

LATIN AMERICA

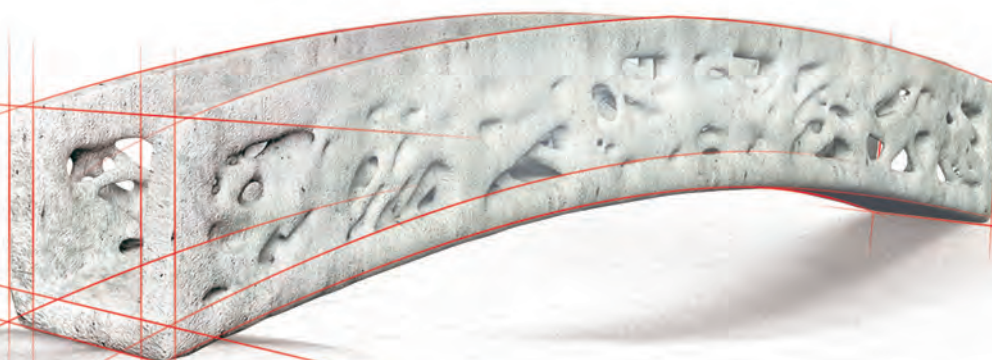
In Search
of Wind
and Sun

INTERVIEW

Ramón Jiménez,
Director of ACCIONA
Industrial



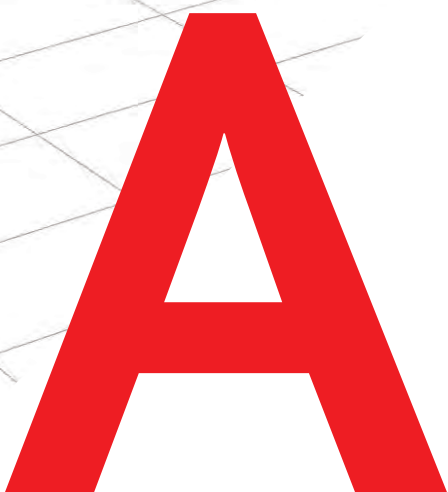
N.64 OCTOBER 2016



THE NEW ERA OF ARCHITECTURE

The world's first civil engineering project printed in 3D

VOCATION, COMMITMENT, NEED

A large, bold, red capital letter 'A' that serves as a decorative element on the left side of the page.

vocation for technological innovation runs through ACCIONA. Technological innovation is not only central to our business vision, but also something we have an ethical conviction about, because it addresses urgent social needs. Therefore, we are deeply committed to promoting it.

Through investment in Research, Development and Innovation (RDI), we have already exceeded expectations for efficiency set just a decade ago. And RDI continues to prove itself to be an essential ally in efforts to protect the natural environment and fight climate change.

ACCIONA is doing its part. The data speaks for itself. We have not only met our goal of being carbon neutral, we have gone far beyond it and will continue along this non-conformist path. In 2015, our renewable energies offset more than 28 times the CO₂ we produce. Technology should not be considered a panacea, but it is obvious that it plays an irreplaceable role. That is why innovation appears as a cross-cutting concept in this issue of ACCIONA.

Our vocation for innovation permeates every business line and helps us anticipate the needs of our customers and society at large from the local communities where we operate. And innovation is at the core of the new ACCIONA Industrial Division and its comprehensive development of large energy infrastructure projects.

At ACCIONA, we are pioneering the use of 3D printing in construction and civil engineering, which promises to revolutionize architectural design and reduce both costs and environmental impacts. We are also conducting research projects, like Integroil and New Sol, that pursue sustainability and are sponsored by the European Commission. And, of course, innovation is the engine driving our renewable energy facilities and plants around the world.

We may have divided our activities among several business lines and companies, but we can say that, at ACCIONA, the common denominator is a dedication to innovation. ■

“ Innovation has
proven to be one of the
basic solutions to
climate change ”

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Innovation based on vocation, efficiency and commitment.

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IN NUMBERS

HOW MUCH WE CARE FOR THE

ENVIRONMENT

Renewable energies offset 28 times the amount of CO₂ produced by ACCIONA. And ACCIONA's positive water footprint was equivalent to the annual consumption of 10 million people.

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ACCIONA is creating the world's first civil engineering project printed in 3D. 3D printing technology frees up architecture, allowing the use of shapes and structures that, until now, were impossible to pull off.



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RENEWABLE ENERGIES



WE RID THE WORLD
OF 17.2 MILLION
TONS OF CO₂

FRESH AIR

IN
2015

ACCIONA's renewable energy activities rid the world of 17.2 million tons of CO₂, more than 28 times the emissions produced by the company's own activities.

IN OTHER WORDS:

ACCIONA IS 28
TIMES **CLEANER** THAN
IT IS POLLUTING

TAKE NOTE

THE COMPANY HAS
**TRAINED AND
COMPETED**
FOR **FIVE YEARS**
TO ACHIEVE THIS GOAL

The results speak to the successful implementation of a strategy set forth in the 2010–2015 Sustainability Master Plan, which called for continued on-site improvements in investment in RDI. Last year:

**180 MILLONES
EUROS, A 3% INCREASE**

AS A RESULT,
THE NON-POLLUTING
TECHNOLOGIES BUSINESS IS
MAKING STRIDES

In 2015, **79%** of EBITDA and **49%** of sales (up 9% from 2014) corresponded to the Green Economy, as defined by the United Nation's Environment Programme (UNEP).

In order to comply with the economic and moral mandate for reducing our carbon footprint, for the second year in a row, **ACCIONA** has calculated the CO₂ emissions of all of its international suppliers and markets.

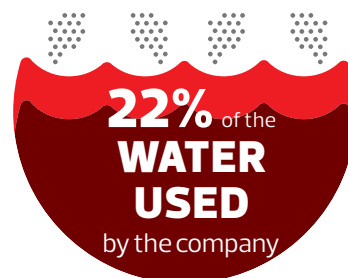
SMART WATER

The responsible management of water resources is another priority of the Sustainability Plan, that is why...

ACCIONA IS ONE OF
THE FIRST COMPANIES
TO ANALYZE WATER
CONSUMPTION IN 100%
OF ITS SUPPLY CHAIN.

TAKE NOTE

Recycled rainwater and water from the network accounts for



30% MORE THAN IN 2014



ACCIONA's positive **water footprint** (generating more than it consumes, **thanks** to its **treatment plants**) is equivalent to the annual consumption of a mega city of 10 million people.

TAKE NOTE

FIFTH

Spanish company in the *ranking* of the top investors in RDI, according to the European Commission.

6%

year-on-year increase in CO₂ emissions savings in 2015.

26.2

MILLION €:
Savings thanks to processes improved through RDI.





HISTORY

TUNNEL VISION

WHEN THE TUNNEL BORING
OF THE METRO HAD A
MORE HUMAN DIMENSION

por Patricia Alcorta

In 1960, when this photo —or snapshot, as they were called then— was taken, Spain was emerging from its economic isolation, Barcelona was defending its league title and Marisol was starring in *Un rayo de luz* (A Ray of Light). Under the surface of that Madrid, the engineers of Cubiertas and the MZOV (Railroad Company from Medina to Zamora and from Orense to Vigo) were looking for the light at the end of the tunnel. They were extending the Tetuán-Vallecas Line inch by inch. Nowadays, a 2,400 ton tunnel boring machine is used for that job, but then, it was an epic task helped along by cement mixers and drills, picks and shovels. In two years, workers excavated 85,000 m³, resurfaced 30,000 m³ and built two stations and a maneuvering yard. ■

NET PROFIT GROWS ALMOST SIXFOLD

PERFORMANCE IN THE FIRST SIX MONTHS OF 2016

596 MILLIONS
OF €
in net profit

The extraordinary circumstance that explains the jump in these figures is the merger of ACCIONA Windpower and Nordex –in which ACCIONA was a reference shareholder– for the amount of 657 million euros. In the first six months of 2015, net profit was 103 million euros. Also, Earnings Before Interest, Taxes, Depreciation and Amortization (EBITDA) were 525 million, 8.4% less than the same period last year, taking into account the drop in electricity prices in Spain (–36%)

and the deconsolidation of the wind turbine subsidiary. This economic context also explains the 16.3% decline in ACCIONA's consolidated turnover, given the fall in earnings from the Energy and Construction businesses. Ordinary net investment rose fivefold totaling 527 million euros. One of the highlights in this period is the 28.6% increase in the Construction and Industrial portfolio for a total of 7.372 billion euros.

EBITDA
rises to
525
million euros
despite
prices fall

28.6%
increase in the
**CONSTRUCTION
AND INDUSTRIAL**
portfolio

527
millions of €
**IN ORDINARY NET
INVESTMENT,**
growing fivefold

PREFERRED BIDDER FOR A HIGHWAY IN NEW ZEALAND

The Northern Express Group consortium, which ACCIONA is a part of, has been designated as a preferred bidder to win the contract for the design, construction, financing, asset management and maintenance of the Puhoi-to-Warkworth highway.

ACCIONA ENERGY WILL BUILD ITS FOURTH WIND FARM IN AUSTRALIA

THE ENERGY PRODUCED WILL
EQUAL THAT CONSUMED BY 60,000
HOUSEHOLDS

The Mt. Gellibrand wind farm (66 MW) will be built 65 km west of Geelong, the second largest city in the State of Victoria. It will begin operating in 2018 and, in addition to strengthening local investment, will help Australia meet the commitments it made in Paris to fight climate change.



CLEANING THE AIRPORT IN VICTORIA, CANADA

ACCIONA Service has been awarded a contract to provide cleaning services at this international airport for a period of five years and has the possibility of renewing the contract for five more years.

