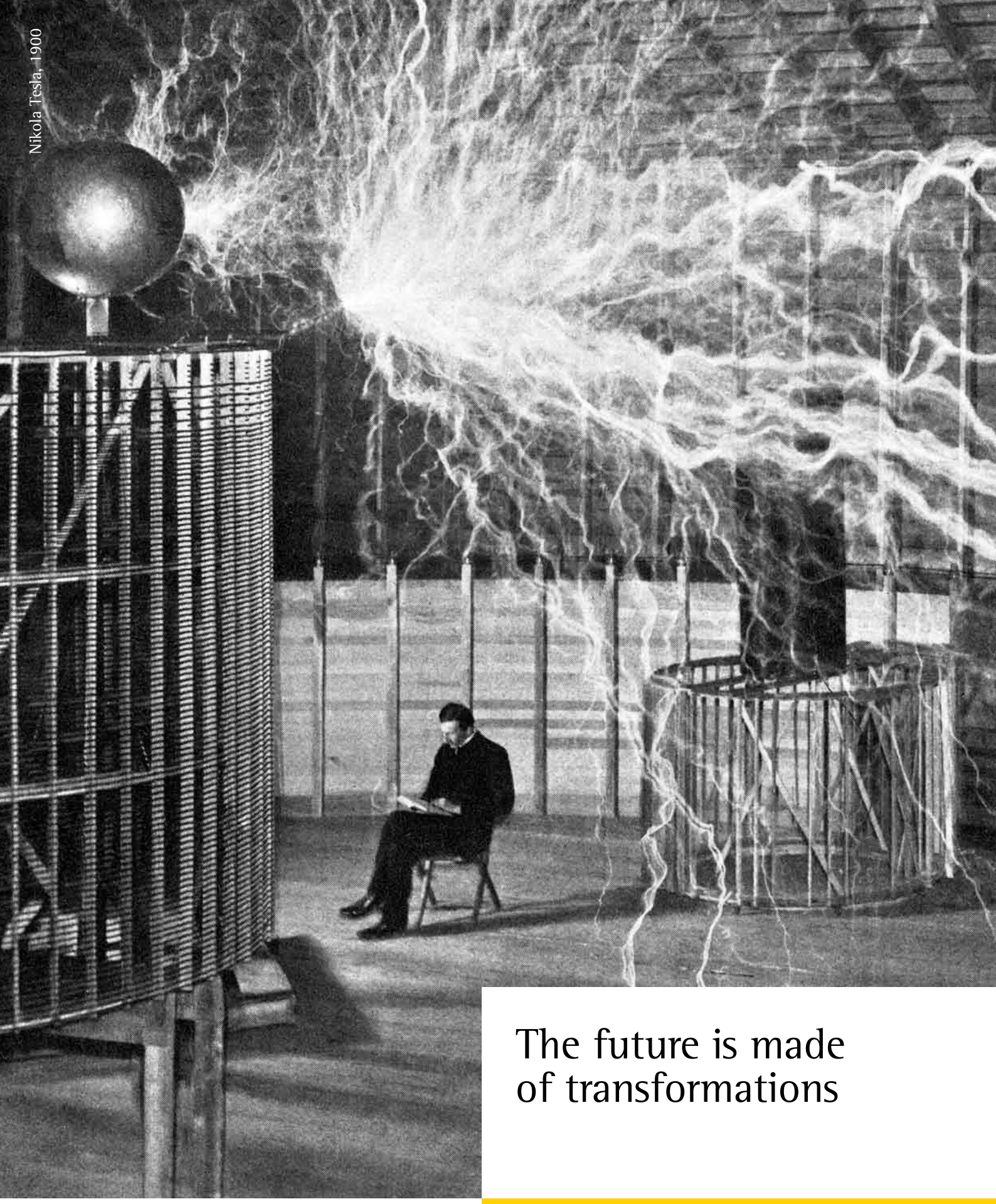


The future is made of transformations

TRASFOR

Made in Switzerland

On the cover: Nikola Tesla, pioneering genius of electricity, in his laboratory.

