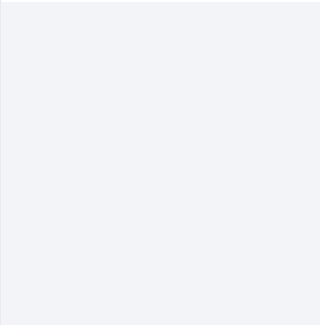





 **PRO5**

Engineering
for good



About

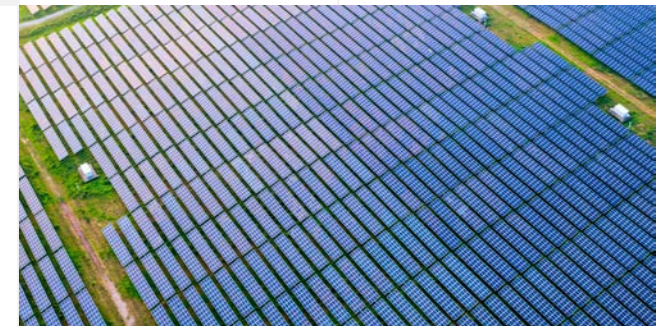
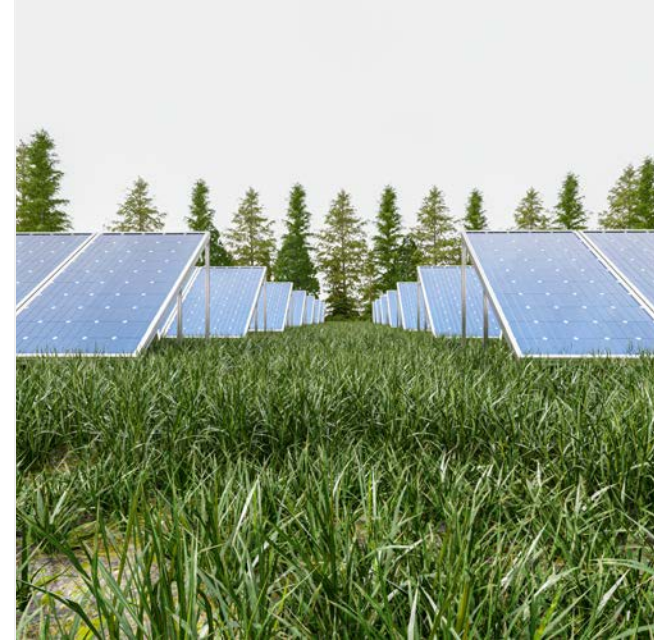
We are PRO5

An independent engineering consultancy specialized in the design and engineering of large PV plants.

About us

We have been working with the leading suppliers of trackers and EPC for more than 15 years, offering a service of maximum reliability and competitiveness.

We offer a high-quality, flexible, honest international service with the utmost confidentiality.



About

Mission

Mission

Our mission is to be an international benchmark in civil and structural photovoltaic engineering, designing the best possible tomorrow for our customers and our planet.

We facilitate long-term relationships with our customers, working like their own in-house engineering teams and helping to reduce their operating costs.



We design the best possible future for our customers and our planet.



Our customers

We work with the leading suppliers of trackers and EPC, offering a service of maximum quality and confidentiality.

