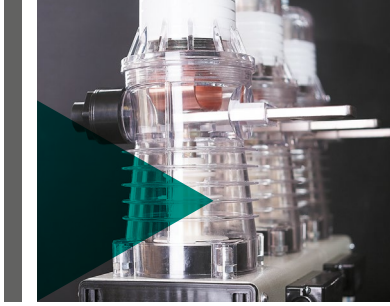


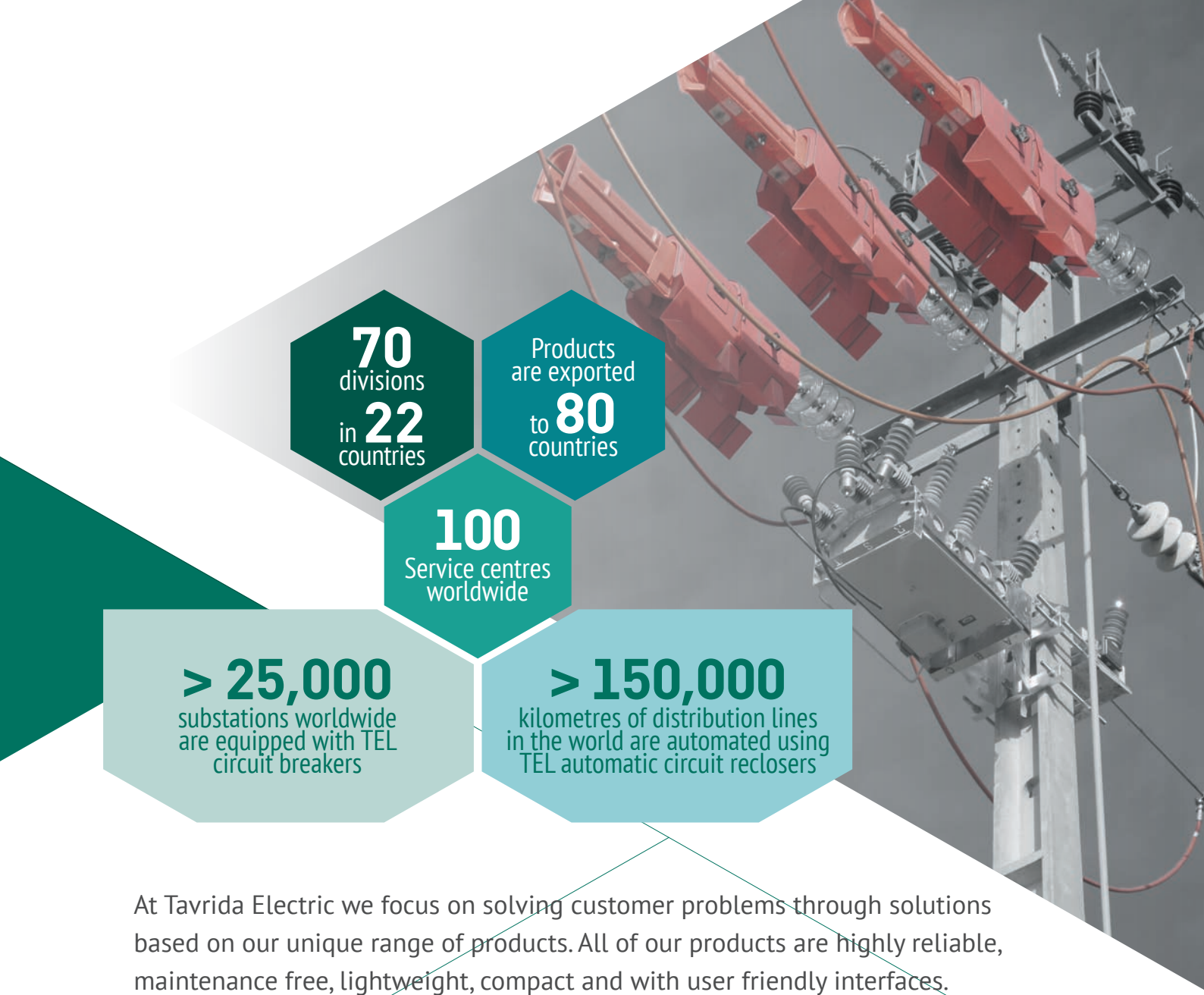
25 Years
in the Market

TAVRIDA ELECTRIC
Excellence in Engineering

CONTENTS

Tavrida Electric was established in 1990 as a research and production company specialising in medium voltage circuit protection. Today Tavrida Electric supplies its products and services to 80 countries around the world.

Tavrida Electric is focused on developing and manufacturing innovative vacuum switching equipment, switchgear and smart solutions for grid Tavrida Electric was established in 1990 as a research and production company specialising in medium voltage circuit protection automation in voltage classes up to 40.5 kV.