Index

Technical precision, constant attention.

Trasfor

About us

More than 40 years of experience in the research, design and manufacture of transformers and reactors has made **Trasfor SA** an international industry leader and a primary company in the industrial fabric of the Canton Ticino in Switzerland. At its headquarters in Molinazzo di Monteggio **Trasfor** occupies an area covering more than 15000 square meters, the result of several phases of expansion and modernization incorporated in various strategies to develop the company and diversify its product lines. The use of insulation and protection systems such as cast resin and vacuum pressure impregnation, as well as the various technologies used in the cooling of components, have enabled **Trasfor** to master all application fields: energy distribution, civil and military marine, offshore, fixed and mobile rail traction as well as in the mining and renewable energy sectors.

This is a characteristic that makes our company unique in the world, as it enables all our customers to take advantage of product and process know-how in addition to the engineering skills of highly qualified employees, fruit of experience gained in the various fields of application and in compliance with the strictest regulations. The constant research carried out over the years has been the driving force behind the innovation aimed at continually improving the design and manufacturing tools/methods which have made **Trasfor** a competitive player. The solidity of the company and its efficient organization allow **Trasfor** to implement an expansion strategy based on strategic partnerships, in particular in emerging countries, which without doubt provide a rich vein of opportunities.

Milestones

1967	**Trasfor SA** is registered as a manufacturer of low voltage transformers and reactors for the Swiss market.
1976	Cast resin technology is implemented and used for transformers up to 36 kV insulation class. It signals the beginning of the company's expansion beyond the Swiss border.
1980-1989	**Trasfor** enters the marine, offshore and rail traction sectors. It is an important moment in the company's growth in terms of both volumes and technology.
1990-1999	ISO Certification 9001.
2000-2010	**Trasfor** becomes a leader in the marine, offshore and rail traction sectors. The share of revenues from exports reaches 90%. Greater attention is given to high-tech products for special applications.

History

Although the name **Trasfor** was registered at the Chamber of Commerce in Lugano in 1953, **Trasfor SA** was only founded in 1967. It is the typical story of entrepreneurs entering the competitive arena of a growing market, reinforcing themselves with a spirit of innovation and precise strategies. Throughout the long history of **Trasfor**, which has not been without its challenges, a number of values can be found that continue to represent its main structure, namely: respect for the environment, constant enhancement of employee skills and sound ethics in business practices and relationships.
The company's evolution has been characterized by important moments of change: in 1976 the introduction of cast resin transformers enabled the company to enter the marine business, which over the following years would become a strategic element in its growth. In 1988 a decision was made to enter the first stage of expansion of the production area, and in 1994 ISO 9001 certification was obtained. In 1999 the company was taken over by four executives in a management buyout. This was a very successful operation and enabled **Trasfor** to significantly improve its international profile. From 2004 the company began a trend of revenue growth, with annual increases of between 20% and 30%.
In 2000 the company obtained ISO 14000. The years 2004/2008 were marked by massive investments in buildings and production methods with the purchase of new and modern machinery, design software, in addition to enhancing its sales network on an international level.

Mission

We provide outstanding customer value to a worldwide clientele for applications in industrial, traction, marine and offshore markets. Our products meet the highest technical standards in order to satisfy the most exigent client specifications.
All the manufacturing processes are driven by respect for the environment. Our company culture is based on continuous improvement of technology and processes to offer exceptional and cost efficient products and services.

Our most valuable resource is the human capital formed by the staff at all levels. We organize work in such way to ensure the greatest personal satisfaction for everyone as well as to create good chances of professional advancement for those that perform well.
We conduct all business in fairness and mindful of the rights and expectations of our clients, employees, suppliers, shareholders and other stakeholders

Employees

Special attention is given to the selection, training and management of our employees in the knowledge that our know-how is our main competitive lever. An accurate visual information system allows us to provide all our employees with information on company performance in terms of quality, orders received, invoicing, absenteeism, safety and suggestions for improvements. By encouraging employees to take an interest in the company's business we aim to promote the "feel good at work" factor. The idea behind this is to enable the potential and entrepreneurial value of every person to be freely expressed as added value in our daily activities. We want to move closer and closer to a culture of Lean Management in order to improve efficiency through flexibility, optimizing the company as a system and its value chain. We have been living this culture change for years. It is a long process where all members of staff participate, aware of their own role in the change and the additional opportunities it provides in terms of professional development.

