

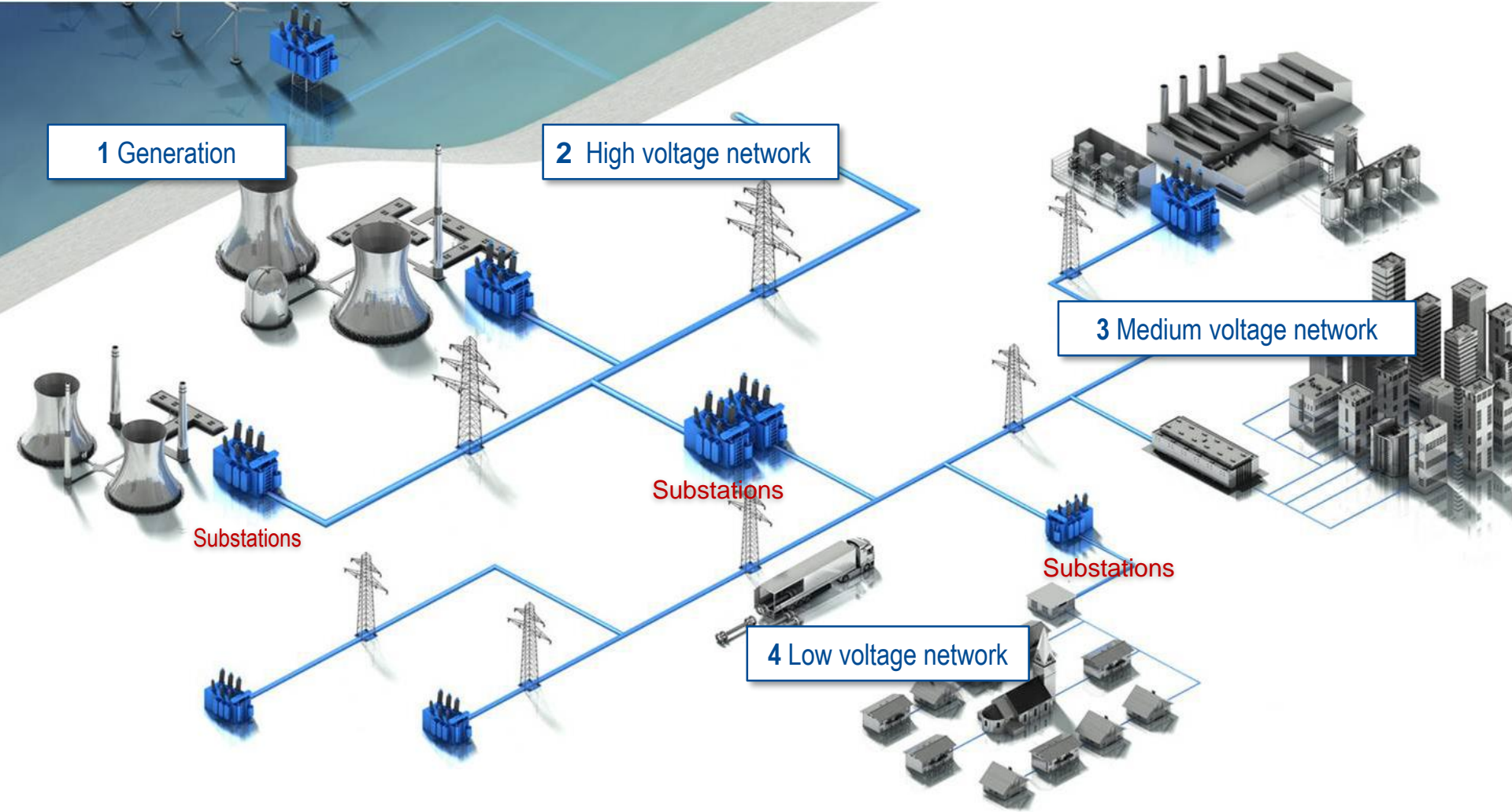


***FUNDAMENTAL METHODS OF ENERGY
TRANSMISSION & DISTRIBUTION***

Company presentation Maschinenfabrik Reinhausen GmbH
CS Sales, 2019

MR

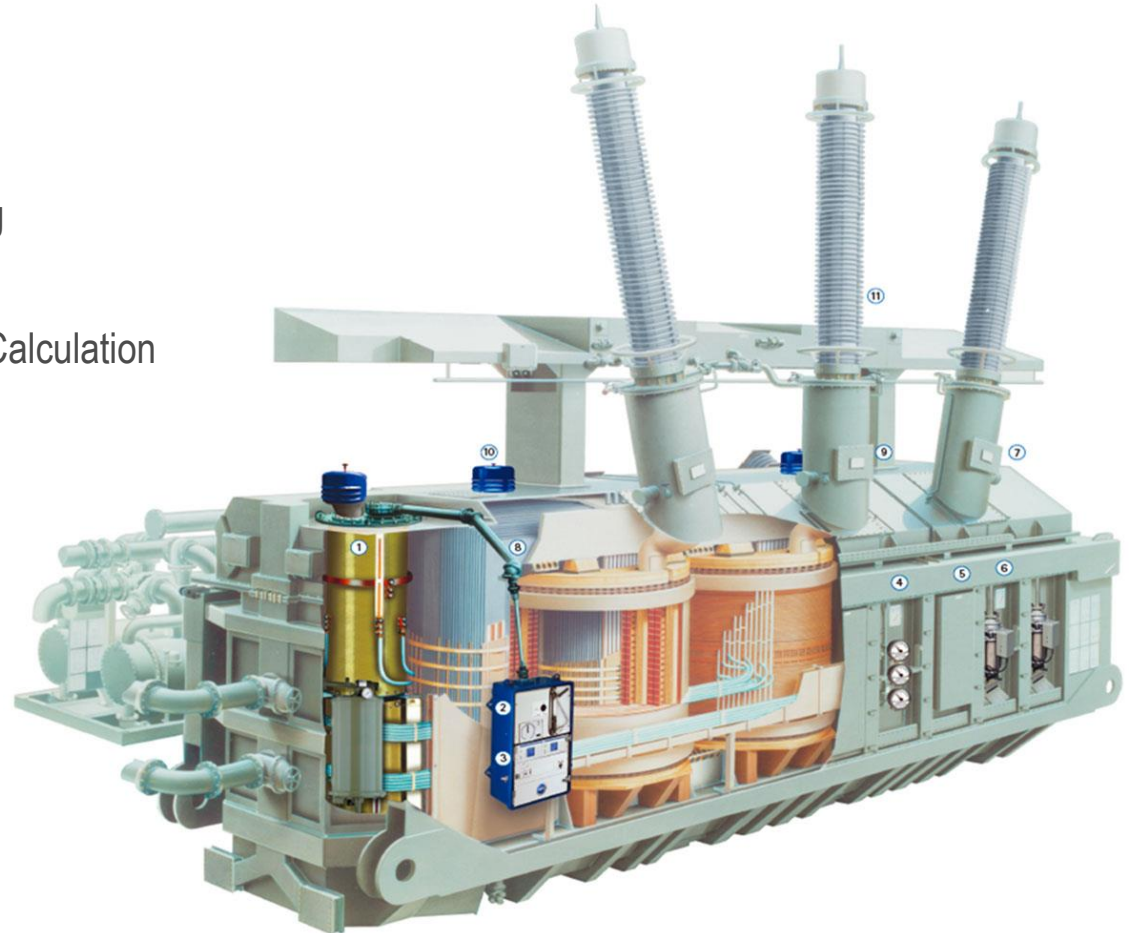
PRINCIPLE OF ENERGY DISTRIBUTION



Components and Systems

for the Transformer Industry

- | 1 On-Load Tap-Changers
- | 2 Motor Drive Units
- | 3 On-Load Tap-Changer Monitoring
- | 4 Winding and Oil Thermometers
- | 5 Electronic Winding-temperature Calculation
- | 6 Maintenance-free Dehumidifiers
- | 7 Digital Oil Temperature Sensors
- | 8 Drive Shafts
- | 9 Oil Level Gauges
- | 10 Pressure Relief Valves
- | 11 Composite Insulators



FUNCTIONAL PRINCIPLE OF TAP CHANGERS

Regulated Transformer:

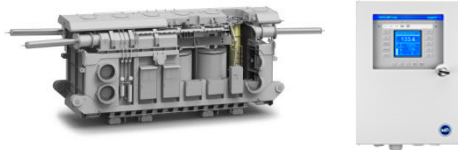


Energy consumption increases

Car with cruise control:



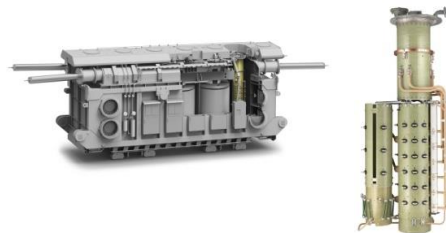
Car drives up a steep hill



Voltage regulator detects voltage drop, sends control command to tap changer



Cruise control detects speed decrease



Tap changer sets transformer windings to new transmission ratio



Gearbox shifts down automatically

Constant Voltage

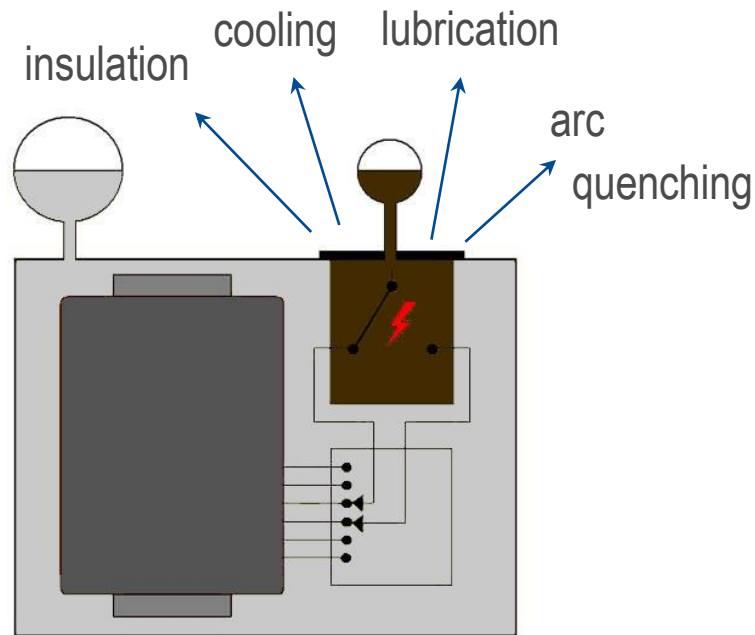
Constant Speed

DIFFERENTIATION BETWEEN OIL AND VACUUM TECHNOLOGY

No interaction between arc and oil:

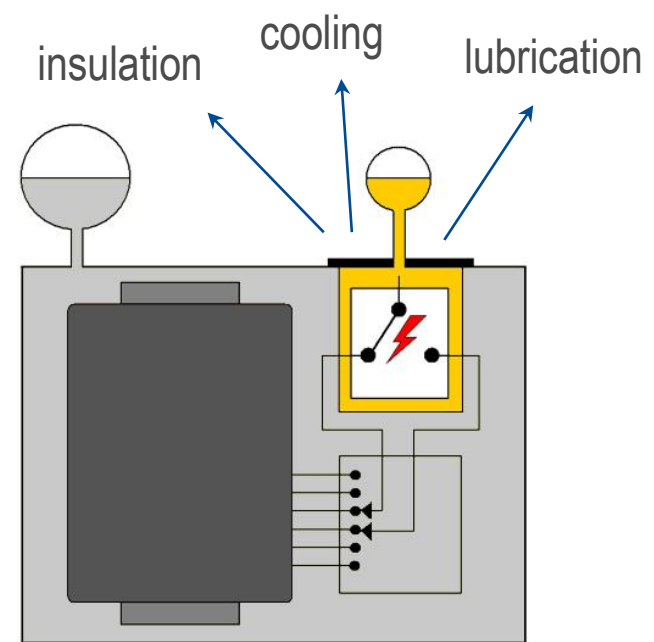
Conventional technology (OILTAP®)

Current breaking in oil



Vakuum technology (VACUTAP®)

