

# ACCIONA ENERGY'S COMMITMENT

ACCIONA Energy is the largest global operator dedicated to the production of electricity exclusively from renewable sources.



Countries with own assets in 2016	Installed capacity (MW)	2016 production (GWh)	Emissions avoided (tonnes of CO <sub>2</sub> )
USA	785	2,187	1,562,087
AUSTRALIA	303	961	830,158
CANADA	181	459	326,313
CROATIA	30	83	62,116
GREECE	0	59	52,111
ITALY	156	272	156,393
HUNGARY	24	48	37,254
INDIA	89	229	227,430
COSTA RICA	50	254	180,848
CHILE	291	134	92,241
SOUTH AFRICA	232	526	570,570
PORTUGAL	166	391	266,661
MEXICO	557	2,191	1,263,186
POLAND	101	189	163,536
SPAIN	5,950	12,847	9,047,804
<b>TOTAL</b>	<b>8,913</b>	<b>20,830</b>	<b>14,838,706</b>

## ACCIONA ENERGY IN 2016

1,910

EMPLOYEES

8,913 MW

INSTALLED CAPACITY

55 %

LOCAL SUPPLIERS

14.8

MILLION t CO<sub>2</sub> AVOIDED

20,830 GWh

PRODUCED

94 %

CUSTOMER SATISFACTION

## HIGHLIGHTS IN 2016

## Economic dimension

» 1,796 billion in turnover and EUR 740 million in EBITDA

» Innovation figure EUR 73 million, up 16 % from the previous year.

» Recurring contracts: 79 % of the ACCIONA Green Energy marketing customer portfolio has been renewed

## Social dimension

» Implementation of the Social Impact Management methodology in 18 projects

» Reduction in the accident frequency rate with work leave of own employees and subcontractors of 14.41 % to 1.39

» Increase in women holding managerial and deputy managerial positions to 18.89 %

## Environmental dimension

» Production of clean, emission-free energy for around six million homes across the planet

» Energy efficiency measures in electricity generation installations intended to reduce energy consumption and emissions

» 1,894 hours of environmental training

## ACCIONA Energy's sustainability performance

Below are the main aspects identified in 2016 as the most relevant to the ACCIONA Energy's key stakeholders. Each aspect describes the sustainability performance for ACCIONA Energy during the year.



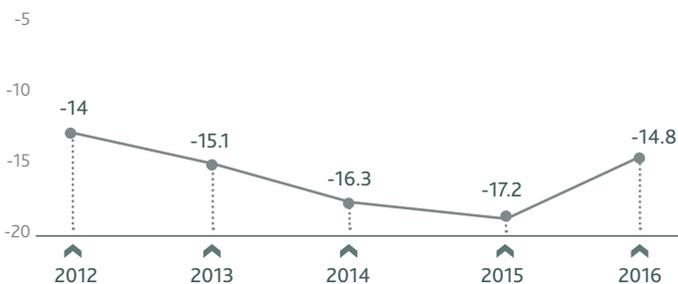
**INVESTING IN RENEWABLE ENERGIES TO ACHIEVE A SUSTAINABLE ENERGY SYSTEM**

The most remarkable characteristic of ACCIONA Energy is its firm, confident choice to produce energy only from renewable sources. This is the foundation behind its business model and a fact that resulted in a positive impact, giving intrinsic value to the fight to mitigate the effects of climate change. Thanks to its technical and economic competitiveness, its investment in renewable energies not only reduces CO<sub>2</sub> emissions that cause climate change, but also offers the best sustainable energy solution.

It should be noted that in 2016 the ACCIONA group achieved carbon neutrality, making it a company with a net balance of zero emissions, a commitment made under the scope of its new Sustainability Master Plan 2020 (SMP 2020).