Trasfor worldwide

Trasfor has a wide network of retailers, representatives, agencies and partnerships. In 2009 **Trasfor** finalized a joint venture in Thailand aimed at strengthening its presence in the Asian markets. Trade fairs provide another opportunity for boosting the company profile. To this end, the company participates in over 20 events around the world. **Trasfor** is further promoted through its participation in industry conferences, which provide a forum for technical/technological issues with round tables on future applications, new technologies and innovations.

Individual competence always at the centre.

Always and everywhere there is energy in motion.

Production

Customer orientation for us means the personalization of products. This is why the wide range of products manufactured by **Trasfor** makes it difficult to apply an easy classification to its production.

To simplify we divide the world of transformers and reactors produced by the company into two general solutions.

Standard solutions

This definition is used to classify all transformers and reactors which have in common large production volumes with few project variables. It is an interesting market characterized by fierce competition. A typical example are Transformers employed in the distribution of electricity. This sector is starting to return to the concept of “energy performance” and economic efficiency of use: this means that “capitalization of losses” is becoming more and more important as a means of increasing productivity and reducing operating losses. In this sense, the design of the transformer plays a key role and enables the use of materials and techniques derived from an advanced project engineering.

Special solutions

The products in this field are endless and truly unique in their design. There is no room for economies of scale, but rather an intensification of the concepts of reliability, efficiency, environmental performance and durability, in other words: product specialization. These solutions are normally applied to the marine sector, whether passenger, military or offshore, in rail traction on board trains, in renewable offshore energy and heavy industry.
The special solution benefits from a truly global and integrated competence and experience that only Trasfor, through the interaction of different designs, has matured over the years and can now make available to its customers. Electro-mechanical finite element design software analyzes and develops appropriate technical solutions with a degree of predictability and reliability that is high enough to render unnecessary the construction of prototypes. In this way we successfully take care of rail passenger comfort by guaranteeing power to ancillary services, or the safety of ship passengers by guaranteeing power to the propulsion engines, or focusing on the profitability of oil platforms that need to operate continuously without any interruption. This is a specialized task that we have learned to perform reliably and timely, providing 24x7 after sales service to deal with emergency situations. For us it is imperative that our solutions are easy to use, whatever the application.

Cast resin transformers

The product is suitable for use with medium voltages, power ratings up to 25/30 MVA and insulation voltage up to 36kV. The windings are made with various shapes of aluminum or copper wire.
Each manufacturing stage of the cast coils passes through automated process controls that enable a product with a uniform quality that tolerates the most severe thermal and mechanical stresses.
The use of “Step Lap” mitred cores enables losses to be significantly reduced, increases the efficiency of the transformer and guarantees low noise levels.

Cast resin	Cooling
Transformers and inductors up to 25 MVA and 36 kV.	From AN up to AFWF (combination of forced air and forced water).
Enclosure Protection	
From IP00 up to IP66.	

Impregnated transformers

This is a solution used to produce low voltage (<1.1 kV) and medium voltage (<= 24kV) coils. The windings in copper or aluminum can have different types of insulating materials, depending on the the various applications. Transformer power can reach 20MVA. The single foil technology allows the current density to be distributed over the full height of the conductor. This helps to eliminate axial stresses from short circuits and facilitates heat conduction along the axis, thus equalizing the temperature.
Coils or complete products are furthermore protected by immersion in a bath of epoxy resin inside pressurized vacuum vessels (VPI process)

Dry type	Cooling
Transformers and inductors up to 15 MVA and 24 kV.	From AN up to AFWF (combination of forced air and forced water).
Enclosure Protection	
From IP00 up to IP56.	

