TECNALIA · **LAB_SERVICES**

TESTING LABORATORIES FOR T&D NETWORKS AND SMART GRIDS

tecnalia

MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

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TESTING LABORATORIES FOR **T&D NETWORKS AND SMART GRIDS**

INGRID IS A NEW **TECHNOLOGICALLY ADVANCED EXPERIMENTAL INFRASTRUCTURE** DESIGNED AND ORIENTED TO MEET THE NEEDS OF ELECTRICAL EQUIPMENT MANUFACTURERS AND UTILITIES IN THE **SPECIFICATION, DEVELOPMENT, VALIDATION AND COMMERCIALISATION OF INNOVATIVE PRODUCTS FOR THE T&D NETWORKS AND THE SMART GRIDS.**

InGRID´s platforms and laboratories integrate the traditional electrical engineering capabilities with advanced power electronics and ICTs technologies, to cope with the needs of new "Smart" product development for the future Smart Grids.

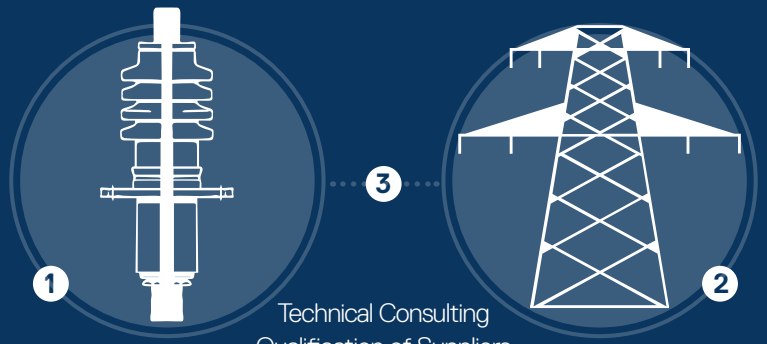
InGRID allows electrical equipment manufacturers to validate their new developments, **from the prototype stage to the final product**, in specifically designed facilities. InGRID allows utilities to evaluate the equipment **performance and functionality** for their massive deployment into the grid ensuring their **safety and reliability**.

Founding member of BELA

bela
Basque Electrical Laboratories Alliance

CONFORMITY ASSESSMENT OF **ELECTRICAL EQUIPMENT FOR TRANSMISSION AND DISTRIBUTION NETWORKS, SMART GRIDS AND INDUSTRIAL USE.**

SERVICES



Technical Consulting
Qualification of Suppliers
Failure Diagnosis

LABORATORY

Type tests of electrical products according to standards, regulations and specifications.

IN-SITU

Diagnosis Testing, predictive maintenance and commissioning.

InGRID is an experimental infrastructure of testing laboratories adapted to new developments, with a forward-looking vision of development and evolution of grids and technologies, in close contact with the industry and the global scientific community.

InGRID LABORATORIES

TECNALIA's new experimental infrastructure for Smart Grids is based on a series of laboratories for cutting-edge research on electrical system technologies. They will be used to manage electric power more efficiently and smartly throughout the entire process - generation, transmission and distribution, until it reaches the end user:

- → **Power Laboratory**
  Laboratory connected to the transmission network at 220 kV. The largest independent Power Laboratory in Spain and Portugal.
- → **High Voltage Laboratory**
  Two Test Bays for executing dielectric tests for High Voltage Products - up to 362 kV.
- → **Temperature-Rise and Environmental Laboratory**
  Temperature-rise, Climatic and Mechanical tests to complete full type testing.
- → **Power Electronics Laboratory and Microgrid**
  Flexible power sources and LV microgrid to simulate conditions for the testing of power electronics equipment (PV inverters, wind converters, electrical energy storage, electric vehicle, active filters for Smart Grids, ...).
- → **Electronic Devices Laboratory**
  Immunity and emission testing for electric-electronic low voltage products and for communications. Measurements of radio acceptance for telecommunications equipment.
- → **Data and Protocols Smart Metering Laboratory**
  International reference laboratory for certification for Smart Meters and Data Concentrators.

InGRID IS TECNALIA´S COMMITMENT WITH THE ELECTRIC POWER INDUSTRY IN TESTING & RESEARCH FOR SMART GRIDS.

