolic trough plant with three hours of thermal storage, which is already online; Khi Solar One, one of the world's largest power tower plants, with 50 MW of installed capacity and two hours of thermal storage; and the 100 MW Xina Solar One, with five hours of thermal storage and which, alongside KaXu, is set to make up Africa's largest solar energy complex.



Khi Solar One, in South Africa, is one of the world's largest power tower plants

## Asia

### Turkey

Abengoa has been entrusted with the development of a **250 km smart grid** for managing water in Turkey. The structure will allow drinking water to be delivered to, and wastewater collected from, the city of Denizli.

### Israel

Abengoa is developing the **country's largest solar thermal plant**, utilizing parabolic trough technology and with 110 MW of installed capacity. It is also building a conventional power plant with 220 MW of installed capacity.

### Kuwait

Abengoa is involved in **power transmission projects spanning more than 120 km** as part of the plan to upgrade the country's existing energy infrastructures.

### Saudi Arabia

Work is continuing on the **high-speed Medina-Mecca railway line**, a contract awarded to the Al Shoula Group, a Spanish-Saudi consortium comprising Abengoa and a number of other partners. The contract embraces the construction, assembly and integral maintenance of the 450 km line for 12 years. The line will transport up to 166,000 passengers a day and trains will reach speeds of up to 320 kph.

The main challenges posed by the project are the extreme temperatures swings, sand storms, dunes, and the different altitudes the route presents.

Abengoa has been chosen to construct the world's first solar-powered desalination plant. The facility will be capable of desalinating 60,000 m<sup>3</sup>/day of water and will supply 200,000 people. It is certainly a groundbreaking project in that a photovoltaic solar power plant will generate sufficient energy to power the reverse osmosis desalination process.



Abengoa is involved in the construction of the first high-speed railway line to cross the desert

## Oman

Construction continues on the **reverse osmosis desalination plant** to supply drinking water to 225,000 local inhabitants of Barka, in north-west Oman. Abengoa was tasked with the design and engineering of the plant and also its operation and maintenance.

The company has also secured its **first power transmission contract** in the country, for the construction of a substation and the associated 25 km transmission line to upgrade and expand the national power grid in Oman.

## India

Abengoa secured its **first concession of a power transmission project** in India and is to engineer, design, construct, operate and maintain two lines covering 134 km. It has also been awarded a further contract for 140 km of transmission line, which can be added to the 1,368 km of high and very high voltage lines the company has already installed in India and Nepal.

## Sri Lanka

Work is ongoing on a **water treatment plant** capable of treating 13,000 m<sup>3</sup> a day. The project also includes the construction of systems to capture river water from the Kalu Ganga, a 2,500 m<sup>3</sup> storage tank and close to 20 km of piping to distribute the water treated at the plant.

Abengoa is also involved in energy-related projects to consolidate its position in strategic markets such as **China, Japan and Australia**.

## Engineering

Abengoa's engineering division **provides efficient and innovative engineering solutions for the energy, water and environmental sectors**. It has well-established offices and facilities in Spain, the United States, Mexico, India, Chile and Poland, and a wealth of experience in international projects.

Thanks to Abengoa's presence and experience, its engineering division has acquired first-hand knowledge of the local markets and is quickly able to roll out new projects in any region. Upwards of 600 people provide up to 900,000 man-hours of work per year.

Abengoa is **the undisputed world leader in solar thermal engineering work**. No other company can match its achievements in terms of the number of plants designed or in the MW of power generated.

Abengoa's engineering division has proven expertise and experience in:

- › Power plants: solar thermal and photovoltaic plants, wind farms, combined cycle plants and cogeneration plants, etc.
- › Hydro infrastructure: water desalination, treatment and reuse plants and transportation and distribution grids and networks.
- › Large-scale power transmission systems: electrical lines and substations.
- › Industrial plants: biofuel plants, steel dust recycling, sulfuric acid recovery, etc.
- › Metal structures: transmission towers and solar power plants, among others.
- › Electrical and electronic systems: medium and low voltage switchgear, modular electrical rooms, etc.
- › Telecommunications: fiber to the home networks to provide voice, data and video services to end users.