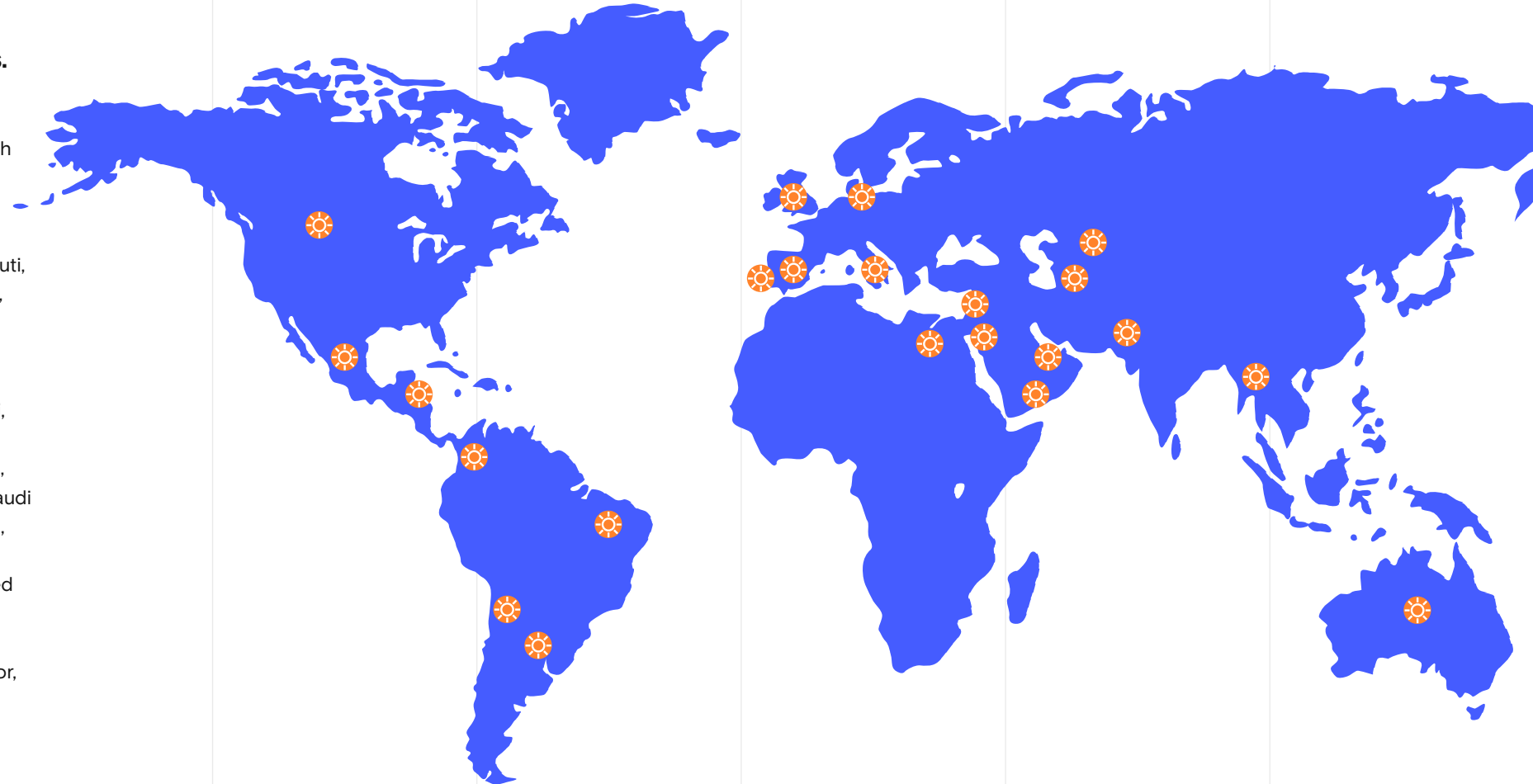
We offer our services both on an occasional basis and on an ongoing basis through long-term agreements (MSA).

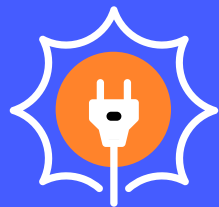


Our work defines us

88 countries. 5 continents.

