

# **WIND TURBINES BUILT ON EXPERIENCE**

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# ACCIONA, profitability, development and sustainability

ACCIONA, one of Spain's largest corporations, is a leader in infrastructure, water, services and renewable energy management and development. With a century of experience and a workforce of more than 30,000 professionals, ACCIONA is present in more than 30 countries on five continents, with revenues of more than 6.499 billion euros in 2014.

ACCIONA focuses its strategy on economic growth, environmental balance and social progress as the cornerstones of its Sustainability Policy and attaches great importance to linking sustainability to its business strategies, as sustainable development represent a major source of opportunities in the sectors in which the Company operates. The Company develops its strategy in these initiatives through a Sustainability Master Plan, integrating sustainability-related initiatives in the Company, which aims to improve the organization's competitiveness and strengthen its position as a leader in sustainable practices.

ACCIONA firmly believes that innovation is the main driver of development and therefore one of the keys to its growth. Likewise, the company aims to gradually reduce its climate footprint and lead the transition to a low carbon economy. In 2014, ACCIONA activities and businesses helped prevent the emission of more than 16 million tons of CO<sub>2</sub> into the atmosphere.

This commitment is ratified by its presence in highly reputed sustainability indices, such as the Dow Jones Sustainability Index (DJSI World), FTSE4Good, MSCI Global Climate Index, CDP Climate Performance Leadership Index 2014, CDP Iberia 125 Climate Disclosure Leadership Index 2014 and CDP Supplier Climate Performance Leadership Index.

ACCIONA Energy

## THE EXPERTISE OF A LEADER

ACCIONA Energy, parent company of ACCIONA Windpower, is a global leader in renewable energy and operates in 5 technologies (wind, photovoltaic, CSP, hydroelectric and biomass).

The company, with 20 years' experience in the sector, owns and operates wind farms totaling more than 7,000 MW, making it one of

the largest owners of wind energy in the world.

ACCIONA Windpower, using this experience, designs, manufactures and operates wind turbines to provide wind power developers with the lowest cost of energy (COE) throughout the machines' working life. It has introduced world-class wind turbines to the market and

has become one of the most significant manufacturers in the global marketplace.

ACCIONA Windpower guarantees that by using our turbines, developers can optimize the energy potential of their facilities, thereby maximizing profitability.



ACCIONA Windpower

# THE ADVANTAGES OF A PROVEN TECHNOLOGY

1

Lowest cost of energy for the wind power developer.

2

Proven in-house technology from over 20 years' experience.

3

Global supplier with strong international presence: 18 countries, 5 continents.

4

Multiple configuration options to optimize performance at any site.

5

Proprietary blade and concrete tower technologies.

6

Manufacturing plants in strategic markets for projects all over the world.

7

1.5 MW and 3.0 MW platforms.

8

Medium-voltage generation to eliminate transformers and boost efficiency.

GREEN PASTURES Wind Farm  
300 MW, USA  
AW 116/3000





KROBIA I Wind Farm  
33 MW, Poland  
AW 116/3000



OAXACA Wind Complex  
306 MW, Mexico  
AW 70/1500



ATLÂNTICA Wind Farm  
120 MW, Brazil  
AW 116/3000

On 5 continents

## A GLOBAL PRESENCE

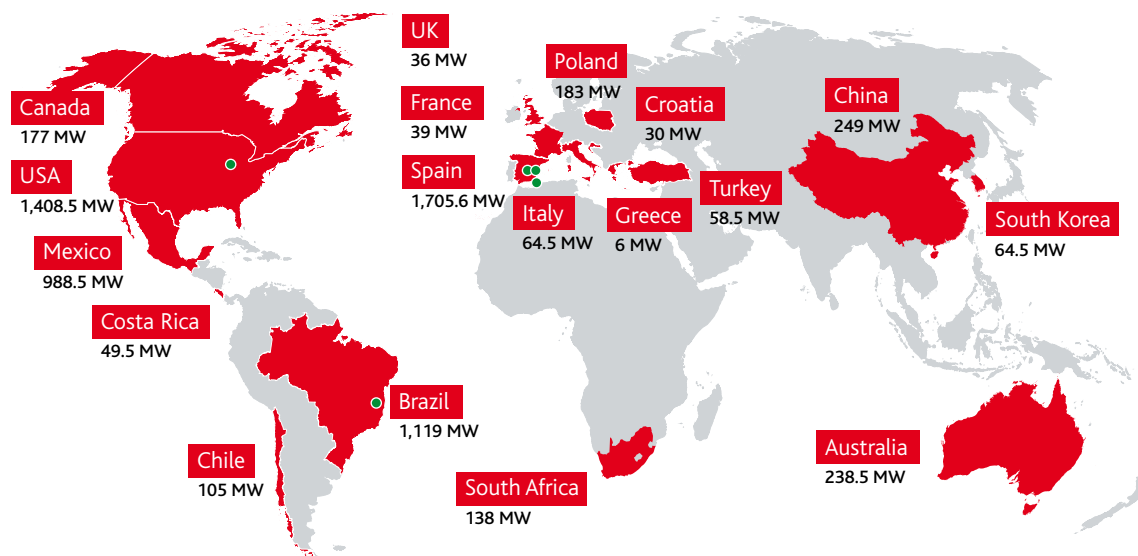
ACCIONA Windpower is a global supplier with a strong international presence and the capacity to undertake projects and provide wind power services in any part of the world.