70 divisions in **22** countries

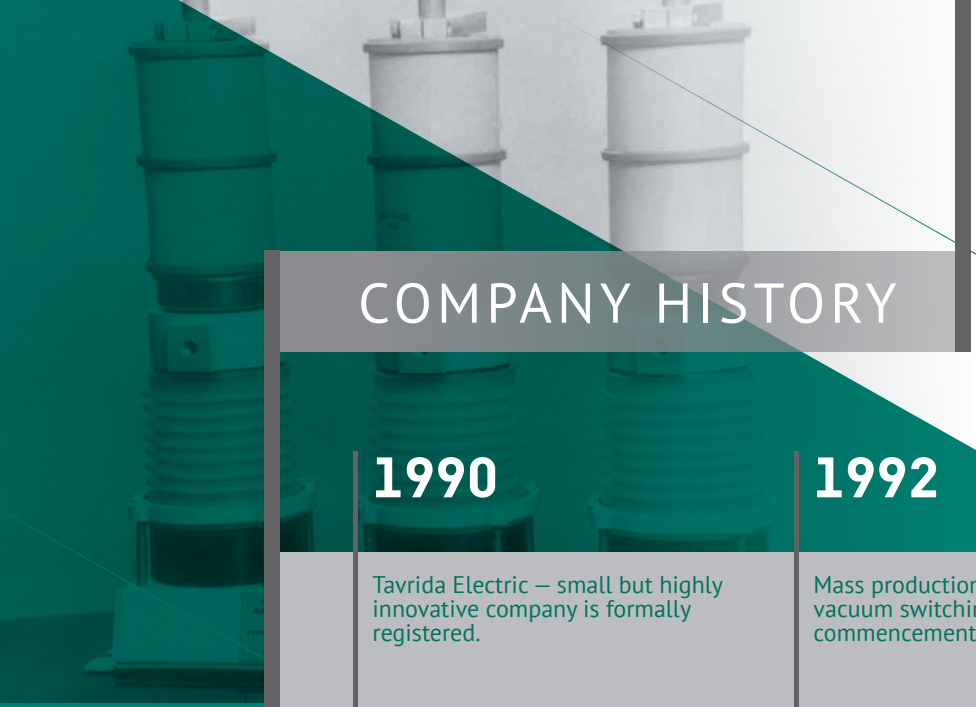
Products are exported to **80** countries

100 Service centres worldwide

> 25,000 substations worldwide are equipped with TEL circuit breakers

> 150,000 kilometres of distribution lines in the world are automated using TEL automatic circuit reclosers

At Tavrida Electric we focus on solving customer problems through solutions based on our unique range of products. All of our products are highly reliable, maintenance free, lightweight, compact and with user friendly interfaces.



The first commercial KVM (KB/TEL) vacuum contactor

COMPANY HISTORY

1990

Tavrida Electric — small but highly innovative company is formally registered.

1992

Mass production of vacuum switching modules commencement.

1993

Fundamental research in arc quenching in vacuum begins in partnership with university.

2001

The company's development centre is established — The Centre for Switching Equipment Design. Regional branch in Germany is registered (today TES).

2002

Production of vacuum switching modules moved to a higher volume facility. Launch of regional branch in China. The Centre for Numerical Simulation is formed.

2003

Mass production of vacuum automatic circuit reclosers commencement. As Tavrida Electric Export is established in Tallinn, Estonia.

2011

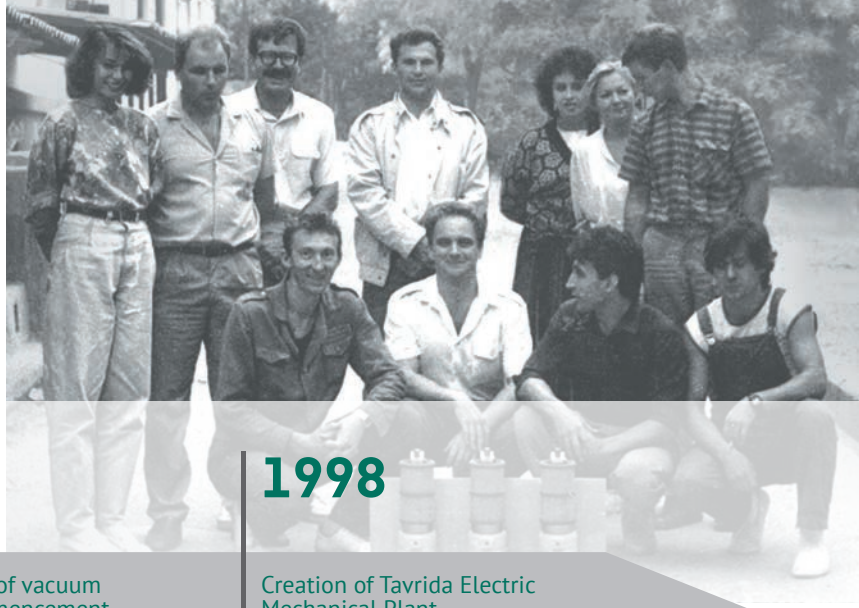
The company has established offices in 22 countries.

2012

Tavrida Electric is among the top three world leaders by medium-voltage circuit breakers annual supply , and is the world leader in automatic circuit reclosers sales.

2013

Mass production of 38 kV automatic circuit reclosers Rec35_Smart commencement.



The first Tavrida Electric team, 1990

1994

Mass production of surge arrestors commencement.

1995

Mass production of vacuum interrupters commencement.

1998

Creation of Tavrida Electric Mechanical Plant.