Abengoa's engineering division strives to provide across-the-board engineering solutions to its clients. To this end, it offers a complete suite of solutions: consulting, layout, calculation and design, conceptual engineering, preliminary engineering, detailed engineering or design, control and oversight of the work and uploading of designs to systems.

It has specialized personnel covering all the different fields of engineering, such as electrical engineering, mechanical and process engineering, civil and structural engineering, instrumentation and control engineering, piping engineering and telecommunications engineering. To reach the levels of quality demanded of it, Abengoa uses only the most cutting-edge calculation and design equipment available on the market.

## Auxiliary manufacture

### Metal structures

Abengoa has **more than 40 years experience** in designing and manufacturing metal structures made from galvanized steel. Its 900-plus operators and 140,000 m<sup>2</sup> of facilities are spread among **three strategically positioned plants** in Seville (Spain), Querétaro (Mexico) and Vodadora (India), enabling the division to offer its services anywhere on earth.



New production center for metal structures in India

Abengoa produces upwards of **150,000 t of steel a year**, which is put to different uses:

- › Power transmission towers
- › Structures for substations
- › Telecommunications towers
- › Support structures for solar thermal and photovoltaic plants
- › Wind turbines

Abengoa also has a **testing facility** in Seville, where it conducts stress tests on its own and third-party metal structures by applying simultaneous stress loads in three different directions. The facility can accommodate towers of up to 72 m in height.



Abengoa conducts testing on towers of up to 72 m in height at Utrera (Seville)

The company has rolled out projects in the United States, Spain, India, Kenya, South Africa, Chile, Israel and Mexico, a country in which we lead the sector. In addition to supporting its own projects, Abengoa supplies structures to third-party clients.

## Capital assets

Abengoa **has more than 60 years of experience in supplying** capital assets for the auxiliary electric power industry and over 40 years for the auxiliary electronics industry. It has **three production centers** located in key positions in Seville and Alcalá de Henares (Spain) and in Tianjin (China), providing a combined production surface area of 25,000 m<sup>2</sup> and a total of 350 employees.



Abengoa has developed a modular piece of equipment for a wind farm located in the East China Sea

Abengoa carries out the mechanical and electrical design, manufacture, wiring, welding and assembly of PCBs and conducts electrical and functional testing on:

- › Low voltage motor control centers and power and distribution boards and medium voltage cabinets
- › Measurement, control and protection boards
- › Electrical rooms and modular equipment
- › Equipment with integrated electronics
- › Inspection and sampling systems and equipment classified for use in the nuclear and defense sectors

The capital assets that leave Abengoa's production centers are put to different uses, including rail transport, on-shore wind power and simulators for plant control rooms.



Abengoa is strategically positioned along the entire solar technology value chain, meaning it can develop, manufacture and supply all the non-conventional main components needed for a solar thermal power plant

## Solar business - components

One of Abengoa's most significant milestones in 2014 was reaching **vertical integration in solar thermal projects**. The company is now fully capable of **developing, manufacturing and supplying all the main non-conventional components** of a solar thermal plant. This achievement means Abengoa is no longer dependent on third parties. This lowers supply risk while allowing the company to offer the most competitive product features on the market.

Moreover, to ensure the most competitive prices and reduce transportation costs from an economical and environmental standpoint, Abengoa is fully able to set up factories to produce solar components in the regions where the project in question is being carried out, thus improving the local economy, creating jobs and providing a significant social service. Examples here would be the mirrors factory set up in South Africa, or the one under construction in Chile for the supply of mirror facets for the facility under construction in the Atacama Desert. This factory will provide more than 350,000 facets over the entire construction and operation of the plant.

Global resources and local presence. These are the hallmarks the company aims for in each of its projects. This means that Abengoa is able to reduce costs through a global supply chain and by diversifying its know-how and being a local supplier. This makes its projects hugely competitive and generates trust and confidence in its clients.

Abengoa has continued to strengthen its position during 2014 across the entire value chain in solar thermal technology, investing heavily to make its technology increasingly competitive and striving to reach and act in each region true to its commitment.