In the field of electricity generation, ACCIONA Energy produces and sells only renewable energy, helping to displace fossil fuels in national electricity mixes. With 100 % renewable installed power of 8,913 MW at the end of 2016, the company promised to invest USD 2.5 billion through to 2020 in renewable generation, in order to reach a total capacity of 10,500 MW that would allow for the avoidance of more than 20 million tonnes of CO<sub>2</sub> emissions per year. In 2016, ACCIONA avoided the emission of 14.8 million tonnes of CO<sub>2</sub> into the atmosphere as a result of its generation of electricity from exclusively renewable sources.

**Emissions avoided by ACCIONA Energy**  
(millions of tonnes of CO<sub>2</sub>)



The production of clean, emission-free energy for around six million homes across the planet is achieved in an increasingly competitive and profitable manner, thanks to a permanent commitment to continuous improvement and innovation focused on enhancing the efficiency of its processes and technological solutions.

**Energy efficiency measures**

In 2016, the 2015 target to propose five energy efficiency measures was exceeded. Specifically, 10 initiatives were analysed regarding the operation and maintenance of electricity generation installations and its integration into the grid, which should allow for energy savings of around 10,000 MWh per year.

THE MEASURES INVOLVED VARIOUS AREAS OF IMPLEMENTATION, INCLUDING, OF PARTICULAR NOTE:

- **Wind power:** proposal to optimise the control of downtime in hydraulic units of wind turbines and analysis of different strategies for the control of the coupling of generation machines for an installed power in excess of 600 MW.
- **Biomass:** studies on the amendment of compressed air systems, the replacement of cooling pump motors or the installation of frequency variators in condensation pumps.
- **Discharge to the generation grid:** identification of switchgear of greater consumption for the proposed efficiency policy in electrical substations.

**In 2016, ACCIONA Energy avoided 14.8 million tonnes of CO<sub>2</sub> emissions into the atmosphere**

### SAFETY AND QUALITY OF SUPPLY AS A MATTER OF CONFIDENCE WITH CUSTOMERS

Safety and quality of supply is a priority for ACCIONA Energy. Through the control, supervision and permanent operation (24 hours a day, 365 days a year), the ACCIONA Energy Renewable Energy Control Centre (CECOER) guarantees the maximum availability and quality of energy, in a predictable form and in compliance with the current legislation in each of the 19 countries (15 own assets and 4 of customers) in which it operates.

#### ACCIONA ENERGY CERTIFICATES

**100 %**

MW INSTALLED  
CERTIFIED UNDER ISO  
9001 AND ISO 14001

**2016 news  
(ISO 9001 and 14001):**

- Certification of ACCIONA Chile S.P.A. Wind farm operation and maintenance services, construction of photovoltaic generation plants and sales of energy.

**100 %**

SUPPLY OF  
RENEWABLE ENERGY  
WITH GUARANTEED  
SOURCE CERTIFIED BY  
THE CNMC

- Solar plant Montes del Cierzo - Tudela (Spain).

#### Customer relations and available services

ACCIONA Green Energy Developments is the branch of ACCIONA Energy that manages the sale of energy produced by the Group's plants, as well as that of other producers of the Specific Regime, which benefit from the group's technical capacity and experience, adapted to suit the customer's needs.

Through this branch, ACCIONA Energy markets electricity with a guarantee of 100 % renewable sources, credited by the National Commission on Financial Markets and Competition (CNMC) to major customers.

ACCIONA's marketing activity also provides its customers with support and assistance that goes beyond the mere sale of electricity, in a bid to offer them the most appropriate contracting method and optimise their electronic bill. These associated services are:

- Regular reports
- Energy audits
- Optimised billing
- Optimised power
- Reactive energy management
- Monitoring of consumption and quality of supply
- Information on assistance in energy efficiency and savings
- 24/7 telephone attention

ACCIONA Green Energy offers its marketing customers various online services: consultation of previous consumption or price forecasts; downloading of invoices and information on CO<sub>2</sub> emissions avoided. These online services are available to all customers, of whom 90 % make active use of them.

