
2023
ANNUAL REPORT
TSK
SOLUTIONS FOR A SUSTAINABLE WORLD
WWW.GRUPOTSK.COM

TREVAGO 76.4 MW SOLAR PARK (SPAIN)

INDICE

LETTER FROM THE CHAIRMAN

SABINO GARCÍA VALLINA

In my capacity as President of TSK, it is a pleasure for me to present the 2023 Annual Report, which includes a summary of our activities, business, strategies and corporate policies during the year, thanking you once again for the recognition and trust of our customers, partners, suppliers and collaborators.

In a once again complex and demanding environment, especially in our sector, TSK has once again demonstrated its capacity for adaptation and growth. We closed the 2023 financial year with the highest sales figure in our history, with growth in all business lines. We have reached sales of 1,265 million euros, 30% more than in 2022, with an EBITDA of 79 million euros, which means an increase of 25% compared to the previous year, which demonstrates our capacity to develop our activity.

I am especially proud to be able to point out that also during the year 2023 we have once again increased the number of employees, reaching the highest number of employees in our 38-year history, 1,581, and fortunately we will continue to do so during the current year thanks to the workload we currently enjoy.

I would also like to highlight that in these years we have been able to overcome a difficult economic environment, affected by the increase in costs and global geopolitical tensions. 2023 has been a crucial year for TSK from a strategic, operational and financial point of view, successfully solved as shown by the results obtained and where our values and our vision have served as a guide. Vision and values that are still more valid today than ever: Innovation is a fundamental pillar of TSK's identity and corporate culture. For all the people who form part of this company, innovation is the guiding thread of our activity. Excellence: we understand that in the global world in which we find ourselves, we can only face the challenges we face by seeking excellence in our actions at all times. Commitment, collaboration, respect, enthusiasm and passion, values that are reflected in all aspects of our business and throughout the organization.

In short, I believe we are very well positioned to continue creating value in a sustainable way for our customers. Over

IN 2023 WE HAVE BROKEN TWO RECORDS, THE HIGHEST SALES FIGURE IN OUR HISTORY, WITH 1,265 MILLION EUROS, AND THE LARGEST NUMBER OF EMPLOYEES, 1,581

the next few years, we will continue to take advantage of the accelerating global market for energy transition and decarbonization, the development of sustainable infrastructure and the digitalization of the economy. With the current portfolio and the order intake achieved during the first quarter of the year, we will surpass the previous year's sales in 2024, setting a new record.

I invite you through the following pages to learn about the most relevant aspects of our activities, business, strategies and corporate policies during 2023, where you will see, for example, that we have an agile and flexible organization that promotes excellence, that we have the necessary financial resources to compete efficiently in different markets, and that we have the capacity and enthusiasm of more than 1,500 employees in 25 countries.

Likewise, we continue to invest in TSK's most important hallmark, innovation, and a clear example of this commitment is the TSK Sustainability Technologies Center, our own tech-

nology center established in 2023, with the objective that the group's investment in R&D&I will reach 2% of sales within 5 years, which implies almost doubling the current investment. This commitment will allow TSK to offer its customers technological advantages in its products that will make them more competitive and improve margins. In short, a fundamental asset for the development of TSK and the generation of high quality employment.

Finally, I would like to end this letter by thanking in a very special way the efforts of all the people who make up TSK, without whom it would not have been possible to reach the goals we have achieved. Their commitment and dedication are absolutely essential to project a sustainable, innovative and profitable future for our company.

SALAMANCA 950 MW CCGT+
SUBSTATION 400 KV AND TRANSMISSION LINE (MEXICO)

CORPORATE STRATEGY

JOAQUÍN GARCÍA RICO

When we faced the pandemic in 2020 and 2021, we did so aware of the enormous difficulties and with the responsibility of moving the company forward and recovering activity levels as soon as possible. Today, three years later, we are very proud to have achieved some objectives, which we knew were very difficult to achieve.

We will close 2023 with the highest sales figure in our history, 1,265 million euros, and an increasingly diversified activity, both geographically and by sector, which will allow us to face the coming years with assurance and confidence.

Despite the pandemic and the different international conflicts, TSK has maintained its firm commitment to growth as its main strategic objective and in this way we have increased our activity in countries for which we had bet years ago such as Mexico, United Kingdom, Canada, United States or Australia, all of them developed geographies with great growth potential, and at the same time safer at a geopolitical, macroeconomic and legal level, where investments in energy transition, minerals and data centers present a great opportunity.

The implementation of a new Strategic Plan, the one corresponding to the three-year period 2024-2027, has meant a deep reflection within TSK on the bases of its development in the medium and long term. The axes that have been defined speak of the search for an increasingly technological company profile that will allow us to differentiate ourselves from our competition and at the same time be more selective in the projects to be executed. To this end, TSK is taking advantage of its solid experience in the industrial and energy sector, with a highly qualified staff of more than 1,500 employees and 4 technological centers, Cologne (Germany) specialized in energy storage, Madrid specialized in energy, Vitoria specialized in biomass and waste recovery and Gijón specialized in energy, industrial processes and digitalization.

TSK's experience and knowledge accumulated over almost 40 years in the main technical disciplines, together with its references in both renewable and conventional power plants and industrial plants, place TSK in an unbeatable position to continue its growth. Investments in decarbonization in the energy industry between 2023 and 2035 are expected to amount to $3.6 trillion, or an annual average of $276 billion, according to Global Energy Perspectives 2022, April 2022, McKinsey. Along these lines, forecasts for other industrial sectors, such as steel and cement, are close to $180 billion per year between them.

We will continue to strive to grow both in terms of volume of activity and technological and service capacity. We know that

VALLADOLID 1000 MW CCGT+ 400 KV SUBSTATION (MEXICO)

we will be there where there are new opportunities and where we can continue to generate value for our customers in the following areas of activity:

ENERGY TRANSITION AND DECARBONIZATION

TSK has been present in the renewable energy sector since 2006 and wants to become a global reference in the investment cycle programmed to reach the Net Zero objective in 2050. We currently have 11 combined cycle power plants and 4 photovoltaic plants in execution with a total accumulated power of more than 8,000 MW, which position us as an international leader in the energy sector.

We are also supplying a cryogenic Boil-off-Gas (BOG) compressor at an LNG terminal, a facility that is in line with European regulations by guaranteeing security of supply and improving the flexibility of the gas system. This compressor will not only improve the flexibility and competitiveness of the facilities, but also their efficiency and sustainability by maximizing the use of energy.

ELECTRICAL INFRASTRUCTURES AND DIGITALIZATION

In the field of electrification and digitalization, we develop high added value solutions that guarantee progress in the current energy transition process and allow improving processes and optimizing their performance, based on enabling technologies under the protection of Big Data, Internet of Things, Artificial Vision or Virtual Reality. Likewise, TSK has its own solutions which, although they were born under the protection of different needs of the rest of TSK's business lines, have become exportable solutions to other sectors, industries and clients.

HANDLING AND MINING

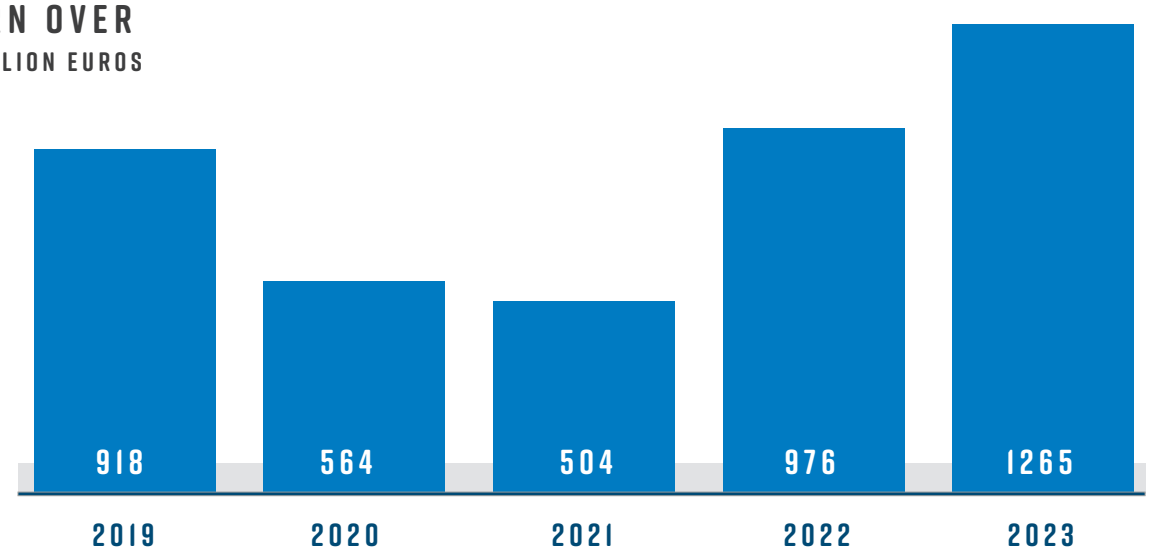
TSK, through its subsidiary PHB Weserhütte, designs and supplies new generation infrastructures that are in high demand in the market and meet today's needs for critical minerals and bulk raw materials.

All of the above makes TSK a company of world reference, prepared to shape the future without being conditioned by the particular circumstances of each moment and where to face the challenges of internationalization, innovation or diversification of activities, we have an excellent human team, to whom I would like to thank once again for their commitment and dedication, the same gratitude that I would also like to convey to our clients for the trust they have placed in TSK to carry out their projects.