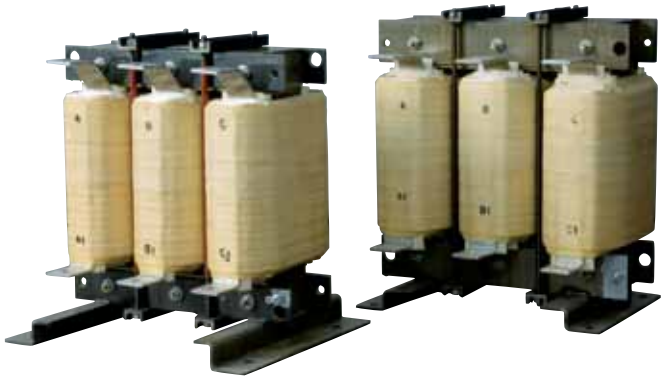
Transformers and reactors with liquid cooling

This technical solution is particularly suitable for applications involving high currents or where space is limited. The conductor may be cooled internally with a liquid refrigerant (direct cooling) or simply placed next to dissipating surfaces where the liquid is made to circulate (indirect cooling). This type of cooling system allows heat to be dissipated away from the points of installation and has the advantage of providing compact solutions in protected enclosures, despite the high concentration of power involved.

Water cooled
Transformers and inductors with heavy current coils (up to 50 kA) with water cooled windings.

Dry type reactors

Chokes and reactors always need to be calculated, designed and built specifically for each application. There are almost no standard products in this field.
Trasfor is able to optimally solve all operational requirements thanks to the experience of its own engineers, an extensive database of applications and specialized proprietary software used for the calculations. The choice of materials used, however, will vary depending on the ultimate purpose of the component and the type of performance and technology to be applied.



Reactors	Cooling
Transformers and inductors up to 50 kA and 36 kV.	From AN up to AFWF (combination of forced air and forced water).

Enclosure Protection
From IP00 up to IP56.

Transformers and reactors for the rail sector

The IRIS standard, the latest to regulate applications in the rail sector, sets out very strict standards for usage in this field. This type of application is characterized by the aggressive environmental conditions, a restrictive MTBF rate (Mean Time Between Failures), the practical exclusion of maintenance and repetitive electro-mechanical stress. In addition, there is the safety aspect regarding the installation position of the units (always outside the train, on the roof or under the carriage). A positioning that needs to satisfy the required mechanical behavior during freezing, shocks and vibration, and demands the employment of highly competent specialists and state-of-the-art electrical and mechanical simulation software to find solutions for situations that become even more complicated when complex systems with multiple transformers and reactors assembled on a single frame are involved. High-speed trains are a good example of this.

Reactors and capacitors assembly	**Cooling**
Transformers and inductors up to 25 kV and 50 kA.	AN, AF, WF, ONAN, ONAF
Enclosure Protection	
IP00, IP04, IP07, IP21, IP56	

Materials

The evolution of technology brings constant improvements to the performance of materials available for use in the electrotechnicalfield. In this sense, **Trasfor** is committed to keeping constantly abreast of the latest developments in order to improve both the performance and competitiveness of its products. Collaboration with various institutes and universities also provides us with additional valuable information which allows us to test the options offered by the market in the context of applied research and development.

A second, though no less important, source of information is generated by our suppliers. They provide a broad platform of interchange that **Trasfor** considers particularly important and to which it dedicates valuable training time, through the institution of quality, in order to nourish a culture aimed at achieving common objectives of competitiveness (co-makership).

Applications

Introduction

Trasfor has a wide involvement in a variety of electro technical applications, but we take a pride in being a center of excellence in the design and manufacture of transformers and reactors. With its considerable know-how **Trasfor** is able to make an important contribution to the application of such products.

Maximum precision, absolute flexibility.

Marine

The first electric propulsion applications were introduced in the late 1980s and subsequently developed with the implementation of static converters which helped to promote the application. The many benefits of this new technology and, in particular, attention to environmental issues, have also helped to increase the number of such installations and, as a consequence, boost the confidence of operators in the sector.