- → **Data and Protocols Smart Grids Laboratory**
  Functional and interoperability assessment of products for Smart Grids. Development and evaluation of solutions for transformation centres automation and monitoring.
- → **On Site-Testing Laboratory**
  Diagnosis and predictive maintenance of large electrical equipment -generators & power transformers, installed in power and industrial plants.
- → **Resonant System for High Voltage Cables**
  Variable frequency resonant system WRV 260/80 that allows to test on-site cables up to 400 kV rated voltage. Experts in on-site measurements of partial discharges.

POWER LABORATORY

CAPABILITIES

Power output: 300 MVA, 1 s.

Current at Medium Voltage (2.8 to 38,5 kV): Up to 40 kA [1].

- Making and breaking: inductive, capacitive and transfer currents.
- Short-circuit making capacity.
- Short-circuit breaking capacity.
- Internal arc / Short-time withstand current tests.
- Ability to withstand short circuits of distribution/ power transformers.

Current at Low Voltage (from 30 to 1000 V): Up to 200 kA.

- Short time and peak withstand current tests.
- Making and breaking capacities.
- Internal arcing.

[1] Decreasing with voltage.

The largest third-party Power Laboratory in Spain and Portugal. Connected to the transmission network at 220 kV.

TESTED PRODUCTS

- Distribution Transformers.
- Instrument Transformers.
- Transformation Centres.
- Low and Medium Voltage Switchgear.
- Low Voltage Boards.
- Fuse links and fuse bases.
- Measuring, Protection and Control Equipment.
- Safety Equipment and Materials.
- Cables and Accessories.
- Connectors.
- Power Electronic Equipment.
- Busbars.
- Resistor banks.

HIGH VOLTAGE LABORATORY

CAPABILITIES

Test Bay 1:

- Power Frequency Voltage (dry and wet): 300 kV.
- Lightning Impulse Voltage: 800 kV.
- DC voltage: 100 kV.

Test Bay 2:

- Power Frequency Voltage (dry and wet): 550 kV.
- Lightning Impulse Voltage: 1.800 kV.
- DC voltage: 200 kV.

Fully shielded room for High Voltage Tests.

TESTED PRODUCTS

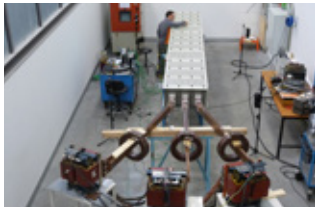
- Distribution Transformers.
- Instrument Transformers.
- MV & HV Cables and Accesories.
- Medium and High Voltage Switchgear.
- Fuse links and fuse bases.
- Insulators and Bushings.
- Overhead line fittings.
- Measuring, Protection and Control Equipment.
- Safety Equipment and Materials.
- Insulating materials.
- Capacitors and Resistors.
- Power Electronic Equipment.

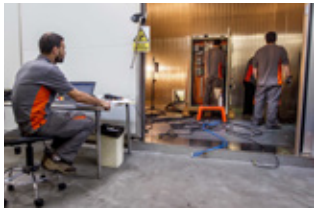
Two Test Bays for dielectric tests:

Test Bay 1 for Medium Voltage Products (up to 72.5 kV).

Test Bay 2 for High Voltage Products (up to 362 kV).

TEMPERATURE-RISE AND ENVIRONMENTAL LABORATORY

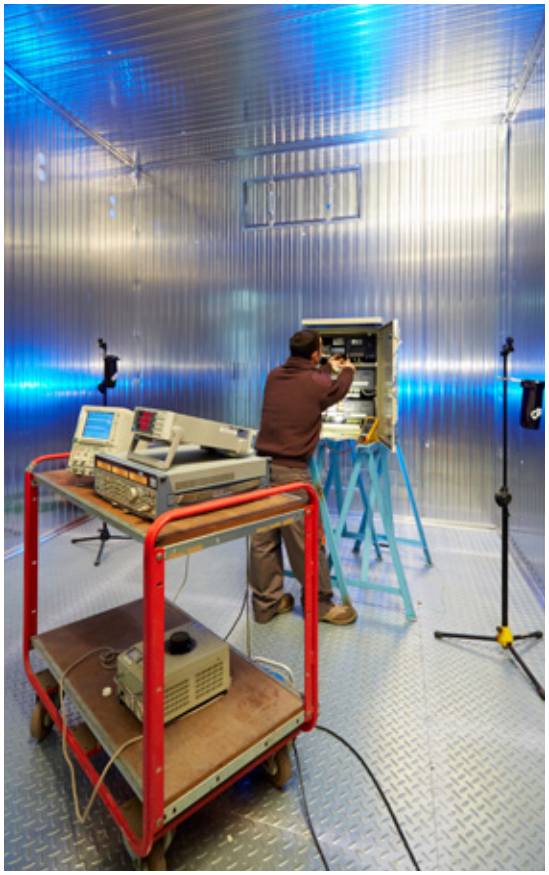




LOW VOLTAGE, CLIMATIC AND MECHANICAL TESTS.