2007

Tavrida Electric enters the US and Canadian markets as Tavrida Electric North America.

2008

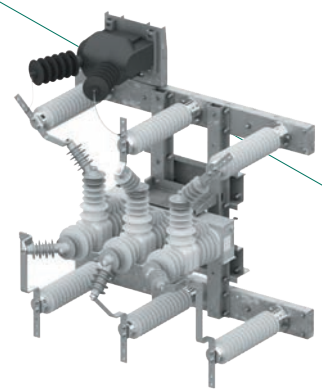
One of the highest volume production facilities of medium voltage breakers in the world is opened in Yoshkar-Ola.

2010

One of the highest volume European production facilities of control devices is opened in Molzino.

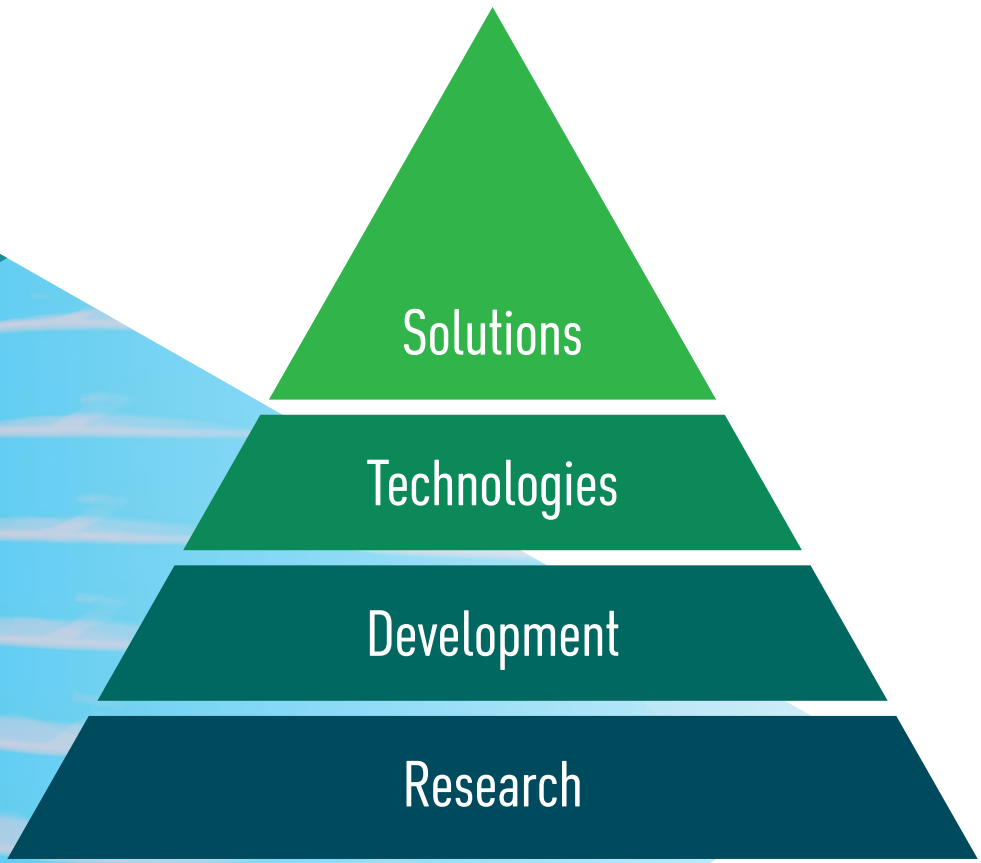
2014

Tavrida Electric starts implementation of several Smart Grid pilot projects based on Rec35_Smart recloser.



Rec35_Smart plug and play distribution automation solution

From the moment of establishment in 1990, Tavrida Electric has focused its efforts on continuous leading edge research and design. The following three key areas form the base for creation of all Tavrida Electric brand products and customer solutions: research, development and unique technologies.



Production
of switching modules

Tavrida Electric incorporates the best practices, experience and technologies resulting from internal fundamental and applied research. Over 500 scientists and engineers work in Tavrida Electric R&D centres — allowing us to solve even the most complicated engineering tasks.

25 years
of fundamental research and development

20
scientific and design centres

500
scientists and engineers

RESEARCH

The R&D centres and scientific partners carry out various tasks some of which are:

- conducting research in the field of arc quenching and electric contacts physics
- creating elaborate simulation models
- creation of unique research equipment
- simulation of distribution grid characteristics
- developing grid automation algorithms

◂Synthetic impulse circuit (100 kA and 70 kV)

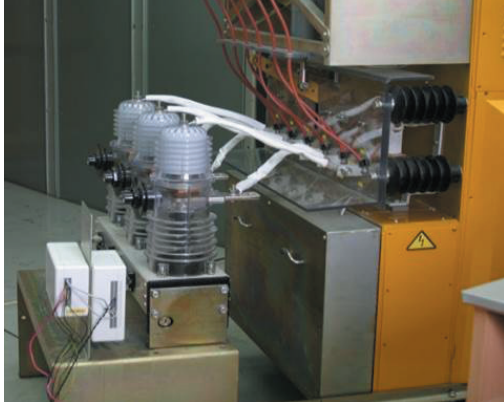
Research equipment development

Tavrida Electric has developed a wide range of laboratory equipment to conduct fundamental research.