MORE AND BETTER WATER FOR THE PEOPLE OF SANTO DOMINGO

The project that ACCIONA Water and ACCIONA Construction are developing along with local investors will expand the Western Aqueduct of the Dominican Republic's capital to meet the growing demand for water from the municipality of Santo Domingo Este. The budget for the project is approximately 88 million euros.



PARK AND GARDEN MANAGEMENT IN LORCA

SMART CITY TECHNOLOGY OPTIMIZES SERVICES

The Lorca City Council (in the Autonomous Community of Murcia) has once again placed its trust in ACCIONA Service to maintain 150,000 m² of green spaces and more than 9,000 trees, as well as gardens and other areas, with sustainable treatments. The services are monitored using a digital platform included in the Spanish Network of Smart Cities.



EXPANSION OF THE METRO IN DUBAI

THE BUDGET FOR THE PROJECT IS 2.6 BILLION EUROS

The consortium formed by ACCIONA, the French company Alstom, and the Turkish company Gülermak will extend the metro from the UAE's capital to the International Expo 2020 site.



WATER-TREATMENT PLANT FOR THE PHILIPPINES

IT WILL PROVIDE SERVICE TO AN AREA OF SIX MILLION PEOPLE

The contract includes the design, construction, and operation of the Putatan 2 water-treatment plant south of Manila. Initial capacity will be 100,000 m³ per day, which can be expanded to 150,000 m³, and the budget for the project is 90 million euros.



TWO TUNNEL BORING MACHINES EXCAVATE THE LONGEST RAILWAY TUNNEL IN SCANDINAVIA

Queen Eufemia and *Queen Ellisiv*—two medieval Norwegian queens—are the names of the first two tunnel boring machines that ACCIONA, in consortium with the Italian company Ghella, will use to build the longest railway tunnel in not only Norway but all of Scandinavia. This tunnel is part of the Follo Line project to connect

Oslo to the city of Ski with 22 kilometers of double tracks. The project, which has a budget of approximately 1 billion euros, will be completed using four tunnel boring machines that are 150 meters long and 2,400 tons each. This is the first time this excavation technology is being used in Norway; that is why its *baptism*, presided over by the Prime Minister, Erna Solberg, got so much media attention.

The ceremony (in the image) was held inside the large machine assembly hall, one kilometer from the entrance to the tunnel. The excavation will begin in Åsland and move toward Oslo; further along, two other tunnel boring machines will drill toward the new public transportation center in Ski.

NEW SUPREME COURT OF JUSTICE IN THE HISTORIC CENTER OF MEXICO CITY

THE BUILDING WILL BE OUTFITTED WITH 1,000 M² OF PHOTOVOLTAIC PANELS

ACCIONA Infrastructure has been awarded an emblematic project in Mexico: the new seat of one of its main judicial institutions, which it will deliver in turnkey conditions at the end of the 15-month term for completion that was agreed upon. The complex, budgeted at 14.2 million euros, covers 18,681 m² and was designed with sustainable energy criteria in mind. It will feature nearly 1,000 m² of photovoltaic panels, which will generate 12% of the electricity it will use. It will also have a rainwater treatment and reutilization plant. Among other facilities, it will include seven levels of offices, two basements with 332 parking spaces, a cafeteria, an auditorium, a multi-use room and a center for retirees.

Digital simulation of the complex, designed to blend into the natural and architectural environment of the city.



“We’re obsessed
with protecting

RAMÓN JIMÉNEZ SERRANO
DIRECTOR OF ACCIONA INDUSTRIAL AND ACCIONA SERVICE


the

by **Juan Pablo Zurdo** photos **Luis Rubio**

environment”



Jiménez says the team's motivation and spirit "have been strong from the start".



ACCIONA INDUSTRIAL IS A NEW ARRIVAL THAT HAS BEEN HERE ALL ALONG.

ACCIONA Industrial was created on August 1, 2015 with its own goals but also with the projects and extensive experience it inherited from the two areas it combines: ACCIONA Installations and Industrial Plants and ACCIONA Engineering. Its Director, Ramón Jiménez, is convinced of the competitiveness that synergy will bring. As the company undertakes new contracts, it will be taking a qualitative leap towards its mission of strengthening its position as a global icon in comprehensive EPC (Engineering, Procurement & Construction) projects in the renewable energy sector in the next ten or even five years. “We want to be an outstanding company and leader in RDI that meets all the expectations of international customers.” In addition to these goals, the Director highlights other priorities, such as keeping staff highly motivated and getting employees to see sustainability as a personal and ethical commitment both in and outside the workplace. “We’re obsessed with innovation that will allow us to leave our children a cleaner, more sustainable world.”

What went through your head when you were faced with the choice of accepting this challenge?

ACCIONA is a company with a very good reputation in technology, renewables and the environment. That good press is matched by the reality inside the company. Our concern about sustainability is genuine; it’s in our spirit; it’s how we understand ourselves. Also, the Industrial project was in its infancy at that time and, for

me, that was an added incentive because it meant I would be heavily involved in developing and launching it. I gave the decision a lot of thought, of course, but I made it without any reservations. The opportunity to come work at a place like this doesn’t come along very often.

So it helps to feel that social backing for the work you do...

Most people are very worried about environmental degradation, and with good reason. So coming up with solutions that help is not just a corporate or marketing strategy for us. It’s a philosophy we share with those people.

Has the adjustment been easy or has the job taken care of molding you?

The first few months are always a bit complicated until you get the swing of things, because organizational culture varies a lot from one company to another. It’s really nice to work here and the change, though radical, has been very interesting. I haven’t encountered any negative inertia here. To the contrary, the entire team is extraordinarily motivated. It’s made up of young, innovative, enthusiastic people who are working on projects that will set us apart. The truth is all I’ve had to do is swim with the current.

Engineers are always stereotyped as problem-solvers. I guess there won’t be any lack of excitement for you at ACCIONA Industrial...

Nothing can be more challenging than the projects themselves. Some are emblematic, cutting-edge, and very complicated technologically. One example is the Noor I Quarzazate plant, the largest thermosolar plant in Africa, which we commissioned this January, in Morocco. Another is the Bokpoort solar plant, in South Africa, which has set the continental record for continuous power generation with CSP (Concentrated Solar Power) technology. Planning, developing, delivering a project on time – which involves the added pressure of ensuring the customer’s investment – and finally seeing everything running smoothly is our top goal.

Why combine what was previously done separately?

The trend among installation companies is to do turnkey projects, assuming more and more



Ramón Jiménez studied Engineering, with a major in Mechanics, at the ICAI (Catholic Institute of Arts and Industry) in Madrid.

PRESENCE IN

23 COUNTRIES

625 MW

OF CONCENTRATED
SOLAR POWER (CSP)

responsibility. On the one hand, there was ACCIONA Installations, whose natural evolution was to install EPC projects, and on the other, there was the Industrial Plants division of ACCIONA Engineering, which was already working on industrial EPC projects. Goals, professional profiles, ordering... there were a lot of places to come together and take full advantage of synergies, resources, capabilities and professional knowledge and experience.

Following the merger, you must have had to tackle immediate priorities...

The first thing we did was lay a foundation with the know-how that was already here; then we strengthened that foundation and developed capabilities in order to do things ourselves and with ever-improving performance and results.

PORTRAIT OF AN ENGINEER

For Ramón Jiménez Serrano, facing down challenges is something of a habit. He not only studied Industrial Engineering, but also he went on to have three children and build a long and successful career directing projects and energy departments. He left his position as Managing Director of Cobra to join ACCIONA at the end of 2014.

If you hadn't become an engineer...

I really would have liked to study Medicine.

Major achievement in your field that you admire the most...

The space missions, because they combine every branch of engineering.

The technological solution you would have liked to invent...

The low-cost electrical energy storage system.

Advice you've been given by your family that you follow at work...

Hard work is always rewarded.



Customers know they are hiring us for an exceptional project they can count on, with cutting-edge technology, reasonable costs and a respectful approach to nature



FIVE OF THE BIG ONES

Noor I CSP Plant

Ouarzazate, Morocco
Capacity: 160 MW
Budget: 579 million €
Customer: Acwa Power (Saudi Arabia)
Delivery: February 2016

Bokpoort CSP Plant

Northern Cape, South Africa
Capacity: 50 MW
Budget: 347 million €
Customer: Acwa Power (Saudi Arabia)
Delivery: March 2016

Kathu CSP Plant

Northern Cape, South Africa
Capacity: 100 MW
Budget: 445 million €
Customer: ENGIE
 Currently under construction

San Rafael Hydroelectric Plant

State of Nayarit, Pacific coast of Mexico
Capacity: 3 x 10 MW.
Budget: 49 million €
Customer: Sociedad Generadora de San Rafael
Delivery: February 2016

Transmission network connected to the combined-cycle power plant Empalme II

Mexico
Project: Construction of three substations and three transmission lines
Customer: CFE
Budget: 85 million €
Transmission Lines: 102.1 km and 117.7 km
Substation: 14 supply lines 1750.0 MVA and 100.0 MVA
 Currently under construction

Establishing this strong base allowed us to show customers that with us they're commissioning an exceptional project they can count on, with cutting-edge technology, reasonable costs and a respectful approach to nature.

And did that process result in a model for EPC projects?

Yes, not only because we found the best way to meet our objectives, but because our customers request it. The bank financing the project wants a set price at a fixed rate and a single company to guarantee the entire project. Before, customers hired and supervised contractors themselves; in other words, they assumed all the risk. That's where we come in to meet the customer halfway and sell our capabilities in a comprehensive, turnkey project.

Has the merger redefined the focus of the different business lines?