CAPABILITIES

- Current for temperature-rise runs up to 12,000 A.
- Small climatic chambers:
  - Temperature -70 to 180ºC.
  - Humidity 10 to 98%.
- Large climatic chambers:
  - Dimensions 4,2 x 3 x 2,6 m.
  - Temperature -45 to 85ºC.
- Large chamber:
  - Dimensions 5.5 x 4 x 4 m.
  - Temperature -25 to 70ºC.
- Dust, salt spray corrosion chambers.
- Vibration table from 1 to 2000 Hz and 70 g.



Capabilities for full Type Testing of electrical products.

TESTED PRODUCTS

- Distribution Transformers.
- Instrument Transformers.
- Transformation Centres.
- Low and Medium Voltage Switchgear.
- Low Voltage Boards.
- Low Voltage switches and breakers.
- Fuse links and fuse bases.
- Measuring, Protection and Control Equipment.
- Cables and Accessories.
- Connectors.
- Power Electronic Equipment.

POWER ELECTRONICS LABORATORY AND MICROGRID

CAPABILITIES

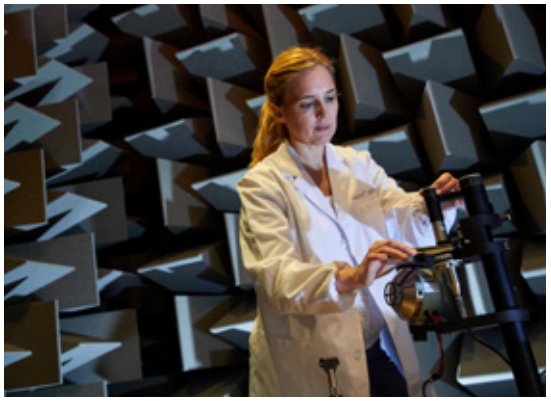
- Electric network management and operation.
  - Integration of Distributed Generation, storage and Electric Vehicles.
  - Active Demand Side Management.
  - Monitoring and supervision of MV/LV grid, based on AMI infrastructure.
- Advanced energy systems architecture: microgrids for energy efficiency improvement in urban areas and remote locations.
- Energy storage: power converters, control strategy and systems.
- Data analytics for network management and other smart grids applications.
- Final use of energy optimization:
  - Smart energy management in buildings.
  - MicroCHP economic dispatching.
  - Smart analytics of consumption patterns and demand flexibility.
- Economic models and cost-benefit analysis for energy markets from the perspective of different stakeholders.
- Cybersecurity and data privacy applied to Smart Grids.

LOW VOLTAGE FLEXIBLE MICROGRID

Control of voltage, current and frequency, voltage dips generation, anti-islanding operation.

- AC fixed source 450 kW.
- AC adjustable source 165 kW.
- DC sources 150 and 300 kW.
- RCL loads for Q > 2.5.

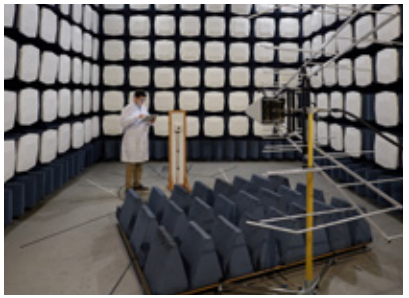
ELECTRONIC DEVICES LABORATORY



Immunity and emission testing for electric-electronic low voltage products and for communications.

Measurements of radio acceptance for telecommunications equipment.

Notified Body for EMC Directive.



CAPABILITIES

Anechoic certification chamber:

- Full compliance with CISPR 16-1-4 (NSA) in 3 m measuring distance.
- Frequency range of 50 Hz to 13 GHz.
- 2 m turntable.

Faraday chambers to measure conducted emission and immunity.