By June 2015, ACCIONA had supplied or signed firm contracts for the delivery of wind turbines in 18 countries on the five continents, for a total capacity of over 6,600 MW.

Building on the experience gained with the AW1500 wind turbine platform, ACCIONA Windpower has added installations of the AW3000 in Spain, USA, Canada, Brazil, Chile, Mexico, Poland, Turkey, and South Africa.

### Sales of ACCIONA Windpower wind turbines

(Cumulative data as of 06.30.2015)



● ACCIONA Windpower Plants

Total sales: 6,660.1 MW

Certified models for all wind sites

## AW3000 PLATFORM

The AW3000 wind turbine is an evolution and upscaled version of the successful AW1500. With double the power rating and a range of rotor options and tower heights, the AW3000 is an

optimal choice to minimize cost of energy for any project. The latest evolution is the AW132/3000 for low-wind sites, which provides the best capacity factor of any wind turbine in its class.

### AW3000. Rotor and tower options

#### 4 ROTOR DIAMETERS



100 m

Swept area: 7,854 m<sup>2</sup>  
Class: IEC Ia



116 m

Swept area: 10,568 m<sup>2</sup>  
Class: IEC IIa



125 m

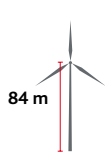
Swept area: 12,305 m<sup>2</sup>  
Class: IEC IIb / IIIa



132 m

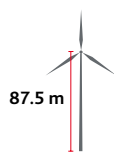
Swept area: 13,720 m<sup>2</sup>  
Class: IEC IIIb

#### 6 TOWER HEIGHTS AND 2 TOWER TYPES



84 m

For rotor:  
132 m



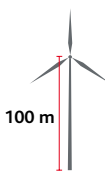
87.5 m

For rotor:  
125 m



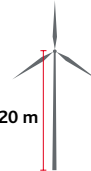
92 m

For rotor:  
116 m



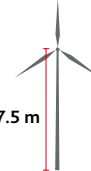
100 m

For rotor:  
100 / 116 / 125 m



120 m

For rotor:  
116 / 125 / 132 m



137.5 m

For rotor:  
125 m

STEEL TOWER

CONCRETE TOWER





AW 125/3000  
120 m Concrete Tower



AW 116/3000  
92 m Steel Tower

## Design advantages

# RELIABILITY IN 3 MW

### OPTIMIZED PERFORMANCE FOR ALL SITES

- Full suite of rotor options covering all wind conditions.
- Proven and bankable designs including double-bearing support on main shaft, glass fiber and epoxy blades and DFIG electrical generation.

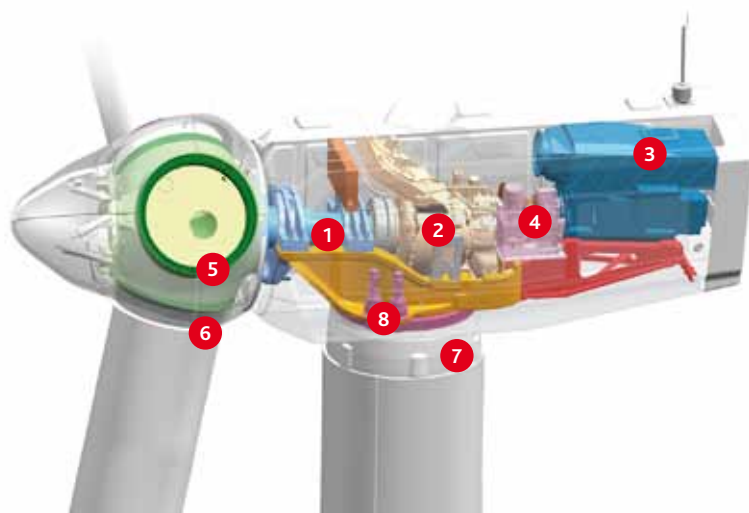
### BUILT BY OPERATORS FOR OPERATORS

- Based on a scaled design of our successful AW1500, the AW3000 provides more energy capture per wind turbine location.
- Our track record of wind turbine performance includes global average availability over 98% and extremely low failure rates of major components.