In 2016, various improvements were made such as easier access to load curves, compatibility with all browsers and improved speed of the website, which successfully reduced complaints by 20 %.

In addition to its role as promoter of installations, ACCIONA Energy also provides capacity to the market to develop projects in different renewable technologies, individually in wind power and photovoltaic, where it already has considerable experience in installations for third-party customers. In 2016, note in particular the start-up of the wind power project Ventikas (252 MW) in Mexico, with EPC developed for third parties with a 20-year O&M contract.

## COMPREHENSIVE CLAIM MANAGEMENT PROCESS AND COMPENSATION TO CUSTOMERS WITH ADDITIONAL IMPROVEMENTS

1. Classification of the claim according to type.
2. Terms: faced with any claim relating to billing, ACCIONA Green provides a positive or negative solution in less than five business days, sending a proposed settlement to the customer.

If the customer refuses it, an alternative solution will be offered; if the claim should not be justified, the reasons for this will be disclosed.

In addition to settling the claim, the following additional services will also be offered:

- For claims relating to the terms of power, a study will be carried out, calculating optimum power to be contracted for the supply in question.
  - For claims relating to reactive energy, a study will be carried out to optimise the condenser battery.
3. Execution of the response: if the customer accepts the solution and rebilling is required, this is conducted immediately and the claim is closed.
  4. Incident register: following the resolution of the incident, the customer is contacted over the telephone, noting the cause and solution and, if necessary, a plan of action to avoid any recurrence, in the CRM tool.

### Customer satisfaction and loyalty

One indicator that enables ACCIONA Energy to assess its quality of service is the annual customer satisfaction survey, which provides direct information on the response the company is offering to their needs. In its energy sales, through the customer manager, ACCIONA Green Energy makes an annual selection of the most representative customers and holds an individual meeting with them to record the perceived quality.

Some indicators of note in respect to customer satisfaction include:

- The index of satisfied customers in 2016 maintains a high degree of excellence, booking 94 % for ACCIONA Energy.
- The customer loyalty target for ACCIONA Green Energy was to renew at least 80 % of the customer portfolio, and this was achieved to 99 %.
- The customer of ACCIONA Energy Chile increased its general satisfaction from 71 points to 86 out of 100.



**The Government of Victoria (Australia) placed its trust in ACCIONA Energy once again by choosing the company to build the MT Gellibrand wind farm.**

In 2017, the company started building the wind farm in Australia, having been awarded the tender held by the Government of Victoria for the purchase of green energy certificates corresponding to the renewable installations in this State. The company already operates the Waubra wind farm in this country, and the Government has reiterated its trust by assigning it the construction and commissioning of a wind farm.

The wind farm of Mt Gellibrand will benefit the region through investment and the creation of employment, and will produce renewable energy equivalent to the electricity consumption of around 60,000 homes, avoiding the emission of around 200,000 tonnes of CO<sub>2</sub> into the atmosphere per year.

### RISK MANAGEMENT IN SUSTAINABILITY

Before starting business development activities in a country, ACCIONA Energy first assesses this using a consolidated analysis model, which includes macroeconomic criteria, criteria relating to the electricity market and, specifically, the renewable sector. These result in a total of 120 indicators that help to ensure a careful selection and continuous analysis of markets, identifying those of greatest appeal and which are most likely to be able to bring value to the company, thereby reducing the associated risks.

ACCIONA Energy has identified four groups of risks throughout the value chain with a different potential impact on the business, as they are all analysed fully by country, market, project, etc. These are:

- Business risks: strategic and geopolitical
- Market and/or financial risks
- Credit and/or counterparty risks
- Operational risks

Among others, operational risks include those related to the impact on the environment, community and employee health and safety.

In 2016, work was carried out to develop and implement its procedures for the identification and quantification of risks, as well as to respond to and monitor this throughout all business areas: Development, Engineering, Construction, Procurement and Energy Management and Production.

