



solute

Wind Resource Assessment

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.

Wind farm development

SOLUTE offers complete plant design engineering services, providing its experience in project management, coordination and analysis with different ranges, that allows the company to take charge of any stage or task within them.

Measurement campaigns management through the installation of SODAR, LIDAR and meteorological masts, attending to MEASNET certification criteria.

Wind resource calculation by means of the **location physical modeling**, the analysis of the wind data for each mast, the class and subclass evaluation in the measurement points, the wind energy mapping of the location, the layout preparation and the energy calculation through uncertainty analysis.

Usage of FUROW for the plant layout optimization, through the continuous recalculation of the energy generated by the plant over different distributions.

Complete plant infrastructure: internal access roads layout, platforms, foundations, connection to existing roads, electric grid, electric substations and electrical network connection. **Optimization** through the balance between economic-financial studies and design criteria. Usage of the Civil-3D software tools for the design and FUROW for energy optimization. Detail

design through a representation system. **Usage of BIM** for the design management, cost calculation, etc.

Edition of the wind farm technical documentation for public tenders and private development over different types of projects:

Preliminary studies for tender

- Wind resource studies
- Civil and electric preliminary designs
- CAPEX estimation

Basics projects for processing

- Restriction studies: environmental, aerial or sea navigation in the case of offshore plants, distribution lines, patrimony, archeology, etc.
- Micrositing and layout review depending on affections
- Machinery selection and production recalculation
- Basic civil and electrical design
- Layout optimization according to CAPEX vs. production
- Decommissioning plan, drawings, measurements and budget

Building and detail projects

- Review of inquiries to different organisms during the processing period
- Final layout definition
- Detail electric and civil design
- Foundation design and calculation based on load calculations
- Drawings, reports, budget and calculation annex
- Final budget
- Safety and health project



Wind resource evaluation through Furow

FUROW is a software that collects all modules and functionalities required to perform a wind farm promotion since the beginning of a wind resource measurement campaign through several sources. Self-developed by SOLUTE and certified by Tüv-Sud, its objective is to evaluate wind energy resource, carrying out meteorological data inspection and processing in order to analyze the wind behaviour.

It compiles all kind of atmospheric variables gathered during a measurement campaign, both through meteorological towers or remote measurement devices (SODAR or LIDAR), as well as data from other models.

It carries out vertical extrapolations and statistic analysis in order to determine the atmospheric behaviour in a measurable point that can be selected among other options, allowing to get estimations of the atmospheric variables.

It gets synthetic variables through mathematical operations obtained from the measured variables. As a result, it is possible to obtain the maximum knowledge as possible of the location from the measured meteorological data.

It is a self-developed wind energy resource calculation engine, composed by two different models: a lineal model, and a fluid dynamic model, for locations that show a complex orography and/or a high roughness.

Versatility: it offers wind resource studies and evaluation of orography of any level of complexity.

Sensibility studies for each meteorological variable in any map coordinate.

The software's output provides with the necessary knowledge for the wind farm design and its adaptation to the location characteristics, through the determination of the wind conditions in all its parts, the restrictions of that environment and the necessary class of the devices.

Optimization module. It allows to introduce restrictions within the location studies (such as buildings, roads, HV lines). This module makes it possible to optimize the plant performance in order to maximize its production, considering the trails effects

Energy module. It calculates the production of each machine and plant, as well as it provides a compiling

report including all the orographic, meteorological and yield results It includes 7 different wake models.

Class and subclass study module. It evaluates the parameters that determine the class and subclass of each wind turbine, as well as it includes the Wind Sector Management strategies design. This analysis is carried out in comparison to different editions of the IEC, including edition 4.

Environmental impact modules. Noise and shadow flicker impact are analyzed to be contrasted with the national, regional or local regulations of the location.

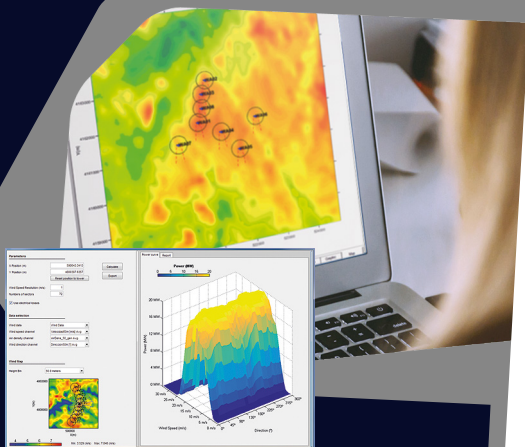
Financial module. It allows the introduction of the estimated economic and financial inputs for the promotion and subsequent construction of the plan, as well as hypothesis about its functioning: estimation of the wind farm lifetime, energy rates, etc. It solves the economic and financial flows and return financial parameters such as the Net Present Value or the Internal Rate of Return (LCOE).



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



Predictive maintenance platform 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)



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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