The Design Centre for Research Equipment has been established within the company to cover the needs of Tavrida Electric scientists and designers.

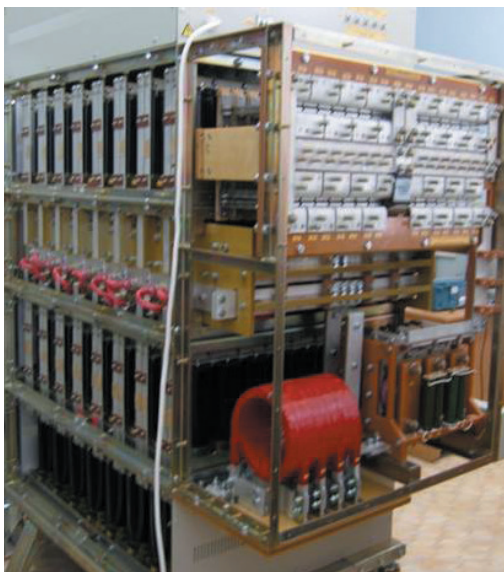
Some examples of this specialized equipment include:

- Synthetic short circuit (100 kA and 70 kV) test sets.
- Apparatus for the study of interrupter switching life.
- Apparatus for the study of arc quenching.
- Current impulse source (90 kA).



▲ Unit for life testing with rated current of up to 1,600 A

▼ Unit for study of processes of forced arc quenching with countercurrent



▶ Source for current square-wave with 90 kA amplitude and 6 ms duration

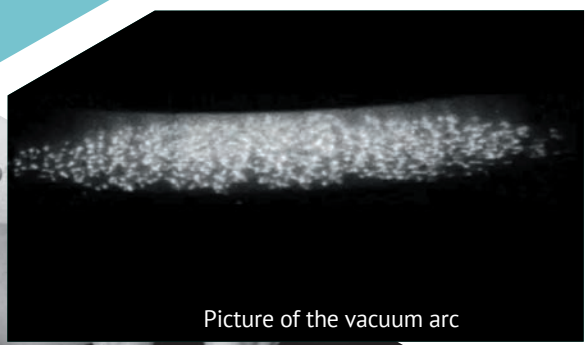
Fundamental research

As a major developer and producer of vacuum interrupters, Tavrida Electric has extensive research facilities for the study of vacuum arc physics. The research is aimed at learning how to control the arc in a way that the interrupter will successfully extinguish the arc using the smallest possible vacuum interrupter.

The arc parameters are comparable with lightning current:

Electric current density **~5 kA/cm²**

Released power **5 MW**



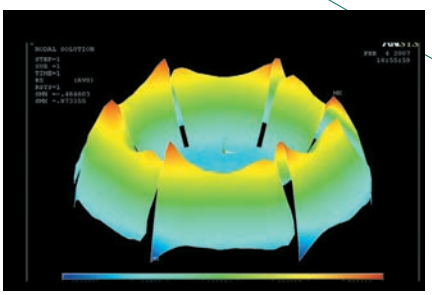
Picture of the vacuum arc

Apparatus for high-speed photography of the arc

Simulation tools development

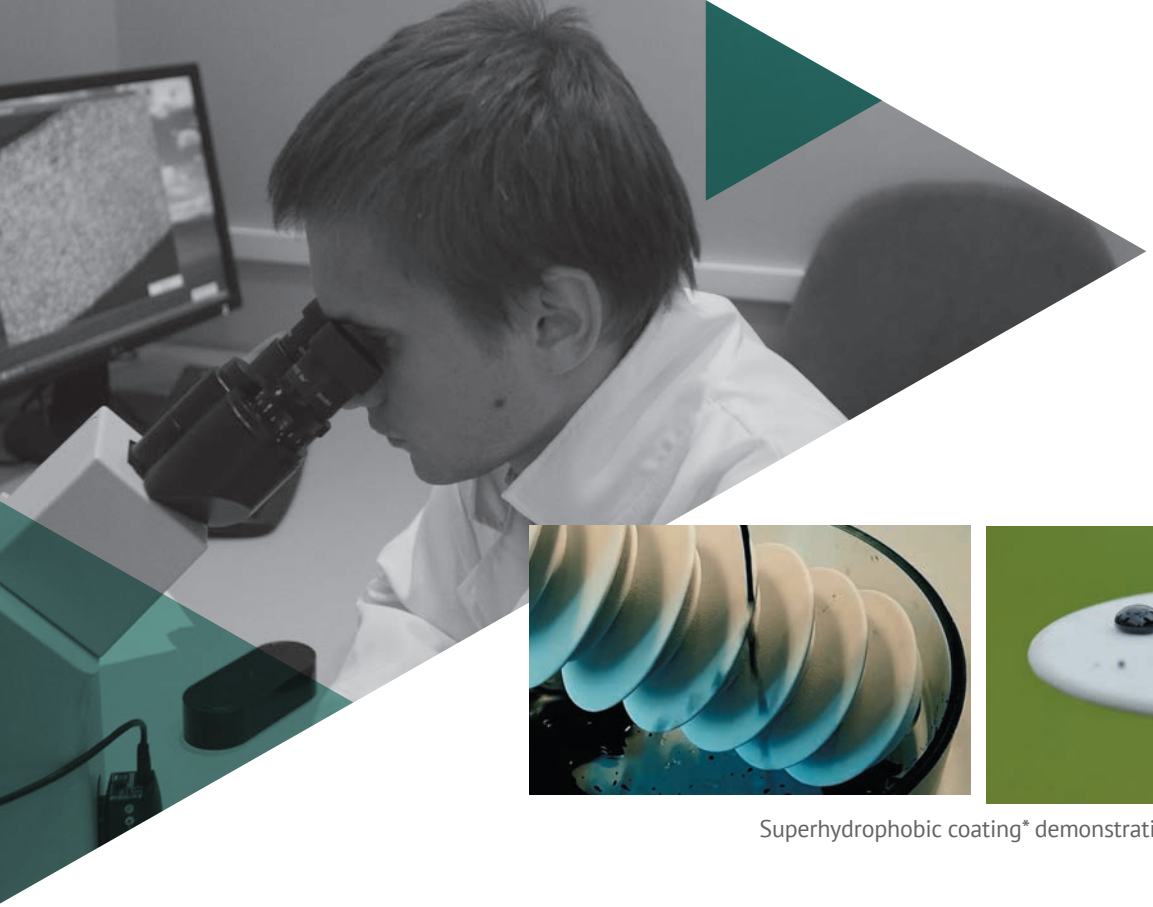
Simulation methods are important tools in the research and development process. The Tavrida Electric Simulation Tools Development Centre is responsible for providing the company R&D teams with proprietary models for principle research including:

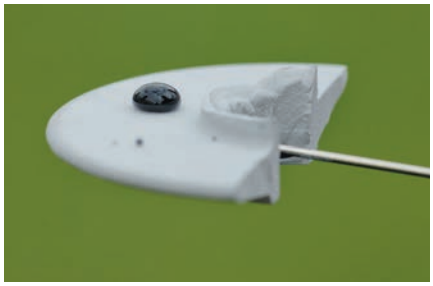
- Vacuum interrupter magnetic field simulation.
- Steady-state thermal calculations.
- Simulation of distribution grids and faults.
- Computer simulation of streamer processes.



Vacuum interrupter magnetic field simulation.

One of the research methods is high-speed photography with further data processing on arcs of up to 100 kA.





Superhydrophobic coating* demonstration

▲ The advanced technologies laboratory

Innovative materials and technologies

In order to design new products that stand out from the competition it is essential to continuously research new materials, their properties and look for new manufacturing technologies.

Tavrida Electric experts in the advanced technologies laboratory investigate protective coatings application means on metal and plastic surfaces, study properties of liquid rubbers, materials, cleaning and surface treatment techniques, new insulation materials and metallography researches.

* Superhydrophobic materials are those demonstrating the so-called "lotus effect". This effect makes itself evident in the fact that, in contact with such a material, the water drop takes a close to spherical shape. With a gentle incline of the material towards the horizon, the drop rolls down from the surface and captures all the surface contaminations during movement.

Test laboratory

Our test laboratory is a vital component of our R&D process.

The major tasks carried out in the laboratory include design verification, mock-ups, prototype models, and execution of validation tests.

Proprietary unique test methods complying with the world standards — GOST, ANSI, IEC, GB.

Dielectric testing
up to **500 kV**

Climatic testing
-60/+110 °C

Switching testing
up to **100 kA**

Thermal testing
up to **3,200 A**

▶ Dielectric testing unit
◀ Thermal testing unit
▼ Climatic testing chambers

DEVELOPMENT

Tavrida Electric has design departments that are engaged in the development of indoor and outdoor switching devices, microprocessor-based control devices, current and voltage measuring sensors, software and panel switchgear.

The product development process is regulated by:

50 internal procedures

100 target parameters

Development steps:

Simulations → Modelling → Prototype production

Each product is developed to meet our strict quality requirements and several international standards simultaneously including ANSI, IEC and GOST.

All Tavrida Electric products contain key technology attributes through the combination of R&D, engineering and process solutions, allowing us to provide maximum customer value.

TECHNOLOGIES

Manufacturing innovative products is only feasible with unique manufacturing techniques. Merely purchasing machines and equipment available in the market is not enough.
To create its truly unique products Tavrida Electric has developed revolutionary manufacturing processes.

Tavrida Electric engineering policy for manufacturing is described by the following key concepts:

- To continuously improve production process and apply new technologies in production.
- To automate the production to the maximum possible extent in order to minimise the possibility of human error.
- To automate the testing system in order to eliminate the subjective factor.

ISO 9001 Quality management and ISO 14001 environmental management systems are implemented in Tavrida Electric.