In those turnkey projects, we want to focus on two fundamental lines: non-conventional power generation —that is, renewables like thermosolar, photovoltaic, biomass, etc.— and Waste-to-Energy, which promises to capture a significant market share in the near future. And in the Oil&Gas line, we're going to put more emphasis on liquefied natural gas and regasification projects, taking advantage of our experience in those fields. We prefer to move in that direction to prioritize cleaner options.

What projects do you have in your sights?

We currently have many opportunities in different places and at different stages, from the preliminary study to the phase right before adjudication, in some sizeable projects. We're opting for projects in South Africa, where our position is growing increasingly stronger and where we've started to build the Kathu plant. We have also presented

TRENDS IN ENERGY

ACCIONA INDUSTRIAL'S VOCATION FOR TECHNOLOGY IS, IN THE WORDS OF ITS DIRECTOR, "ALMOST OBSESSIVE", AND CUTS ACROSS THE ENTIRE COMPANY.

Cutting-edge research underway or slotted for the future:

- **New Sol Project.** Sponsored by the European Commission. Run by ACCIONA Infrastructures, ACCIONA Engineering, the University of Évora, the CISC (Spanish National Research Council), and other European partners. Research on new materials to improve solar heat retention, reduce losses and

optimize power generation at night.

- **Digitalization process** to design plants and facilities in 3D, and plan and control costs, all in one.
- **ACCIONA Industrial** is paying close attention to the Waste-to-Energy trend, which entails the extraction of clean energy from waste. It would be an urgent solution to saturated landfills resulting from densely populated cities.

bids in Ghana and the francophone part of Africa. In southeast Asia, we will be up against stiff competition from Indian, Korean and especially Chinese companies, although in the case of China, many customers are starting to understand that what's cheap in the short run can end up being very expensive in the long run. And we will continue to work in Latin America, a natural market for us, considering our shared language and culture and its proximity. We have also opened new businesses, such as power line installation and energy efficiency contracts like the two we have been awarded in Mexico. I think the balance for this first part of the year is positive and we hope it will end even better.

Are the biggest plants also the most important ones? Or is size irrelevant?

We don't emphasize some projects over others in that way. It would be like having to choose which child you love the most. Of course, some are more visible because of their capacity, but they are all necessary. And they are all going through a critical phase that requires that the entire company knuckles down. There is no easy project; if they were easy, they would build themselves and we wouldn't be here now.

You learn something from every child...

That's the idea. When we finish a project, we always make a list of lessons learned to apply them to the next one. The list includes both good decisions and errors in decisions you thought were good but weren't in the end. Also, working in Gabon isn't the same as working in Kuwait. Every place teaches you something. And you will always find something new that you can extrapolate to other places. That's why every one is important, because you can win other projects thanks to it.

Investment in RDI is the key to international expansion and sustainability as strategic objectives. What else?

A lot more. Sustainability is an obsession for us. It's on our minds all the time. And technological innovation provides the solutions that we, our customers and the world need to build a safer and more just place to leave our children. Customers are increasingly aware of this and commission renewable energy plants instead of coal or heavy fuel plants. Thanks to technology, their costs are competitive enough to dispel all doubts. I believe that innovation in this sector has far exceeded expectations for efficiency established 10 or 15 years ago. And that's why I believe it has the capacity to slow climate change.

You've also gone beyond your expectations at ACCIONA...

At the last Paris Climate Conference, ACCIONA's President announced that we had met our commitment to being carbon neutral. But our mission is to keep pushing forward and continue improving every day in the coming years. ■

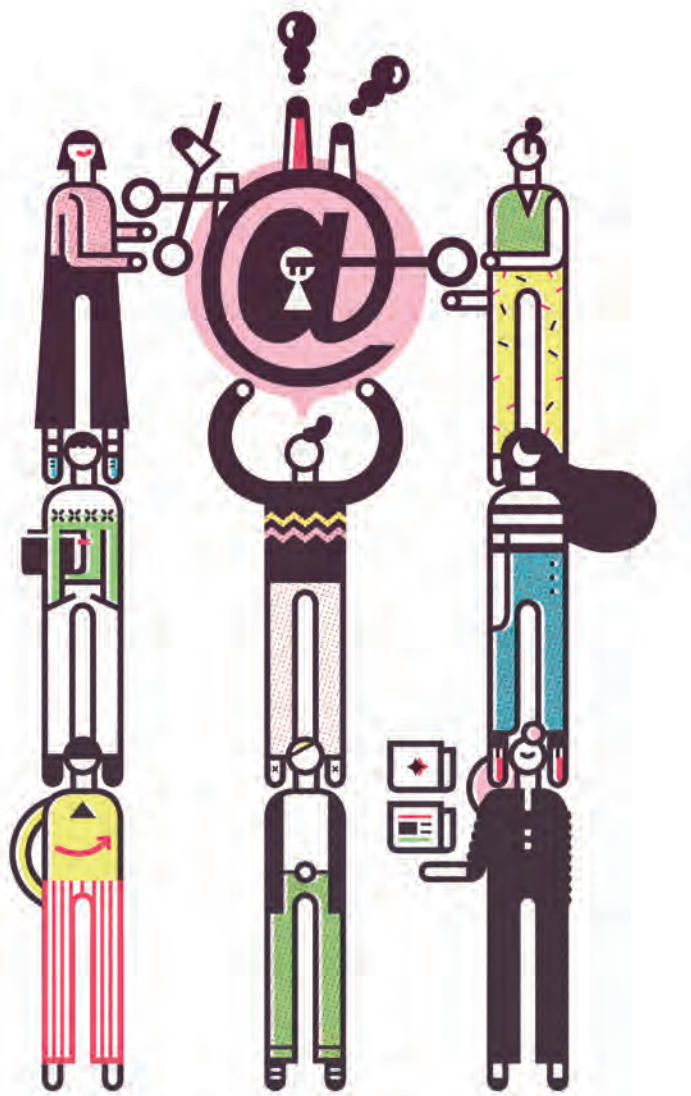
THREE GLOBAL CHALLENGES

THE SPAIN-USA FORUM ENCOURAGES DEBATE ABOUT THREE CHALLENGES THAT KEEP THE FUTURE ON TENTERHOOKS: DECONTAMINATION, CYBERSECURITY, AND THE PROMOTION OF CULTURE. FULL COOPERATION BETWEEN GOVERNMENTS AND COMPANIES IS PART OF THE SOLUTION

by
J.P. Zurdo

Illustration
Del Hambre

At the last annual Forum — on June 17th and 18th, in Santiago de Compostela — participants spoke openly, insisting that global development requires attention to risks and a bold approach to solutions. They reached several conclusions. First, the smartest way to confront big challenges is to turn the solution into an economic opportunity. Second, in order to achieve this, public-private alliances are as urgent as they are in times of scarcity. Third, innovative financing models need to be developed in order to fund the two previous conclusions.



1

CYBERSECURITY

If the Network collapses, the economy collapses. In four years, another 1 billion people will be connected. There will be twice as many smartphones. According to the World Economic Forum, only 5% of companies can be described as having mature cyber risk management. The palliative treatment? Awareness, unity and money. “If you really don’t want to be a victim, there are ways, but they’re not cheap or quick,” said Richard Clarke, the former head of cybersecurity at the White House. International coordination can be improved and should reconcile differences between coding and privacy on both sides of the Atlantic. Training is the weakest link. “There is a lack of great talent in cybersecurity. We don’t have enough people to defend us,” said Kevin Mandia, President of FireEye.

2

DECARBONIZATION

It is possible to grow and, at the same time, reduce carbon emissions. The USA is 28% richer than it was in the year 2000 and it is 6% cleaner. Nineteen European countries have shrunk emissions while growing GDP. But sustainable companies need stable policies geared toward a zero-emissions model. The Forum recommends that countries and companies take the leap from regulations dealing with climate change to innovation in the climate environment and in cooperation models. One example is the cooperation model that Johnson & Johnson has established with, believe it or not, its competitors. Its virtues include the creation of a specific fund for cutting-edge, energy efficient technologies. In seven years, this has turned into 150 projects with a 90% return rate. Without models like this, it will be difficult to fund the transition to a clean economy.

3

ART AND CULTURE

In the USA, art and culture contribute 698 billion dollars to the economy every year. How many millions of tourists and euros would Spain lose without its heritage and nonmaterial wealth? Many, surely. But the importance of art and culture —and of education that teaches us to appreciate them— cannot be assessed in terms of money. What is the price of social harmony? Cultural differences have to be assimilated in globalized societies. And progress is based on a humanist approach able to see diversity as a resource. Understanding between countries begins with the mutual understanding forged through cultural exchange. “In order to make immigrants feel comfortable in your country, honoring their music and their culture; is a wonderful way to start,” said Roger Brown, President of the Berklee College of Music. It has never been so easy and so cheap to share culture through innovative digital media. One example to imitate is the Art Google Project. ■

**JOSÉ MANUEL
ENTRECANALES**

Executive Chairman of ACCIONA


“In order to attract billions, you have to create the right profitability”



José Manuel Entrecanales, President of the Spain-USA Council Foundation, pointed out the need for private investors in the effort to decarbonize the planet: “We’re going to have to attract capital from around the world over the next 25 years at incredible interest rates. The crux of what we’re debating here is: how do we generate the right profitability to attract 13, 15, 17 billion in private capital?” With regard to culture as a source of development, he suggested that institutions “stay up to date with the wave of globalization” and “remain on the crest” with a more international vision.

THE POWER OF IMAGINATION

3D



Concrete
resistance test.
Next page, left:
José Daniel García
Espinel, María
Trinidad Barrios
and Luis Rodolfo
Clemente.