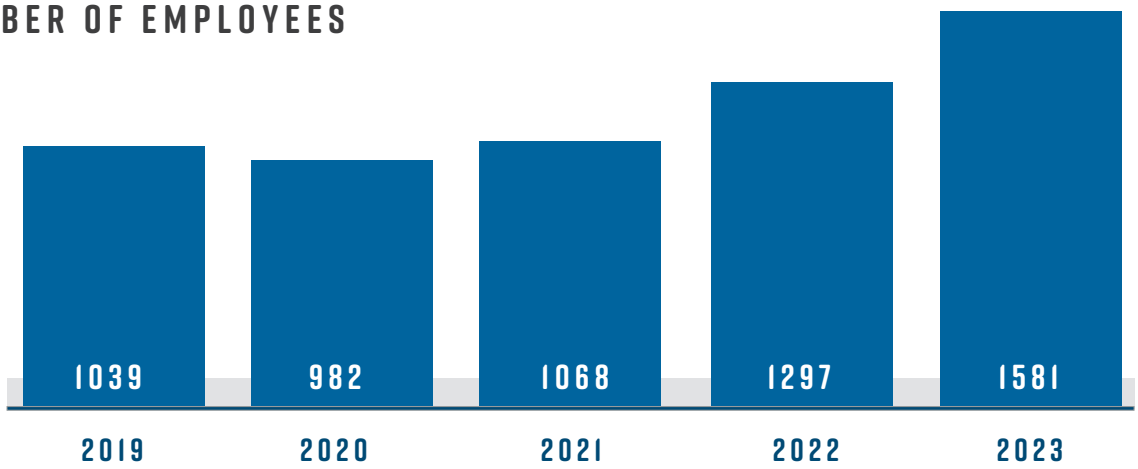
MAIN FIGURES

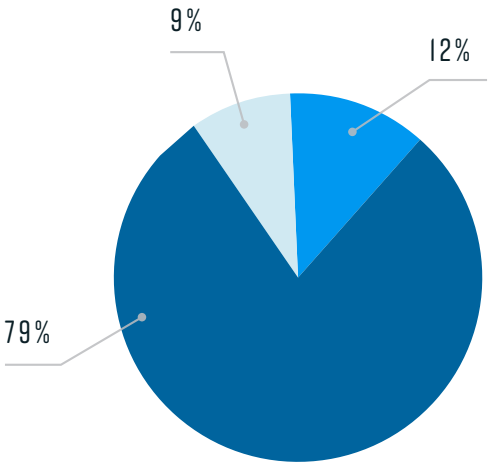
TURN OVER

#MILLION EUROS



NUMBER OF EMPLOYEES



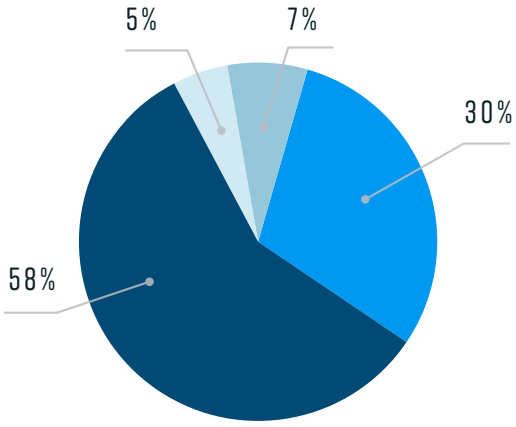


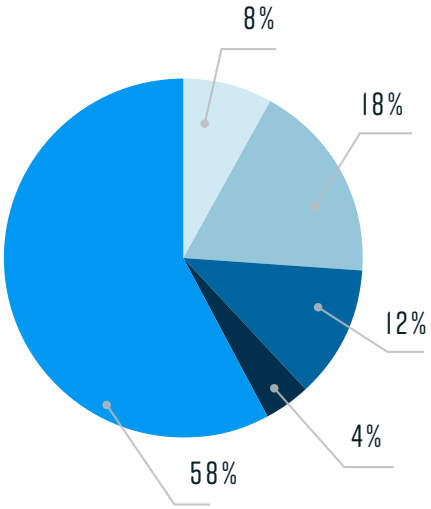
SOLUTIONS

- ENERGY TRANSITION AND DECARBONISATION
- INDUSTRY AND DIGITALISATION
- HANDLING AND MINING

STAFF DISTRIBUTION

- ENGINEERING / TECHNOLOGY
- PROJECTS
- CORPORATIVE SERVICES
- R+D+I





SALES BY MARKETS

- NORTH AMERICA
- MIDDLE EAST AND ASIA
- EUROPE
- AFRICA
- CENTRAL AMERICA AND THE CARIBBEAN

KEY FEATURES

OVER 35 YEARS OF EXPERIENCE IN THE INDUSTRIAL AND ENERGY SECTOR

ONE OF THE INTERNATIONAL COMPANIES WITH MORE REFERENCESIN PROJECTS IN ENERGY, INDUSTRIAL, HANDLING, ELECTRICAL INFRASTRUCTURES AND ENVIRONMENT SECTORS

ADEQUATE FINANCIAL CAPACITY TO HANDLE LARGE PROJECTS

PROVEN TECHNICAL CAPACITY AND HIGHLY QUALIFIED PERSONNEL

PROVEN EXPERIENCE IN O & M. (OPERATIONS AND MAINTENANCE) OF INDUSTRIAL AND ENERGY PLANTS

BALANCED GROWTH AND COMPENSATION BETWEEN BUSINESS LINES

AGREEMENTS WITH THE LEADING INDUSTRIAL TECHNOLOGISTS

OWN TECHNOLOGY IN VARIOUS FIELDS

OUR MANAGEMENT´S ESSENTIAL IDEAS

CUSTOMER ORIENTED AND FOCUSSED

MANAGEMENT COMMITMENT AND LEADERSHIP

PERSONAL DEVELOPMENT OF OUR EMPLOYEES

STRATEGIC PLANNING

PERSONNEL INVOLVEMENT

HEALTH AND SAFETY AT WORK

R&D+I

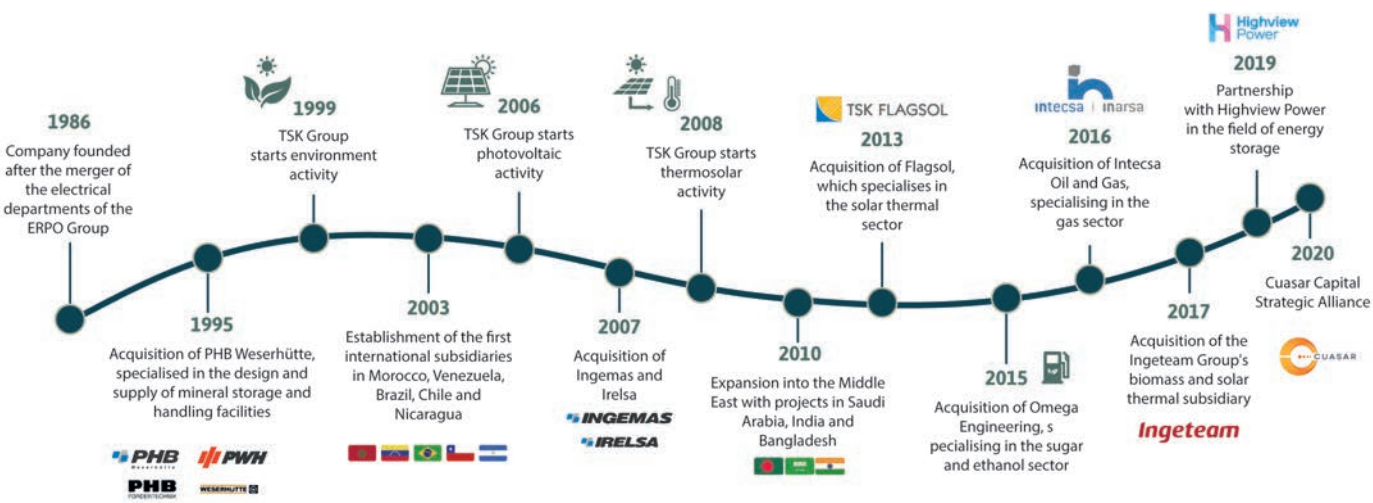
KNOWLEDGE MANAGEMENT

RESPECT FOR THE ENVIRONMENT

COMMITMENT TO QUALITY

CONTINUOUS IMPROVEMENT

MOST SIGNIFICANT MILESTONES



THE ACCUMULATED EXPERIENCE OF THE COMPANIES INCORPORATED INTO TSK TOTALS
MORE THAN 200 YEARS

LIDER IN RENEWABLE ENERGY
WIND, SOLAR, GREEN HYDROGEN, GEOTHERMAL, HYDRO AND BIOMASS

IN-HOUSE HYBRID PLANTS AND ENERGY STORAGE TECHNOLOGY

MORE THAN 1,000 PROJECTS EXECUTED IN MORE THAN 50 COUNTRIES

+ 25.000 MW EXECUTED

DRIVING DIGITAL TRANSFORMATION AND SUSTAINABLE DEVELOPMENT

PRESENCE IN THE MAIN INDUSTRIAL SECTORS:
STEEL, CEMENT, FERTILISERS, MINING, GAS TO POWER, FOOD, PAPER, PORTS

126.5 MW FUNDÃO PHOTOVOLTAIC PLANT + SUBSTATION 220 KV AND TRANSMISSION LINE (PORTUGAL)

CORPORATE STRUCTURE

TSK

CORPORATE SERVICES

ECONOMIC - FINANCIAL MANAGEMENT

TALENT AND SUSTAINABILITY MANAGEMENT

LEGAL SERVICES DIRECTORATE

DIGITISATION AND IT MANAGEMENT

COMMERCIAL MANAGEMENT

R&D+I MANAGEMENT

PURCHASING MANAGEMENT

BUSINESS DEVELOPMENT MANAGEMENT

TSK

ENERGY TRANSITION
DECARBONISATION
DIGITALIZATION
INDUSTRY

PHB Weserhütte

HANDLING AND MINING

ESERSA

CONCESSIONS

MANAGEMENT

SABINO GARCÍA VALLINA
CHAIRMAN

JOAQUÍN GARCÍA RICO
CEO

BUSINESS LINES

ARTURO BETEGÓN BIEMPICA
PHB Weserhütte CEO

ANDRÉS CUESTA LARRÉ
Managing Director Power & Industrial Plants

CARLOS RUIZ MANSO
Managing Director Electrical Infrastructures

PEDRO SUÁREZ LÓPEZ
Managing Director Technology & Proposals

CORPORATE SERVICES

BEATRÍZ GARCÍA RICO
Chief Financial Officer

SARA FERNÁNDEZ - AHUJA
Managing Director Talent and Sustainability

ANA ISABEL BERNARDO PÉREZ
Managing Director Internal Audit

OSCAR RODRIGUEZ ACINAS
Managing Director Purchasing

IGNACIO DE LA PUENTE
Managing Director Risk Management

DIEGO FENTE VÁZQUEZ
Corporate Managing Director

PABLO GARCÍA FERNANDEZ
Chief Commercial Officer

JOSÉ MARÍA GONZÁLEZ FERNÁNDEZ
Managing Director Chairman´s Office

RAÚL NODAL MONAR
General Manager Legal Services

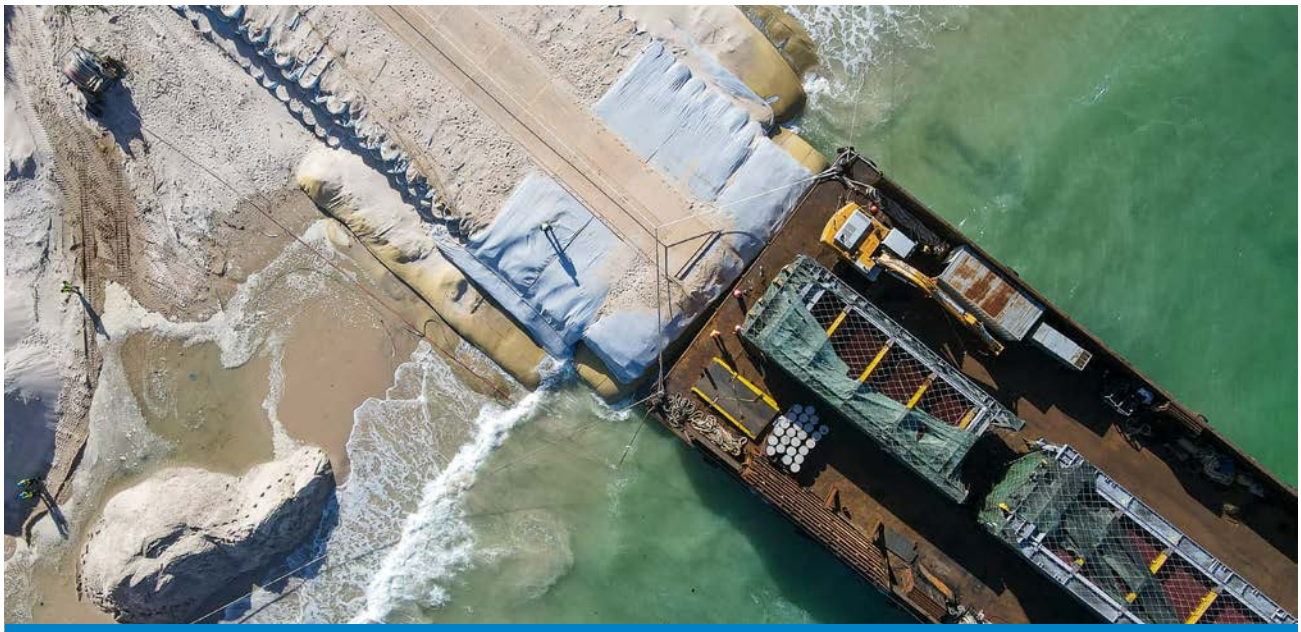
CARMEN RODRÍGUEZ LÓPEZ
Compliance Manager

ANTONIO SUÁREZ RAMÓN
Managing Director Business Development

EDUARDO PÉREZ GANCEDO
Managing Director Information Technologies and Digitalization.