Cruise ships

The operational requirements for this type of ship have made electric propulsion a winner over the traditional engines in the following areas:

- Reduction of noise and vibration, which means increased comfort for passengers and recovery of space, which translates into higher profits
- Reduction of maintenance
- Increased reliability and flexibility
- Reduction of polluting emissions
- Accuracy of manoeuvrability

Propulsion calls for 6, 12 and 24-pulse transformers, 12 MVA of power and primary voltage of 6.6 or 11 kV depending on the requirements of the onboard electricity network. For improved functionality the preferred solution has IP 44/56 enclosure protection and a cooling system using a combination of forced water and forced air (AFWF). Because of the high criticality of the application due to the effects of resonance, the presence of harmonics and stress caused by repeated use – many years of experience in the industry are necessary to guarantee a reliable product able to make a decisive contribution to the above-mentioned advantages.

Military vessels

In this type of application, the above-mentioned advantages regarding passenger ships are exploited even more, in particular regarding reliability, manoeuvrability and silent operation. The increased complexity of design and manufacture is due to the operating conditions arising from situations of conflict in which the ship may find itself subjected to prolonged series of shocks and vibrations caused by both explosions and the stresses of manoeuvers.
Also in this case the most common configuration is to install transformers with IP44 enclosure protection and AFWF cooling systems. The transformer is also installed on a system of dampers to absorb the vibrations from the deck. The design of each element necessarily requires a fine element calculation (FEM), both electrical and mechanical. Propulsion is provided with 6, 12 and 24-pulse transformers with a power rating of 12 MVA and primary voltage of 6.6 or 11 kV.

Container ships

The first container ships derive from oil tankers. Today, however, these ships constitute a class of their own and are among the largest vessels in the world. Their carrying capacity has increased over the years from an average of 4000/5000 TEU to the current 14000 TEU. The greater load capacity and increased speed of navigation have naturally led to a demand for an increase of the installed power for both the propulsion (with the traditional diesel solution) and power for the ancillary services. Each container ship installs a consistent number of distribution transformers, mainly used for powering the refrigeration units of the containers. These are power transformers of between 800 and 1250 kVA, with IP44 protection, but with natural air cooling (AN). It is a very compact technical solution which helps to free up valuable space which can be used to increase the load capacity.

Dredgers

These technical craft are used mainly for excavation operations in shallow waters. The presence of high and prolonged vibration means that components with high mechanical resistance are vital, and transformers are no exception. For this application a suitable design is achieved by using special software for finite element simulation of both the electrical and the mechanical and structural design. The most common implementation for these vessels consists of transformers with forced air cooling (AF) and IP23 enclosure protection.

Offshore platforms

The critical environmental conditions and high efficiency of this application call for an absolutely dedicated design. Nevertheless, they are usually required to have IP44 class protection and air-forced and water-forced cooling (AFWF), the design also needs to take account of the significant electrical stress and mechanical characteristics involved. The transformers are used to power both the drilling rigs and the thrusters on the platform. Interruption of any of these activities because of a transformer defect would have serious economic repercussions. This is why in addition to good product performance we also provide an efficient support service which is able to intervene and deal with all kinds of emergencies.

Trains

Installation on board trains

This application refers to installations on board locomotives and coaches and includes trains, trams and metro systems. Transformers and reactors are designed in a simulated environment in order to ascertain how they respond to electrical and mechanical stress, which is particularly intense in this kind of application. In fact, the installation conditions, underneath the train or on the roof, expose the unit to harsh weather conditions and constant mechanical stress from shocks and vibration, and make it necessary to perform highly selective testing, such as complete immersion of the unit in water for 96 hours and a corresponding electrical test under the same conditions. Tests on vibrating tables examine the unit's response to shock and vibration. These particular resistance characteristics are made even more critical by the specifications of customers, who demand compact, lightweight and robust designs. IRIS certification, which **Trasfor** holds, combined with many years of experience in the sector, provides a guarantee of reliability for the required period of time.