ACCIONA IS ABOUT TO UNVEIL THE WORLD'S FIRST CIVIL ENGINEERING PROJECT PRINTED IN 3D. THE FREEDOM TO BRING UNPRECEDENTED DESIGNS, STRUCTURES AND SHAPES TO LIFE –THE FREEDOM TO GIVE FREE REIN TO CREATIVITY– IS PRECIPITATING A RADICAL TRANSFORMATION IN ARCHITECTURE AND ENGINEERING. HERE, THAT TRANSFORMATION IS ALREADY UNDERWAY.

by
Ángel Luis Sucasas

photos
Jacobo Medrano



A

FUTURE IN WHICH ARCHITECTURE IS UNCONSTRAINED IS FAST APPROACHING.

This is a future in which Cultural Heritage monuments are replicated and in which pallets of bricks will disappear from construction sites in historic neighborhoods. It is a future in which all citizens will be able to design their own homes using their own ingenuity; and it is one in which artificial structures will imitate natural ones.

That is the future of 3D printing on a large scale. And ACCIONA is getting ahead of that new building paradigm here and now with a unique concrete footbridge that will rise 12 meters over the pond at the Castilla-La Mancha Park in Alcobendas. The structural design of the footbridge's railings, a succession of wave-like shapes that are seamlessly integrated into the natural environment, would have been impossible to achieve using any other technique. The project –headed by ACCIONA Industrial, ACCIONA Engineering and the Institute for Advanced Architecture of Catalonia– will be the world's first civil engineering project built using 3D printing.

“We’re very excited about it. It’s a pilot to explore everything this technology can do for the company, mainly in engineering and infrastructure,” explains Luis Rodolfo Clemente, Manager of Technology Transfer at ACCIONA. This technology will be capable of rendering how the design and calculations line up so that the construction can push

A CONTAINER-SIZED PRINTER

COMBINED WITH SPECIAL
MODELING SOFTWARE



The process is a cycle involving two heads that print out the shapes defined by the design equipment. In order to do this, specific

modeling software, controlled by the same computer that is connected to the printer, is essential in giving the heads absolutely precise instructions about the shape each piece should be. For the moment, the printer is just a prototype used to build the footbridge in Alcobendas. But in the near future it could become a mass produced industrial machine that can be transported to any corner of the world and used in any type of infrastructure or engineering project. That is why it has been designed to fit inside a 40-foot (12.2-meter) container, which can be loaded on a ship.



Anatomy of a Unique Object



The bridge is 12 meters long, 1.5 meters wide and weighs 30 tons.
It is made up of eight, two-meter-long, concrete modules. Railing height: 1.3 meters.



A BEAUTIFUL BUT SAFE PROJECT ENGINEERING MAKES COMPLEX DESIGNS COME TO LIFE

A pioneering footbridge project that is putting engineers' abilities and responsibilities to the test. "The Institute for Advanced Architecture of Catalonia (IAAC) sends us their version of the design and we look at it from an engineering point of view, analyzing the limiting factors of the design and the printing technology itself and ensuring that the structure can be built in the end," explains Mariano Martín Cañueto, Head of ACCIONA Industrial's Structural Engineering Division, who is also the creator of this project and the site director.

"The biggest challenge was dealing with complex geometric shapes that can't be boiled down to simpler models. We used the calculation of volumetric finite elements (dividing complex three-dimensional shapes into much smaller fragments that can be mathematically analyzed) with the ANSYS computer software. The other big challenge was large-scale 3D printing with a new material that had to be characterized," he points out.

Installing it will be much simpler. It will be loaded already assembled on a truck and pedestrians will be able to use it in a matter of hours.



limits that, until now, were not questioned. Clemente sums it up in a single phrase: "Freedom of shape." Take, for example, the reproduction of the extraordinarily lovely Dama de Elche, sculpted in brittle sandstone more than two thousand years ago. Today, a twin Lady "sculpted" layer-by-layer is on display not far from the printing room where it was created and evokes reflection on the possibilities of three-dimensional printing in art restoration. "It's a test of the level of detail we can achieve."

ENGINE OF CHANGE

That qualitative jump in freedom is redefining the relationship between architecture and engineering. "They have been walking side-by-side, but not necessarily hand-in-hand," says Carlos Gustavo García, Manager of Bids, Marketing and Innovation at ACCIONA Engineering. "With this technology, it's not just that they come together; they merge."

José Daniel García Espinel, Director of Technology Transfer and Member of the ACCIONA's Innovation Board, argues that 3D construction will be one of the engines of growth and change in the sector worldwide. "Think about everything you need now in order to build a house. First, the architect designs it for you. Then, the builder evaluates the project and builds the house with machinery and workers. But 3D printing simplifies the entire process; it allows you to jump directly from the design to the finished product. It's the direct transition between the digital and the physical."

The fact that the design is no longer tied to many of the old limitations on building means that there are also new business opportunities. The consulting firm McKinsey estimates that in 2025 the economic impact of 3D printing will be around 550 billion euros. In fact, McKinsey praises it as one of the 12 technologies with the greatest capacity to transform the planet. The shake-up will

affect business and household expenses. For example, the Chinese company Winsun claims to have built and printed 10 homes measuring 200 square meters in just one day for less than 5,000 euros each.

In the medium term, 3D printing is likely to expand to diverse sectors, from the health industry to the food and textile industries... providing almost any type of structure.

ONE OF TWO... SCHOOLS

ACCIONA has analyzed the dominant 3D printing technologies and chosen the complete and the most groundbreaking one. "We call them the American School and the European School," Clemente explains. They are two very different approaches to printed structures. The first, also known as contour *crafting*, works like a pastry bag: "It applies successive layers of material, as if they were contour curves

THE ECONOMIC IMPACT OF THE 3D SECTOR WILL BE AROUND 550 BILLION EUROS IN 2025

on a topographical map." However, the system presents basic weaknesses that make it incompatible with ACCIONA's needs. "For example, in order to pour one layer, you need another one below it. This limits the geometry of the piece and doesn't allow for the creation of corbels or complex shapes," Clemente adds. The European method, on the other hand, prints very thin layers of material that are stuck together using a liquid polymer. This glue makes it possible to join every layer together in order to achieve the most



CARLOS GUSTAVO GARCÍA JARABO

Manager of Bids, Marketing and Innovation at ACCIONA Engineering

**"Innovating
makes all the
difference in
the medium
and long term"**

He had only been in Cairo a few days, leading a project. Suddenly, two hours before a delivery he had committed to, the entire staff left the office. "They had gone to pray." That moment taught this engineer the key to international success in his field: "Flexibility and an understanding that cultural components can be just as decisive as technical ones." Today, he is fully dedicated to innovation and is certain about why the leading companies have to break the mold: "In the short term it's not appreciated, but in the long term it makes all the difference. At ACCIONA Engineering, we know that those of us who are already committed to innovation will have an advantage over the competition."

Previous
page:
ACCIONA's 3D
printing room,
in Madrid.



María
Trinidad Barrios,
in the drying
chamber for
printed pieces.

intricate shapes. The piece is digitally designed in 3D and a specific program breaks the structure down into sheets that are then printed. “The advantage of this method,” Clemente affirms, “is that we always have the support material. Any curved shape is possible because the previous layers support any element that is printed over them.”

And so, it was possible to create a footbridge with an internal structure made out of a cluster of holes and curves that imitate the porous textures found in nature that are both light and resistant. This type of configuration is known as biomimetic design. “It looks like a bone inside,” Clemente points out.

REALISTIC PROJECTION

Let’s believe the most ambitious ideas can be printed in 3D. Even if it takes decades, this new intensive and extensive technology will make it possible to both reproduce what has been lost and build what has never been built before. The cities of the future will not have to succumb to the monotonous repetition of concrete blocks; we will be able to infuse

MARÍA TRINIDAD BARRIOS GARCÍA

3D Printer Operator at ACCIONA

**“This is a new technique;
we have to learn everything
from zero and that’s what
I like about it”**

She’s had a number of firsts in her life: working in topography, directing civil engineering projects and, now, breaking ground as one of the first 3D printer operators. “I started working as a topography assistant when I was 18. My father was in charge of the project and I enjoyed the work, so I followed in his footsteps. Four years later, I was practicing that profession in the civil engineering sector. Metros, highways. Here in Spain and abroad,” explains this native of Cadiz who has made her home in Madrid. Since May 2015, her professional life has undergone a comple-

te transformation. “Daniel [García Espinel] told me he had a challenge for me that I was going to like. And yes, I loved it. The 3D printing technique is completely new; we have to learn everything from zero and that’s what excites me about it.”

María Trinidad has a clear explanation for the lack of women in technological professions: “I don’t think we’re given the choices we should be given from the time we’re little girls. We’re not offered these types of jobs. But I encourage you to believe that you’re capable of whatever you put your mind to.”

PIZZAS, ORGANS, PILLS, AND A HOME

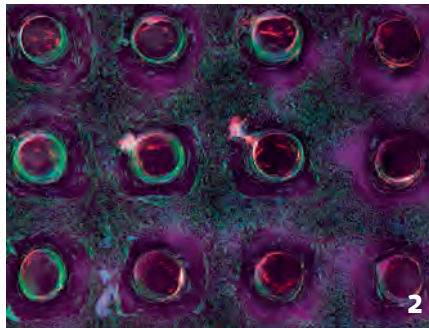
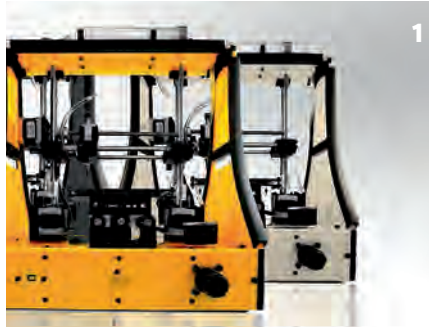
PIONEERS IN HEALTH,
SPACE TRAVEL AND
SUSTAINABLE HABITATS

1. Pizza in Space: NASA is transforming tasteless space food into something more appetizing, and familiar looking, using a printer that makes pizzas in space using natural ingredients.