MAIN PROJECTS IN PROGRESS

200 MW IVIRIZU HYDROELECTRIC POWER PLANT	ENDE VALLE HERMOSO	BOLIVIA
MIRASOL 127 MW PHOTOVOLTAIC PLANT + SE 138 KV + LT	**AES**	**DOMINICAN REPUBLIC**
PERAVIA I Y II PHOTOVOLTAIC PLANTS	AES	DOMINICAN REPUBLIC
SAN PEDRO DE MACORIS 125 MW COMBINED CYCLE POWER PLANT	**ENERGAS**	**DOMINICAN REPUBLIC**
SAN FELIPE 470 MW COMBINED CYCLE POWER PLANT	GSF	DOMINICAN REPUBLIC
COPPER SMELTER HANDLING SYSTEM. MANYAR SMELTER PROJECT	**CHIYODA INTERNATIONAL INDONESIA**	**INDONESIA**
ATINKOU 420 MW COMBINED CYCLE POWER PLANT	ERANOVE	IVORY COAST
RED POTASH WAREHOUSE. AQABA PK2. ARAB POTASH	**APC – ARAB POTASH CO**	**JORDAN**
SAN LUIS RÍO COLORADO 648 MW COMBINED CYCLE POWER PLANT	CFE	MEXICO
GONZÁLEZ ORTEGA 641 MW COMBINED CYCLE POWER PLANT	**CFE**	**MEXICO**
MERIDA 500 MW COMBINED CYCLE POWER PLANT + SE 230 KV	CFE	MEXICO
VALLADOLID 1000 MW COMBINED CYCLE POWER PLANT + SE 400 KV	**CFE**	**MEXICO**
SALAMANCA 950 MW COMBINED CYCLE POWER PLANT + SE 400 KV + TL	CFE	MEXICO
SAN LUIS DE POTOSI 450 MW COMBINED CYCLE POWER PLANT + SE 230 KV	**CFE**	**MEXICO**
EL SAUZ 300 MW COMBINED CYCLE POWER PLANT + SE 400 KV + TL	CFE	MEXICO
BELT CONVEYING SYSTEM. OCP FERTILIZER PLANT	**JESA**	**MOROCCO**
COAL HANDLING SYSTEM. JORF LASFAR THERMOPOWER PLANT	O.N.E.E.	MOROCCO
COMPLETE SULFUR HANDLING SYSTEM. JORF LASFAR. OCP	**O.C.P. GROUP**	**MOROCCO**
STEMANE 450 MW COMBINED CYCLE POWER PLANT + SE 400 KV	GLOBELEQ-SASOL-EDM	MOZAMBIQUE
FUNDÃO 127 MW PHOTOVOLTAIC PLANT + SE 220 KV + TL	**DOS GRADOS CAPITAL**	**PORTUGAL**
MARAHU 485 MW HYBRID SOLAR PARK+ SE 115 KV + TL	AES PUERTO RICO	PUERTO RICO
PITCH AUTOMATION SYSTEM. SANTIAGO BERNABÉU STADIUM	**REAL MADRID FUTBOL CLUB**	**SPAIN**



JETTY BUILT FOR THE DELIVERY OF HEAVY AND OVERSIZED EQUIPMENT BY SEA TO THE TEMANE 450 MW CCGT (MOZAMBIQUE)

PUNTA LANGOSTEIRA HANDLING SYTEM OF AGRI-FOOD MATERIALS (SPAIN)

PUNTA LANGOSTEIRA HANDLING SYTEM OF AGRI-FOOD MATERIALS	GRUPO NOGAR	SPAIN
BULK MATERIALS RECEPTION, STORAGE, TRANSPORT AND SHIP LOADING SYSTEM	**EIFFAGE**	**SPAIN**
KILOMBERO SUGAR PLANT	ILLOVO SUGAR COMPANY (BRITISH SUGAR – ABF)	TANZANIA
MARITIME BULK TERMINAL FOR THE EXPORT OF BULK AGGREGATES	**JACOBS**	**UAE**
GRETNA AND SELLINDGE GRID STABILITY PLANTS	WELSH POWER	UK

ACTIVITIES BY BUSINESS LINES

ENERGY TRANSITION AND DECARBONISATION

As an industrial engineering and construction company, TSK offers a comprehensive technical service that ranges from consulting and design activities to the construction and commissioning of turnkey installations for different sectors such as:

POWER

The experience acquired in the variety of projects in which TSK has participated, as main contractor or in consortium with the most prestigious technologists in the world, allows us to offer the most appropriate technical, economic and financial solution for each client.

- Gas-fired power plants (simple or combined cycle).
- Cogeneration plants
- Incineration plants
- Biomass
- Waste
- Wind energy
- Solar energy
- Geothermal
- Hydraulic energy
- Hydrogen

#INDUSTRIAL PLANTS

The experience and knowledge accumulated during all these years in the most varied technical disciplines allows TSK to tackle industrial projects from process engineering to the installation and commissioning of the different plants in the Food, Paper, Mining, Steelworks, Fertilisers, Biofuels and Renewable gases.

GAS TO POWER

After the purchase of Intecsa Oil&Gas engineering, with more than 50 years of experience, TSK has acquired the necessary experience and references in the gas sector to execute projects from conceptual engineering to installation and commissioning of complete plants.

- Gas compression stations.
- Oil pipelines and gas pipelines.
- Underground natural gas storage facilities.
- LNG terminals
- Fuel storage terminals
- Pumping and metering stations

#ENVIRONMENT

TSK is aware that society demands, with increasing insistence, a better quality of life and, therefore, the conservation and preservation of the multiple and valuable natural resources of our planet.

50 MW DHOFAR EOLIC PARK + 132 KV SUBSTATION (OMAN)

We are convinced that the protection and investment in the environment, water, air and soil, is not a hinderance on development, but the best strategy to achieve economic and social growth in a sustainable way by ensuring the conservation of the most valuable heritage of humanity: Planet Earth.

For various reasons (scarcity of economic resources, water shortages, disasters, etc.), many populations lack clean water to cover their basic needs, which has a serious impact on the population's own health. Aware of this problem, TSK has a series of products of its own which, based on various treatment technologies, make it possible to cover the needs of drinking water supply to populations.

• Containerized DWTPs (Drinking Water Treatment Plants): With a flow rate of up to 200 m^3/h and a surface area of 200 m^2, they are capable of supplying towns of more than 25,000 inhabitants. Its design in containerized structures allows the installation of several DWTPs together. Easy to transport, install and operate, they are the ideal solution for the urgent supply or for the supply of drinking water to populations with various problems.

• Modular DWTPs: For flows of up to 10,000 m^3/h, designed for minimum civil works requirements, they are suitable for the supply of drinking water to medium and large populations that, due to various circumstances, cannot carry out civil works.

• Conventional DWTPs: Designed in civil works, they are the most widely used water treatment plants to date, given the lack of other satisfactory technical alternatives.

• Upgrade DWTPs: These are redesigns of existing water treatment plants, in which, with minimal modifications, it is possible to extend the treatment flows or improve the quality of the treated water if it is insufficient.

• TSK containerized WWTPs (Waste Water Treatment Plants): They are included in containment structures, aimed at the treatment of domestic or urban wastewater from population centres of up to approximately 5,000 inhabitants or equivalent wastewater flows.

• Modular WWTPS: They are designed with prefabricated tanks and minimum civil works requirements, aimed at population centres of up to around 100,000 inhabitants or equivalent industrial wastewater flows.

• Conventional WWTPs
They are designed in civil works for the treatment of wastewater from large population centres.

• Upgrade WWTPs: This is an application of great interest for existing WWTPs which, for various reasons, function inco-

rrectly, not achieving the results in terms of treated water quality for which they were designed (increase in flow, increase in polluting water, etc.). With the moving bed technology and with the introduction of small modifications it is possible to tune these WWTPs.

Water supply and purification facilities are common elements of any production process. Therefore, the sludge generated in these processes are only by-products of these production cycles. Sludge is not, however, a non-valuable by-product; on the contrary, properly treated and following the well-known and current policy of the 3Rs on waste (Reduction, Recycling and Reuse), sludge is a recoverable by-product in today's society.

ELECTRICAL INFRASTRUCTURES AND DIGITALISATION

With a track record of over 35 years, TSK has become a leading company in the engineering and electrical equipment sector.

We develop power and control projects associated with new industrial installations, as well as innovations in existing installations.

Throughout all these years we have accumulated proven experience in the development of turnkey electrical projects in the sectors of power, telecommunications, iron and steel, metallurgy, food, paper, petrochemicals, cement, environment, fertilizers, ports and industrial plants in general.

The combination of quality, technical capacity and dedication to our customers has allowed us to achieve a leading position in all sectors in which we are present. We have a large number of highly qualified professionals and are equipped with the most advanced technical means for the design, calculation, assembly and commissioning of all types of electrical installations.

INTEGRATED MANAGEMENT OF ELECTRICAL PROJECTS

Design and engineering, planning, procurement management, manufacturing and supply of equipment, installation and assembly, quality control, training, commissioning and operation and maintenance.

- Transformer substations up to 500 kV.
- Transmission lines
- Electrical installations for thermal power stations, solar plants, wind farms, cogeneration plants and industrial plants in general.
- Automation and digitalisation of industrial installations, control and regulation processes.
- Environment and waste treatment facilities.
- Infrastructure and building.
- Manufacture of M.T. Cells, CCMs, CDBTs.
- O&M

DATA CENTER AND DIGITALISATION

We are increasingly aware of the need to digitally transform the industrial processes that our clients manage and, as TSK is well aware of the enabling technologies and solutions for this purpose, the undertaking has been clear and decisive. Thus, a new specialized department has been created, capable of designing, proposing and carrying out projects of this nature that allow our clients to reduce their operating costs and therefore improve their performance.

From TSK we take our experience to other industrial sectors to help our customers be more efficient in their production processes. This work ranges from the digitalization of the client's assets to the digital transformation of the productive processes that use those assets. Through new processes, we manage to reduce losses, production times, energy consumption, minimise stoppages, increase the life of the assets, as well as to ensure the traceability and quality flows of the manufactured products.

TSK, highlighted as a leading company in large-scale industrial projects, is positioned as a pioneer in sustainability and decarbonization. This commitment not only reinforces its role in technological evolution, but also contributes to the development of essential infrastructures to meet the growing demand for digital services.

TSK's entry into data center construction is not simply a natural

230KV SUBSTATION. SAN LUIS DE POTOSI 450 MW COMBINED CYCLE POWER PLANT (MEXICO)

extension of its vast industrial experience and highly professional team; it is a tangible manifestation of its adaptability and vision for the future. TSK's ability to offer turnkey projects on a global scale not only underscores its leading position, but also consolidates its position as one of Spain's leading companies in the data center construction sector.

This strategic expansion reflects TSK's ability to anticipate and address the changing needs of the technological landscape. Its focus is not only on technical excellence, but also on the integration of sustainable solutions, marking a significant milestone in the convergence of innovation and environmental responsibility.

DIGITAL TRANSFORMATION

Following a consultancy of industrial processes, we design and propose the best technological solutions that allow us to carry out this process improvement that directly affects our clients' profit and loss account. To this end, we implement solutions such as MES (Manufacturing Executing Systems), MOM (Manufacturing Operations Management), Energy Efficiency, CMMS (Computerized Maintenance Management System), BPM (Business Process Management), BI (business intelligence)... that allow us to tackle the digital transformation of the entire process of Operation and Maintenance of the plants.

We make available to our customers the set of tools that our R+D+i teams have been developing and testing in our own plants and where we can find today packaged solutions such as:

SISREM: Remote monitoring system for industrial plants. Solution that allows optimizing the supervision of industrial plants through a unified technological architecture and a web platform for remote visualization.

SISDRON: Aerial system for the supervision of industrial plants. Through aerial missions carried out automatically by means of drones and intelligent algorithms for image and data analysis, specific inspection tasks can be carried out.

SISTER: Electrical substation busbar supervision system based on automatic thermography analysis. By means of real time thermographic analysis, the supervision and monitoring of the state of electrical substations is carried out.

SISMETER: Analogue sensor digitizing system based on automatic image analysis. This tool is specifically designed for the digitalization, supervision and monitoring of analogical sensors of diverse nature existing in any industrial installation.

SIXPERIENCE: Intelligent supervision and training system based on virtual and/or augmented reality. This new set of tech-

PITCH AUTOMATION SYSTEM. SANTIAGO BERNABÉU STADIUM (SPAIN)

nologies is used to create immersive virtual and augmented reality experiences from which to carry out everything from training and coaching tasks to the operation of the plant itself.