Throughout the value chain of ACCIONA Energy projects, the risks associated with sustainability from a social, environmental and economic viewpoint are identified and assessed according to the likelihood of occurrence and potential impact, in order to prevent them and implement mitigation measures.

### ENVIRONMENTAL IMPACT MANAGEMENT

ACCIONA Energy environmental management is hinged on the principle of improving environmental performance. Having strong management systems and a structure of responsibilities adapted to the reality of each country in which the business operates is essential in order to perform with the highest environmental management quality standards, regardless of the country in which it is operating.

In this sense, the various areas establish specific targets to reduce the environmental impact. For example, 2016 saw the development of noise maps for hydropower plants.

At ACCIONA Energy, water needs to be collected for the production of renewable electricity via its hydraulic plants. The water collected then flows through the plant before being returned to the source without any change to its composition. To minimise possible impacts, work is carried out by applying the regime of environmental flows established by the company or hydraulic administration if it should set such flows.

Regarding the management of both non-hazardous and hazardous waste, this was reduced by 3.6 % in 2016 compared with the previous year. In this regard, note in particular the optimisation of 100 % of the ash and slag generated in three biomass renewable generation plants. Ash is used in agriculture as a fertiliser, given its considerable potassium content, while combustion slag is appreciated both in agriculture and construction. In all, 2,000 tonnes of ash and 25,400 tonnes of slag were reincorporated back into the value chain.



#### Plan to conserve the fauna and flora in the Atacama Desert. ACCIONA Energy

Historically, much of the territory of the Atacama region represented the habitat of populations of the guanaco, a species classified as endangered. In this context and under the scope of the construction of the photovoltaic plant El Romero Solar, the five-year Conservation Plan will improve knowledge of the populations surrounding the installation, identify threats and develop a programme of environmental sensitivity intended for rural populations neighbouring the project.

The biological plan for flora includes target species of cacti, shrubs and bulbs local to this semi-arid area of the country. To date, approximately 300 specimens of cacti and 11,000 bulbs of the flowering desert have been rescued and relocated. Additionally, six species of shrubs are being cultivated in a plant nursery with a view to reproducing approximately 12,000 specimens.

Lastly, there has also been a rescue and relocation plan for terrestrial fauna, for reptiles and amphibians from the project environment. By running six campaigns, a total of 486 individual reptiles have been obtained.

## CONTRIBUTION TO SOCIETY

Just like the other company businesses, ACCIONA Energy helps improve society with its projects. The impacts generated include different dimensions: effects on people, in community life or in the generation of wealth and employment in the region.

We can specifically note three types of actions that manage and measure these different impacts: Social Impact Management, investment associated with projects and the measurement of the socioeconomic impact.

Below is a description of how these actions are put into practice by ACCIONA Energy, and at the end of the paragraph an example of these is given for the photovoltaic plant El Romero Solar (Chile).

### Social Impact Management

ACCIONA applies its own Social Impact Management (SIM) methodology, whereby, right from the offer or design phase, it knows the social risks that its works, operations or service provisions may cause in the areas of influence of its projects; the aim is to generate positive impacts and minimise negative ones on the local communities and environment in which it operates (more information is provided in the Society chapter).

In 2016, ACCIONA Energy took a great step forward in the installation of its SIM methodology, which has been applied in a total of 18 projects, compared with 2 in the previous year. At the end of the year, 8 projects were in the design of social measures and dialogue phase and 10 were undergoing implementation and monitoring of the social measures.

These projects took place in eight different countries (Australia, Chile, Costa Rica, the USA, India, Mexico, Poland and South Africa), including 13 wind farms and 5 photovoltaic plants.