2. Blood Capillaries: Harvard University and the University of Sydney were the first to print small blood vessels. This could be the tipping point for the creation of much more complex and promising structures —such as perfectly functional human organs— in the medium term.

3. Printed Villa: This recently installed home in the Tongzhou district of Beijing is made completely out of printed concrete pieces. It is 400 square meters, with walls that are 25 centimeters thick. The printing process took 45 days.

4. Anti-epileptic: Aprecia is the first pharmaceutical company to get a 3D pill approved for the US market. *Spritam levetiracetam* was developed to treat epileptic seizures. It would be impossible to achieve the porousness of the drug using any other industrial process.



ARETI MARKOPOULOU

Academic Director of the Institute for Advanced Architecture of Catalonia.

“The IAAC
has learned
a lot from the
3D bridge”

Her accent barely gives away her native Greek. She came to Barcelona 11 years ago to do a master's program and got taken in by urbanism and architecture “on a very powerful scale that is also citizen-friendly”. The education program she directs at the IAAC is advanced architecture, open “to sustainability, cost reduction and social wellbeing.”

That is why she sees 3D printing as an ally and has been working with it for years on projects like Large Scale 3D Printing.

“Along with other trends, it will bring about a radical change and save costs and energy by optimizing the transportation and assembly of materials,” Areti suggests. “We have learned a lot from the bridge. It proves that complex design, architecture and production can reach a level of simultaneous collaboration never seen before.”



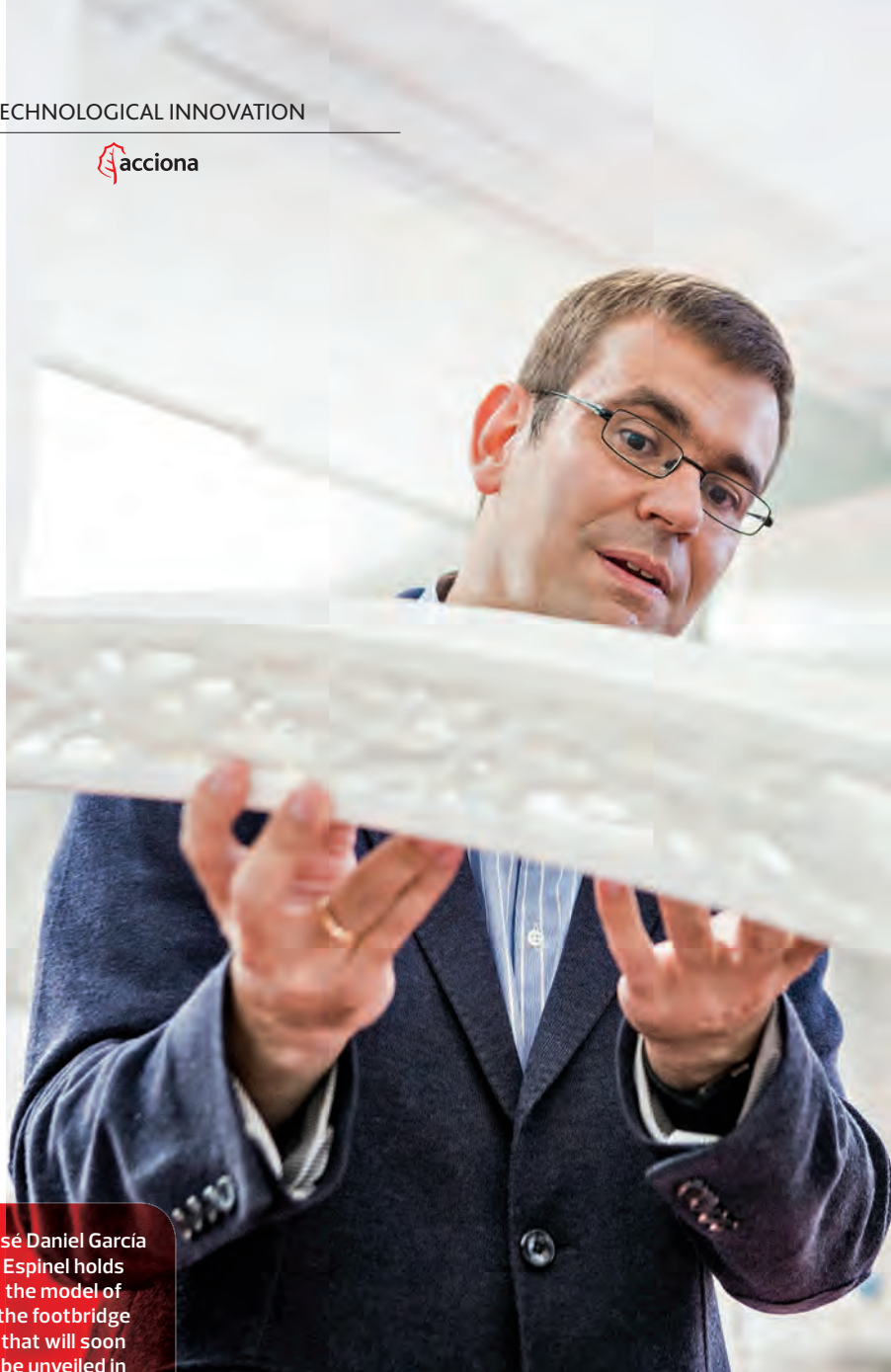
**LUIS RODOLFO
CLEMENTE ORTEGA**

Manager of Technology
Transfer at ACCIONA S.A.

**"We're
always trying
something
new"**

Innovation as a philosophy that goes beyond his profession. "Detecting emerging technologies and implementing them in all of ACCIONA's businesses; that's the challenge," says Clemente. Overcoming this challenge requires ongoing efforts to understand innovations capable of revolutionizing business models: "We don't get bored. We're always trying something new."

Clemente has been at ACCIONA for eight years. The first four, he was in R&D at Infrastructure. "We were like site managers using new technologies in the company's projects." But in his current post, he can perform "some similar tasks, although with a much wider range of action. This makes innovation possible in all of the company's businesses." The one thing he enjoys the most: "Breaking out of the routine. When you're in it, you can't innovate."



**José Daniel García
Espinel holds
the model of
the footbridge
that will soon
be unveiled in
Alcobendas.**

**"YOU'LL BE ABLE
TO MEET WITH AN
ARCHITECT AND DESIGN
THE HOUSE OF YOUR
DREAMS": JOSÉ DANIEL
GARCÍA ESPINEL**

JOSÉ DANIEL GARCÍA ESPINEL

Director of Technology Transfer at ACCIONA S.A.

“Our mission is to turn innovation into business”

In 2007, just before the crisis, García Espinel had already put his stamp on emblematic projects like Line 11 of the Madrid Metro, the Radial 2 highway and the entrances to the Terra Mítica theme park. His career was gathering steam. “But I was called and asked if I wanted to work on innovation. I had already been a recipient of one of the company’s first scholarships for research. I took the plunge and said yes, even though everyone in my sector said I was crazy,” he explains. His professional responsibility and personal passion is to push ACCIONA “to optimize technological innovation.” “If we innovate, we can create new businesses and become more efficient.”

 José Daniel García Espinel

 @ttinerfeno



3D Pieces
Logo, Dama
de Elche and
structures.



cities with unique architecture and furniture, with designs that are only limited by the scope of our creativity.

THE FORUM, RESURRECTED

“When I’m in Rome and I walk through the Roman Forum, I always imagine what it looked like in its prime. It’s true that you can see a photographic reconstruction in books. But experiencing it reconstructed would be impressive. This technology will reach a point where that’s possible. If you’re capable of reproducing what something was like in the past using a digital model, you can build it using 3D printing,” García Espinel points out.

For the Director of Technology Transfer, innovation is the domino that sets off a chain reaction. But bolstering all of 3D printing’s potential uses will require overcoming deep-seated prejudices. “When you tell a construction expert you’re going to forgo the formwork, he’ll look at you like you’re crazy. ‘Are you really going to change the way we work with concrete, even though we’ve been doing it the same way since Roman times?’ Of course, now we can build with concrete and do without the formwork.”

Just like we can do without so many other routines, limitations and mental structures. García Espinel insists that this is not one of those imaginative predictions intended to dazzle readers: “In less than two decades, you’ll be able to meet with an architect, design the house of your dreams, and print it.”