IP INFRASTRUCTURES

From the Information Technology project team, we have specialized in the design and implementation of technological solutions that respond to the contractual technical requirements of our clients. Our experience backs us up as specialists in the execution of turnkey projects that range from the deployment of structured cabling networks and wireless networks to the integration of different technologies such as unified communications systems, public address and industrial intercom systems, VMS (Virtual Management System) solutions for the monitoring and control of production processes, access control systems for people or vehicles, and acoustic warning systems for the population for the sounding of areas affected by disasters.

At the same time, and pursuing a cycle of continuous improvement that responds to the current demand of the industrial technology market, we have specialized in the design, implementation and maintenance of perimeter security systems based on thermal vision technology and temperature control in critical equipment with thermographic vision technology.

It is also important to note that for this type of project, not only do we undertake the design, execution and start-up phases, but we also have a specific area to offer operation and maintenance services.

CYBER SECURITY

All these new challenges mentioned imply functional, technical, regulatory and even physical protection requirements, but it is worth highlighting a new challenge that concerns all of them in a transversal way and that is none other than the safeguarding of the data in terms of its confidentiality, integrity and availability. The current reality of the union of the worlds of Information Technology and Operation Technology implies new risks and given the context in which they occur, such as the industry, with a specific and different need and way of addressing them.

The Information Technology team of TSK has been actively participating for several years in pioneering work groups in industrial cyber security, carrying out cyber security assessments in industrial infrastructures and of course attending to our own

needs. Cybersecurity has become part of the DNA of the business, both out of conviction and obligation, in order to be able to continue executing our projects with excellence as an objective.

We model cybersecurity from the gestation of the projects, including and / or responding to their requirements from the base design, detail, procurement process, engineering, testing, etc. Likewise, we are continuously improving the state of existing plants in terms of cyber security, auditing them and applying measures and procedures aligned with our continuous improvement processes, which in no other technique are as important as in cyber security, where going one step behind can be an unbearable risk.

DATA ANALYTICS

As we face new technological challenges, we are also confronted with the constant, growing and inevitable need to work with heterogeneous data sources, as well as the integration of process and business information that, among other things, will make it possible to optimize costs, improve processes, extend the useful life of industrial plants, and even make them safer. Using all the enabling technologies that we know for this purpose, we are able to execute data and image analysis projects by means of technologies or concepts, such as: big data, machine learning, deep learning, edge computing, virtual reality, augmented reality or digital twin, which together offer our customers dashboards and solutions that accompany them throughout the entire life cycle.

HANDLING & MINING

With more than 150 years of experience, PHB Weserhütte has developed projects for the storage and transport of materials in various sectors such as port terminals, mining, cement, iron and steel, power plants, fertilisers, oil & gas and agri-food. We offer integral technological solutions from the feasibility stages to the commissioning of the facilities.

#HISTORY

In 1844 Weserhütte A.G., an engineering company established in Bad Oeynhaussen, began its activities in Germany, followed by POHLIG in Siegen and BLEICHERT in Leipzig in 1874 and finally HECKEL in Saarbrücken in 1905.

In 1882 POHLIG began its activity in Spain, carrying out projects such as a cableway for transporting materials for Hnos. Chávarri y Cía. in Bilbao, mining and iron and steel installations in Asturias for Fábrica de Mieres in 1890, installations for Portland Iberia in Toledo in 1912 and the Montserrat funicular railway in Barcelona in 1929.

In 1962, PHOLIG A.G., HECKEL A.G. and BLEICHERT GmbH merged to form PHB A.G.

In 1980 PHB A.G. and Weserhütte A.G. reach a merger agreement in Germany, whereby the PHB Weserhütte A.G. Group or PWH is formed. In the same year, PHB, S.A. and Weserhütte, S.A. merged in Spain to form PHB Weserhütte, S.A..

In 1987 the parent company is taken over by another German industrial group which modifies the structure of PHB Weserhütte A.G., leading to the independence of the Spanish subsidiary, which retains all the technology, references and brand of the German group, resulting in a Spanish-German company, with a majority of Spanish capital.

In 1995, TSK acquired all the shares of PHB Weserhütte S.A., the latter being integrated into the TSK Group.

As specialists in port systems our installations operate with the highest degree of efficiency in many ports around the world, handling all types of bulk solids, such as coal, iron ore, bauxite, fertilisers, clinker, cement and cereals, offering different solutions for sea or river ports: Bulk solids storage and handling terminals, unloaders and loaders, cranes or ecological hoppers.

PHB Weserhütte also designs circular or longitudinal storage yards with a wide range of picking and combined machines that allow a high degree of homogenisation to be achieved in any type of bulk solids: Longitudinal and circular yards, stackers, scrapers, homogenisers, rotor blades and conveyors.

COAL HANDLING SYSTEM. JORF LASFAR THERMOPOWER PLANT (MOROCCO)

TSK'S COMMITMENT

TSK'S MISSION

TSK's mission is focused on being a highly competitive organization in the execution of technological solutions in the infrastructure, energy, industrial and environmental sectors, pursuing the satisfaction of the client and the people who make up TSK at all times, in a commitment to their personal and professional development.

TSK'S VISION

The Group's vision is to be a cutting-edge company, leader in terms of human resources, technology and profitability, in order to offer efficient solutions that contribute to a more sustainable development, ensuring the satisfaction and confidence of our customers, partners, employees and society in general.

TSK'S VALUES

COMPETITIVENESS

As an inherent value of the company for the successful achievement of our vision.

INNOVATION

TSK is committed to innovation in its processes and ways of working, offering the customer the most innovative services on the market. We maintain a vigilant and proactive attitude towards opportunities, in a process of continuous development.

EXCELLENCE

Quality is an intrinsic value of the company, which aims to offer products and services that aspire to excellence. Our companies must be perceived by the customer as companies that offer solutions and installations of the highest quality.

COLLABORATION

This value is always present in the organisation and culture of TSK, extending to daily relations with customers, suppliers, employees and society in general. Our spirit of collaboration is reflected in our daily actions.

COMMITMENT AND RESPECT

These are values that are deeply rooted in the organisation. Commitment must be a sign of identity in all our actions, as well as respect for all groups with which we have a relationship.

FLEXIBILITY

The activity of our companies is framed within the services to the industry, so flexibility is a fundamental factor to compete with larger companies and resources. We want to transmit this flexibility in all our companies, being able to adapt to the changes that may occur.

ENTHUSIASM AND PASSION

Only through the enthusiasm and passion we put into our projects, behaviour and actions is it possible to achieve our common goal, to make TSK the leading company and a reference in the market.

ATINKOU 420 MW COMBINED CYCLE PLANT (IVORY COAST)

SUSTAINABILITY

TALENT

The most important aspect about a company with our history is the people who make it up. For this reason, people management has been, and always will be, a key aspect of our business strategy.

TSK considers people as the fundamental pillar of its development and therefore implements policies to promote employment stability and equality policies, career plans and social benefits.

TSK has the best professionals in the sector, with levels of qualification and specialization of recognized prestige. At the end of 2023, TSK had more than 1000 employees. An important group within this staff is the expatriate professionals in the projects; ensuring their commitment and maintaining the sense of belonging is a key aspect for TSK. The company extends to these professionals all the measures it implements in terms of human resources.

The workforce average age is 43,70 years, with an average length of service in the company of around 8,30 years. 92,50 percent of employees have a permanent contract, 76,22% are men and 23,78% are women.

DIVERSITY AND EQUAL OPPORTUNITIES

At TSK we promote a working environment that allows equal opportunities and the possibility of making the professional and personal lives of our staff compatible. TSK has established an Equality Committee in order to ensure respect for diversity and equality

TSK has an Equality policy which reflects the clear commitment of the organisation to the people who work for TSK and with society.

In its efforts to promote and implement equality policies in the organization, the management of TSK signed a declaration of intent that establishes:

- Its commitment to equality. Equal opportunities between men and women as a strategic principle.
- The promotion and encouragement of measures to achieve effective equality.
- Special attention to situations of indirect discrimination that may occur through the management of human resources policies.
- The projection of a company image in line with this commitment.

The implementation of these principles is carried out through the design and implementation of the equality plan, the objectives of which are as follows:

- Formalising the commitment to equality and establishing indicators for the appropriate monitoring and evaluation of equality policies.
- To establish an objective selection system that guarantees non-discrimination in the selection process, either directly or indirectly.
- Guarantee that access to training and professional development in the company is the same for everyone.
- Establish a clear pay system and a procedure for salary review based on objective criteria.
- Establish the appropriate means to promote equality and work-life balance as an element of the organisational culture.

TALENT MANAGEMENT AND CONSERVATION

In the current context, the human resources function needs to be flexible, adaptable and capable of driving change, and it must provide a rapid and efficient response to business needs and priorities.

TSK promotes the professional and human development of its staff and encourages the exchange of ideas at a global level, with the conviction that this way new concepts are created, especially when professionals from different disciplines and with different backgrounds meet. This unity, guarantees the long term success as the best team, counting on the potentials of each one of the different members of the team.

Another key aspect of preserving and improving the company's human capital is to provide professionals with the necessary training resources and knowledge.

KNOWLEDGE MANAGEMENT AND DISSEMINATION

TSK has different tools for information management that facilitate internal communication and the exchange of knowledge and experiences:

• Project database, which makes information and documents on TSK projects available to employees
• Document management tools that allow the coordination of independent working groups for projects. Thanks to these tools it is possible to store and manage documentation, establish permissions, control the versions of documents and allow the immediate use or consultation of them, in the appropriate safety conditions.
• Requesting services through the intranet. This tool allows requests to be made regardless of where people are physically located, such as requests for holidays, permits, advances, computer equipment, incidents or other general services.

The continuous training of our employees is vital in order to be able to acquire the necessary knowledge to develop our activity in the long term. For us, it is an investment in the people of TSK and is an important factor for their development and motivation.At TSK we have training programs to cover the needs of employees:

• Technical training, provided by external suppliers or by company specialists, who transmit knowledge and experience to the team.
• Language training through free programs
• Training in management skills.
• Training in information technology with the aim of improving knowledge of computer tools, both generic and specific to the company.

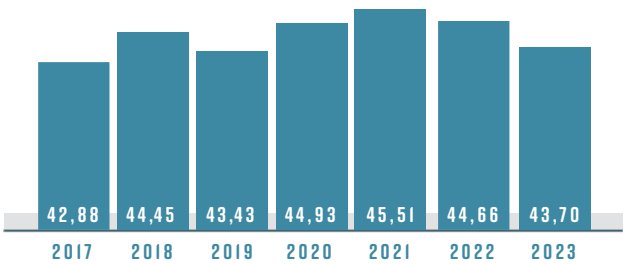
TALENT APPEAL AND RECRUITMENT

The objective in terms of attracting talent and selecting personnel is to identify and incorporate the best talent available, both great professionals committed to the TSK project who have the necessary skills, and young talent with development potential. In order to achieve this, it is important for us to establish close relations with universities and research centres We want to be an attractive company for our employees and we compete for the most qualified, offering a wide range of incentives.

The key to success is attractive benefits, performance-related pay and opportunities for international development. We give particular importance to a company culture that is oriented towards dialogue and teamwork. Our selection processes are carried out according to the following criteria: equal opportunities and non-discrimination, respect for the person, honesty, professional ethics and confidentiality.