Railway substations

These are transformers and reactors for supplying power to overhead lines, as well as the distribution transformers for ancillary services. The power transformers operate in high overload conditions for short but continuously repeated periods. Determining the correct rating is a basic requirement for these components and influences the lifespan of the components.

Industry

Heavy industry

We manufacture components that are used to obtain the powerful and high energy conversion that is needed, for example, in the steel industry, paper manufacturing and silicon production. The transformers and reactors used for these applications have particularly robust construction characteristics from an electrical and mechanical point of view and with regard to corrosion resistance, because of their frequent use in environments with high humidity and pollution and the presence of dust and corrosive agents.

Chemical industry

For the chemical industry **Trasfor** designs power transformers with currents up to 50 kA. The lines used in galvanic treatments or the production of chlorine require complex transformers with multiple converter systems, generally with direct cooling of the windings with compatible fluids. The components used in these applications must have excellent resistance to corrosion, moisture, dust and corrosive agents in general.



Power stations

Trasfor manufactures excitation transformers in three-phase or single-phase versions for various types of power plants. They are usually high-power rectification transformers. These installations are characterized by the presence of high harmonic content, which means that additional losses need to be carefully controlled. It is therefore necessary to operate in a simulated environment in order to find the correct rating for the transformer. The choice of configuration (groups, phase displacement, etc.) depends on the type of generator used.

Wind

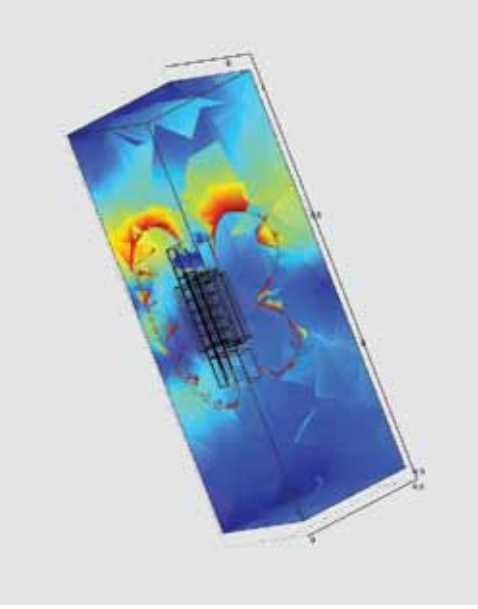
Wind energy is produced by converting the kinetic energy of wind into other forms of energy. At the moment, it is usually converted into electrical energy. Wind power is without doubt the first choice amongst all forms of renewable energy in terms of cost efficiency. This has led to clear market interest, which has resulted in huge investments. **Trasfor** has identified an important line of development in this market and provides both medium voltage transformers in resin and reactors for conversion to low voltage. Considering the nature of the power involved, the associated high currents and the constant need to reduce weight and volume, reactors are often installed with direct and indirect water cooling systems. The same is true for the medium voltage step-up transformers.

Photovoltaics

The photovoltaic plant is an electrical facility that uses solar energy to produce electricity. This plants are divided into two main groups: island plants, known as “stand alone”, and plants connected to an existing distribution grid managed by a third party, known as “grid-connect”. In the photovoltaic sector Trasfor provides transformers and reactors for DC/AC converters and the networking of the energy produced. Their main characteristic is the reduced no-load losses and high efficiency, which are heavily regulated by EU directives. The main features of these power supplies are low cost and limited losses. In this sector, the use of noble raw materials and the careful design of the windings is also important. Finally, special devices facilitate the mass production of these products. They are thus mass-produced products which require quality but also special attention to cost-optimization.

UPS

The components used in this sector are of low voltage and medium power, which means that combined transformer technology can be used. This consists of designing and constructing the transformer and reactor as a single component. This solution allows the volume and weight to be reduced and consequently also the dimensions of the enclosure are smaller.
It is a commodity product characterized by mass production in which it is important to assert a cost leadership while respecting the strictest standards of quality. In addition, low-cost production realities and automated processes are favored.



