solute

Mechanical
Loads Analysis

About SOLUTE

SOLUTE is a multidisciplinary technical engineering consultancy with over 15 years of experience, headquartered in Madrid, with branches in Barcelona, Badajoz, and Toledo.

Throughout our history, we have primarily specialized in the renewable energy sector, particularly in the wind industry, where our capabilities cover all phases of wind farm development. Other sectors in which we specialize include automotive, solar energy, software development, weather forecasting services, and virtual reality, among others. This, along with the development of projects in more than 20 countries and for some of the most important clients in the sectors in which we operate, endorses us as one of the leading engineering consultancies in our country.

Our mission is to provide multidisciplinary solutions on a global scale, through the technical rigor and expertise of our engineers, ensuring the quality and excellence of our work in every project.

We highlight R&D&I as one of the main drivers of SOLUTE, as since the company's inception, we have launched several in-house developed tools, which are now offered as products to our clients. Some of these are Furow, a comprehensive wind resource software; Aphelion, a platform for weather and energy forecasting services applied to the wind sector; and EVE, our suite of virtualization services in industrial environments.

We believe that the best solutions are achieved as a team

Aeroelastic load calculation

New products development

Aeroelastic models

Aeroelastic models generation through the compilation of the machine definition parameters (tower, foundations, nacelle, rotor and blades): geometric dimensions of each tower section and its mass distribution, characteristic modules of the used materials. Hub and nacelle geometric dimensions, mass distribution and stiffness, inertia, aerodynamic coefficient, geometric and structural definition of the blade and polars (thrust, drag and lift according to the angles of attack) that are determined by the aerodynamic profiles geometry.

Usage of several codes, both commercial (such as Bladed, Flex5 Hawc2) and free (FAST), or even the manufacturer's in-house developed models.

Models translation to different codes. Validation based on the effective correlation of the obtained results.

Offshore

Complete analysis of loads for fix or floating substructures, including additional hydrodynamic loads originated by waves, currents and tides.

Meta oceanic data processing in order to define load cases (dispersion model, extreme values, etc.)

Complete analysis of floating turbines loads, considering the dynamic and Strip Theory relevant loads effects, as well as the dynamic analysis of anchoring lines.

Control adjustment

Checking of the operation modes, nominal and extreme values of certain parameters under which the wind turbine must be operating. Through the application of specific global statistical analysis, as well as specific time series detailed analysis, it can be verified if the control and wind turbine operation are appropriate or if some adjustments must be performed.

Frequencies analysis, Campbell diagrams.

Verification of existent margins between natural and excitation frequencies and evaluation of the results on the control adjustment according to the analyzed modes,

Study of new components designs

Analysis of the wind turbine loads when some of the components are redesigned. Not only the redesigned component but also all the rest are again analyzed from a loads perspective to validate if the wind turbine is still suitable.

Sensitivity studies regarding to some of the win¬¬¬d turbine specific parameters in relation to the strategy definition and decision-making process.

Power curves calculation

Generation and analysis through the work with a large number of simulations that try to cover all the possible scenarios over which the wind turbine could be operating. In that sense, a wide range of wind conditions (density, shear and turbulence intensity) is considered.
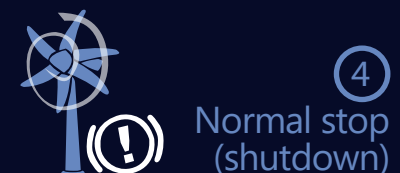
Wind farm evaluation

Calculation of site-specific loads. Analysis of the site-specific conditions (wind definition, layout) and creation of wind farm files and load cases under IEC standard. Generation of time series and calculation of extreme and fatigue loads through the use of several post-processing, methods and components analysis tools.

Lifetime extension studies. Analysis of the implementation of strategies that, on one hand, do not negatively affect production and, on the other hand, allow to extend the wind turbine lifetime. Analysis of the impact of these strategies on the loads that imply changes in the control strategies, in order to make appropriate decisions.

Databases generation

Preprocessing and post-processing tools for the data specific management, the automation of processes and the achievement of productivity and traceability improvements. Effective management of a large volume of load cases and a wide range of conditions.