In addition, as a dialogue tool with the different stakeholders, ACCIONA Energy uses the "Principles of Ecuador", a series of principles adopted voluntarily by financial institutions whose aim is to ensure that certain projects they fund are developed in a socially responsible manner and with correct environmental management. In particular, the sixth principle establishes the need to set out a Complaints Mechanism for the different interest groups to express their concerns over a given project. In response to this commitment, ACCIONA Energy makes the following form available to persons or groups considered as affected, through which they can submit requests and/or suggestions relating to any project promoted by the company (<http://www.accion-energy.com/sustainability-innovation/queries-or-suggestions/>).



### Relationship with the communities: WISE project

ACCIONA Energy took part in the WISE Power project on the social acceptance of electricity plants, a European initiative that was launched in May 2014 and which ended in October 2016. The EU-funded project, which was organised by the European Wind Energy Association (WindEurope, formerly EWEA), aimed to improve local support of wind power projects and boost the participation of local communities in their planning and development. The consortium of participants in WISE Power included municipal and regional planning authorities, regulators, representatives of the renewable industry, national energy agencies, scientific institutes and others.

The main results of the project were:

- Preparation of a monitoring tool applicable to concrete cases, which according to the different phases of a project enables the identification of barriers and measures to be implemented to improve social support.
- General guide in 11 different European languages, intended to teach and train, describing the steps to be applied in order to ensure community involvement.
- Test exercises in four different countries, carried out by sector experts, with the aim of validating the monitoring tool and guide.
- Application of social acceptance measures in five real cases of projects developed.
- Dissemination and training on a local/regional, national and EU level through leaflets, creation of a website, sending of e-mails to distribution lists addressed to sector professionals, press coverage, publication in sector and corporate magazines, interaction with other initiatives and presentation of various events (congresses, symposiums, etc.).

### Social investment associated to projects

ACCIONA Energy maintains a firm commitment to the socioeconomic development of the communities in which it operates. To do so, it pursues specific social initiatives in each of the countries in which it works. Among others, the following stood out in 2016:

#### Oaxacas Complex, Mexico

ACCIONA Energy continues to carry out studies of the needs of towns surrounding the wind farms in Oaxaca. On the basis of this study, the projects develop within the area of health, education and the environment. More than 5,600 inhabitants of the neighbouring communities of the wind farm have benefited from the various initiatives, including, in particular:

- 30 higher education scholarships for careers relating to wind power in the neighbouring communities of the wind farms.
- Construction of a small power wind turbine prototype in alliance with the University of Istmo.
- Implementation of the Sustainability Workshop project in four schools of the neighbouring communities of the wind farms.
- Implementation of the educational quality project through an IT centre also offering educational psychological support for teachers.
- Discussions, workshops and activities in connection with the community's urban solid waste.
- Nutrition project addressed to children of the community of La Venta.
- Fostering of local entrepreneurship.
- Investments to improve the educational infrastructures of the neighbouring communities of the wind farms.

#### Wind farms, Australia and the USA

Through the construction and operation of wind farms, ACCIONA seeks to create added value at local level, establishing different channels to allow communication with communities near the farms. The initiatives being carried out include the aid to education through scholarships, training aimed at school pupils on topics of sustainability, wind energy and the environment and support to local organisations, among others.

#### Gouda wind farm, South Africa

Some activities involving dialogue with stakeholders and socioeconomic development are particularly worth noting:

- Education: training of schoolteachers in the municipality of Drakenstein on matters of renewable energies and sustainability, start-up of the Life Skills programme for 200 children through dialogue and games.
- Infrastructure: improvements to the health infrastructure at the primary school of Gouda, purchase of furniture for the school of Bakerville and the local clinic of Gouda, construction of a new building for the educational centre of Gouda.
- Health: support to the State nutrition programme at breakfast, from which 1,100 children have benefited, weekly programmes for young adult and adult drug and alcohol addicts.
- Sport and community: sports support to the community rugby club, annual sessions and dialogue for 100 unemployed field workers on responsible paternity.
- Employment: start-up of the local entrepreneurship programme.