Research and Development

This is one of the main activities of **Trasfor** into which we channel significant investments in both simulation systems and experiments in our laboratories. Collaboration with institutes, specialized centers and universities promote the multidisciplinary nature of research and development. The Swiss Confederation provides concrete backing for the developments promoted by our company.
Our activities are divided between the pursuit of technical development for our clients and the development of our own projects. The first one is a research activity with the characteristics of consultation and integration with the customer, and usually includes lead times, while the second one is driven by corporate strategies, both in terms of basic research and applied research for a specific product. The research environment makes use of advanced development tools, both mechanical: Pro/Mechanica-De-featuring, Pre-processing, preliminary analyzes (Static, Dynamic, Shock), simple post-processing; MSC Patran-Pre processing , detailed post-processing; MSC Nastran-accurate analyzes (Static, Dynamic, Shock, Fatigue) MSC Fatigue-Fatigue analysis and electrical: Comsol Multiphysics and its modules: AC/DC Module-Conductive Media DC; Shell Conductive Media Dc; Electrostatics; 3D Quasi-Statics, Electromagnetic; 3D Quasi-Statics, Magnetic; 3D Quasi-Statics, Electric; 2D Perpendicular and Azimuthal Induction Currents, Vector Potential. In addition to the Heat Transfer Module and its components; General Heat Transfer (2D and 3D) Stationary and Time-dependent; Thin Conductive Shell Stationary and Time-dep; Weakly Compressible Navier-Stokes (2D and 3D) Stationary and Time-dependent.

All the energy of the world,
all the force of nature.

Environmental commitment

The demand for energy supplies is constantly growing and **Trasfor** is aware that in the context of climate change one of the key issues to address in the near future is energy efficiency throughout the supply chain. Environmental management is, without doubt, a competitive lever in the medium to long term, both at the level of advanced economies and the competitiveness of the country.
We envisage, therefore, a future framework in which the themes of production, environmental protection and energy efficiency will need to be approached in a realistic manner and with scientific rigor for the sustainable development of our planet.

In parallel to studies on how to optimize product efficiency by using components with low environmental impact, **Trasfor** is committed to preventing pollution by pursuing a number of additional targets, such as:

» Compliance with all laws, rules, directives and ordinances applicable to products and processes on which **Trasfor** can have influence, assuming legal responsibility.
» Collaboration with national authorities and other organizations to develop regulations and practical guidelines aimed at protecting natural resources and the environment in general.
» Reduction in the consumption of material and energy resources to a minimum.
» Reduction of the production of waste and contamination of air, water and soil.
» Ensure that unavoidable waste is disposed of in an environmentally compatible manner.
» Adoption, whenever possible, of technologies that enable the company to achieve these goals.
» Raising the awareness of all employees of the environmental impact of their activities and the company policy on this.
» The carrying out of routine checks to ensure compliance with this policy and a continuous improvement of the environmental performance of **Trasfor**.