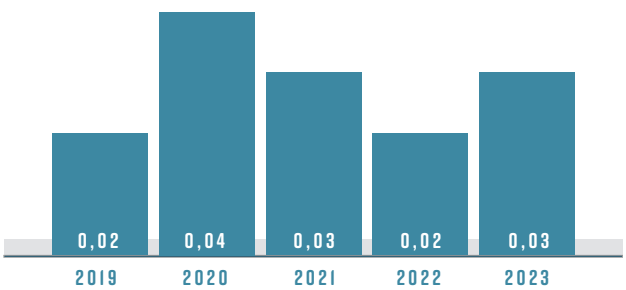
AVERAGE AGE

YEARS



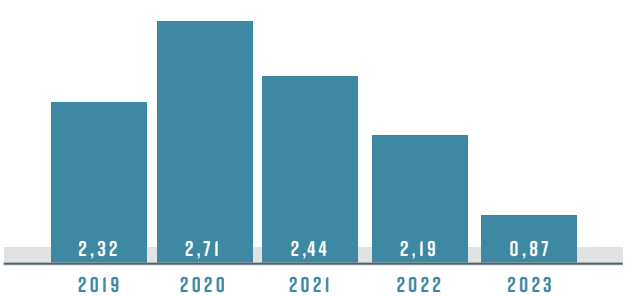
SEVERITY RATE

(Lost days / Worked hours) x 1.000



FRECUENCY RATE

(LTI / Worked hours) x 1.000.000



The TSK wage system includes fixed and variable components. On the other hand, we encourage mobility and promote the filling of vacancies through internal promotion, facilitating the voluntary movement of staff to enhance the development of their professional careers, talent management and the better matching of people to positions. This process allows employees to apply for those positions they find attractive, advising and supporting candidates who show interest in a particular position.

In relation to social benefits, TSK is committed to the continuous improvement of the quality of life of its employees. It makes a special effort to ensure and guarantee their lives, support the integration of the disabled and implement best practices to facilitate the combination of professional and personal life, such as flexible working hours, splitting of holiday periods and reduction of working hours, amongst others.

MANAGEMENT SYSTEMS

At TSK we define ourselves as a company guided by ethical behaviour and committed to Health and Safety at Work, Quality and the Environment. In accordance with our strategic framework, we have evolved based on a process of continuous improvement in all areas of our activity, with a firm commitment to proactively promote an ethical culture, paying special attention to people's safety, the quality of projects, and the protection and conservation of the Environment.

This commitment has materialized in our Integrated Management System, which is externally certified under the ISO 9001:2015, ISO 14001:2015, ISO 45001:2018, ISO 37001:2017, UNE:19601:2017, SR10, ISO/IEC 27001:2013 and UNE 166002:2014 standards and which covers all phases of the project life cycle, extending to our suppliers and subcontractors.

TSK's policy includes the commitment to carry out projects and provide services with due quality, respecting the environment, in health and safety conditions at work,

8M CELEBRATION. VALLADOLID 1000 MW COMBINED CYCLE POWER PLANT (MEXICO)

complying with legal requirements and other associated requirements, and always improving the satisfaction of our stakeholders.

TSK has an excellent team that allows the Company to overcome the challenges it faces and achieve its objectives in a sustainable, responsible manner and with the quality standards required by the market.

OUR PRIORITY: HEALTH AND SAFETY MANAGEMENT

At TSK we understand that health and safety is a fundamental and priority issue due to the nature of the activity we develop and therefore we work to maximize health and safety throughout the life cycle of our projects.

We have had an Occupational Health and Safety Management System since 2007, which we are currently certified under ISO 45001:2018, which considers all phases of the project life cycle, from design to construction and commissioning.

Our goal is always "zero accidents" and the guidelines for action are transmitted from the highest levels of the organization. This objective is applicable to all the people involved in our projects (employees and subcontractors), collaborators, suppliers and visitors to our facilities and projects.

TSK has a preventive organisation based on a joint prevention service - made up of professionals covering the preventive specialities of safety in the workplace, industrial hygiene and ergonomics and applied psychosociology - complemented by an external prevention service covering health surveillance. Workers who travel from Spain to international projects are given the necessary medical examinations, explorations and actions.

Within the preventive organisation of TSK, the prevention delegates of the different companies of the group are effectively integrated in representation of the workers, and a health and safety committee has been set up to provide information, participation and consultation on all matters relating to health and safety.

As part of our management system, TSK prepares specific health and safety plans in which the scope of work and the necessary preventive measures in the projects are defined.

So that safety is fully implemented in all our projects, from TSK we work for the standardization of health and safety procedures with the aim of increasing efficiency in the dissemination and assimilation of corporate policies.

Our commitment to health and wellness is a priority and one of the basic pillars of our employee value proposition. We establish programs that focus on three main areas of action: physical activity, emotional well-being and healthy habits and diet.

ENVIRONMENT

TSK, aware of the responsibility we have with the environment, contributes to sustainable development and to the prevention and protection of the environment. This is a priority integrated in the strategy marked by the Management.

TSK has an Environmental Management System implemented and certified in accordance with the ISO 14001:2015 standard, conceived to maintain an adequate level of environmental management in all our projects. In this way, we guarantee respect for the applicable environmental legislation.

At TSK we offer our clients our technical capacity and know-how to include sustainability criteria in the design, construction and operation of projects, trying at all times to achieve maximum production ratios with the lowest possible energy cost and always maintaining the highest levels of quality.

The value that TSK gives to the strong commitment with sustainability and the environment, makes the company to be always looking for and investing in more efficient solutions and technologies that allow us to reduce to the maximum the tons of CO2 emitted to the atmosphere.

COMPLIANCE

TSK promotes a culture of ethics and compliance in its activity which encourages and strengthens the principles and values established internally. For this reason, we are firmly committed to promoting the ethical behaviour of all our stakeholders, regardless of where we carry out our activity, through the use of the necessary resources in the control of business processes that allow us to differentiate ourselves in the market and ensure competitiveness. In this regard, it has published its own Compliance Policy and Code of Ethics, in addition to the implementation, since 2013, of a Crime Prevention Plan, which establishes the principles and values that must govern all business relationships and whose review and updating is the responsibility of the Ethics Committee. For the resolution of any doubts in this regard, it has an open communication channel, where any irregular conduct or conduct contrary to the internally established principles and values can also be reported.

The Criminal Compliance Management System is certified in accordance with the UNE 19601 "Criminal Compliance Management Systems" and UNE-ISO 37001 "Anti-bribery Management Systems", the first and most demanding certifiable international standard for developing and implementing management systems in this field. In this way, we guarantee our commitment to strengthening the ethical and compliance culture in the development of our activity.

SUSTAINABILITY

In TSK we wanted to take a further step in integrating the criteria of social responsibility, both economic, environmental, social, ethical management, good governance and transparency, through the development and implementation of a Management System certified by AENOR, based on the standard IQNET SR10. This System helps us to systematize, and integrate with other systems in our organization, the criteria and require-

MINGLANILLA 100 MW SOLAR PARK + SUBSTATION + TL 132 KV (SPAIN)

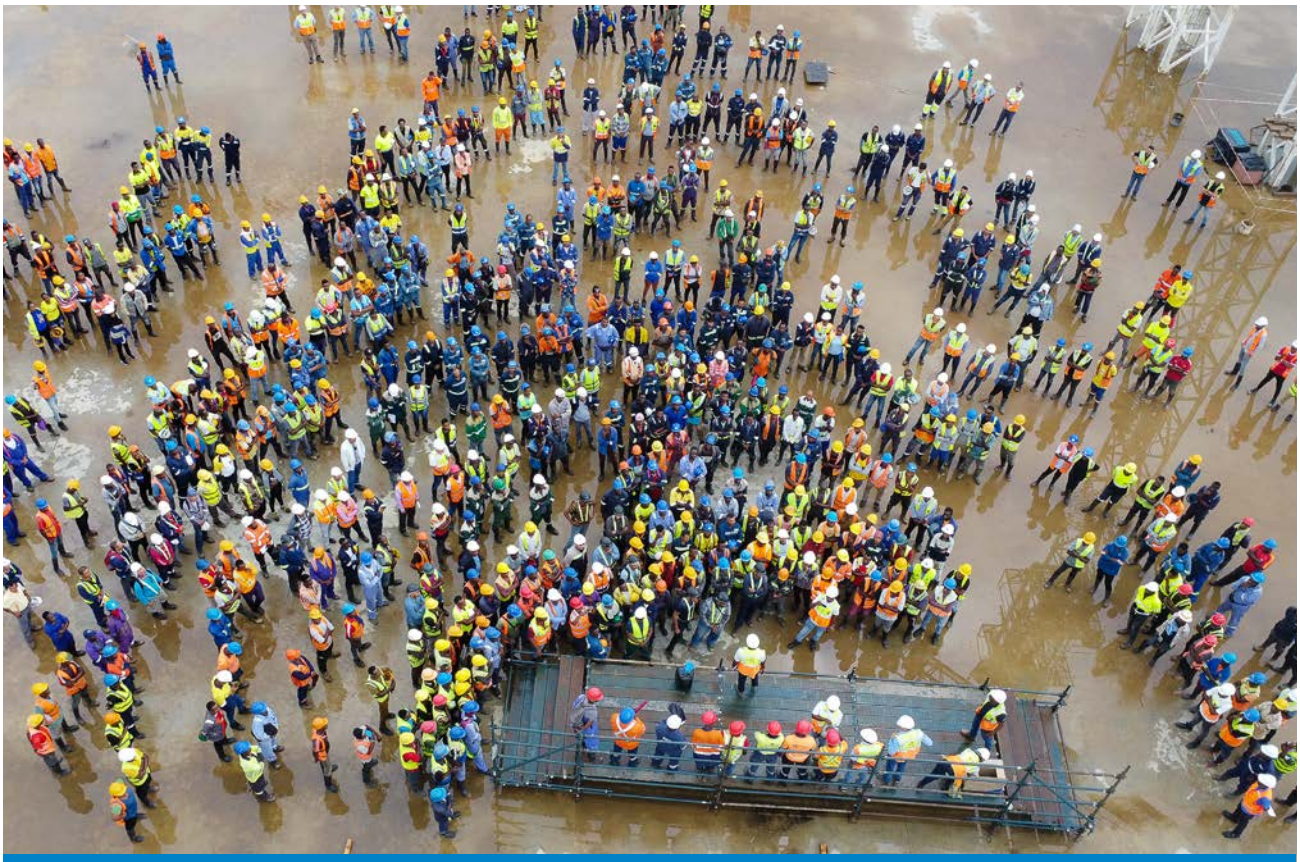
ments contained in this standard, as well as those contained in the international standard ISO 26000, a guide that provides guidance on the principles underlying social responsibility, recognition of social responsibility and stakeholder involvement, identification of risks and material aspects, and how to integrate socially responsible behavior in the organization, emphasizing the importance of results and improvements in the performance of social responsibility.

Key actions such as the identification, prioritisation and advanced dialogue with our Stakeholders, the identification of our sustainability risks, in the areas of ethics, the community, the environment or people, have allowed us to draw up a Policy, a Code of Ethics, and a Plan of Objectives and Actions, coherent and aligned with our priorities and with the concerns of our stakeholders, aimed at improving our social, economic and environmental performance.

Social progress, environmental balance and economic growth must always go hand in hand.

Our commitment to sustainability is a commitment to our vision, mission and values, incorporating in our Corporate Social Responsibility and business policy the Sustainable Development Goals (SDGs) approved by the UN, whose purpose is to promote economic growth, work for social inclusion, fight against climate change and protect the environment.

In order to identify those SDGs that are relevant to our organisation, we have carried out a materiality analysis, which



KILOMBERO SUGAR PLANT (TANZANIA)

takes into account both the interests of the organisation and the concerns of stakeholders and the communities where we operate, identifying four improvement plans or main initiatives on which the objectives and actions to achieve them are based, framed within our strategic plan: Talent Engagement and Loyalty Plan, Transparency and Good Governance Plan, Innovation and New Technologies Plan and Environmental Impact Improvement Plan. These Improvement Plans are related to 5 of the 17 SUSTAINABLE DEVELOPMENT GOALS

SOCIAL ACTION

At TSK we are convinced that social commitment is inherent in business activity, to which the growing level of prosperity and well-being of society is largely attributable. Our main responsibility is to be able to provide a better service to our customers every day. This is what allows us to create value, generate quality jobs, invest in research and development and get involved in activities that benefit society.

Within this social management, we highlight the following activities:

- Community Relations. We maintain a constant dialogue with authorities and community representatives during the execution of our projects.

- Social impact. Although the company's impacts are mostly positive, TSK analyzes local regulations in order to offer mechanisms for information, complaints and restoration of negative social impacts.