Abengoa has built up a wealth of knowledge in plant operation and maintenance, enabling it to make design and construction improvements to its plants and operating methods

› **The Mojave example**

After a rich and rewarding three-year experience, 2014 saw the company unveil the **world's second largest STE** (solar thermal electricity) **plant featuring parabolic trough technology**, second only to Abengoa's own Solana plant in the state of Arizona, which has been in operation since October 2013. Mojave will feed the power grids of California from Harper Dry Lake, with an installed capacity of 280 MW, enough to provide clean energy to roughly 54,000 households. The site, covering 714 hectares, contains a total of 1,128 new generation parabolic troughs made up of no less than 315,840 parabolic mirrors. The new dimensions and properties of the troughs and mirrors ensure improved performance in terms of net power generated and a longer useful life. Thanks to its vertical integration of its business model Abengoa enjoys significant control over the key components that comprise the Mojave solar power plant, supplying the mirrors for the parabolic troughs and the metal structures of the troughs. This control and monitoring also extends to operation and maintenance work, with products including the hydro-cleaning trucks to keep the mirror surfaces free of dust, and the portable Condor device to measure and track the reflectivity of the mirrors operating in the solar field. This enables Abengoa to meet its annual power generation commitments with the client.



The new dimensions and properties of the parabolic troughs and mirrors at Mojave boost performance in terms of net power generated while extending their useful life



## 06.4

# Operation and maintenance

Abengoa has an impressive portfolio of proprietary assets in the field of operation and maintenance. These range from assets under concession, where revenues are governed through long-term contracts, to technology-heavy business lines, such as biofuels.



<b>Key financial figures</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>Chg. 14-13 (%)</b>
Revenue (€ M)	2,496	2,413	2,636	9 %
EBITDA (€ M)	303	461	602	31 %
EBITDA margin (%)	12	19	23	21 %

<b>Key figures - Power transmission</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>Chg. 14-13 (%)</b>
Km constructed	1,476	1,723	2,375	38 %
Average availability factor (%)	99.4	99.8	99.5	-

<b>Key figures - Solar</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>Chg. 14-13 (%)</b>
Plants in operation (MW)	743	1,223	1,503	23 %
Plants under construction and in pre-construction (MW)	910	640	580	(9) %
Production (GWh)	964	1,310	1,959	50 %

<b>Key figures - Water desalination, treatment and reuse</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>Chg. 14-13 (%)</b>
Installed capacity (m³/d)	565,000	665,000	815,000	23 %
Annual production (m³)	107,469,355	112,379,632	123,954,585	10 %

<b>Key figures - Cogeneration</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>Var. 14-13 (%)</b>
Installed electricity capacity (MWe)	70.6	348.4	348.8	-
Installed thermal capacity (MWt)	142.9	1,156	1,156	-
Annual electricity generated (MWh)	345,231	2,054,791	2,617,541	27 %
Annual thermal power generated (MWh)	238,703	3,204,345	4,440,381	39 %

<b>Key figures - Bioenergy</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>Var. 14-13 (%)</b>
Installed capacity (ML)	3,175	3,175	3,175	-
Annual production (ML)	2,516	2,357	2,655	13 %
Installed electricity capacity (MWe)	1,316,500	1,643,400	1,643,400	-
Annual electricity generated (MWh)	1,548,416	1,335,384	1,579,863	18 %



Solana, with an installed capacity of 280 MW, is the world's largest parabolic trough facility.

## Solar Energy

Abengoa has an installed capacity of 1,503 MW in commercial operation, with a further 360 MW under construction and 220 MW in pre-construction.

### United States

#### Solana

In 2014, Solana celebrated its first full year of successful commercial operation. The facility offers enough clean, non-polluting energy (generating no greenhouse gases) to meet the energy demands of 70,000 homes. In just one year, it has managed to cut yearly CO<sub>2</sub> emissions by nearly half a million metric tons.