Documentation. Generation of all the technical documentation that is necessary to present to the previously accorded certification entity.

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1 Production

2 Fault occurrence during production

3 Start up

4 Normal stop (shutdown)

5 Emergency shutdown

6 Idling

7 Fault occurrence while parked

8 Transport, assembly, maintenance and repair

Our products

Our mission is delivering solutions on a global, multidisciplinary level through our technical rigor and our engineers´ knowledge, with R&D as our backbone.

The result of more than 15 years listening to different stakeholders´ problems is the development of products for the renewable energy industry, in the shape of software, hardware and services.
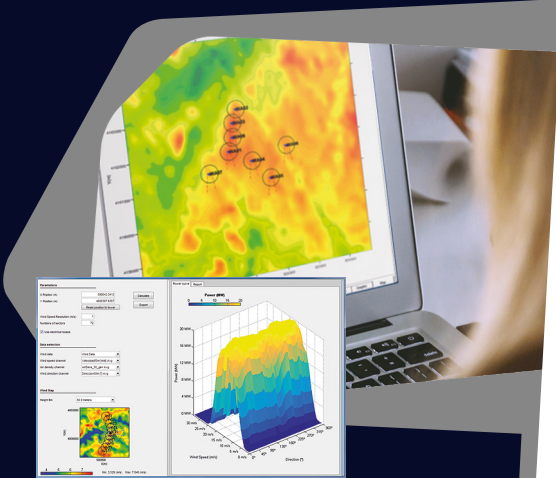
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furow~

WRA and Wind farm design software

Furow is a complete and exhaustive wind energy software, which possesses features directly with wind resource assessment calculations, wind farm modelling and project development at any given stage. Furthermore, its compatibility is flexible while working with other software, therefore, allowing users easy access to share and compare information

- Data analysis
- Wind resource assessment calculation (lineal model &CFD)
- Micrositing

aphelion

Multi-function weather and energy forecast software

Our meteorologists, data scientists, and software engineers are specialized in tools optimization in order to obtain the most accurate forecast for a wide variety of projects and clients.

From a high-resolution forecast, Aphelion offers meteorological and energy forecast as well as climate consultancy within a two-weeks' time horizon. Moreover, these capacities can be useful for both companydriven and particular-driven services.

Hybrid forecast model + Machine Learning

- ► Up to four multi-view maps with different models and variables
- ► Extensive range weather forecast (up to 16 days)
- ► Short-term weather forecast (0-72 hours)
- ► Four daily forecast updates and detailed meteograms

Aphelion Wind

- ► Automatic software with +5 machine learning architectures and ad-hoc features
- ► Wind farm and wind turbine forecast
- ► Customizable forecast ranges, updates, granularity, and time resolution
- ► ML models can calculate uncertainty estimations for production assessment scenarios (p90, p10, among others)

EVE

Enhanced Virtual Environments

Virtualization and digitalization services for industrial sectors

- High detail 3D laser scanning
- Virtual tours with embedded technical information
- Maintenance tasks digitalized in tablet device for field guidance
- VR platform for operation and emergency instruction
- Multi device and multiplayer options

EOLIAN

Predictive maintenance plaftorm for renewable farms

Deep Learning on the Edge and IA algorithms combined for an optimization of the maintenance interventions in renewable energy farms

- Asset sensorization and monitoring
- Remote cloud monitoring
- Predictive maintenance IA algorithms
- Big data techniques for traceability, accessibility and analysis
- Real-time processed on edge data uploaded to servers (IoT+edge computing)

TSRWIND

Comprehensive wind turbine inspection

TSR Inspector

TSR Wind customers' cloud software platform for inspection data processing and management.

EOLOS

External blade inspection robot with high resolution photo camera, capable of climbing any metal surface by permanent magnets

CERBERUS

Remote inspection of blade interiors by small mobile robot with 3 high resolution video cameras to access impossible places for technicians.

KRATOS

Bidirectional magnetic coupling robot designed to climb any metal surface and follow the welding cords using an NDT ultrasound equipment

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