### COMPATIBILITY & CONTROL

- Zero voltage ride-through beyond current regulatory requirements, in addition to grid integration and reactive power solutions to allow for maximum control for stringent grid codes.
- Control software that allows intelligent automatic monitoring and operation.

## AW3000. Platform main components



### AW3000 DESIGN ADVANTAGES

1. Double bearing supported main shaft
2. Robust gearbox with HALT completed
3. 6-pole DFIG 12 kV generator
4. Elastic coupling
5. Cast hub with access from nacelle
6. Blades with structural shell design and proven materials including glass fiber and epoxy resin
7. Steel and concrete tower options from 84-137.5 m hub heights
8. Yaw bearing and caliper brakes



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Over 2.5 GW sold in nine countries

# AW3000: A COMMERCIAL SUCCESS

Since its full-scale commercial launch in 2011, the AW3000 has received an enthusiastic reception from the marketplace. With over 2.5 GW of orders by June 2015, including 85% outside of the ACCIONA Group, the AW3000 has demonstrated the ability to achieve the lowest cost of energy in important and competitive markets.

Orders for AW3000 wind turbines  
(Data as of 06.30.2015)



Brazil:	1,119 MW (43.9%)
USA:	465 MW (18.3%)
Mexico:	381 MW (15%)
Canada:	132 MW (5.2%)
Turkey:	57 MW (2.2%)
South Africa:	138 MW (5.4%)
Spain:	105 MW (4.1%)
Poland:	63 MW (2.5%)
Chile:	45 MW (1.8%)
USA:	42 MW (1.6%)

For other customers  
2,154 MW (84.6%)

For ACCIONA  
393 MW (15.4%)

TOTAL 2,547 MW



GOUDA Wind Farm  
138MW, South Africa  
AW100/3000



AW3000





acciona





The beginning

# AW1500 PLATFORM

With more than 4,000 MW operational in 15 countries, the AW1500 platform has proven to be one of the most robust and reliable turbines on the market.

The 1.5 MW AW1500 wind turbine is the result of over 10 years' experience in the operation of wind turbines of different technologies

and under a wide range of conditions. It can be the best choice for sites where the AW3000 isn't an option.

## AW1500. Rotor and tower options

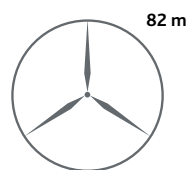
### 3 ROTOR DIAMETERS



Swept area: **3,848 m<sup>2</sup>**  
Class: **IEC Ia**

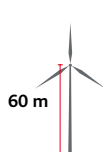


Swept area: **4,657 m<sup>2</sup>**  
Class: **IEC II**

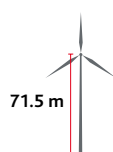


Swept area: **5,289 m<sup>2</sup>**  
Class: **IEC IIa**

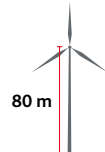
### 4 TOWER HEIGHTS AND 2 TOWER TYPES



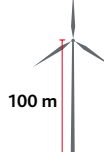
For rotor:  
**70 m**



For rotor:  
**77 m**



For rotor:  
**70 / 77 / 82 m**



For rotor:  
**82 m**

**STEEL TOWER**

**CONCRETE TOWER**

For the highest wind turbines

# CONCRETE TOWER TECHNOLOGY

While steel towers are available for all our turbine models, ACCIONA Windpower has also developed a proprietary concrete tower technology that can maximize energy production while reducing the cost of energy. Available in hub heights up to 137.5 meters, ACCIONA concrete towers make it possible to take advantage of wind shear and the

stronger wind resource available at taller heights. Concrete towers can be manufactured on-site, which reduces transportation costs and increases the local content of a project.

First tested with the AW1500 platform nine years ago, concrete towers were developed primarily for use with the AW3000, starting with a 100 meter option

and now expanding to 120 and 137.5 meter hub heights. As of the end of June 2015, there were over 287 ACCIONA concrete towers installed with another 350 to be installed as part of contracted sales.

The design is fully certified, and ACCIONA has developed experience building towers in local on-site facilities in different countries.