Its installed capacity of **280 MW** makes it the **world's largest parabolic trough plant**. The facility also boasts a six-hour molten salt thermal storage system, enabling it to generate energy both day and night to bring production in line with demand.

## Mojave Solar

Located 150 km north-east of Los Angeles, close to Barstow, California, the Mojave Solar plant was brought online in 2014. This **280 MW parabolic trough plant** generates enough clean energy to power over 54,000 households, while cutting yearly CO<sub>2</sub> emissions by over 350,000 metric tons.



Mojave Solar, the world's second largest parabolic trough plant, was brought online in 2014



## Europe

### Solucar Complex

The Solucar Complex houses a number of plants that are not only commercially operational but also engaged in technology innovation. The platform features the world's first two solar power towers to have been brought online, along with **three parabolic trough plants and two photovoltaic plants**. In total, these installations provide a combined installed capacity of approximately **183 MW**. Moreover, the complex brings together numerous research, development and innovation facilities, including two pilot power tower plants, various loops for testing out parabolic trough technologies and other pilot plants testing a number of different technologies. All these structures were built and operate independently.

Thanks to the experience Abengoa has gained in the operation and maintenance of the seven commercial plants at the Solucar Complex, it has become an undisputed leader in the management of solar power plants.

### Extremadura Solar Complex

2014 marked the first year of successful commercial operation of Solaben 1 and Solaben 6, two of the four 50 MW parabolic trough plants making up the Extremadura Solar Complex. All of the plants were constructed and currently operate independently. It is the **biggest solar complex in Europe** and one of the largest in the world, with 200 MW of installed capacity and enough total production to meet the power needs of roughly 105,000 homes. At the same time, it has helped cut yearly CO<sub>2</sub> emissions by approximately 126,000 metric tons.

Abengoa holds a stake of 70 % in Solaben 2 and Solaben 3, while the Japanese giant ITOCHU controls the remaining 30% of the two plants. In contrast, Abengoa is the full owner of Solaben 1 and Solaben 6.

1. The Solúcar Complex is a unique technology center in that it houses all types of solar technology used at commercial plants, pilot plants and R&D+i laboratories.
2. The Extremadura Complex is Europe's largest solar power platform.

## Écija Solar Complex

The complex is home to **two 50 MW parabolic trough plants**: the Helioenergy 1 and Helioenergy 2 plants, both of which were constructed and operate independently and are operated jointly by Abengoa and E.ON.



The Écija Platform is operated jointly by Abengoa Solar and E.ON.

## Castilla-La Mancha Solar Complex

The complex, which is nestled between the municipalities of Arenas de San Juan, Villarta de San Juan and Puerto Lápice in the province of Ciudad Real, features **two identical 50 MW parabolic trough plants**, each built and operating independently.



The Castilla-La Mancha Solar Platform features two 50 MW parabolic trough plants, each of which was built and operates independently.

### El Carpio Solar Complex

The complex houses **two 50 MW parabolic trough plants**, both of which were built and operate independently. Both plants are jointly owned by Abengoa and the Japanese conglomerate JGC. Abengoa, which operates both plants, holds a 74 % stake.



The Solar El Carpio Platform has helped cut annual CO<sub>2</sub> emissions by 62,800 tons

### Photovoltaic plants

Abengoa has five commercially operating photovoltaic plants in Spain:

- › Las Cabezas PV, featuring conventional photovoltaic technology and single axis tracking, is located in Las Cabezas de San Juan, Seville.
- › Sevilla PV, a photovoltaic plant utilizing low-concentrating technology (1.5x-2.2x) and dual-axis trackers, is located in Sanlúcar la Mayor, Seville.
- › Casaquemada PV combines concentrating and conventional photovoltaic technologies, employing a dual-axis tracking system. The facility is located in Sanlúcar la Mayor, Seville.
- › Copero PV, a conventional silicon photovoltaic plant with dual-axis tracking, is located just outside Dos Hermanas, Seville.
- › Linares PV, a conventional photovoltaic plant with dual-axis tracking, is located in the province of Jaén.