That enormous evolutionary breakthrough is already happening. You can touch it and even stand on it in the case of the footbridge in Alcobendas that will be unveiled in just a few weeks’ time. ■



VIEW VIDEO
www.acciona.com



OIL

INTEGROIL PROJECT

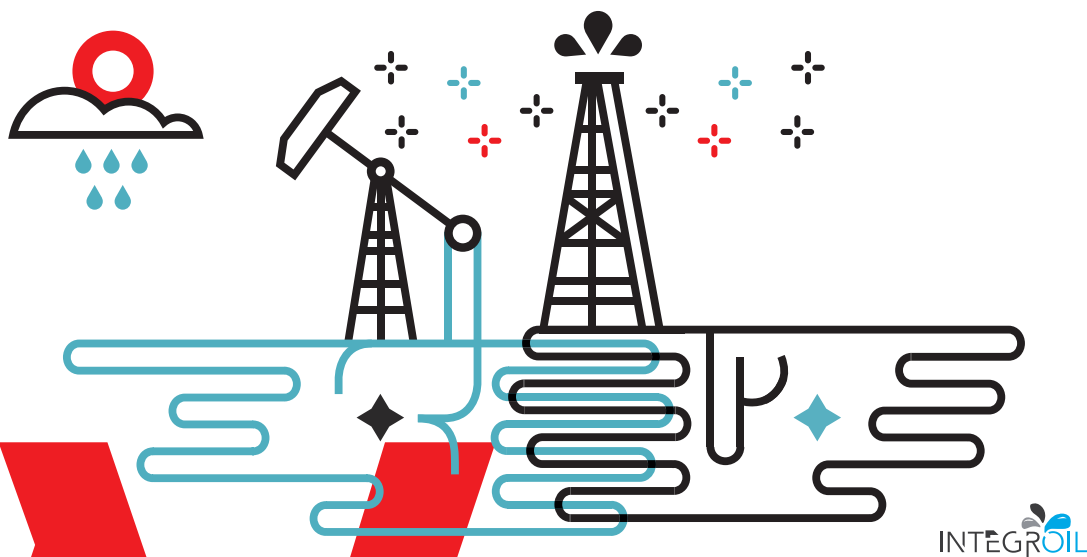


by
Javier de la Cruz

Illustration
Del Hambre

SAVING WATER

THE PROCESS OF
EXTRACTING AND
REFINING CRUDE OIL
EMPLOYS INDUSTRIAL
AMOUNTS OF WATER.
UNTIL THE INTEGROIL
PROJECT CAME ALONG.



WATER AND OIL, INTIMATE RIVALS.

ACCIONA is bringing together these time-honored rivals, water and oil, in a marriage of convenience. And the glue that will hold them together is Integroil, an innovative industrial engineering project that draws on ACCIONA's experience in water treatment, physical-chemical processes and big data analysis. The goal: an intelligent technological platform capable of cleaning and reutilizing a large part of the water employed by oil production equipment, in order to abate the growing pollution of water resources in the first world and developing regions cited by the World Health Organization.

Water is an essential resource in the Oil&Gas sector. It is injected into wells to maintain internal pressure by displacing the outflowing oil and gas. When wells start running dry, up to eight times the usual volume of water is needed. Also, the oil fields themselves contain water that mixes together with hydrocarbons. That is called extraction water or produced water. The refinery cycle, on the other hand, employs a large amount of water to separate different petroleum products. In this case, we are talking about wastewater.

Under the sponsorship of the European Commission, Integroil aims to present a mature system, in just over two years, that will reutilize up to 70% of all extraction water and recover 60% of all wastewater. How will it achieve this great feat? Marina Arnaldos, a specialist at the RDI Department at ACCIONA Water, breaks the technology down step-by-step.

ACCIONA COORDINATES

A TEAM OF NINE EUROPEAN
OTHER PARTNERS

The Integroil project –coordinated by ACCIONA, with the participation of nine organizations from seven countries– is part of the EU's *Horizon 2020* strategy to promote innovation in scientific research. The European Commission selected it from 143 proposals for the five million euros funding.

ROLLOUT

THE SYSTEM WILL FIRST BE TESTED FOR TWO YEARS

The water treatment technologies and IT system with big data analysis will be tested for one year in a setting that simulates crude oil extraction. Then, the device will be transported to a refining plant in Turkey to treat wastewater. The roll-out is expected to take place in 2019.



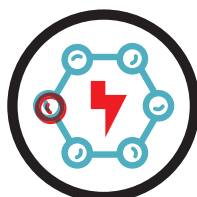
DECISION-MAKING SUPPORT SYSTEM

The data mining IT brain is Integroil's big innovation. All of ACCIONA's R&D insights on water treatment formulas will be fed into it to calculate the proportion of each pollutant in every process, with the help of specific sensors. It will be like a Plug&Play technology that does not require operator experience. And it will automatically adapt to the quality of the incoming water and the decontamination goal for the outgoing water, whether it is used for petroleum extraction, refining processes, or other purposes.



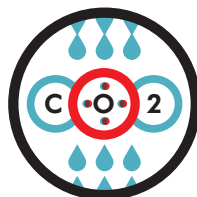
DISSOLVED AIR FLOTATION

Imagine a type of jacuzzi with jets that release extremely fine streams of air. This creates a very dense blanket of bubbles that encapsulate greases, oils, and suspended particles and eliminate the turbidity of produced water. This technique is already used in purification and desalination and will be adapted to the hydrocarbon industry, which produces some very specific pollutants.



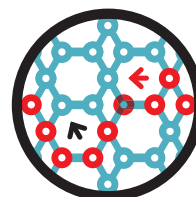
ULTRA-FILTRATION MEMBRANES

The mechanism in this phase is the same: exclusion. Everything that is bigger than the membrane's micropores, which work as a filter, is removed. The membranes can be polymeric membranes—made out of plastic material— or ceramic, like dinner plates. Ceramic membranes are a bit more expensive in terms of energy consumption, but they do have advantages: they withstand very high temperatures and resist the abrasiveness of many chemical agents that polymeric membranes do not.



ADVANCED OXIDATION

This involves the separation of organic molecules dissolved in water through a chemical process that turns them into CO₂ and water, the two most stable components found in nature. It is achieved by introducing a combination of oxidants and catalysts, such as ozone and ultraviolet rays, or iron with peroxide. These advanced oxidations degrade complex pollutants—such as hydrocarbons—contained in product water and wastewater. Also, they manage to do it in very low reaction times, with the resulting savings in infrastructure.



REVERSE OSMOSIS

This also uses polymeric membranes, but ones that are completely dense and without pores. Here, rather than filtration, there is diffusion. Reverse osmosis is the opposite of natural osmosis. In human beings, salts and alcohol dehydrate cells, which are semipermeable and lose water due to the effect of the laws of thermodynamics. In the industry, to reverse this process and concentrate non-water compounds, a certain amount of energy is applied. This eliminates even the smallest contaminants, including salts and compounds not degraded by advanced oxidation. The result is high-quality water.

A Step Toward Renewables in Latin America

THE HIGHLY COMPETITIVE PRICES OF ENERGY FROM WIND FARMS AND PHOTOVOLTAIC PLANTS ARE PROMOTING THEIR DEVELOPMENT IN THE REGION. ACCIONA HAS WON IMPORTANT ELECTRICITY TENDERS IN MEXICO AND CHILE AND IS WORKING TO EXTEND ITS PRESENCE TO OTHER COUNTRIES.

by
José Arrieta



El Romero Solar photovoltaic plant, the largest in Latin America, is ACCIONA's own facility under construction in Chile's Atacama desert.

A large, bold, red letter 'A' that serves as a background for the main headline text.

ACCIONA IS ALREADY COMPETITIVE IN THE REGION AND GROWING ALL THE TIME.

Plunging costs in renewable energy — especially wind and photovoltaic— along with improvements in efficiency have made these sources fully competitive with conventional sources in many countries, and Latin America is no exception.

These factors, combined with efforts to expand electricity sector competition in markets where, until now, there were few actors, and the need to obtain energy resources to meet growing demand without depending on costly fossil fuels imports, as well as the common goal of halting climate change, have laid the foundations for a new energy paradigm in Latin America.

The expansion of the renewable energy sector is taking place at a time when related technologies are reaching maturity. In the last two decades, the growth of clean energy sources in developed countries has fueled the creation of legislation to help them get off the ground in an energy context dominated by conventional sources.

As a result, renewable energy generation has increased significantly in those countries — Spain is one of them— and in some cases, has led to the creation of national companies that

are now exporting their knowledge to emerging markets, while creating wealth and employment in the country of origin.

The situation in Latin America, however, is completely different. Wind and solar now rival the price of conventional energies in a good number of markets because their costs, technological efficiency and economy of scale have reached levels that make them competitive. These factors are contributing to lower tender costs and a boon for end clients on their electrical bills. They are also contributing to the common goal of every energy policy: reducing emissions.

Now, no one questions the fact that renewables are going to be the energy source with the greatest growth in the future, just as they have been in recent years. Investors, large corporations, financial institutions, and governments are aware of this reality and the race has begun in promising emerging markets.

STRONG PRESENCE

ACCIONA Energy is well-positioned in some countries in the region where it has valuable assets in operation, important facilities that it has been commissioned to build or that are under construction, and business initiatives established through bilateral contracts.

The company was awarded the supply of 578 MW in electrical tenders held this year in Mexico and Chile. It also owns and operates a wind farm in Costa Rica and is going to participate in tenders in other countries.

This strategy is in line with the investment opportunities available in Latin America in the renewable energy sector.



VENTIKA 252 MW. Operational. For customers

PUERTO LIBERTAD 227 MWp. Awarded

EL CORTIJO 168 MW. Awarded

EURUS 250.5 MW. Operational. Company-owned
OAXACAS 306 MW. Operational. Company-owned
INGENIO 49.5 MW. Operational. For customers

CHIRIPA
 49.5 MW. Operational.
 Company-owned

In Mexico, ACCIONA is a leader in wind power, with 858 MW produced at company-owned or third-party plants, equivalent to 28% of the market.

EL ROMERO
 246 MWp.
 Under construction, nearing completion

PUNTA PALMERAS
 45 MW. Operational
 Company-owned

SAN GABRIEL
 183 MW. Awarded



MEXICO

AWARD OF 400 MW IN TWO TENDERS

In 2016, ACCIONA Energy was awarded a total of 395 MW in the first two long-term electricity auctions following Mexico's Energy Reform. These auctions demonstrate what an excellent time it is for renewable energies.

In the first auction, held on March 30, ACCIONA was awarded the supply of 585.7 GWh, for which it will build the 168 MW El Cortijo wind farm in the State of Tamaulipas, expected to enter service in 2018. The auction also awarded lots for the installation of facilities, in the coming years, that will produce 1,691 MW of solar power and 394 MW of wind power, at an average price of USD 47.78 per MWh.