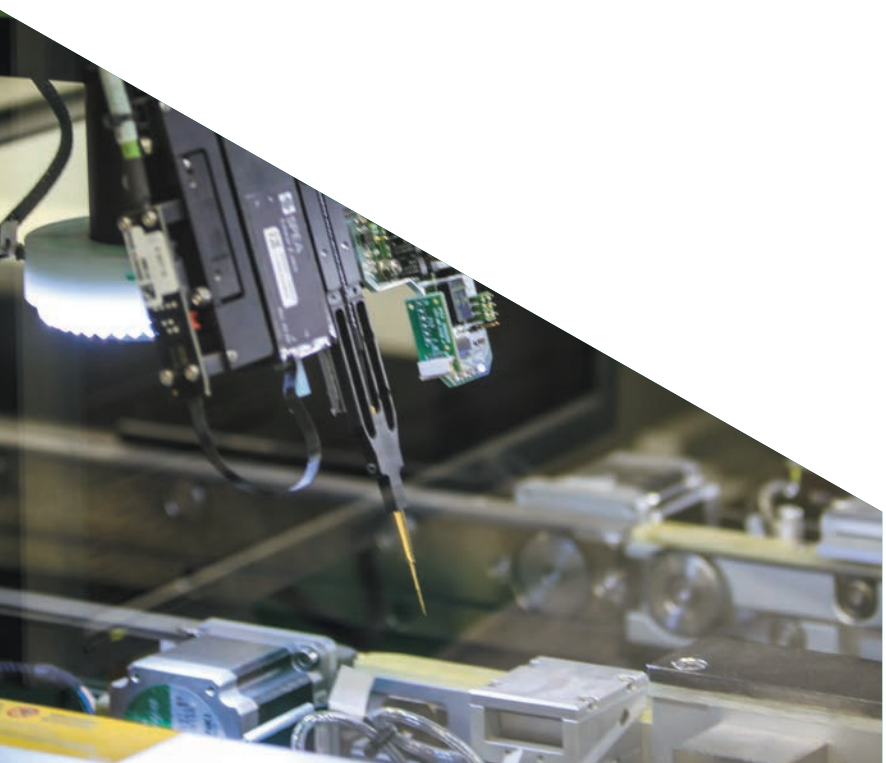
Vacuum interrupters manufacturing

- The world's only manufacturer of vacuum interrupters with an external bellows assembly.
- Two-fold acceptance testing.
- Vacuum interrupters are soldered in a single step through a single-shot technique.
- Bellows robot welding ensures vacuum interrupters superior reliability.
- Welding robot is equipped with optical quality control system.

165,000
vacuum interrupters
per year

Microprocessor-based control device manufacturing

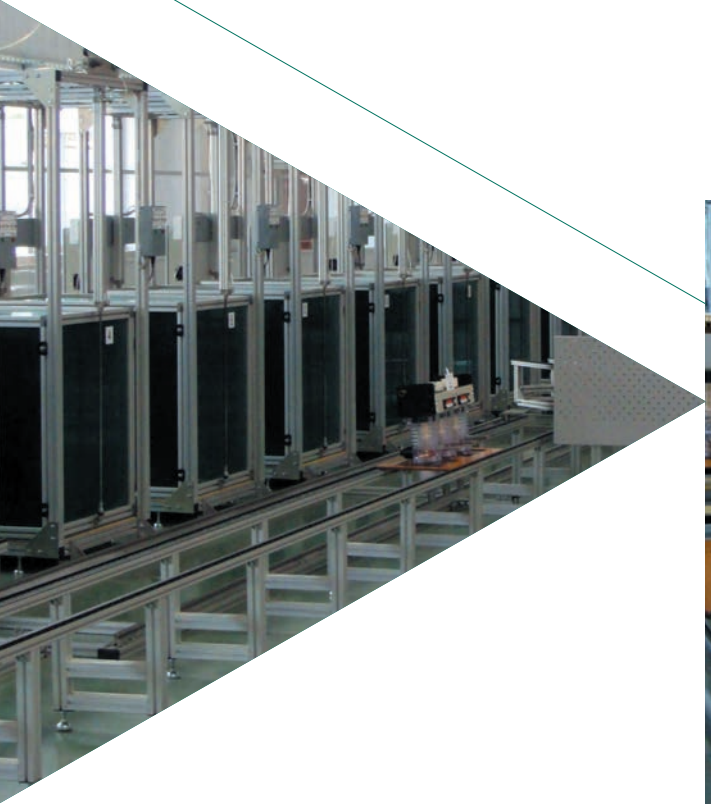
- Quality control takes 60% of production time.
- 1,000 on-off cycles at ambient air temperature of 55°C during routine testing.
- Lead-free soldering techniques.



80,000 control modules per year

State-of-the-art purpose built facilities

40,000 electronic components per hour



Quality inspection takes **2/3** of process time

50,000 switching modules per year

1,000 close-open test cycles

Indoor and outdoor switching modules manufacturing

- Assembly-line manufacturing.
- 6 automated test stages monitoring 16 key parameters.
- Vacuum interrupter conditioning.
- Quality control after each consecutive assembly step.