## Africa

### KaXu Solar One

KaXu Solar One, a **100 MW parabolic trough plant with nearly three hours of thermal storage based on molten salts**, was completed towards the end of 2014. Thanks to its storage capabilities, the facility is able to generate clean energy between dusk and dawn. The project has also boosted the region's economy and social status by expanding the network of local services. Abengoa is joined by IDC and KaXu Community Trust as partners on this venture.



Construction of KaXu Solar One was completed in 2014 and the plant will begin operating commercially in early 2015

## North Africa and the Middle East

### Shams-1

Shams-1, the **first solar thermal plant to be built in the Middle East**, with 100 MW of installed capacity, celebrated its first year of successful operation in 2014. It generates enough clean energy to meet the power demands of 20,000 homes. Abengoa owns a 20 % stake in the plant.



Shams-1, the Middle East's first solar thermal plant, celebrated its first year of successful operation in 2014

### Hassi R'Mel

Abengoa operates this 150 MW **integrated solar combined cycle power plant** out of Hassi R'Mel, Algeria. It is one of the world's first integrated solar-gas power plants. Abengoa is a pioneering figure in the construction and operation of solar power plants in the north of Africa. It shares ownership of the plant with one other partner, NEAL (New Energy Algeria).



Hassi R'Mel is one of the world's first integrated solar-gas combined cycle plants

## Other sources of power generation

### Uruguay

Abengoa has commenced operation of **two 100 MW wind farms** in Uruguay. The company has been awarded the operating concession of these assets for 20 years.



Photo of the Peralta wind farm. Abengoa has started up a 50 MW wind farm in Uruguay

### Mexico

The company operates the **country's biggest cogeneration plant** at full capacity (300 MW), supplying electricity and steam to the Nuevo Pemex gas processing complex. The plant is currently being upgraded to generate 1,245 MW. Abengoa is to operate the asset for 20 years.

The company has also secured a contract to construct a second **924 MW combined cycle facility** and will also handle the operation and maintenance for a 25-year term.

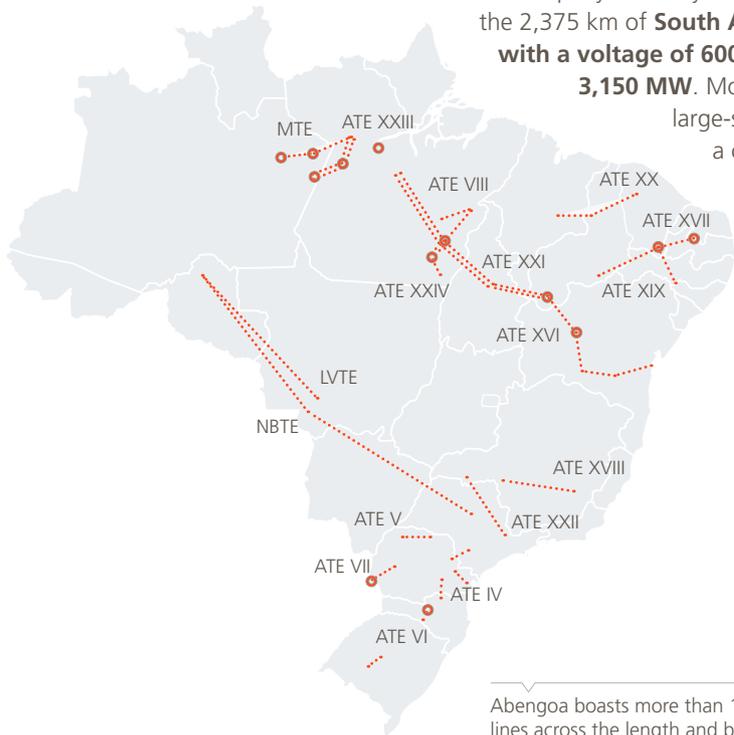
## Power transmission lines

Abengoa is **one of the leading private concession holders in Latin America**, with a grand total of 12,000 km of transmission lines across Peru, Chile and, above all, Brazil.

### Brazil

The Brazilian government's decision to greenlight the private venture to develop the country's massively important power transmission line network has made Abengoa **one of the main private power line concession holders** in the country.