Australia, China, India, Indonesia, Malaysia, Pakistan, Philippines, South Korea, Sri Lanka, Thailand, Vietnam, Albania, Algeria, Angola, Armenia, Azerbaijan, Benin, Bulgaria, Burkina Faso, Chad, Cyprus, Denmark, Djibouti, Egypt, Ethiopia, France, Gambia, Georgia, Germany, Ghana, Greece, Hungary, Irak, Ireland, Israel, Italy, Jordan, Kazakhstan, Kenya, Kuwait, Lebanon, Lesotho, Lithuania, Malawi, Morocco, Mozambique, Namibia, Netherlands, Nigeria, Norway, Oman, Poland, Portugal, Qatar, Romania, Saudi Arabia, Senegal, South Africa, Spain, Sweden, Tunisia, Turkey, Uganda, Ukraine, United Arab Emirates, United Kingdom, Uzbekistan, Zambia, Zimbabwe, Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Suriname, Trinidad and Tobago, Uruguay, Canada, United States of America



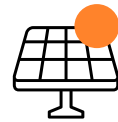


+13 GW

installed in 22 countries worldwide.

Services

We offer a high-quality, flexible, honest international service with the utmost confidentiality



STRUCTURAL ENGINEERING OF SOLAR PHOTOVOLTAIC PLANTS

- Application of structural regulations in each country
- Wind speed and snow load reports
- Structure external loads
- Analysis and application of wind tunnel result
- Calculation and verification of the superstructure
- Calculation and verification of the foundation
- Load test analysis
- Analysis of the effect of environmental and soil corrosion
- Monitoring the execution of the work
- Geological and geotechnical analysis
- Review of reports of structures and foundation of third parties

CIVIL ENGINEERING OF SOLAR PHOTOVOLTAIC PLANTS

- Design and optimization of the project layout
- Fitting of the structure in the ground
- Calculation and optimization of earthworks
- Design and calculation of the drainage system
- Design and calculation of internal roads and platforms
- Review of third party's calculations and design



STRUCTURAL ENGINEERING OF SOLAR PHOTOVOLTAIC PLANTS

Application of structural regulations in each country

We have proven experience in international projects. This has provided us with deep knowledge of each country's different regulations and codes. In addition, we have a network of local engineers who certify and validate projects with the relevant authorities.

Wind speed and snow load reports

We carry out a study of wind speed and site-specific conditions, analyzing elements such as exposure or orography. In this way, we obtain the wind speeds for the plant's design and calculate the pressures and loads to which the structure will be subjected.

Structure external loads

We approach the calculations of external loads according to each country's legislation, using the previous studies of the loads to which the structure is subjected, such as wind, snow, temperature, earthquakes, etc. We calculate wind loads in two ways:

Without wind tunnel

We use the local code and form coefficients applicable to the country regulations to obtain the loads and reactions on the piers of the structure.

With wind tunnel

We rely on the coefficients provided by the customer to perform the aeroelastic calculations of the structure, using the loads distributed throughout it to obtain the reactions on the foundation.

Analysis and application of wind tunnel result

Over the past 15 years, PRO5 members have witnessed and participated in the evolution of wind tunnels, both conceptually and in terms of results. This allows us to apply the coefficients obtained to the formulation of the corresponding structural regulations with maximum reliability. In addition, we help our customers to analyze the results and optimize them for subsequent structural design.

Calculation and verification of the superstructure

We use the loads obtained to verify the structure and the joints proposed by the customer, checking if it complies with the provisions or if it is oversized, in which case we suggest its optimization.

We calculate and verify the components of the structure above ground level with the loads previously obtained. We analyze the behavior of the different steel sections according to local regulations, validating the proposals by the customer or proposing their optimization in case they are oversized.

Thanks to our deep knowledge and continuous updating of international regulations, our calculations provide the most competitive structures according to current regulations.

Calculation and verification of the foundation

We rely on the loads acting on the piers, the terrain conditions and the local regulations to determine the most appropriate type of foundation for the project. Then, we carry out the structural verification of the different sections used.

Our geotechnical knowledge is based on our own experience throughout the planet, as we had the opportunity to face soils with a wide variety of problems; from the expansive clays of Australia to the frozen soils of Canada, the deserts of Saudi Arabia or the peat soils of Denmark.

Load test analysis

We perform a complete and thorough analysis of load testing campaigns, both for design (destructive) and for verification during execution (non-destructive).