#### Measurement of the socioeconomic impact of projects

ACCIONA continues to work on its method of measuring the socioeconomic and environmental impact that its projects have on a given country, obtaining quantitative results of the impact of the company's activity in terms of employment generation (direct, indirect and induced) and contribution to country's GDP, as well as taking into account other positive effects on the environment and communities (more information is available in the Society chapter).

In 2016, work continued to measure the contribution made by the ACCIONA Energy projects throughout their life cycle. The following stand out:

- Comparison of the results of the socioeconomic impact throughout the life cycle for the wind power technology employed in Mexico and the wind and solar photovoltaic technologies used in South Africa, with two non-renewable technologies: carbon plant and natural gas.
- New calculations on the socioeconomic footprint throughout the life cycle of the solar plant in Chile.

## More than **164,000 people** directly or indirectly benefited from the social initiatives pursued in various ACCIONA Energy projects in 2016



### Photovoltaic plant of El Romero Solar (Chile)

The photovoltaic plant in the Atacama region is the largest in Latin America to date. Its maximum power is 246 MWp and its annual production is estimated at around 493 GWh, which equates to the supply of 240,000 Chilean homes, avoiding the emission of around 474,000 t CO<sub>2</sub>.

This ACCIONA Energy project is a good example to show the implementation of the three actions described in this section: the Social Impact Management method, social initiatives and the calculation of the activity's socioeconomic impact.

#### Social Impact Management (SIM)

Since 2016, even during plant construction, SIM methodology has been implemented.

With the aim of gradually strengthening the relationship with the communities near the project, while the social impact study was being conducted, a combination of two types of actions were carried out – one-off and related to training – mainly connected with employment insertion, such as training in the installation and maintenance of solar panels and the training of private security guards.

Following the social impact study and dialogue with communities, social investment proposals were implemented for the community while awaiting revalidation in order to be able to develop investment plans for the operative stage of the project.

#### Social initiatives

ACCIONA Energy Chile is implementing a series of social actions in line with the specific needs detected in the area, with a view to helping ensure the sustainable development of the communities situated in the area affected by the project. Around 11,000 people have benefited from the following initiatives:

- Educational campaigns for the community and environmental workshops
- Financing of a course to train installation and maintenance technicians of photovoltaic panels in the city of Copiapó, awarding grants to 48 students of Vallenar together with the Corporación de Fomento para la Producción (Production Development Corporation).
- Food donation campaigns to specific members of the community.
- Support offered to 45 members of the Vallenar goat farmers' association.
- Training for private security guards.

#### Socioeconomic impact of El Romero Solar

The socioeconomic impacts of the photovoltaic plant mainly consist of the contribution made towards the GDP and the generation of employment in Chile, as well as its impact in other external aspects (CO<sub>2</sub> emissions avoided, water saved and improved air quality). The estimated impacts are:

- Contribution to the GDP throughout its useful life (35 years): EUR 298 million.
- Creation of employment throughout its useful life (35 years): 7,876 employees/year\*.
- Emissions avoided: 327,242 t CO<sub>2</sub> per year.
- Water saved: 701,310 m<sup>3</sup> water per year.
- Air quality 2,854 t SO<sub>2</sub> and NO<sub>x</sub> avoided per year.

\*Employees/year: full-time equivalent job for one year.

### HEALTH AND SAFETY AT ACCIONA ENERGY

ACCIONA Energy has an Integrated Management System for the entire division, with guidelines that set out the minimum health and safety requirements to be met by all its companies and countries. This system is certified in compliance with the OHSAS 18001 standard.

Within ACCIONA Energy there is a Health and Safety Commission, which offers support to all employees in Spain, with the equal participation of company management and worker representatives. The commitment of the division to health and safety applies to all levels and has a direct impact on the performance of employees. For years, ACCIONA Energy's objectives have included goals relating to health and safety for all employees on three levels: company, department and staff.