Switchgear regional manufacturing

Advanced, modular switchgear systems

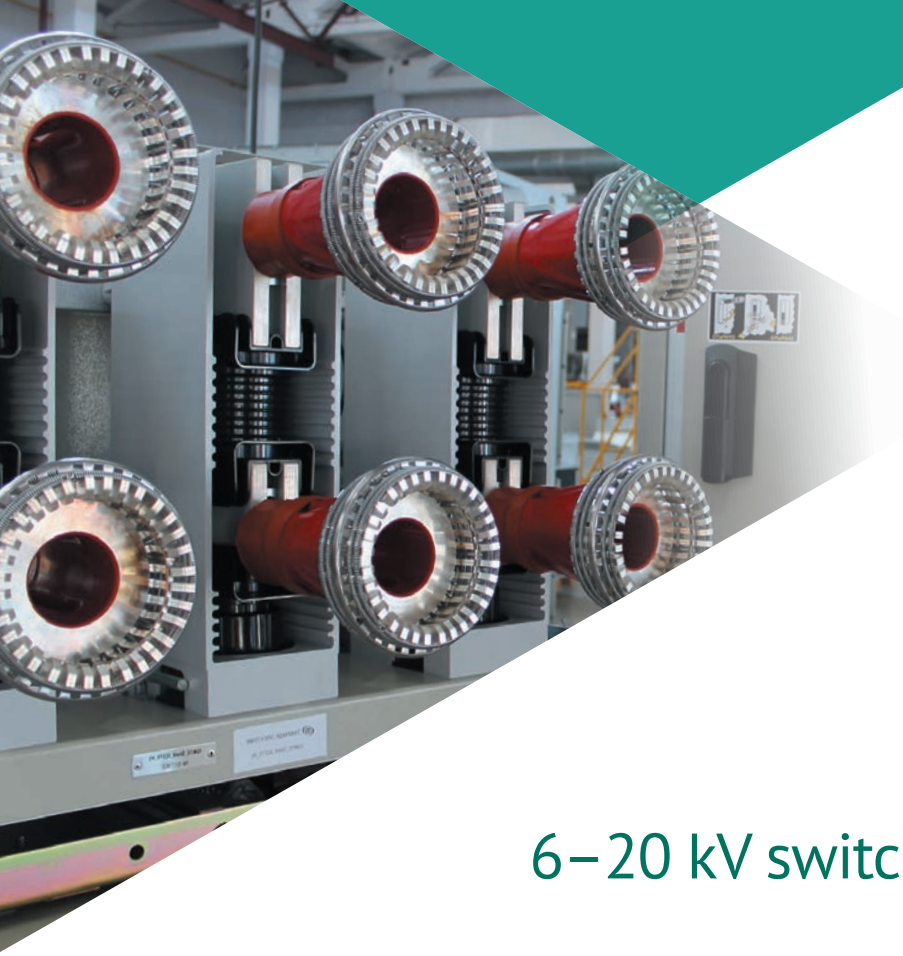
> 2,500
switchgear panels per year

Complete panel assembly

SOLUTIONS

Based upon innovative products, Tavrida Electric offers the following to its customers around the world:

- Existing switchgear retrofit/refurbishment solutions: key elements replacement to extend switchgear lifetime, improve safety and reliability of equipment at the lowest capital investment and minimised operational costs.
- Smart Grid solutions that allow increased power supply reliability, network visibility and better integration of renewables.
- Outdoor structure mounted substations retrofit and new customers connection solutions for voltages up to 38 kV.
- Overhead line automation solutions.
- OEM partnership programmes.



> 20 years on the market

~ 10 % of world market

> 400 K circuit breakers in operation

6–20 kV switchgear retrofit

Tavrida Electric Vacuum Circuit Breaker

Overhead line automation

> 10 years in the market

~ 30 % of world market

> 40 K automatic circuit reclosers in operation

Tavrida Electric automatic circuit recloser
15 (27) kV for overhead lines

40 % smaller than competitors

50 % lighter than competitors

2 times longer lifetime

Substation retrofit and customer connection to 33 kV networks

Rec35 automatic circuit recloser

TAVRIDA ELECTRIC PRESENCE WORLDWIDE

Retrofit Unitole, Eaton, Netherlands

European Union

The leader in the secondary distribution market in Italy, an active player in the retrofit market in Benelux countries. The supplier of switching devices for OEMs in Belgium and Germany. The supplier of automatic circuit reclosers for overhead network automation in Poland, Portugal and Romania.

North America

Supplies complete recloser packages throughout the US, Canada and Mexico to utility, industrial and commercial clients. Key supplier for large scale grid automation projects in Mexico. Supplier of indoor breakers for mining and retrofit solutions throughout North America.