SIGNATURE OF THE COLLABORATION AGREEMENT WITH THE TECNOLÓGICO DE MONTEREY

PROJECT IMPLEMENTATION

Depending on the needs and expectations of the community where we are, we offer the possibility of carrying out projects to support it.

SPONSORHIPS

TSK has sponsored the TSK Roces Sports Club for over twelve years, with a group of over 500 children. In addition, every year TSK sponsors various events and sports clubs, in order to promote sport among the youngest and employees of TSK.

COLLABORATIONS WITH OTHER ENTITIES

In TSK we consider that it is also our responsibility to support organizations that work for the improvement of society. For this reason, we collaborate with different associations and organizations related to the environment, culture, research, education and corporate social responsibility with the aim of sharing their business experiences and acquiring the most appropriate and innovative practices. Among the most noteworthy are:

- Sponsorship of cultural exhibitions.
- Collaboration with the University of Oviedo.
- Commitment to Asturian industry and the development of the region.
- Collaboration with the Asturian Quality Club, Asturian Innovation Club, Femetal, Asturian Family Business Association, Ademi, Sercobe, Prodintec. and the Tecnologico de Monterey.

DONATIONS TO SOCIAL ACTION ENTITIES

Each year TSK allocates a portion of its budget to donations to entities that promote projects and actions related to education, health, culture, sports and international cooperation. Among other institutions, TSK supports the Princess of Asturias Foundation, the Foundation for Biosanitary Research of the Principality of Asturias (FINBA) and the Global Health Institute Foundation for child vaccination.

R+D+I

R&D&I: TSK'S GROWTH AND DIFFERENTIATION ENGINE.

At TSK, Research, Development and Innovation (R+D+i) is a fundamental pillar of our success. We promote technological innovation in the projects we develop for our clients, while at the same time we are committed to R&D which is strengthened and expanded in our new business innovation center, created to make a qualitative and quantitative leap in this field. In the last 5 years our investment in R&D&I has resulted in a total of 61 million euros, corresponding to 1.2% of sales.

NEW CORPORATE R&D CENTER: A SPACE FOR RESEARCH AND DEVELOPMENT

TSK SUSTAINABILITY TECHNOLOGIES CENTER was created with the aim of taking advantage of and enhancing TSK's extensive experience in the various projects and technological areas in which it has been involved for years. This diversity allows us to offer an integral vision of the challenges of the present and the future, and to develop innovative solutions that adapt to the specific needs of each client.

Our main lines of research are: decarbonization and energy transition, with projects in the hydrogen value chain, energy storage and CO2 capture; and digitalization and smart industry, with the development of software, IoT sensorics, data analysis and immersive technologies.

Through the center we drive innovation and the development of disruptive technologies through three pillars: a multidisciplinary team of experts who collaborate and exchange ideas, a strategic focus on key research areas that differentiate us in the market, and collaboration with universities, research centers and leading companies to promote innovation and the development of new technologies.

Within the catalog of R&D+i projects underway, we currently highlight the European TRINEFLEX project focused on research into new energy flexibility technologies; the HIVERED project related to the generation of green H2 or ALIMTECH, framed within the PERTE Agroalimentario call for proposals.

MORE THAN A BET ON THE FUTURE

At TSK, R&D+i is not only a business strategy. It is the driving force that drives us to grow, to overcome barriers and to offer our customers increasingly innovative and efficient solutions. It is much more than a commitment to the future; it is our present. Thanks to it, we are able to develop unique products and services that differentiate us from our competitors and position us as market leaders.

During the year 2023, as proof of this commitment, we have received the "Business Award of the Principality of Asturias" in the Innovation category for the technological and innova-

PROJECT PRESENTATION "TECHNICIAN 4.0 IN THE FOURTH INDUSTRIAL REVOLUTION".

tive nature of our developments and the "Innova Industry 4.0 Award" rewarding, in particular, the transformation, differentiation and evolution achieved from the area of digitalization.

In short, R&D+i is the key to maintaining our position as a leading company in the market, providing tailor-made, high-performance solutions to our customers and contributing to the progress of society.

R&D&I PROJECTS

The following projects have been implemented during 2023:

PROJECT SUBSIDIZED BY THE MINISTRY OF INDUSTRY, COMMERCE AND TOURISM WITHIN THE PERTE AGROALIMENTARIO WITHIN THE FRAMEWORK OF THE RECOVERY, TRANSFORMATION AND RESILIENCE PLAN.

Financiado por la Unión Europea NextGenerationEU
Plan de Recuperación, Transformación y Resiliencia
Gobierno de España · Ministerio de Industria, Comercio y Turismo

ALIMTECH: RESEARCH, DEVELOPMENT AND IMPLEMENTATION OF TRANSVERSAL TECHNOLOGICAL SOLUTIONS THAT ENSURE TRACEABILITY, SAFETY, QUALITY AND SUSTAINABILITY OF THE AGRI-FOOD SECTOR._PAG-010000-2023-2

The ALIMTECH project is motivated by the urgent need of the agri-food industry to adapt to the current global situation: the scarcity of resources that once existed, the high degree of pollution due to the toxic processes of the industry, the high level of food waste and the high consumption of fossil fuels, are some of the almost systematic problems that prevail in this industry, and that ALIMTECH wants to face, from a highly scientific and technological perspective, assuming the necessary research risks that we firmly believe that the Axis1 of the Agri-Food PER-

TE requires. To this end, it will focus on different chains in a cross-cutting and representative manner of the agri-food industry as a whole, working to find solutions not only for the sectors of the traditional industry sectors, not only in the meat, fruit and vegetable, ingredients and wine industries, but also in new solutions for novel or alternative food industries, such as functional ingredients or ingredients of insect origin, especially important for this new global situation that accompanies the industry and society. One of the most important motivations of ALIMTECH, which is perfectly aligned with PERTE Agroalimentario, is to solve the problems of traceability and food safety, because it is equally important to improve processes and products, to trace them in an immutable and accurate way, to achieve a significant improvement in resource efficiency of all value chains of the agri-food industry. In this way, a platform will be developed that will allow the different companies and project participants to create their own traceability models using blockchain technology. This is a platform, called ALIM TRACK, for traceable assets in the agri-food sector, which will enable traceability processes to be deployed in a simple way. And each of the companies will have a related performance where it evaluates the incorporation of its processes. On the other hand, the companies will also seek complementary solutions for the industry, both to improve the competitiveness of the subsectors and thus improve production processes and the energy expenditure associated with them, and to improve their sustainability through the use of waste, in line with objective 3 of the Spanish circular economy strategy – Spain 2030: Reduce the generation of food waste throughout the food chain.

The project, made up of a total of 15 companies and with the participation of 12 technology centers and universities, such as TECNALIA, CSIC and GAIKER, among others, is led by TSK and has obtained a total fundable budget of 12.5 million euros, with a subsidy of 8.8 million euros, to be executed until 2025 and which deals with the research, development and implementation of transversal technological solutions that ensure traceability, safety, quality and sustainability in the agri-food sector.

ACTIVITIES CO-FINANCED BY THE MINISTRY OF ECONOMIC AFFAIRS AND DIGITAL TRANSFORMATION AND EUROPEAN FUNDS FROM THE RECOVERY AND RESILIENCE MECHANISM (RRM), THROUGH THE UNICO I+D 5G-6G 2023 CALL: PROGRAM FOR THE UNIVERSALIZATION OF DIGITAL INFRASTRUCTURES FOR COHESION, WITHIN THE ADVANCED 5G R&D PROJECTS PROGRAM.

IMMERLIVE: REAL-TIME IMMERSIVE CONTENT FOR REMOTE AND COLLABORATIVE MONITORING OF DIGITAL TWINS OVER 5G NETWORKS 5G_TSI-064200-2023-4

The overall objective of this project is to advance the state of the art in the generation and representation of digital twins in the industrial environment incorporating immersive content captured in real time. It is intended to improve existing systems by enhancing static 3D models, augmented with IoT information but also with visual information captured in real time. As a representative use case, the fusion of a 3D model of an electrical panel with its capture by volumetric video from several points of view in real time will be investigated. Depending on the use case, the immersive content could be generated using 2D video, volumetric video, 360º or other capture technologies. The goal is to achieve real-time digital twins, which offer the possibility for remote supervisors to collaborate with on-site personnel for different tasks in various domains.

PROJECT SUBSIDIZED BY THE CENTER FOR THE DEVELOPMENT OF INDUSTRIAL TECHNOLOGY (CDTI) AND SUPPORTED BY THE MINISTRY OF SCIENCE AND INNOVATION

SOFIA: RESEARCH ON AN APPLICATION ECOSYSTEM FOR PRODUCTIVITY IMPROVEMENT IN THE SOFTWARE DEVELOPMENT

INDUSTRY THROUGH THE INTENSIVE USE OF RELIABLE AI THROUGHOUT ITS LIFE CYCLE_MIG-20232056

The SOFIA project promotes cooperation around the use of AI in software development and its safe application in industrial environments with the objectives of advancing scientific and technological knowledge, including legal and ethical aspects, for the use of Reliable Artificial Intelligence throughout the software development cycle in order to achieve an unprecedented improvement in production efficiency and cybersecurity, perform Proof of Concepts (PoC) to validate the technologies investigated (TRL4) that provide methodologies and lessons learned for future developments and industrialization; share best practices between knowledge centers and companies, in different technological and business fields, allowing an effective collaboration in order to prepare for the subsequent industrialization and commercialization of the results, as there is no conflict of interest; to analyze and investigate the reliable, efficient and safe applicability of the investigated technologies to different scenarios of software development cycles such as Software Factories, Naval Systems (industrial), Optimization Robotic Process Automation (RPAs) (high level), IoT (low level) and Visualization Systems (human-machine interface); and to strengthen and position the Consortium and its partners as benchmarks in their fields of action, enabling their participation in international initiatives, such as Horizon Europe, Key Digital Technologies Joint Undertaking (KDT JU), Important Projects of Common European Interest (IPCEI) and international research networks.

SOLSTICIA: SOLUTIONS FOR BUILDING CYBER-SAFE AND INTELLIGENT INDUSTRIAL SOFTWARE SYSTEMS BY DESIGN BASED ON ARTIFICIAL INTELLIGENCE TO DRIVE PRODUCTIVITY AND GROWTH IN A CYBER-SECURE ECONOMY AND SOCIETY

Industry is incorporating many intelligent systems that need to be secured by design if they are not to increase the surface area of exposure to cyber-attacks. The developers of these intelligent systems are highly competent, but they unconsciously design and develop systems that are prone to vulnerabilities in all domains and use cases, even when operating in tightly controlled development, laboratory and test environments. SOLSTICIA investigates to answer the question how we can therefore build intelligent systems to be robust and secure in complex and ambiguous contexts such as those of the industrial domain where the possible consequences of a cyber-attack impact lives or large business losses?

The SOLSTICIA project aims to optimise and secure all intelligent software development processes. During the execution of the project, TSK will work on the Industry 4.0 platform that it has developed over the last few years and on which it has built a catalogue of solutions such as SISREM, SISDRON or SIXPERIENCE. The results of the project will optimise the company's intelligent software development process.

This project is led by CAPGEMINI in consortium with TSK, MTP, ATOS, PROXYA, COTESA and THE REUSE COMPANY. The consortium has the collaboration of the Tecnalia technology centre and the Polytechnic University of Madrid.

INMERBOT: RESEARCH IN IMMERSIVE AND SENSORY TECHNOLOGIES FOR COLLABORATIVE INDUSTRIAL ROBOTIC INSPECTION_MIG-20211008

This project arises from the existing limitations in efficient human-robot and robot-robot collaboration in inspection and maintenance environments of industrial facilities. The scope of the INMERBOT project is to advance knowledge of teleoperation and management of multi-robot systems in highly immersive environments for inspection and maintenance applications, which involves research into haptic and robotic technologies, analysis of the environment using various sensors, as well as research into the use of artificial intelligence for mobility, defect detection and reconstruction of the environment based on data from sensors and vision cameras.