Anechoic precertification chamber for R&D.

Immunity and emission testing for electric-electronic low voltage products and for communications.

Measurements of radio acceptance for telecommunications equipment.

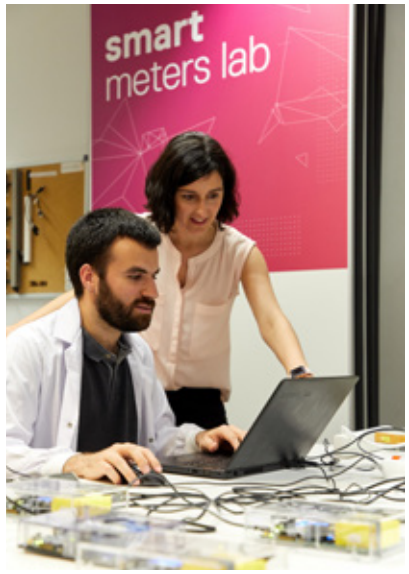
Notified Body for EMC Directive.

TESTED PRODUCTS

- Measuring, Protection and Control Equipment.
- Protection and auxiliary relays.
- Inverters and Chargers.
- Smart Meters.
- Telecommunications equipment.
- Switchgear and controlgear.
- Household appliances.
- Professional electronic equipment.

DATA & PROTOCOLS SMART METERING LABORATORY

International reference laboratory for certification of Smart Meters and Data Concentrators. Development and evaluation of solutions for automation and monitoring of transformation centres.



CAPABILITIES

- Certification tests:
  - Integration of Distributed Generation, Storage and Electric Vehicles.
  - Active Demand Side Management.
  - Monitoring and supervision of MV/LV grid, based on AMI infrastructure.
- Additional tests: CENELEC, EMC, climatic, etc.
- Interoperability Tests & Communications Performance in real environment.
- Product Development Tests.
- Development and commercialisation of testing tools: PRIME, DLMS, ...
- Technical assistance and Consulting Services.

TESTED PRODUCTS

- Smart Meters.
- Data Concentrators.
- Modems, chipsets, integrated circuits and evaluation boards.
- Auxiliaries: filters, attenuators, cables.

PRIME ALLIANCE

dlms device language message specification ™

meters and more OPEN TECHNOLOGIES ASSOCIATED MEMBER

G3-PLC Alliance

tecnalia certification

DATA & PROTOCOLS SMART GRIDS LABORATORY

Functional and interoperability assessment of products for Smart Grids.

CAPABILITIES

TECNALIA supports electrical equipment manufacturers and utilities in the development of new products and ensures compliance with:

- Standards used in electrical substation automation.
- PLC-LV and PLC-MV technologies for Smart Grid services.
- Standards used for telecontrol in electrical networks and power system automation applications.
- Protocols associated with Demand Management.
- Protocols associated with Electric Vehicle communications and network integration.
- Standards used in control and monitoring of wind farms.
- RTU functionality tests, Chargers and Control Relays for Medium Voltage installations.
- Certification tests:
  - IEC 61850 certification according to UCA Edition 2 Server Test Procedure.
- RTU functionality tests, Chargers and Control Relays for Medium Voltage installations.

Deeper studies could be completed in order to model and characterize the old grid that uses new PLC communications.

PRODUCTS

- Remote Terminal Units (RTU) and Monitoring Relays for Medium Voltage installations.
- Chargers / Rectifiers for Low and Medium Voltage installations.
- Telemanagement Cabinets.

UCA International Users Group

IEC 61850 users group

ON-SITE TESTING LABORATORY

CAPABILITIES

Rotating Machines:

- Dielectric insulation testing of windings: polarization index, leakage current, HIPOT at AC and DC, measurement of tan delta and partial discharges, TVA; ohmic resistance.
- Evaluation of the magnetic core; EL CID test.
- Verification of RTDs and thermocouples and instrument transformers.
- Commissioning Tests of hydraulic generators: No-load, permanent and sudden short-circuit, determination of characteristic values, Mordey curves.

20 years experience in the diagnosis and predictive maintenance of large electrical equipment installed in more than 70 power plants, industries and substations.

Power Transformers:

- Capacitance and Tan Delta of bushings.
- Capacitance and Tan Delta of windings.
- Insulation resistance and polarization index of windings.
- Ohmic resistance of windings.
- Characterization of magnetic core.
- FRA - Frequency Response Analysis.
- FDS - Frequency Domain Spectroscopy.
- Transformation ratio.
- Recovery voltage.
- Short-circuit impedance.