In 2016, the strategy started in 2015 was consolidated with regard to the commitment and leadership of company management in matters of health and safety. The QESIP (Quality, Environment and Safety Improvement Plan) has been bolstered and the presence strengthened of health and safety matters on the agendas of the Steering Committees.

In particular, as part of the QESIP programme, various actions have been developed and implemented to improve safety, quality and the environment in operation, maintenance and construction activities, including of note:

**ACCIONA Energy's objectives include goals relating to health and safety for all employees on three levels: company, department and staff**

- 5 minutes of safety: this is a daily coordination and planning practice at the start of the day, pursued by staff attending the work centre. The manager sets out a series of guidelines to be considered and/or the workers express any doubts or comments they may have.
- Preventive observations: practice of inspection and control of safety conditions at the work centre, based specifically on what is carried out by the control line, beyond the staff dedicated exclusively to occupational health and safety.
- Pre-job briefing: planning and control practice carried out before work is conducted by those assigned to do so. The philosophy is that no task is started before having analysed and proven that safety conditions are under control.

### THINK SAFE: INCREASING WORKER HEALTH AND SAFETY AWARENESS

The programme to be implemented in 2017 involves the entire workforce attending group awareness-raising sessions of 10 people. During these sessions, short film sequences shall be shown that recreate a fictitious accident, and with the help of an external moderator the group analyses the following concepts:

1. Accident presentation.
2. First consequences.
3. The family drama.
4. Causes.
5. Conclusion with positive reinforcement.

After the initial session, the employee receives a reminder after three months and another after six months.

The programme will have an app for new employees who have been unable to attend sessions.

In addition, in 2016, the action plans in the event of emergency situations were revised and reinforced and the Think Safe programme was prepared to improve awareness of worker health and safety matters.

The Construction Management Plan was also established to allow for the development and execution of projects in compliance with the highest quality and efficiency standards, moreover in a standardised manner in any country.

All initiatives carried out ultimately aim to reduce the division accident rates. Overall, considering own employees and subcontractors, in 2016 the accident frequency rate with work leave dropped (1.39) below that of last year (1.62). Likewise, the frequency rate of own staff of ACCIONA Energy reduced (0.5) compared to 2015 (1.6), as did the absenteeism rate (333.79 in 2015 and 136.8 in 2016).

At ACCIONA Energy, the following targets were defined as regards health and safety, in line with the 2017 objectives:

- To reduce the accident rate by 5 %, with a decline in own employees and subcontractors, in line with the result obtained in 2016
- To implement the health and safety improvement tools as established in the action plans of the QESIP project in the areas of construction, operation and maintenance.
- To increase the reporting and communication of unsafe actions by 20 %, by developing the Think Safe programme.

#### Health and safety in the supply chain

For the activity pursued by the division, its commitment to health and safety is extended to include the supply chain. ACCIONA Energy encourages and fosters the training of subcontractors via the minimum training requirements that they should have to be able to operate in any of its installations. In 2016, this was boosted through:

- The need by all collaborators for minimum training and certification in compliance with the Global Wind Organisation (GWO) standard for work on wind farms.

The action plans in the event of emergency situations have been revised and reinforced and the **Think Safe programme** was drawn up

- Inclusion of multimedia supports to consolidate basic knowledge: first aid and access to remote parts of a wind turbine, among others.
- Development of an IT tool for the management and control of health and safety training needs and related execution.
- OHS bulletin internally and for suppliers.

The frequency rate for contractors of ACCIONA Energy has increased slightly, going from 1.6 (2015) to 1.9 (2016). This is mainly due to the growth of labour-intensive activities for workers with basic qualifications, and service activities.

## INNOVATION, DEVELOPMENT FACTOR AND PROGRESS

At ACCIONA Energy, innovation is an essential cornerstone through which to maintain a leadership position in an increasingly competitive sector. In 2016, its innovation figure was increased by 16 % on the previous year, reaching EUR 73 million (4.08 % on sales). Within the technological innovation lines, various projects stand out as being of strategic importance to the company.