▲ Automatic circuit recloser in the grid automation project in Mexico city

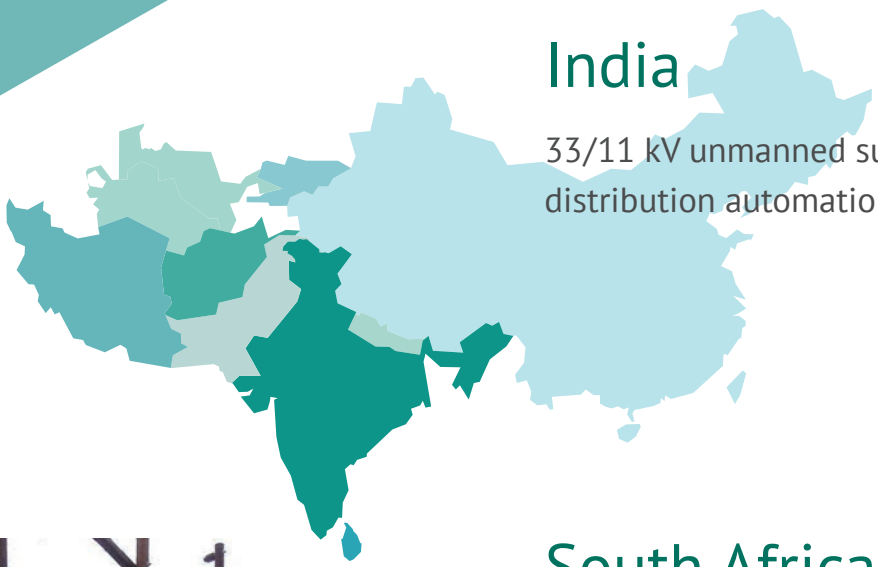
South America

Tavrida Electric circuit breakers were installed in the substation feeding the FIFA 2014 world in Brazil.

The substation provides power to first aid facilities, FIFA offices, TV infrastructure and other entities of the sport complex.

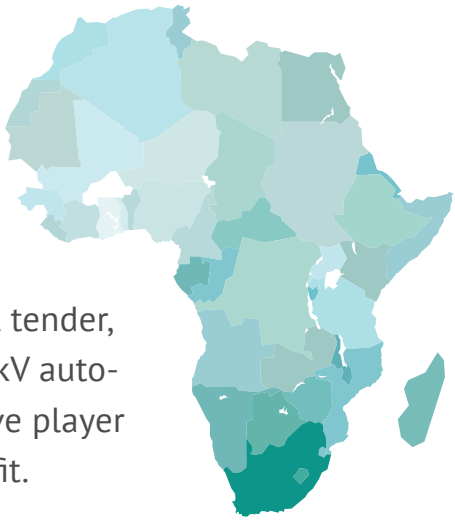
▶ Arena Corinthians, São Paulo, Brazil

Unmanned 33/11 kV substations in Himalayas



India

33/11 kV unmanned substation and distribution automation projects.



South Africa

The winner of ESKOM national tender, ESKOM — main supplier of 22 kV automatic circuit reclosers. An active player in the British switchgear retrofit.

27 kV outdoor substation with automatic circuit reclosers

China

Tavrida Electric switching devices are used as by local OEMs for the most demanding applications where other manufacturers can't provide the required level of performance.

▲ T-Good Electric container-type switchgears for railways

Turkey

Several distribution network automation turn-key projects have been commissioned in Turkey.

▲ Fuse-switches replacement in Turkey

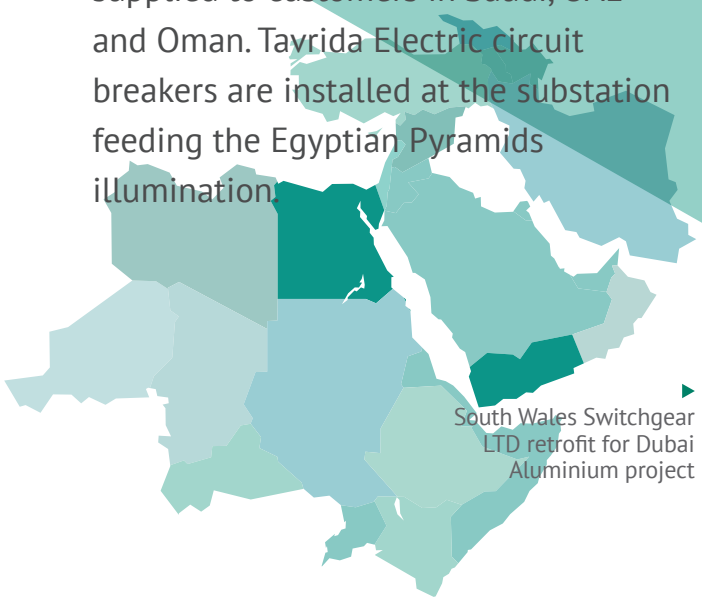
Russia

Dominant in the medium-voltage switching devices market. An active player in the indoor switchgear, overhead distribution automation and smart grid solutions markets.

The first installation of Rec35_Smart automatic circuit recloser in Russia

Middle East

Tavrida Electric provides switching devices for markets of Bahrain, Yemen, Saudi, OAE and Egypt. Reclosers supplied to customers in Saudi, OAE and Oman. Tavrida Electric circuit breakers are installed at the substation feeding the Egyptian Pyramids illumination.



South Wales Switchgear LTD retrofit for Dubai Aluminium project

SERVICE AND TECHNICAL SUPPORT

Tavrida Electric's approach is to focus on the problem and develop a solution using engineering ingenuity and high quality products.

Tavrida Electric specialists provide the full scope of services from careful analysis to solution development, project implementation and customer support throughout the equipment lifetime.

To provide excellent customer service Tavrida Electric.

We analyse our customer's problem, identify the root cause and engineer the optimal solution. All of our solutions have a unique set of key features:

- high reliability and long life design
- maintenance free for the entire lifetime
- no SF6 or other dangerous materials
- most compact dimensions and lightest weight
- user friendly interface and future-proof functionality

www.tavrida.com