TESTED PRODUCTS

- Large rotating machines installed in:
  - Nuclear power plants.
  - Thermal power plants.
  - Combined Cycles.
  - Hydroelectric power plants.
  - Industrial plants.
- Power transformers in substations and industrial plants.

RESONANT SYSTEM FOR HIGH VOLTAGE CABLES

CAPABILITIES

- Maximum voltage: 260 kV.
- Maximum current: 80 A.
- Frequency Range: 20-300 Hz.

Capacity to energize cables from 45 to 400 kV rated voltage and maximum lengths up to 12 km [1].

Possibility of testing higher voltage cables and longer lengths using various resonant systems through collaborative agreements with other entities.

[1] Depending on the actual capacitance of the cable.

TEST RANGE

- Withstand voltage tests.
- Partial discharge measurement (off-line and on-line).
- Oversheath test.
- Measurement of electrical resistance of conductor and screen.
- Line impedances measurement.
- Capacitance measurement.
- Tan Delta measurement.

Mobile Variable Frequency Resonant System WRV 260/80 for field commissioning of cables up to 400 kV.

Experts in on-site measurements of partial discharges.

Over 600 circuits tested in Colombia, Portugal, Spain, France, Italy, Germany, Netherlands and Poland.

TESTED PRODUCTS

- High Voltage Underground Cables.
- High Voltage Submarine Cables.
- Gas Insulated Substations (GIS).

ACCREDITATIONS AND **ACKNOWLEDGEMENTS:**

- ILAC-ENAC accreditation for:
  - Equipment for Generation, Transmission, Distribution and Use of Electric Energy, Low, Medium and High Voltage.
  - Electromagnetic Compatibility Testing (EMC) and Evaluation of Human Exposure to Electromagnetic Fields.
  - Mechanical and Climatic Tests.
  - Control Agency for Directive 2014/30/EU, OC-L188 Accreditation.
- Registered laboratory ES-02 by the European Association LOVAG (Low Voltage Agreement Group).
- IECEE CB Scheme Testing Laboratory.
- Applicant to STL (as member of AELP).
- Approved laboratory by the main Middle East utilities: ADWEA, DEWA, DCRP, SEC.
- Notified Body for:
  - Directive 2014/30/EU Electromagnetic Compatibility.
  - Directive 2014/35/EU Low Voltage Safety.
  - Directive 2014/32/EU MID (Measuring Instruments Directive).
- Certification tests:
  - Directive IEC 61850 certification according to UCA Edition 2 Server Test Procedure.
- Laboratory recognised by LAPEM (Mexico), for the acceptance of reports according to the accreditation of ILAC-ENAC 4/LE148.
- Laboratory designated by the Basque Government:
  - For verification of accuracy and type approval of instrument transformers.
- Founding member of AELP, Spanish Association of Power Laboratories.
- Founding Member of BELA, Basque Electrical Laboratories Alliance.
- UCA International Users Group authorised laboratory for IEC 61850 protocol.
- Laboratory recognised by IMQ.
- Laboratory recognised by INTERTEK.
- Laboratory recognised by UL.

STL Liaison

WORLDWIDE RECOGNITION OF OUR REPORTS ENABLES OUR CLIENTS TO ACCESS INTERNATIONAL MARKETS.