The consortium of this project is led by TSK with the participation of ALISYS, COTESA, ECAPTURE, ROBOTNIK, APTICA, GPA SEABOTS and SYLTEC. The ITCL and LEITAT technology centres and the Polytechnic University of Madrid and the University of Oviedo are also collaborating.

TSK is mainly participating in the project by researching immersive technologies (virtual, augmented and mixed reality) for remote operation and interaction with multi-robot systems

"INMERBOT" PROJECT PROTOTYPE FOR INDUSTRIAL OPERATION AND MAINTENANCE

in industrial inspection scenarios. It will also work on the design of new sensors and artificial intelligence algorithms for the detection of events and anomalies.

SECBLURED:HOLISTIC APPROACH TO CYBERSECURITY IN THE INDUSTRIAL LOT (LLOT)_MIG-2022I051

Due to the current trend of attacks suffered by industry and considering the wireless technologies to be progressively implemented (substantial savings in the deployment of new systems), the SecBluRed project proposes a holistic research approach to cybersecurity for the Industrial IoT (IIoT, from now on), which could be extended to other industrial technological environments. To this end, three research axes are proposed:

IIoT Securitisation: building secure IIoT systems, based on secure components. The aim will be to identify new mechanisms complementary to the current ones to increase the cybersecurity of IIoT systems. This line of research is oriented towards the development of IIoT systems that consider 5G networks, the post-quantum stage (which is much closer than we think) and guaranteeing the identity of IIoT nodes (self-sovereign identity), among other aspects.

BlueTeam IIoT: IIoT system defence mechanisms. The objective is to provide additional mechanisms to an IIoT system (new or in operation) to increase its defence against cyber-attacks from malicious internal and/or external employees in order to stop information leakage or manipulation. This is a line of research on network-level defence mechanisms in the IIoT domain. Specifically, what is proposed is an intelligent network monitoring system that is non-intrusive in deployed systems, running on IIoT hardware designed for this purpose. An OT

communication and control unit (wired) with new cybersecurity capabilities is also proposed.

RedTeam IIoT: validate the proposed security and defence mechanisms. The aim is to validate that the new IIoT system construction components are cybersecure, and that the IIoT defence mechanisms proposed in the project are effective. This is the last line of research aimed at minimising the likelihood of a security breach in IIoT systems incorporating the solutions proposed in this project, as there is no way of guaranteeing that there will be no security breaches.

The consortium of this project is led by MÉTODOS Y TECNOLOGÍA DE SISTEMAS Y PROCESOS, S.L. and counts on the participation of TSK ELECTRÓNICA Y ELECTRICIDAD, S.A., AMPLÍA SOLUCIONES, S.L., EDOSOFT FACTORY, S.L., OPEN CANARIAS, S.L. and SCHNEIDER ELECTRIC ESPAÑA, S.A., OPEN CANARIAS, S.L. and SCHNEIDER ELECTRIC ESPAÑA, S.A. The Polytechnic University of Madrid (UPM), the University of Oviedo (UNIOVI), Tecnalia, the Technological Institute of Castilla y León (ITCL), Ikerlan, Gradiant and AICIA are also collaborating.

PROJECT CO-FINANCED BY THE CDTI AND BY THE EUROPEAN UNION THROUGH THE FEDER FUNDS

READY TWIN: RESEARCH IN EMERGING TECHNOLOGIES TO ACHIEVE INNOVATIVE SOLUTIONS FOR DIGITAL TWINS _IDI-20190974

The READY TWIN project will facilitate the adoption of technological solutions capable of generating accurate Digital Twins in an automated manner through the use of 3D and IoT modelling technologies; as well as improving Digital Twin Asset Management through the use of Artificial Intelligence, Visualisation Technologies, Virtual Reality and Augmented Reality Simulation Technologies and Blockchain. All of them are disruptive technologies in the international and national technological panorama.

AID4PV: MODULAR UAVS-BASED SOLUTION FOR DECISION MAKING AND DIAGNOSTIC TASK SUPPORT OF PHOTOVOLTAIC PLANTS USING ELECTROLUMINESCENCE IMAGING, THERMOGRAPHY AND RGB VISION CAMERAS, ELECTRICAL ANALYSIS AND GEOVISUALISATION _IDI-20210170

The AID4PV project aims to research, develop and demonstrate in an operational environment a modular solution based on unmanned aerial vehicles (UAVs) for PV plant monitoring and advanced diagnostics. The autonomous UAV platform will capture photographic (RGB), thermographic (IRT) and electroluminescence (EL) images to enable near real-time fault detection, leading to PV plant diagnostics in time and cost. The results will be presented in an advanced reporting and geo-visualisation platform including geospatial analysis and visualisation tools. Decision support capabilities will also be investigated, adding the possibility to perform some kind of predefined actions from the UAV platform, minimising the time from detection of an anomaly to corrective actions.

PROPERPHOTOMILE: PREDICTING THE OPERATIONAL LIFETIME OF PEROVSKITE PHOTOVOLTAIC CELLS. ACCELERATION FACTORS IN THE STUDY OF STABILITY THROUGH THE APPLICATION OF MACHINE LEARNING_IDI-20170171

The overall objective of the ProperPhotoMiLe project is to develop an automated scheme to analyse the stability data of Perovskite Halide Solar Cells (PSCs) generated by standardised accelerated tests. This analysis will determine the most relevant accelerated test for normal operating conditions, as well as the acceleration factor (which relates the measured stability parameters to the operational lifetime of the PSC) and the expected lifetime.

HYPER: HYBRID PLANT CONTROLLER _IDI-20210809

The overall objective of the project is to develop a novel tool for the real-time control of hybrid technology generation power plants (mainly solar thermal and photovoltaic), that allows this type of plant to operate as a single equivalent plant.

LUG: PARAMETERIZATION OF THE FACTORS INVOLVED IN THE DEGRADATION OF SOLAR SALT AT HIGH TEMPERATURE. _IDI-20211041

The objective of the project is to determine the degradation equilibrium values of molten salts used in power generation

plants where an operating temperature of 565ºC is required. It is desired to know these equilibrium values as a function of parameters such as temperature, oxygen partial pressure, surface/volume ratio, gas volume/molten salt volume, etc.).

PROJECT CO-FUNDED BY THE GOVERNMENT OF THE PRINCIPALITY OF ASTURIAS THROUGH IDEPA, THE SCIENCE, TECHNOLOGY AND INNOVATION PLAN (PCTI) 2018-2020 AND THE EUROPEAN UNION THROUGH ERDF FUNDS.

SISHOME: DESIGN OF A COMPREHENSIVE RESIDENTIAL MONITORING SOLUTION ORIENTED TO EFFICIENCY AND WELLBEING _IDE/2020/000326

The general objective of the SISHOME project is to build a modular solution that allows the integral monitoring of all existing sources of information THAT influence the home and that allows the extraction and definition of indicators and policies both in terms of energy efficiency and people's well-being and quality of life.

BIO-TECS: RESEARCH ON THE HYBRIDISATION OF DEEP LEARNING, EDGE COMPUTING, INTERNET OF THINGS, AND MICRO-ENERGY GENERATION TECHNOLOGIES FOR BIODIVERSITY CONSERVATION IN ISOLATED, REMOTE AND POTENTIALLY HOSTILE ENVIRONMENTS. _IDE/2021/000455

The aim of the project is to investigate how far current technology is capable of going in terms of hardware (processing, communications, image capture sensors), image processing algorithms (based on Deep Learning and Edge Computing contemplating approaches for optimisation), intelligent information management (using IoT protocols and technologies such as NB-IOT and/or LoRa), remote monitoring of equipment (consumption, characterisation of devices, detection of theft, etc.), microgeneration systems for the correct supply of energy to electronic elements, and hybridisation procedures for all these components, all applied to a use case for the conservation of biodiversity in isolated environments.), microgeneration systems for the correct supply of energy to the electronic elements, and hybridisation procedures for all these components, all applied to a use case for the conservation of biodiversity in isolated, remote and potentially hostile environments, although the results will be directly extrapolable to other fields in which highly efficient image processing capacities are needed, in real time and with minimum energy consumption, such as industry or security.

DATIVEHAUS: STUDY AND RESEARCH INTO THE DESIGN OF AN ENERGY-OPTIMISED MODULAR DATA PROCESSING CENTRE_ IDE/2021/000462

The aim of the project is to investigate a new design for a modular container for edge-type data centres that can significantly improve their energy efficiency and environmental impact through the inclusion of bioclimatic construction techniques and green generation sources.

DAGDA: DESIGN OF A DATA STORAGE AND DATA MANAGEMENT PLATFORM FOR POWER PLANTS_IDE/2021/000384

The general objective of the project is to research the technologies for obtaining a Big Data tool that extracts, consolidates, analyses and presents all the data generated in electricity generation plants. The tool will be capable of adapting to the user to offer the capabilities and analysis that will be useful to them, either by providing daily operating reports, digital twins of equipment and/or systems, availability evaluations or any other study based on real operating data.

DAMTAQ: DATA FUSSION METHODOLOGY FOR REMOTE MONITORING OF WATER QUALITY IN RESERVOIRS _IDE/2022/000558

The overall objective of the project is the remote monitoring of reservoir water quality. It is intended to provide a methodology that allows the management and analysis of multiple sources of information related to reservoir water quality in order to derive relevant results. The overall objective is the remote monitoring of reservoir water quality, for which a low-cost sensor and communication solution will be investigated and the use of remote sensing and satellite data, the application of data analysis algorithms and the combination and correlation of different sources of information to generate indicators and guide decision making will be addressed.

SECURAT: IMMERSIVE PHYSICAL SECURITY SYSTEM BASED ON AUTONOMOUS AND TELEOPERATED ROBOTIC PLATFORMS._IDE/2022/000605
This project aims to go one step further in the current video-analytic systems, proposing innovations that allow physical security to be oriented towards an autonomous, augmented, dynamic and immersive security system through research in robotic platforms (as well as the sensorics to be included in them) and immersive technologies.

OPENCLAD: INDUSTRIALIZATION OF AUTOMATED PROCESSES OF CORROSION AND WEAR RESISTANT HARDFACING FOR COMPONENTS WITH HIGH REQUIREMENTS IN SERVICE_ IDE/2022/000793
The final objective of this open innovation project is the industrialization of an automated hardfacing process for components with high mechanical requirements, such as those used by PHB in its bulk material handling applications.

ACTIVITIES CO-FINANCED BY THE SEKUENS AGENCY AND THE SCIENCE, TECHNOLOGY AND INNOVATION PLAN (PCTI)

HIVERED: STABLE GREEN HYDROGEN IN MICROGRIDS_ IDE/2023/000202
HIVERED is going to study, in a first stage, the stability of the electrolysis process when the electrolyzer is fed by a photovoltaic park with a power close to its own. For this purpose, a simulation stage of the microgrid and the control system will be carried out (for this purpose, the LEMUR group of Uniovi will be involved). In a second phase, a demonstrator will be assembled and tests will be carried out to confirm the results of the simulation in terms of stability and process control. The electrolyzer used in the demonstrator will be a pressurized alkaline one.

SITETRAK: RESEARCH ON NEW TECHNOLOGIES FOR THE INTELLIGENT MONITORING OF EPC PROJECTS_IDE/2023/000202
Project monitoring is an indispensable tool for maintaining control of the risks associated with its execution, and is a control service capable of anticipating and detecting current or potential risk situations at an early stage, allowing preventive rather than corrective action to be taken.

The large amounts of data and information collected at each stage of the project require appropriate management, allowing all parties involved to control the process parameters associated with each stage. In this context, the SITETRAK project was born, which aims to combine the monitoring and comprehensive management of EPC (Engineering, Procurement and Construction) projects developed by the TSK Group, through the use of Industry 4.0, in order to offer the client an intelligent monitoring that does not exist in the current market, by means of the latest technologies.

The need for this project therefore lies in the challenges faced by EPC projects in terms of controlling, monitoring and optimizing execution. These projects often involve multiple disciplines, suppliers and subcontractors, making it difficult to monitor in real time and make decisions based on accurate information.