Current breaking in vacuum interrupter



DIFFERENTIATION BETWEEN OIL AND VACUUM TECHNOLOGY

No regular maintenance or oil replacement necessary with vacuum technology:

Conventional technology (OILTAP®)

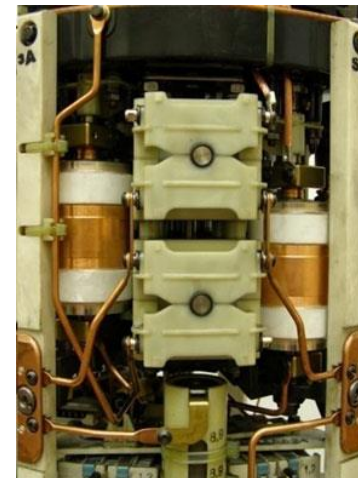
- | Oil ageing due to carbon particles resulting from arc quenching
- | Oil filter to be changed regularly
- | Maintenance: after 70,000 operations or after 7 years in service



Tap-Changer after 80,000 operations

Vacuum technology (VACUTAP®)

- | No arc in Tap-Changer oil
- | No replacement of oil necessary
- | Inspection after 300,000 operations
- | Replacement of vacuum interrupter after 600,000 operations



Tap-Changer after 300,000 operations



Tap changers (VACUTAP®, OILTAP®)

- | More than 80 years of experience in producing on-load tap changers
- | More than 230,000 units in operation worldwide
- | Pioneer of vacuum technology with more than 20 years of experience in network applications and special applications as HVDC, Arc furnace transformers, electrolyses, renewables
- | synthetic and natural ester application etc.

Off-circuit tap changers (DEETAP®)

- | Longest lifetime and reliability (even after years of no operations)
- | Compact, most robust and intelligent design:
 - | – Tube and bar material made from glass fibre reinforced plastic (GRP)
 - | – Modular concept, Optimized field design through smooth surfaces, soft edges and use of innovative materials

Drives (TAPMOTION®)

- | Modular design with high variance for all applications and individual customer requirements
- | Easy-to-access position signaling unit allows upgrading and later adaption to future indicator technologies



Converter station Chuxiong

Project: YUNNAN – GUANDONG

End user: China Southern Power Grid, China

Power rating: 5000 MW

Voltage level: DC: +/- 800 kV
AC: 500kV/ 500kV; 50Hz/ 50Hz

Type of plant: Long distance transmission line 1.450 km

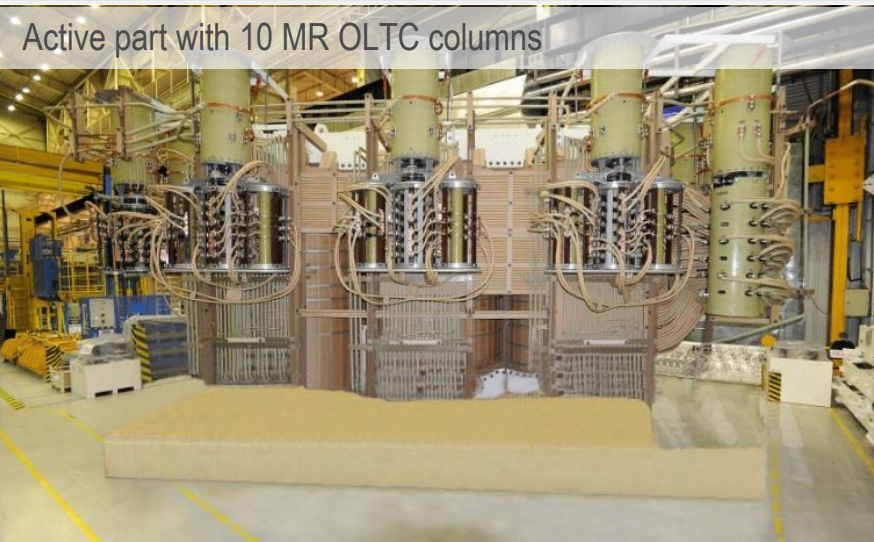
Range of supply: 56 HVDC-transformers; 250 MVA