### On-shore wind area

The main lines of action are:

- **Life extension project:** extension of the useful life of wind assets using advanced predictive maintenance techniques.
- **Remote control project:** improves the availability of wind turbines.
- **Craneless project:** improves and optimises the wind farm construction processes and maintenance of the wind turbines, identifying profitable technical and economic solutions for assembly and maintenance without the use of cranes.
- Improved efficiency in the operation and maintenance of the wind turbines, aiming to reduce wind power electricity production costs. The following stand out: i) the continuity of the **CoE (Cost of Energy) reduction project**, consisting of work groups for continuous improvement in wind power production, which have achieved savings of more than EUR 3.8 million; and ii) the **OPTIMUS project**, based on the development, testing and validation of monitoring systems on mechanical wind turbine trains, thereby improving predictive maintenance and operating costs.

### Solar photovoltaic area

Under the scope of the **ADVANCED-PV project**, new automatic operating, management and maintenance systems of large photovoltaic plants are being developed. The main lines of action are:

- Monitoring of production in photovoltaic plants through advanced analysis tools, big data and machine learning.
- Automated system of thermographic analysis for large photovoltaic plants.
- Automated module cleaning systems.
- Advanced operation of photovoltaic plants and control strategies for ramp compliance.

### Electric storage area

With a view to maximising the integration capacity of renewable energies in the electrical system, guaranteeing quality and optimising management, work takes place across two working lines within the storage project:

- **PV + Storage:** the development of optimised strategies for energy control and dynamic storage capacity reserve in photovoltaic plants.
- **Wind + Storage (HYWINDESS project):** a hybrid storage system (energy and power modules) is developed with new converters and a control system in the Experimental Barasoain Farm in Navarre (Spain).

### Solar thermoelectric area

Through the **CSP-IMP project**, the efficiency of the turbines of the operative solar thermoelectric plants has been improved. By optimising the design, control system, start-up procedures and maintenance protocols, the yield in steam turbines is being increased. This year saw the completion of the third stage with the implementation of new turbine start-up curves in the plants of Majadas, Palma del Río I and Palma del Río II, achieving a reduction of 18 minutes in daily start-ups as well as improving reliability and extending their useful life.

### Biomass area

ACCIONA Energy also continues to work towards efficiency improvements of the electricity production plants in operation starting from the combustion of biomass residues; therefore, the focus is on the lines to improve efficiency in heater combustion, optimising the useful life of the equipment against corrosion and making good use of the slag and ash produced by the combustion of different biomasses.

### Hydropower area

In 2016, the following stand out:

- **CANALS**: development of a control system to monitor the conduct of the hydraulic elements (canals, forced tubes and pressurised tunnels) in real time in hydropower plants.

Finally, it should be noted that in line with the SMP 2020, ACCIONA Energy paid particularly close attention to the collaborative innovation achieved through the launch of **open innovation** programmes to boost collaborative innovation with various selected suppliers and other agents, such as technological centres and start-up networks.



### Gouda wind farm (South Africa)

Gouda is ACCIONA Energy's first wind farm to be installed in South Africa (45 wind turbines, each 3 MW). Located in Drakenstein, approximately 100 km north-east of Cape Town, each year it can produce clean energy to cover the consumption of around 200,000 South African homes.

#### Innovation

The **innovations** featured in this project include:

- The incorporation, for the first time in the country, of concrete towers with a hub at a height of 100 metres. Use of self-compacting cement (SCC) to manufacture the tower segments. This solution results in lighter tower constructions that are more respectful to the environment, due to less materials being used and a lower impact from transportation.
- The SCADA system and planned control of active power and frequency, which has enabled compliance with the South African network codes, maintaining highly efficient control in following the grid instructions for the farm's active power and the coordinated response in the event of any abnormal variations to the grid frequency.