The second auction, held at the end of September, awarded ACCIONA the supply of 478.3 GWh, which it will provide by building a photovoltaic complex with a capacity of 227 MWp (180 nominal MW) in the State of Sonora. This will be the company's first project in the photovoltaic sector in Mexico. In this auction, 8.9 GWh of electricity from renewable sources were awarded and will be provided by the construction of 2,871 MW at an average price of USD 33.47 per MWh, equivalent to 30% less than the previous auction.

The Mexican government's goal is for 35% of the electrical energy consumed in the country to come from renewable sources by 2024. The two auctions held so far have confirmed the wisdom of this decision.

ACCIONA already owns and operates 556.5 MW in Mexico, all in the State of Oaxaca, which accounted for 18% of the country's operational wind-power capacity at the end of 2015. And it has built another 301.5 MW of wind power facilities for customers —among them, the Ventika complex— and has numerous other projects underway.



TENDER

Auction: Long term 2015/2016

Announcement: March 30, 2016 / September 28, 2016

Power auctioned: 5.4 GWh / 8.9 GWh

New renewable power: 2,085 MW / 2,871 MW

Average price: \$ 47.78 MWh / \$ 33.47 MWh

Investment: \$ 2.6 billion / \$ 4.billion

Award to ACCIONA: 585.7 GWh / 478.3 GWh



CHILE

168 MW OF WIND POWER IN THE LATEST AUCTION

In 2016, ACCIONA was once again awarded an energy tender in Chile: a total of 506 GWh of electricity, which will allow it to build the 183 MW San Gabriel wind farm in La Araucanía region.

In the auction held in December 2014, the company was awarded a total of 600 GWh of electricity. The majority of this energy will be provided by the El Romero solar plant in the Atacama desert. With capacity for 246 MWp (196 nominal MW), this will be the largest photovoltaic plant in Latin America and is already in the final phase of construction.

All types of electricity generation technologies participated in this year's auction. Of the 12,430

GWh that were auctioned off, more than 40% were awarded to wind power projects and 10% were awarded to solar plants, in spite of the fact that conventional technologies mostly participated with energy from plants that are already operational.

The average tender price was USD 47.60 per MWh, more than 40% less than the average price established in the previous auction. The lowest prices were in photovoltaic energy, with bids as low as USD 29.10 per MWh.

Chilean authorities highlighted the success of the auction, in terms of the high level of competition and downward trend in prices, which will have a positive impact on the prices paid by consumers. Energy Minister Máximo Pacheco summed it up by saying: "It's a triumph for Chile".

This award reinforces ACCIONA Energy's position in the country, as it will now supply 246 MWp of photovoltaic power and 228 MW of wind power, with high expectations for an increase in these figures with new contracts.

Previous page,
wind farm
in Oaxaca,
Mexico.
Below, the
Chilean Punta
Palmeras Wind
Farm. Punta
Palmeras



TENDER

Auction: Supply
2015 /01

Announcement:
August 18, 2016

Power auctioned:
12,430 GWh
(conventional and
renewable)

Result: 52% renewable
and 48% conventional

Average price:
\$ 47.6 MWh

Investment: \$ 3 billion

Award to ACCIONA:
506 GWh



JESÚS ANTONIO DEL RÍO PORTILLA
DIRECTOR OF THE RENEWABLE ENERGY
INSTITUTE AT THE NATIONAL AUTONOMOUS
UNIVERSITY OF MEXICO (UNAM)

“Developing renewable energies in the region is an urgent task”

by **Beatriz Orgaz Ortega**

DEL RÍO PORTILLA IS ONE OF MEXICO'S TOP SCIENTIFIC AUTHORITIES.

He is also one of Latin America's top experts in research and innovation related to renewables, especially in the field of nanotechnology. Not only is he the director of a scientific institution that is considered an authority on clean energy sources, but also the technical director of the emblematic Mexican Center for Innovation in Solar Energy and a renowned member of the Mexican Academy of Sciences. And his approach to renewables transcends the confines of the lab.

Mr. Del Río Portilla understands renewables from a comprehensive perspective, considering their social effects beyond the market. For him, there is no doubt that the new energy paradigm is an ally in strengthening the region's emerging economies. And although he considers the implementation of renewables to be an urgent matter —especially in the case of wind and solar power; hydroelectric power is already well developed— he advises a cautious approach, slow but steady steps, and informational transparency to ensure that renewables have the greatest possible support from society.

How important are renewable energies in the development of Latin American economies?

They represent the possibility of a paradigm shift, of achieving a much more equitable distribution of energy resources and of strengthening the region's economic development through local job creation.

Are they being implemented fast enough?

I would not like to see lightening-fast development; I would rather see, and contribute to, the equitable development of the renewable energy industry in this region by bringing a perspective of efficient energy use. The full-speed-ahead models lead to inequalities, with laws that favor some over others and do not lead to social well-being. The share of electricity produced in the region from renewable energy sources is still low, but it's important to recognize that the region's economic and social development levels are not comparable with those in Europe, Canada or the United States.

What types of energies have the greatest growth potential?

I could be tempted to say solar in its different forms: photovoltaic and photothermal. But given the geography of Latin America, all the renewable sources play a very important role. In some places, it makes more sense to use geothermal energy. In others, solar. In others, wind or mini-hydro power generators. Of course, energy from the oceans is another possibility open to the entire region. And let's not forget the production of electricity or bio-fuels with solid or liquid waste.

In such a diverse region, are there certain factors that point to a promising future?

From my perspective, the development of different renewable energy sources is an urgent task. But the implementation of these types of resources requires

a big push by everyone involved: the government, private initiatives and society at large. Also, media coverage of the benefits of these energy sources is essential. And letting society know that they are already a reality and not part of a hypothetical future is even more important. The decades when renewable energy sources were expensive and in their technological infancy are far behind us.

Speaking of technological maturity, is enough innovation occurring?

We still owe society a lot in this area. The climate, environmental conditions and meteorological phenomena that affect the region require different solutions than those offered at other latitudes. And offering those solutions is where the greatest possibilities lie for technological developments that will lead to innovations.

Is there enough aid available for the development of renewables, such as funds and loans for researchers and students?

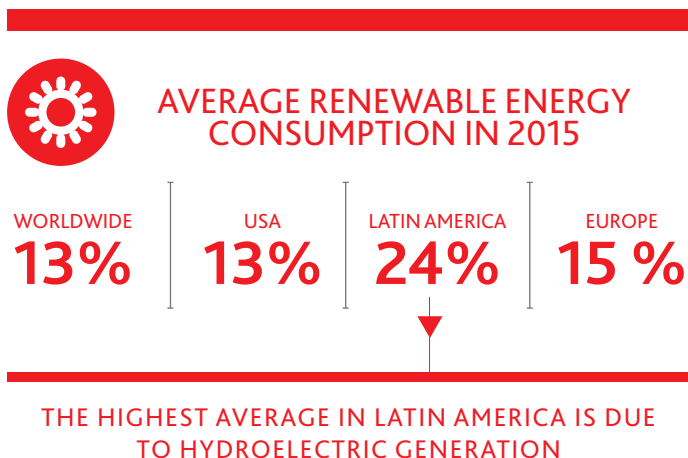
Incentives help. But from my point of view, there's an even bigger need for information. People need to know, for example, that in Mexico it is currently cheaper to install photovoltaic systems than pay the household rate for high consumption or even some business rates. They need to know that it's much cheaper to heat water up to 80° for household or industrial use with solar power than with any fossil fuel.

Mexico is implementing extensive energy reforms. How has that impacted on the renewable energy market?

It is providing possibilities, but it is also exposing the market to unfair competition with hydrocarbons. Electricity from fossil fuels is subsidized; renewables aren't.

The National Energy Strategy 2016–2026 aims to increase the share of electricity produced by clean energies from 10% to 35%. Do you think that is an attainable goal?

I think it's a feasible goal, although there are certain inhibitors that are slowing the development of renewable energies in Mexico: the long-term return on investment rates and the fact that the majority of the energy sources are available intermittently, with the exception of geothermal and biofuel production. ■





CHANGE CALLS FOR CHANGE

AFTER 14 MONTHS OF RECORD BREAKING TEMPERATURES IN A ROW, AND THE SIGNING OF THE PARIS AGREEMENT, SUSTAINABILITY INDEXES HIGHLIGHT THE COMPANIES MOST COMMITTED TO TACKLING CLIMATE CHANGE.

by **J.P. Zurdo**

THREE WARNINGS:

LET'S TAKE A LOOK AT
SOME SOBERING DATA ON
GLOBAL CLIMATE CHANGE.

This is the kind of data that, instead of paralyzing us, should move us to take responsibility for what is happening. The US National Oceanic and Atmospheric Administration (NOAA) certifies that:

- 1 The month of June was the warmest month on the planet for as long as there have been reliable global records (that is, since 1880).
- 2 That month and the 13 months leading up to it constituted the warmest consecutive period in 137 years. The temperature during that period was 1.67°C warmer than the average of the temperatures recorded over the past century.
- 3 The warming is especially striking in the ocean. In June, ocean temperatures were 0.77°C above average. Another historic record.

According to the NOAA, the marine ice in the Arctic covers 40% less area than it did three decades ago.

This glacial retreat is the result of global warming. At the current rate, European glaciers will disappear within the next century.

ACTION TAKEN BY ACCIONA

LEADING SUSTAINABILITY INDEXES

Below find five global indexes that measure companies' commitment to the fight against climate change. ACCIONA is mentioned in all of them.