OLTC: 56 VRFII1302-72,5/D-14273W

Commercial operations: 2010

Technique: First 800kV DC project

PHASESHIFTER TRANSFORMER



Phaseshifter Transformer

- | Possibility for feed-in of electricity produced in offshore windparks
- | International opening of electricity markets
- | Optimization of management for load flow in different networks
- | Best possible capacity utilization

Reference Project: Alstom Turkey

Location: Stadtwerke (municipal energy supplier) Flensburg

- | 10 OLTC columns
 - 3x VRC I 1301-123/C-18 53 1G (for in-phase regulation)
 - 3x VRC I 1301-123/C-18 35 3G (for phase shifter (angle 90°) coarse tapping part 1)
 - 3x VRC I 1301-123/C-18 35 3GR (for phase shifter (angle 90°) coarse tapping, pt 2)
 - VRF III 1000Y-123/C-18 17 0 (for phase shifter (angle 90°), fine tapping)
- | Transformer power: 60 MVA; 60/62 kV
- | Special voltage regulator: TAPCON® 260 for precise control

VARIABLE SHUNT REACTORS

- | Overvoltage can be reduced effectively
- | Voltage can be kept in allowed limits anytime
- | Transmission losses can be reduced
- | Less number of Variable Shunt Reactors are needed compared to fixed Shunt Reactors
- | With VACUTAP[®] Tap-Changer Type VRG regulating range of 80% is advisable
- | **In this manner:**
 - | **Most economic solutions are feasible**
 - | **Lowest life cycle cost can be realized (including loss evaluation for regulation)**



Source: Web ALSTOM

INTRODUCTION TO REINHAUSEN GROUP



INTRODUCTION TO REINHAUSEN GROUP

Regensburg – World Cultural Heritage

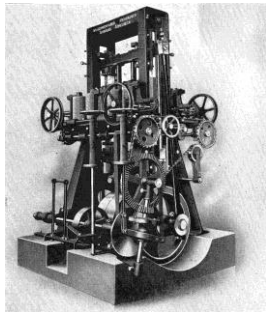




COMPETENT AND EXPERIENCED

1868

Founded in what is now the Reinhausen city district



1901

Company renamed Maschinenfabrik Reinhausen (MR)