## Main Advantages

- Meets local content requirements in markets where this is compulsory.
- Saves on transportation costs with towers made on-site.
- Wider base section for increased working area.
- Smaller foundations than a comparable steel tower.
- No maintenance.





ACCIONA Blades Plant, Spain

Our own technology in wind turbine blades

# IN-HOUSE BLADE MANUFACTURING TECHNOLOGY

Because blades are a critical component of the wind turbine, ACCIONA has developed the capacity to design and manufacture high-performance blades in-house.

In 2007, ACCIONA Blades was founded to manufacture wind turbine blades for ACCIONA Windpower.

Located in Lumbier, Spain, ACCIONA Blades can produce blades from 34 to 64.7 meters in a state-

of-the-art facility using the latest technologies.

ACCIONA Windpower also has relationships with third-party blade suppliers that build to the ACCIONA design.

## AW3000 - AW1500. Blade lengths

AW 116/3000



56.7 m

AW 125/3000



61.2 m

AW 132/3000



64.7 m

AW 70/1500



34 m

AW 77/1500



37.5 m

AW 82/1500



40.3 m



To obtain the highest profitability from your investment

## THE LOWEST COST OF ENERGY

At ACCIONA Windpower, we understand that to be successful in the marketplace, our products must result in the lowest COE for our customers. Hence, in 2012 we launched an initiative called "COE 20-14" to reduce COE 20% by 2014.

In 2013-2014, we have exceeded our goals, reaching cost of energy savings of 28% over the period, and we are now aiming to achieve 16% additional savings in the next two years. Paramount to the initiative has been to maintain the highest standards of quality while lowering COE. The company was able to creatively develop cost-saving

solutions in areas such as balance of plant, energy production, transportation, and purchasing to accomplish the objectives.

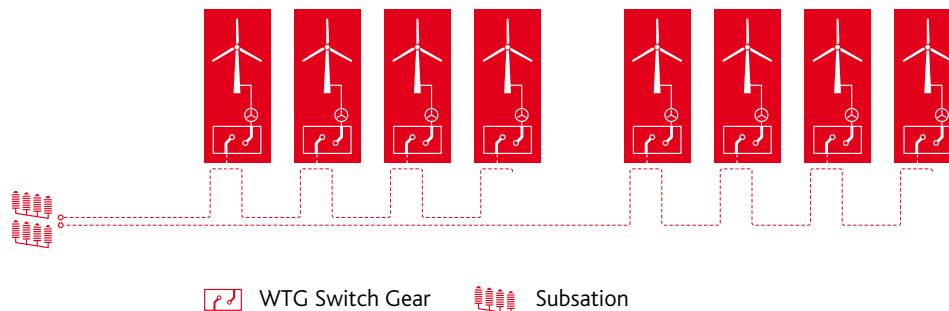
As a result of this effort, we are able to offer products with optimal performance and attractive pricing to allow our customers to maximize their return on investment.





A unique opportunity to realize efficiencies

## MEDIUM-VOLTAGE GENERATION



PUNTA PALMERAS Wind Farm  
45 MW, Chile  
AW 116/3000

ACCIONA Windpower turbines are designed to generate at 12,000 volts, rather than 690 volts, which is more common for other manufacturers.

This design choice of medium voltage generation was based on years of successful experience with hydroelectric power plants and provides a unique opportunity to realize efficiencies with our wind turbines. For wind farms that are in close proximity to a substation

for connecting the project to the grid (<5km) this technology could save a project developer significant costs with the correct design optimization:

- Cost savings of up to 50% in power collection infrastructure.
- An average increase in production of 1% due to the losses avoided through the use of a transformer.
- Avoidance of maintenance and potential transformer failures.

To obtain the highest profitability from your investment

# WARRANTY SERVICES

ACCIONA Windpower offers comprehensive services packages that give customers additional confidence in the performance of our equipment. In conjunction with O&M Services, the warranty packages may include guarantees around power curve, sound, and

availability in addition to mechanical defect failures, should they occur.

For owners or developers who are looking for the ultimate protection, ACCIONA Windpower can provide long-term “bumper-to-bumper” warranty

coverage for terms of 15 years or even longer.

We understand that different customers have different needs. ACCIONA has the flexibility to offer customers the exact scope of service they need. We offer a range of service options.

Service Options

- Technical support.
- Preventive maintenance.
- Small corrective maintenance.
- Major components maintenance.
- Full-service maintenance.
- Customized maintenance services.





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# ACCIONA Windpower

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