We adjust the terrain modeled in a preliminary phase to the actual behavior of the soil obtained in the load test. In this way, we achieve the most competitive final design, based on real results of soil-foundation interaction.

We specialize in analyzing the viability of direct driving or the need for drilling to install the piers. Our experience tells us that the capacity of the terrain to be driven is one of the most delicate aspects when building. This is why we advise our customers and help them to plan the construction with all the guarantees.

Analysis of the effect of environmental and soil corrosion

We analyze the possible impact of environmental factors and the chemical composition of the soil, both in the design of the foundations and the structures. We work daily on international projects with different regulations, making estimates of corrosivity with American, Australian or European regulations, among others. After more than 10 years of carrying out bibliographic studies on all continents, we have reached a level of differential expertise in the design of foundations consisting of steel piers.

Monitoring the execution of the work

We support our customers during the execution of the design on site, solving the possible questions about the installation or possible unforeseen events related to geotechnical conditions. In this way, we offer constant support and provide a specific solution according to the loads and the terrain.

Geological and geotechnical analysis

We had the fortune to face all kinds of soils throughout the planet; from marshy ground reclaimed from the sea to liquefiable soils. Almost every day, we receive and analyze geotechnical reports from around the world, assessing risks and identifying gaps to ensure the success of our customers' projects.

All this accumulated knowledge allows us to adapt the geotechnical tests to the reality of the solar plant with very high consistency and reliability.

In addition, we also develop technical specifications for pier load tests, always tailored to our customers and taking into account the characteristics of the tracker installed.

These tests facilitate the selection and final design of the foundation of the project: direct driving, pre-drilling or concrete pile.

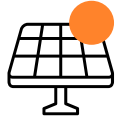
Review of reports of structures and foundation of third parties

We review the design and projects carried out by third parties to give our customers a second opinion, helping them to continue with the following stages of their projects with maximum guarantees.

Thanks to our international experience, our review processes are fast and efficient.



Services



CIVIL ENGINEERING OF SOLAR PHOTOVOLTAIC PLANTS

Design and optimization of the project layout

We carry out the plant's layout and general design integrating all the disciplines that make up the project: civil, structural, and electrical.

Fitting of the structure in the ground

We calculate the height of each pier in the ground, which facilitates the installation of the structures and avoids issues or increases in costs during installation.

We provide the data in such a way that, using the current equipment, the installation of the piers is executed in the most automatic way possible. In addition, in this way, the correct installation of the rest of the structure is guaranteed.

Calculation and optimization of earthworks

The analysis of the earthworks is carried out by taking into account the constraints of the structure, the limiting slope it supports in different directions, and the height tolerances on the ground of the different supports or piers.

Possible specifications or preferences on the part of the customer are also taken into account, such as volumetric compensation or the reduction of the difference in height between adjacent N/S trackers (north/south).

We minimize civil works costs by minimizing earthworks.

To do this, we avoid generalized leveling and thoroughly analyze all trackers and their interdependence.

Design and calculation of the drainage system

We carry out the design and calculations of the drainage system, always taking into account the following elements:

- Size and arrangement of the ditches
- Road and internal road protections
- Measures against erosion
- Mitigation of flood areas
- Rainfall and hydrological conditions of the place
- Analysis of the drainage basins received by the plant
- Etc.

Design and calculation of internal roads and platforms

We calculate the vertical geometry and the impact on the ground, based on the plan geometry of the general layout and the proposed type section for the internal roads. We also calculate the platforms of elements such as the substation, the inverter pads or the auxiliary buildings.

Review of third party's calculations and design

We review the design and projects of third parties, helping our customers to continue their projects with maximum guarantees. Thanks to our international experience, our review processes are fast and efficient.



Contact

Let's make things happen. Let's talk.

Let's see how we can help you.

You can find us at Av. de Brasil 17,
planta 17, 28020 Madrid (España)
or email us at
info@pro5engineers.com

 **PRO5**