The company currently has 1,100 km of lines in operation, plus the 2,375 km of **South America's longest direct current line, with a voltage of 600 kV and a transport capacity of 3,150 MW**. Moreover, the company is working on ten large-scale power transmission projects for a combined total of 7,200 km, with the average contract length for operation of the assets being 30 years.



Abengoa boasts more than 13,000 km of finished lines across the length and breadth of Brazil



Abengoa has brought the world's longest direct current power line online



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Abengoa operates the Peru's longest power transmission line

## Peru

The country has a similar regulatory set-up to Brazil and Abengoa is one of the most active companies in developing the nation's power network, where it already operates 1,500 km of transmission lines.

2014 witnessed the operational **start-up of the country's longest power transmission line**, spanning 916 km at 500 kV. The line will improve the lives of five million people, and is a further addition to the 583 km of line that the company was already operating in Peru, together with the close to 500 km of line already under construction.

## Chile

Abengoa operates two power transmission lines spanning **130 km** in Chile's second region, which supply energy to the Sierra Gorda mining facility.

## India

Abengoa has been awarded its **first contract** for a transmission line venture in India. The company will be tasked with the engineering, construction, start-up, and subsequent 25-year operation and maintenance of 134 km of power line. The project will improve the lives of 10 million people.

## Water desalination, treatment and reuse

### Africa

#### Skikda (Algeria)

Desalination plant that supplies drinking water to the port of Skikda, which lies on the Mediterranean coast some 80 kilometers west of Annaba, Algeria. It is the first concession-based project to have been undertaken in Algeria. The facility has an installed capacity of 100,000 m<sup>3</sup>/day and supplies fresh water to half a million people. It has been in operation since 2009 and employs reverse osmosis technology.



The Skikda desalination plant (Algeria), with a capacity of 100,000 m<sup>3</sup>/day, has been in operation since 2009

### Honaine (Algeria)

This desalination plant takes in seawater to generate drinking water for the city of Tlemcen Honaine. The facility has an installed capacity of 200,000 m<sup>3</sup>/day and supplies fresh water to nearly one million people. It has been in operation since 2011 and employs reverse osmosis technology.



1

## Asia

### Chennai (India)

The Chennai plant, located in the Indian state of Tamil Nadu, generates 100,000 m<sup>3</sup>/day of desalinated water to supply the city of the same name, and has been in operation since 2010. It employs reverse osmosis technology.



2

### Qingdao (China)

Seawater desalination plant for both industrial processes and human consumption close to the city of Qingdao. It has an installed capacity of 100,000 m<sup>3</sup>/day and has been operational since 2013. It employs ultrafiltration technologies for pretreatment and reverse osmosis.



3

1. The Honaine desalination plant (Algeria), with a capacity of 200,000 m<sup>3</sup>/day, has been in operation since 2011

2. The Chennai desalination plant (India), with a capacity of 100,000 m<sup>3</sup>/day, has been in operation since 2010

3. The Qingdao desalination plant (China), with a capacity of 100,000 m<sup>3</sup>/day, has been in operation since 2013

## Europe

### Almería (Spain)

Desalination plant that takes in seawater to generate drinking water fit for human consumption to supply the Spanish city of Almería. It has an installed capacity of 50,000 m<sup>3</sup>/day and has been operational since 2005. It employs reverse osmosis technology.



The Almería desalination plant (Spain), with a capacity of 50,000 m<sup>3</sup>/day, has been in operation since 2005

### Cartagena (Spain)

Desalination plant operational since 2005 that converts seawater into drinking water fit for human consumption. It has an installed capacity of 65,000 m<sup>3</sup>/day and employs reverse osmosis technology.



The Cartagena desalination plant (Spain), with a capacity of 65,000 m<sup>3</sup>/day, has been in operation since 2005

## Bioenergy

Abengoa has made significant technological advances in the field of bioenergy in 2014. Work has continued on the waste-to-biofuel project (W2B) in Salamanca (Spain) and a new plant will join the ranks of the 14 existing plants to produce cellulosic ethanol from agricultural residues on a commercial scale in the United States. Moving down to Brazil, the company is focusing on the development of second-generation ethanol from sugarcane bagasse and straw. Work is ongoing to design Abengoa's first n-butanol plant and after various years spent on technological development, we are now witnessing enzyme production on an industrial scale with proprietary technology, which will soon be market-ready.