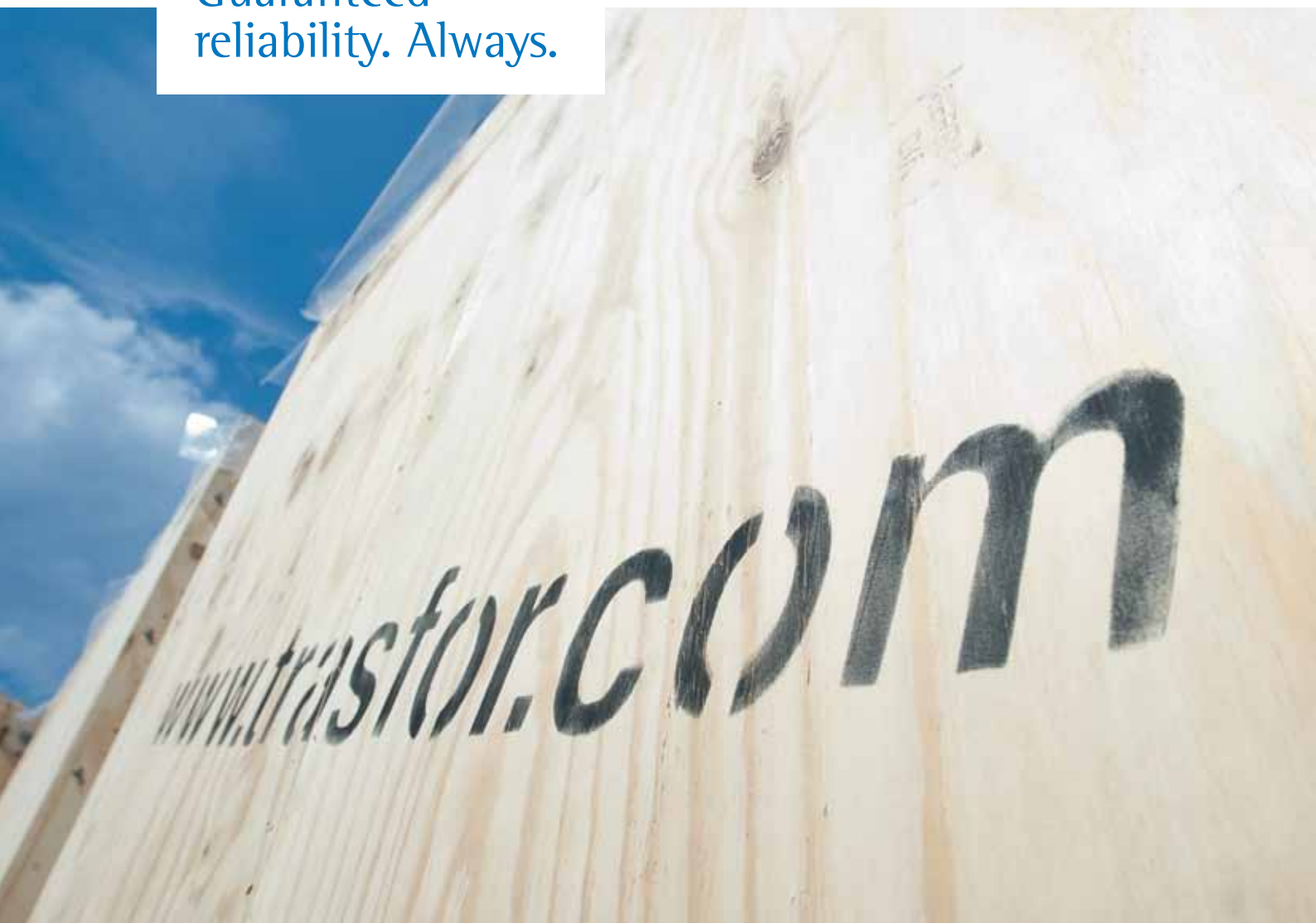
With this operational plan, and the active participation of all employees, each of whom is attentive and responsible to the impact on the ecosystem of their work, **Trasfor** has adopted objectives for environmental management in its business strategy at a global level.
It is to underline this commitment that we wish to make public this policy of ours, in the same way that we publish transparent reports on our environmental performance in the **Trasfor** Annual Environmental Report.
The documents cited are available to the public at any time upon request.

GP. Palladini CEO

Service

Worldwide Consulting, Maintenance, Technical Assistance & Service. To consolidate its position **Trasfor** has created an additional service arm to offer a complete technical consultancy, ranging from project specific engineering studies to routine inspection and maintenance. **Trasfor Consulting** offers a unique world-class service for any type of transformer, starting from commissioning, through scheduled and unscheduled maintenance and immediate intervention. **Trasfor Consulting** team of qualified and certified experts is ready 24/7 to fly all over the world and face any level of emergency situation, reducing to the minimum your down time. For more in-depth technical analysis **Trasfor Consulting**, through a pool of specialist, electrical mechanical and structural engineers, is able to assist with specific product developments and provide solutions to the most complex technical requests. This also thanks to the availability of technical equipment for thermographic studies, vibration and shock monitoring.
We analyze your installation and we suggest to you a list of the most important and critical spare parts.

Guaranteed reliability. Always.

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