CABINET: AUTOMATIC IDENTIFICATION AND VERIFICATION OF ELECTRICAL COMPONENTS THROUGH ARTIFICIAL INTELLIGENCE TECHNIQUES_ IDE/2023/000562
The general objective of this R+D+i project is to find an innovative technological solution to automate and optimize the verification process of each panel while achieving complete traceability of the same. Through the use of video techniques and information and communication technologies (ICT), the aim is to speed up the process of verifying the presence of the components and compliance with the technical requirements established in the technical data sheet of the electrical cabinets. As anticipated, this would result in a reduction of costs associated with incomplete shipments and operator trips to correct missing elements, in addition to minimizing the risks inherent to these tasks.

Aware of the advantages that ICT technologies can bring in this area, TSK has decided to take a step forward and develop

an innovative solution that optimizes and automates the verification process, achieving complete traceability of the process and thus improving operational efficiency and customer satisfaction.

HOLLOCOLAB: RESEARCH ON MIXED REALITY TECHNOLOGIES TO IMPROVE COLLABORATIVE PROCESSES IN BIM_ IDE/2023/000570

The main objective of the project is to investigate mixed reality technologies to improve collaborative processes in BIM projects. Going a step further than the current BIM model visualization applications, this project will allow to manipulate the model within an extended environment, modify the position of model elements (this change being registered), change the perspective to one in which the user can have a 1:1 scale experience, consult any data associated with the elements and even dynamically generate annotations through voice recognition.

In this way, the project aims to improve the current coordination systems, proposing innovations that allow to orientate the collaboration towards an extended, connected system with an intelligent change management, which in turn has all the project data at all times through the research of Mixed Reality and intelligent voice processing technologies.

PROJECT CO-FINANCED BY THE GOVERNMENT OF THE PRINCIPALITY OF ASTURIAS THROUGH THE REGIONAL MINISTRY OF RURAL AFFAIRS AND AGRICULTURAL POLICY WITHIN THE RURAL DEVELOPMENT PROGRAM OF THE PRINCIPALITY OF ASTURIAS 2014-2020

GO AHUMADO: PGO AHUMADO: PROJECT FOR THE DEVELOPMENT OF A SMOKING SYSTEM TO INCREASE EFFICIENCY, SAFETY AND SUSTAINABILITY OF THE PRODUCTION PROCESS_GOP/16/2023

The smoking process consists of subjecting a food to a source of smoke from a wood fire. It is an ancient food preservation technique that gives the food certain important sensory qualities that are highly valued by the consumer. The "traditional smoking" process used in Asturias is based on the use of "fire carts", where a fire is made from noble woods (oak or chestnut), and smoke is generated. This markedly "traditional" character means that the work methodology is based on expert knowledge and does not have any type of control tool, which generates a series of problems: i) excessive dependence on manual labor; ii) lack of control during the combustion process; iii) quality problems of the final product; iv) high risk of fire; and v) high consumption of human resources.

In response to this problem, the GO-SMOKED innovation project proposes the design, development and validation of an innovative modular smoking system composed of different technological solutions aimed at digitalizing and automating the production process, while maintaining the differentiating organoleptic characteristics of the final product.

To address this objective, GO-SMOKED proposes different lines of action, all of them interrelated and aimed at increasing the competitiveness of companies through the implementation of tools capable of providing solutions to the problems and needs detected:

· Isolation of the smoke generation area from the smoking area, allowing the optimization of combustion and eliminating the risk of fire.
· Optimization of the smoke generation process through the use of more sustainable specific raw material (pellets) or woodchips.
· Digitalization and automation of the Asturian sausage production process through the development and implementation of sensors and algorithms capable of monitoring and controlling, in real time, process parameters and product quality parameters.

In this project, TSK is the representative of the group, with the technical collaboration of ASINCAR, and as beneficiary partners of the group: FORESTRY AND WOOD TECHNOLOGICAL CENTER FOUNDATION (CETEMAS) and Jesús Perez Mayor S.L.

PROJECT CO-FINANCED BY THE "PORTS 4.0" FUND OF STATE PORTS

PARVAMAP 3D: UNTHRESHED GRAIN MAPPING SYSTEM AND INTERFACE DEVELOPMENT FOR THE OPERATION (PROJECT 245)

The objective of the project is the improvement of stock management and automation of machinery present in the bulk solids handling facilities. By means of laser technology, the 3D mapping of the stockpiles is achieved in a fully automatic way and with the development of a very simple graphic interface, the handling facilities are coordinated and operated from the control room.

This new system can be used both in new machinery and storage yards, as well as in the adaptation and improvement of existing yards and machinery. This results in increased productivity, better management of existing warehouse stock and minimization of field operation risks, among others.

PROJECT CO-FINANCED BY THE BASQUE GOVERNMENT AND THE EUROPEAN UNION THROUGH THE EUROPEAN REGIONAL DEVELOPMENT FUND 2014-2020 (FEDER).

REPAPEL: RECOVERY AND USE OF HIGH ADDED VALUE COMPOUNDS PRESENT IN INDUSTRIAL PULP AND PAPER MANUFACTURING STREAMS._ZE-2021/00013

The main objective of the REPAPEL proposal is the recovery and use of high added value compounds present in industrial pulp and paper manufacturing streams, seeking circular economy in the paper sector. The technologies developed here will serve as a basis for their implementation in other industries at national and international level, as well as in other industrial sectors where the application of waste recovery technologies and the concept of circular economy is also necessary. With the execution of this project, different technical, economic and environmentally viable solutions will be defined to provide a global solution to waste reduction, process improvement and the manufacture of products with better and more sustainable performance.

DARSEDET: ON-BOARD DETECTOR OF ENTRY AND EXIT EVENTS AT BUS STATION DOCKS_ ZL-2022/00152

The main objective of the project is to research, design, and develop an intelligent sensory embedded system integrated in intercity buses that allows automated detection through cognitive vision algorithms of the entry and exit events of buses in the station docks. The project will allow TSK to consolidate its position as a solution provider in the smart and sustainable mobility market, which has been growing rapidly in recent years, by addressing and proposing a solution to a currently detected deficiency related to the monitoring of bus entry and exit events.

PROJECTS FINANCED BY THE GERMAN MINISTRY OF ECONOMY AND ENERGY (BMWI)

AVUSPRO

The objective of this project is to develop a method for predicting the fouling of photovoltaic panels and parabolic trough collectors.

VENITE: HIGHER TEMPERATURE AND LIFETIME FOR NITRATE SALTS

The objective of this project is to study the physicochemical behavior of molten salts at 565ºC to reduce risks in future projects.

PROJECT FINANCED BY THE EUROPEAN UNION (HORIZON)

TRINEFLEX: TRANSFORMING ENERGY-INTENSIVE PROCESS INDUSTRIES THROUGH THE INTEGRATION OF ENERGY, PROCESS AND RAW MATERIAL FLEXIBILITY_ 101058174

TRINEFLEX is a set of integrated tools for the transformation

of EIIs following the "X-as-a-Service model". For end-users (EIIs), TRINEFLEX will function as an end-to-end service that will manage the digital lifecycle of the plant and the transition process towards flexible and sustainable operation. This process will be enabled through advanced and green data acquisition, Big Data infrastructures, process analytics, model development and finally digital twins with integrated multi-agent decision support systems.

ACTIVITIES CO-FINANCED BY THE MINISTRY OF INDUSTRY, TRADE AND TOURISM, THROUGH THE 2022 CALL FOR INNOVATIVE BUSINESS GROUPS

I-EN3D: NEW SYSTEM FOR 3D DIGITISATION OF MULTI-ENVIRONMENT INDUSTRIAL PLANTS COMPATIBLE WITH VIRTUAL REALITY SYSTEMS FOR TRAINING, PROCESS CONTROL AND MAINTENANCE IN REAL TIME _ AEI-010500-2022-41

The objective of this project is the design and development of a new solution that allows the generation of realistic industrial environments captured by means of 3D digitalisation, correctly characterising all their details and their subsequent transformation to be used for their visualisation and interaction in a Virtual Reality system. At the end of the project, the aim is to obtain a technologically advanced prototype whose implementation in industrial plants will serve to optimise operation and maintenance by facilitating the supervision of their status (in real time and by means of historical records), and to enable access to technical information and simulations that train the operators of industrial facilities. The capture of real industrial environments will be carried out using 3D digitalisation techniques, for which a set of protocols based on laser technology and Structure from Motion (SfM) photogrammetric reconstruction will be researched and developed. This research and development aims to respond to two major challenges: automated in situ digitisation and the processing of the resulting large volume of data to achieve high quality and realistic 3D models. Once this process has been completed, optimisation of the model will be carried out using a process called retopology, which allows the size of the images to be reduced without losing the quality and detail of the 3D models.

The project will define this process and its associated methodology. In addition, research will be carried out into its automation, one of the main technological challenges that will be addressed.

Based on the different 3D environments captured, we will work on their visualisation in a Virtual Reality solution allowing interaction with them. In this way, the user will be able to interact with the environment (grabbing objects, making use of tools, interacting with panels on machines, etc.) and options for manual actions will be provided, where necessary, by means of virtual panels.

Finally, it should be noted that 6 entities will participate in the project, all of them actively. Two of them are clusters (METAINDUSTRY4 and AIN) registered in the Registry of Innovative Business Groups (AEIs) of the Ministry of Industry, Trade and Tourism. Of the remaining 4 companies, two belong to the industrial sector (TSK and IBERASTUR), one is an expert in digital solutions (TALENTO) and the last one is specialised in 3D documentation engineering (DOGRAM).

ACTIVITIES CO-FINANCED BY THE MINISTRY OF INDUSTRY, TRADE AND TOURISM, THROUGH THE CALL FOR INNOVATIVE BUSINESS GROUPS OF THE YEAR 2023

EMI: INTELLIGENT METALLIC STRUCTURES THROUGH ELECTRONIC SENSOR PRINTING_AEI-010500-2023-287

The overall objective of the project is the design of a sustainable digital printing process capable of developing electronic sensors for monitoring metal structures providing an intelli-

gent system that allows transmitting high-value information on the state of structural health remotely. Therefore, the project aims to design and validate a sustainable digital printing process through the development of a prototype consisting of a strain gauge, its associated electronics and an RFID communication antenna for monitoring metal structures in industrial use cases.

To address this objective, the following lines of action are proposed:

Printing materials compatible with the metallic structures to be monitored will be identified and selected, prioritizing those that facilitate longer sensor life, reusability or recyclability of the sensors. The digital printing process capable of solving complex designs in both 2D and 3D for the production of electronic sensors will be defined. The electronic elements for the sensorization of the structure and transmission of information will be designed. Structural prototypes will be designed and developed for the validation of the technology to allow the integration of printed sensors or direct printing. For this purpose, the metallic structures to be monitored will be defined and sensor validation tests will be performed to evaluate the functionality of the sensors.
PARTNERS: TSK.; GONVARRI MS R&D; Fundación IDONIAL; Clúster de Fabricación Avanzada de la Industria del Metal de Asturias (MetaIndustry4 o MI4); Clúster de Impresión Funcional y Aditiva(Functional Print o FP); TAFCO Metawireless, S.L.Know-How Innovative Solutions S.L. (KHIS GROUP) ROTIMPRES S.A.

COPPER SMELTER HANDLING SYSTEM
MANYAR SMELTER PROJECT (INDONESIA)

INTERNACIONAL EXPERIENCE

THE KNOWLEDGE ACQUIRED IN THE WIDE VARIETY OF PROJECTS CARRIED OUT IN MORE THAN 50 COUNTRIES ALLOWS US TO ADAPT TO THE TECHNICAL AND CULTURAL FEATURES OF EACH COUNTRY AND SUCCESSFULLY COMPLETE OUR INTERNATIONAL PROJECTS. OUR INTERNATIONAL STRATEGY IS BASED ON CLOSE COOPERATION WITH LOCAL COMPANIES, ENABLING US TO ADD VALUE FOR ALL THE COUNTRIES IN WHICH WE WORK, COMBINING TECHNOLOGY, EXPERIENCE AND RESOURCES.

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