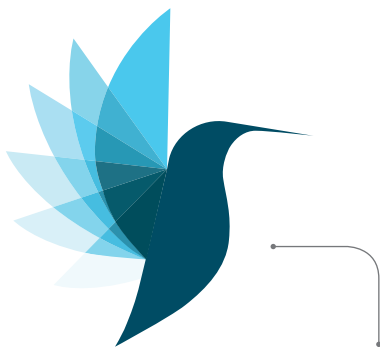
- MSCI Global Climate Index. This index includes companies that are leaders in the short and long-term mitigation — through renewable energies and clean and efficient technologies— of factors that contribute to climate change.

- STOXX Global Climate Change Leaders Index. This is a new index modeled on the stock exchange: it features the 105 companies with the best environmental performance according to Climate A List, developed by the Carbon Disclosure Project (CDP).

- CPD. Climate A List. This includes the 113 companies that received the highest rating for their actions to mitigate climate change.

- ACCIONA has been named in the Dow Jones Sustainability World Index for 10 years in a row. It has also been included in the Dow Jones Sustainability Index Europe.

- Finally, ACCIONA has spent five consecutive years in the FTSE4Good index, which is based on increasingly demanding social, environmental, and corporate governance criteria.



PARIS AGREEMENT

A metaphor: The forest is burning. The forest creatures are paralyzed by panic. A hummingbird fills its beak with a tiny amount of water and drops it on the flames. The animals react with skepticism, or simply make fun of its efforts. “I’ve done my part,” the hummingbird shoots back.

That is the attitude. Let us therefore not be surprised by the apparent lack of momentum to international nego-

tiations. Following the adoption of the Paris Agreement, the United Nations opened it for ratification in April. At the G20 meeting in September, it was ratified by the US and China, who together are responsible for almost 40% of global emissions. At the next COP 22 (Conference of the Parties, the governing body for the United Nations Framework Convention on Climate Change), to be held in November in Marrakech, new ratifications are very likely.

And in both civil society and the private sector there is a growing conviction —and potential for convincing others— that the challenge demands urgent action and the mobilization of governments that have still not ratified the Agreement. In order to enter into force, the Agreement must be signed by at least 55 countries, responsible for at least 55% of global emissions.

BRAND NEW BEACHES EVERY DAY

ACCIONA SERVICE KEEPS
ALMERIA'S BEACHES CLEAN AND
SAFE SO TOURISTS CAN ENJOY
THEM AT THEIR LEISURE.



Sand is made for going barefoot. And when you're on the beach, you want to look at the view, not down at your feet in case of hidden surprises.

For a vacation hotspot like Almeria, impeccable beaches are a must all year round, but especially in the high season, when they are busy morning, noon and night. Most of the sunbathers who enjoy the quality and tranquility of Almeria's beaches are probably unaware of the enormous investment that goes into them, required by local, national and European regulations.

ACCIONA Service and Grupo Generala are meeting this daily challenge at 14 of the 16 municipal beaches along the Gulf of Almeria. These include beauty spots such as Retamar, Zapilo, El Toyo, Costacabana and Las Salinas de Cabo de Gata. The companies pick up and





VIEW VIDEO
www.acciona.com

transport all kinds of natural and man-made waste washed up on the shore or disposed of by beachgoers at the beach entrances and along the boardwalks.

The vehicles used in the project testify to the complexity of the specialized tasks performed with them. The fleet includes tractors to pull heavy machinery, quads for work hard-to-reach areas, sifters, stone removal machines, sand and fine gravel levelers, pavement sweepers and cleaners, mechanical sprayers that use certified environmentally-friendly disinfectants, and hose-down machines for showers and wastebaskets, a new piece of equipment being launched this season. There is even a catamaran that cleans the first 20 meters of the sea running along the beach. ■

The mechanical sifter turns over and aerates the sand and fine gravel to maintain the level of cleanliness regulations require.





A TOAST TO CASERÍO DE DUEÑAS

BODEGAS VIÑA MAYOR'S NEW PROJECT TASTES LIKE TRADITION, IMPROVED
WITH A CONTEMPORARY VISION. A LEAP IN THE QUALITY OF THE RUEDA D.O.

by
Patricia Alcorta

Viña Mayor has entered a new era, with women at the helm. This ripe business venture is the result of 30 years spent honing its craft. The winery, owned by ACCIONA, was one of the first to emerge at the dawn of the Rueda Designation of Origin (D.O.). And over the last year and a half, it has been pushed to the next level by Almudena Alberca, a Wine Expert and the Technical Director at Viña Mayor. Almudena is defining the personality of the new wines coming out of Caserío de Dueñas, the name of the historic farm—in Villaverde de Medina, between Medina del Campo and Naval del Rey—whose lands yield hearty staples and delicious wines. The simple gesture of serving one of their first wines belies the long sequence of decisions that went into making it. It all started with a vision: *verdejos* (a variety of wine grape) native to Rueda, along with a leap in quality reflecting the contemporary style of the Designation. And it led to unique wines, recognizable at first taste, with fresh but complex mouth and balance between all the variables in play.

SUPERIOR AND FERMENTED

Almudena and her colleague María Ángeles Santamaría—a Wine Expert at Caserío de Dueñas—are certain they have hit the mark. They have two masterpieces: *Caserío de Dueñas Verdejo Superior 2015* and *Caserío de Dueñas Fermentado en Barrica 2014*. Just a few brush strokes outlining their creation highlight how difficult it is to strike the perfect balance. The first wine combines grapes from a studied selection of vineyards: some from the Caserío estate, providing the base of the wine's structure and freshness; others from distinguished vineyards in the area, to reinforce the notes of the Rueda D.O.; and some from Segovia that, grown at a higher altitude, add shades of mineral quality and acidity. It is aged on fine lees—fermenting yeast—for five months.

The second is produced using grapes from the most venerable vines in the region, 60 years or more. They are treated with care out at every stage, out of respect for the old vines. First, the grapes are harvested by hand and placed in 15kg boxes so they do not get crushed. Then, the bunches are sorted by hand. This is followed by the soft pressing and cold clarification of the must. And eight months of peace in French oak barrels.

Close your eyes a moment. And remember all that tender loving care when you taste these delicious wines. Cheers! ■

400 YEARS IN A WINE BOTTLE

Knowing a little about the Caserío de Dueñas estate provides some insights into its wines, and wine in general. It has been a village since the 17th century, and a farm since the expropriations of the 19th century. And it still boasts the original underground cellars, austere mansion and the chapel with the bell tower that inspired the brand's logo. The 300 hectares of vineyards grow in gravelly lands and in a climate with extreme temperature swings between day and night. These vineyards produced another one of the winery's star products: the Viña Mayor Verdejo, a Gold Medalist at CINVE (International Wine and Spirits Competition) and the Brussels World Competition.



Almudena Alberca (left), Technical Director at Viña Mayor, and María Ángeles Santamaría, Wine Expert at Caserío de Dueñas.



RELIVE THE HISTORY OF OMAN

THE NATIONAL MUSEUM
OF OMAN IS AN
EXHIBITION IN ITSELF.
GROUND-BREAKING
EDUCATIONAL
TECHNOLOGIES AT THE
SERVICE OF CULTURE.

by
Patricia Alcorta

What is more important: the package or the content? When you are talking about a thoughtfully-conceived museum, the two concepts blend together.

A coherent sequence of pieces, a variety of display models, sensational audiovisual technologies, staging that evokes curiosity... all these design features make a museum much more than a package for content. They make it part of the exhibit, a work of art that gives meaning to the other pieces.

That is the case with the iconic National Museum of Oman, which opened this summer. Here, ACCIONA Productions and Design (APD) has rec-

The Museum is new in more ways than one. So is new and so is the content: 80% of the pieces it contains are being displayed for the first time.

reated the history of the sultanate: some 6,000 pieces displayed in thematic and chronological order, in 250 display cases divided among 14 permanent galleries. It also includes a temporary exhibition gallery and a discovery area for children. The National Museum of Oman is the first museum in the Middle East to have storage and reserve areas open to the public, and Oman is the first country in the region with permanent cutting-edge conservation facilities and a learning center.

AUDIOVISUAL GEM

Oman, The Jewel of the East in the Land of Hope, is the technological centerpiece of the exhibi-



tion: filmed and produced by APD, it is projected in ultra-high 4K resolution —four times higher than standard HD video— on a gigantic 8.3 megapixel screen located in a cinema hall. Its journey through Oman's early history includes aerial images of astounding beauty. Another spectacular feature at the museum consists of the life-size replicas of old boats.

Like all of APD's projects, this one prioritizes social innovation. It is the first museum in the Middle East adapted for visually-impaired people. And it is also the first museum in Oman with facilities for visitors with reduced mobility.

ADP is one of Europe's top specialists in engineering applied to the design and execution of museums, exhibitions and multimedia events. Its international activities span countries as diverse as Spain, Brazil, Japan, China, Germany, Turkey, Switzerland, Romania, the United Kingdom, Kuwait, Qatar and, of course, Oman, where it has a permanent delegation. ■

Eighteen million euros were budgeted for this museographical project.



SPAIN

TEACHERS FOR A DAY

SUSTAINABILITY EXPLAINED TO YOUNGSTERS: MORE THAN 600 EMPLOYEES TAUGHT 13,000 BOYS AND GIRLS FROM 13 COUNTRIES HOW TO TAKE CARE OF THE PLANET WITH SIMPLE EVERYDAY ACTIONS.

#voluntarios
ACCIONA

CANADA



CHILE



MEXICO



Employees used metaphors, like superheroes defending nature, to explain Sustainable Development Goals to children, especially the four goals that ACCIONA knows best: water management, renewables, infrastructure and climate change. They were teachers for a day at more than 100 schools in Australia, Brazil, Canada, Chile, Costa Rica, Greece, India, Spain, Mexico, Poland, Portugal, Qatar, and South Africa.