## United States

Production of cellulosic ethanol at Hugoton.

After more than ten years of research, Abengoa has brought to market second-generation ethanol, also known as cellulosic ethanol.

Abengoa's first commercial-scale cellulosic ethanol plant is located in Hugoton, Kansas. The plant will use around 300,000 tons of agricultural waste, such as corn stover and wheat straw, (approximately 15 % of the biomass can be found within 50 miles of the plant) to produce up to 25 Mgal of cellulosic ethanol and 21 MW of renewable electric power annually.

Thanks to the use of enzymes developed and patented by Abengoa, the residual biomass material is broken down into sugars, allowing for fermentation and the production of sustainable ethanol.

The biomass boiler and electric power generation system began operation and exportation of electric power to the grid in December 2013. In late 2014, the company celebrated the commissioning of the plant for the production of second-generation ethanol.

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Aerial view of the cellulosic ethanol plant Abengoa has at Hugoton (Kansas, USA)

## Europe

### Waste-to-biofuel project

The W2B project arose as an integrated solution for the management of municipal solid waste (MSW), providing a more sustainable and efficient solution for landfills waste.

Abengoa's W2B technology is currently in its demonstration phase in Salamanca, Spain. The existing biomass plant, Biocarburantes de Castilla y León, has been modified to use municipal solid waste as feedstock. The work performed in the demonstration plant will provide proof of concept for the production of ethanol from MSW, as well as, in-depth understanding of how to design and commission a commercial-scale municipal solid waste plant.

This demonstration plant was preceded by a pilot-scale MSW pretreatment facility that was built to optimize waste pretreatment that has supported the W2B demonstration plant.



Demo plant of W2B technology at Babilafuente (Salamanca, Spain)

### Catalysis: n-biobutanol

In order to diversify and add value to its first-generation plants, Abengoa continues to focus on the development of catalytic technology to produce biobutanol, a product widely used in the chemicals industry. Some main applications of butanol are the manufacturing of acrylate for coatings, paints and varnishes, as well as, the production of acetate and glycol ester. Likewise, butanol can be used as a direct solvent.

To this end Abengoa has started the construction of a butanol plant in collaboration with Biocarburantes de Castilla y León in Salamanca, Spain. The facility is now being converted to manufacture a product with a wide range of applications. This process turns n-butanol into a renewable alternative to fossil-based butanol, reducing the CO<sub>2</sub> footprint of final users, and allows Abengoa to enter the bioproducts market that includes higher value-added chemicals.