CUSTOMERS **REFERENCES**

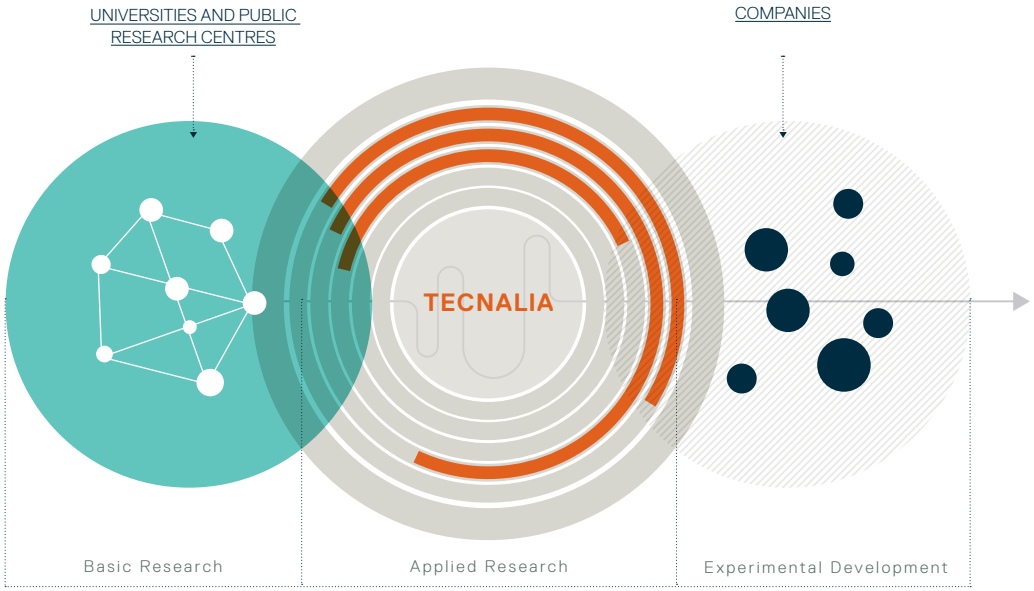
ELECTRICAL EQUIPMENT MANUFACTURERS

- ABB
- ALFANAR
- ALSTOM
- ARTECHE
- ATMEL
- EFACEC
- EPM
- FANOX
- GAMESA
- GENERAL ELECTRIC
- IMEFY
- INAEL
- INGETEAM
- LANDIS & GYR
- MESA
- NEXANS
- ORMAZABAL
- POMMIER
- PRONUTEC
- PRYSMIAN
- SAGEMCOM
- SCHNEIDER
- SIEMENS
- URIARTE
- ZIV

UTILITIES

- EDF
- EDP
- ENDESA
- GAS NATURAL FENOSA
- HC ENERGÍA
- IBERDROLA
- RED ELÉCTRICA
- SAUDI ELECTRICITY COMPANY
- TERNA
- VIESGO

TECNALIA
IS A BENCHMARK RESEARCH AND TECHNOLOGICAL DEVELOPMENT COMPANY IN EUROPE



FROM SCIENCE

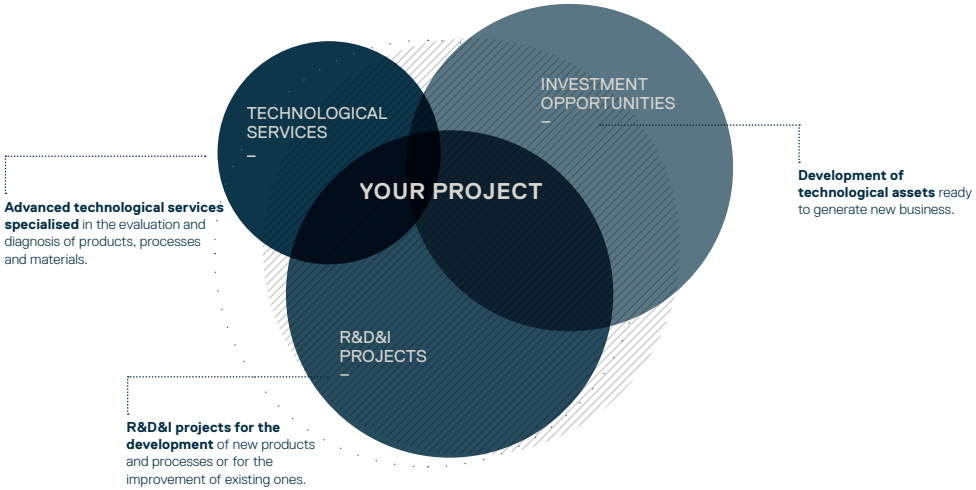
TO MARKET

MISSION

We transform technology into **GDP**

We transform technology into wealth to obtain beneficial visible results for companies, society, our environment and in short, for people.

SERVICE OFFER



Advanced technological services specialised in the evaluation and diagnosis of products, processes and materials.

Development of technological assets ready to generate new business.

R&D&I projects for the development of new products and processes or for the improvement of existing ones.

WE CAN DO SO MUCH **TOGETHER**

Our work is not understood without yours; we want to work together so your company can compete better. Because together, we can develop technologies that transform the present.

The future is technological, let's share it!

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