1926

Patent obtained for the high-speed resistor-type tap changer



Hansen

1973

High-speed resistor-type tap-changer OILTAP® M



1995

Registration of the VACUTAP® brand family

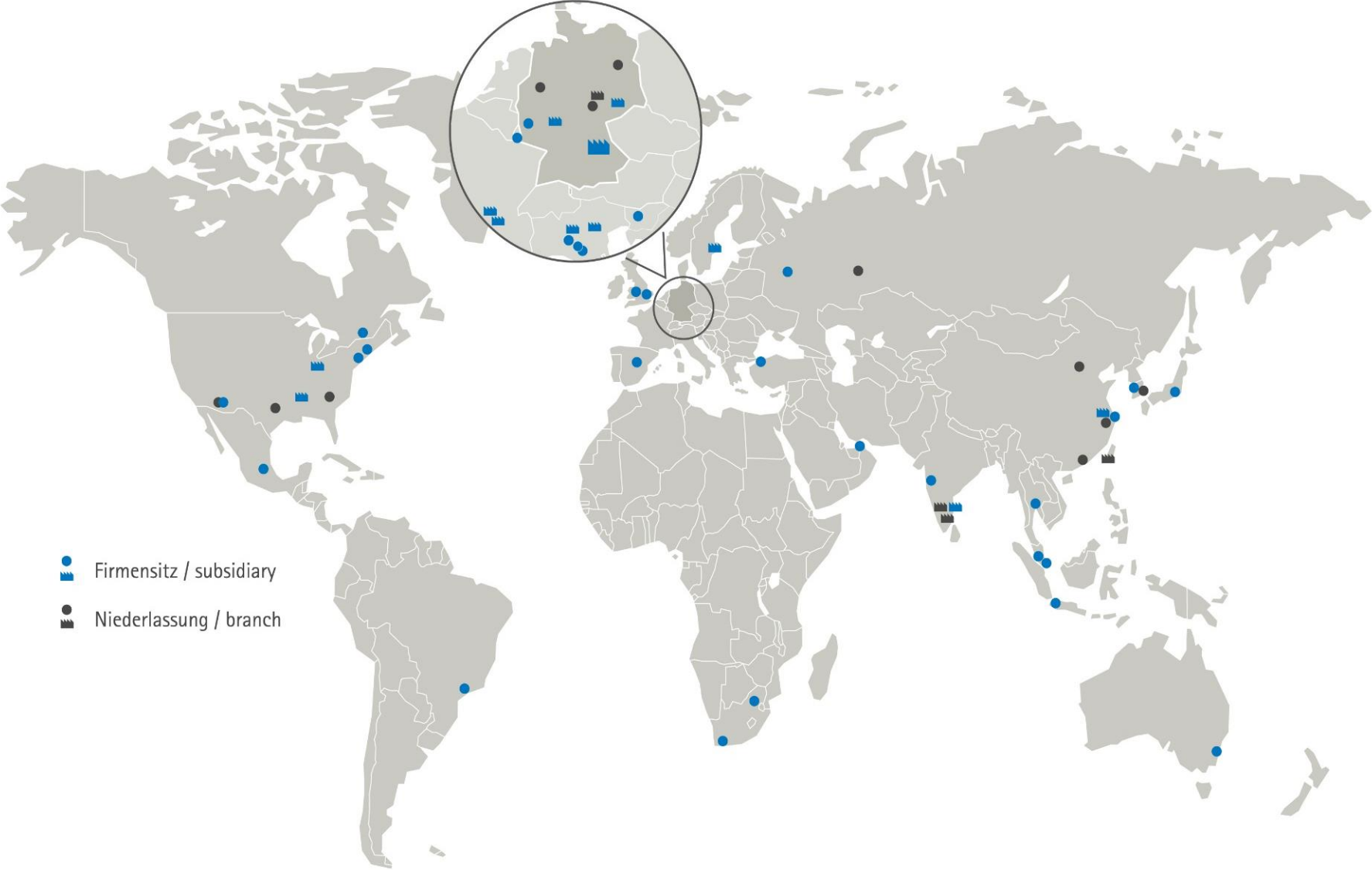


2016

772 patent applications worldwide since the foundation



LOCAL PRESENCE WORLDWIDE



- Firmensitz / subsidiary
- Niederlassung / branch



APPROACHES WITHIN THE GROUP

Goal	Increase corporate value in global niches of electrical energy engineering while maintaining the independence of the company and collaborating across the group						
Company vision	MANUFACTURING Marketing of proprietary technologies		TRANSFORMER No transformer without MR products			POWER Smart grid nodes for system stability, automated testing technology	
Approach	VALUE FACTURING	POWER COMPOSITES	TRANSFORMER CONTROL	TRANSFORMER AUTOMATION	TRANSFORMER SERVICE	POWER QUALITY	HIGHVOLT TESTING
Description	Production 4.0 with optimized machine-tool & production-aid flows	High-voltage insulators made from composite materials	Transformer components of relevance to operators	System capability on the transformer	Availability thanks to global services	System stability at critical mains node	Automated quality assurance of grid components
Services	<ul style="list-style-type: none"> Integration of data models for automated production Services to increase productivity 	<ul style="list-style-type: none"> Insulation and strength using GFRP cylinders Hollow composite insulators for HV and MV devices 	<ul style="list-style-type: none"> Actuators for distribution and power transformers Smart accessories for transformers 	<ul style="list-style-type: none"> Automation and digitalization on the transformer Data and fleet management for operators 	<ul style="list-style-type: none"> Services for all transformer aspects Lab-assisted oil analytics (PrimeLab) 	<ul style="list-style-type: none"> Reactive power compensation and clean sine Voltage stabilization and power control 	<ul style="list-style-type: none"> Integrated measurement technology for HV and MV testing Stationary and mobile (factory) test systems
Portfolio examples							
Customer	Machining firms, Austria, Germany, Switzerland	OEM	OEM	OEM / EPC / Operator	OEM / Operator	OEM / EPC / Operator	OEM / Operator
Brand	THE POWER BEHIND POWER. www.reinhausen.com						

THE POWER BEHIND POWER.

www.reinhausen.com