Pilot unit to separate and purify butanol

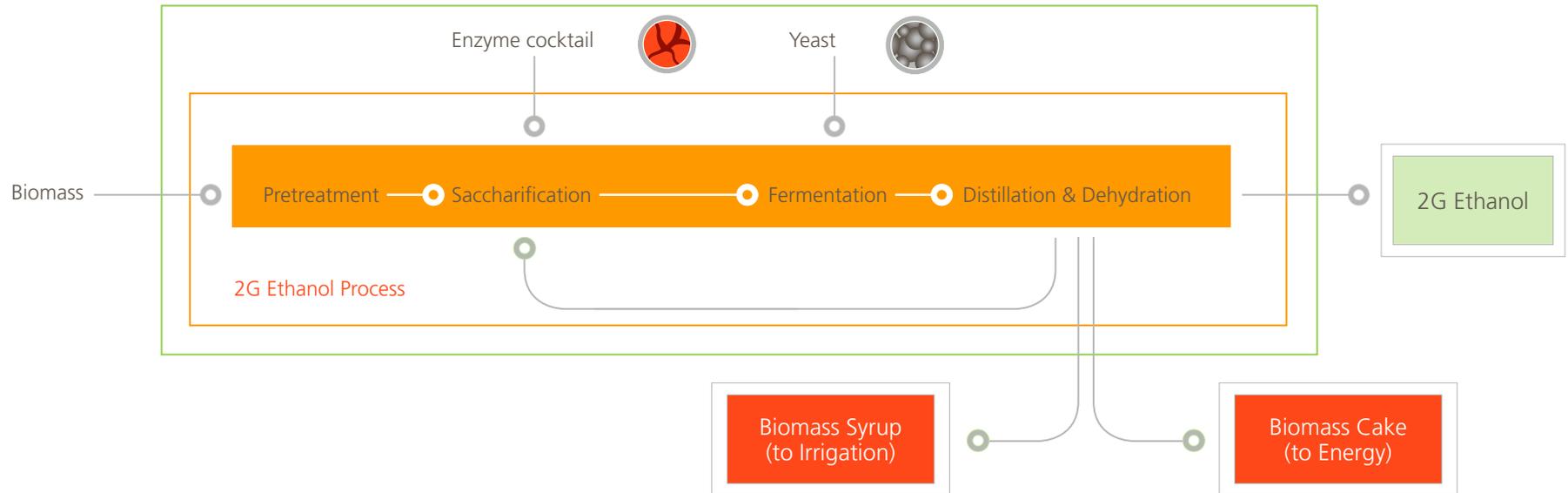
## Brazil

### 2G Hybrid in Brazil

In Brazil, Abengoa is working to use sugarcane waste as feedstock for the production of second-generation (2G) ethanol, by integrating new production lanes into its existing facilities in Sao Luiz (Pirassununga, Sao Paulo).

This new project, which involves the installation of new second-generation ethanol lines using Abengoa's enzymatic hydrolysis technology, will add value to the existing plants. The upgraded facilities will have the capacity to process dry biomass (sugarcane bagasse or straw) resulting in the production of some 80 ML of bioethanol.

Construction at the facilities to process the new sugarcane waste feedstock into second-generation bioethanol will start in 2015. It is expected that the plant will be in full operation by 2017.



Biomass-to-2G ethanol production process

## Custom-made buildings

### Mexico

In Texcoco, Abengoa runs the **Mexiquense Bicentenario Cultural Centre**, one of Mexico's most important cultural centers. The company unveiled the center in 2011 and has an operating concession for 21 years. The centre spans an impressive 35,000 m<sup>2</sup> and is used to stage all manner of cultural events, ranging from exhibitions, concerts and plays to courses and conferences, attracting a yearly average of 300,000 visitors.



Mexiquense cultural centre

## Brazil

Abengoa is unflinchingly committed to developing hospital infrastructure across Latin America. The **hospital in the northern part of Manaus**, covering 30,000 m<sup>2</sup> and with the first wing already opened, marks the first public-private partnership in the Amazonas state of Brazil. Abengoa has been tasked with the construction and supply of medical equipment and the maintenance and management of the hospital's non-medical services under a 20-year concession.

## Uruguay

Abengoa has been entrusted with the operation of a correctional institution in Montevideo occupying 42,000 m<sup>2</sup> of land and featuring 25 different buildings. The project is being developed through a public-private partnership (PPP).

## Spain

Abengoa has been awarded a 30-year concession for Hospital del Tajo, in Madrid, covering 58,000 m<sup>2</sup>, and a 40-year contract for Hospital Costa del Sol, in Malaga, spanning 56,700 m<sup>2</sup>. The company also operates the courthouses in Olot, Cerdanyola and Santa Coloma de Gramanet in Catalonia under a 17-year contract.



**07**  
Management  
structure



<b>Abengoa Research</b> (Technology)	<b>Abeinsa</b> ( Engineering and construction)	<b>Abengoa Concesiones</b> (Concessions)	<b>Abengoa Bioenergía</b> (Bioenergy)	<b>Abengoa Solar</b> (Solar)	<b>Abengoa Water</b> (Desalination, treatment and reuse)	<b>Abengoa Hidrógeno</b> (Hydrogen)	<b>Abengoa Energy Crops</b> (Energy crops)
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