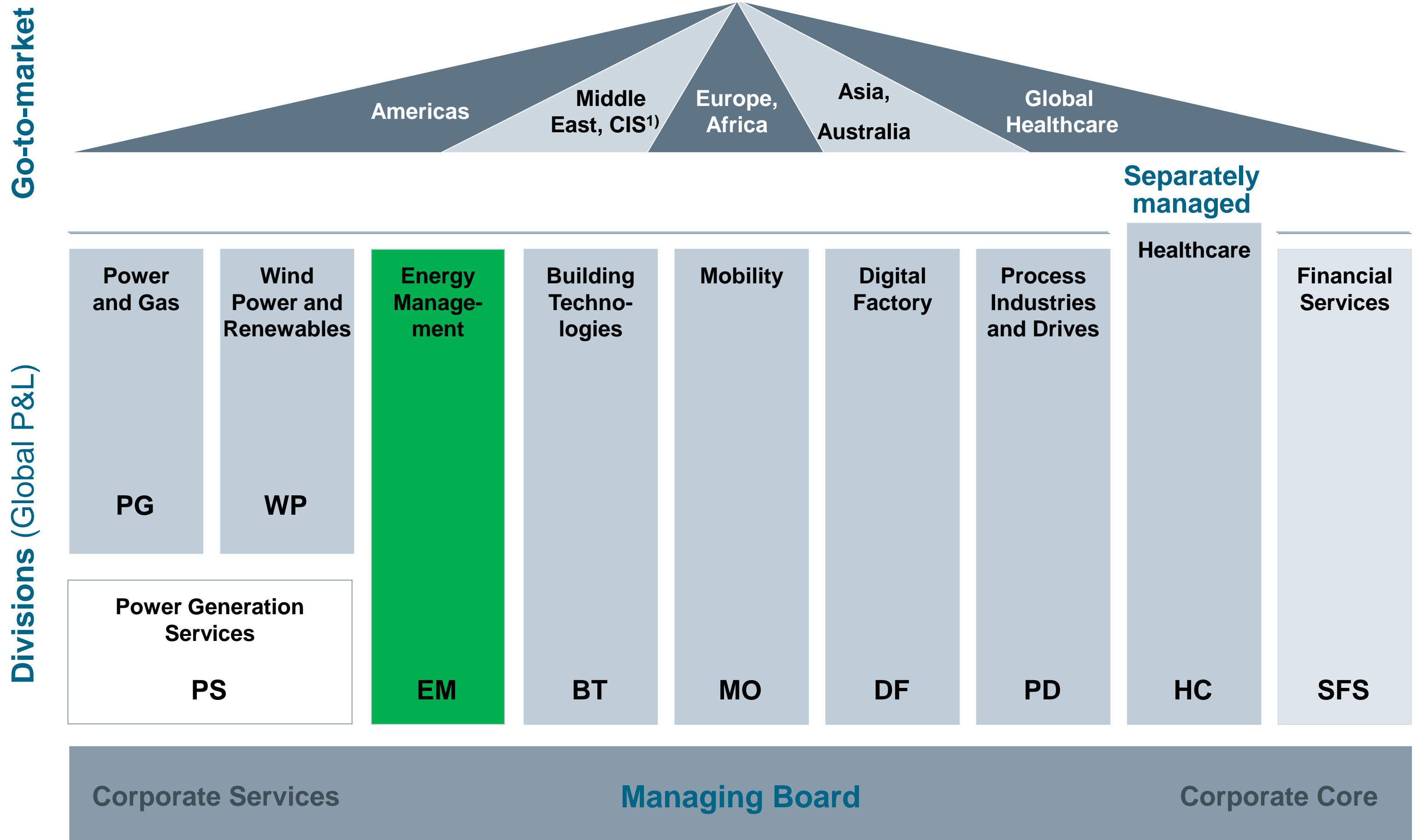




EM TR DT STM

**SIEMENS**  
*Ingenio para la vida*

# Flat and market driven organization along the value chain



# The Business Units of Energy Management

## High Voltage Products



Circuit Breakers  
 Disconnectors and Earthing Switches  
 Hybrid Switchgear  
 Instrument Transform.  
 Surge Arresters  
 Coils  
 Bushings  
 Gas-Insulated Switchgear (GIS-Systems)

## Transformers



Power Transformers  
**Distribution Transformers**  
 Special Purpose Transformers  
 Traction Transformers  
 Phasemifter Transformers  
 TLM™  
 Transformer Components

## Transmission Solutions



High-Voltage, Direct-Current Transmission (HVDC)  
 Reactive Power Compensation / FACTS  
 Turnkey Grid Access Solutions  
 Solutions for Gas- and Air-insulated Switchgear (GIS, AIS)  
 Gas-insulated lines (GIL)

## Medium Voltage & Systems



Air & Gas Insulated MV Switchgear  
 LV Switchgear & busbar trunking systems  
 Generator Switchgear  
 Storage, grid coupling and sub-sea solutions, e-houses

## Low Voltage & Products



LV Protection, switching, measuring & monitoring devices  
 LV distribution boards /systems  
 MV vacuum circuit breakers, contactors & interrupters

## Energy Automation



Grid automation  
 Grid protection  
 Communication devices  
 Power quality  
 Sensors

## Smart Grid Solutions & Services



Grid control center  
 Grid applications  
 Meter data management  
 Data analytics  
 Software solutions  
 Integration services  
 Asset services

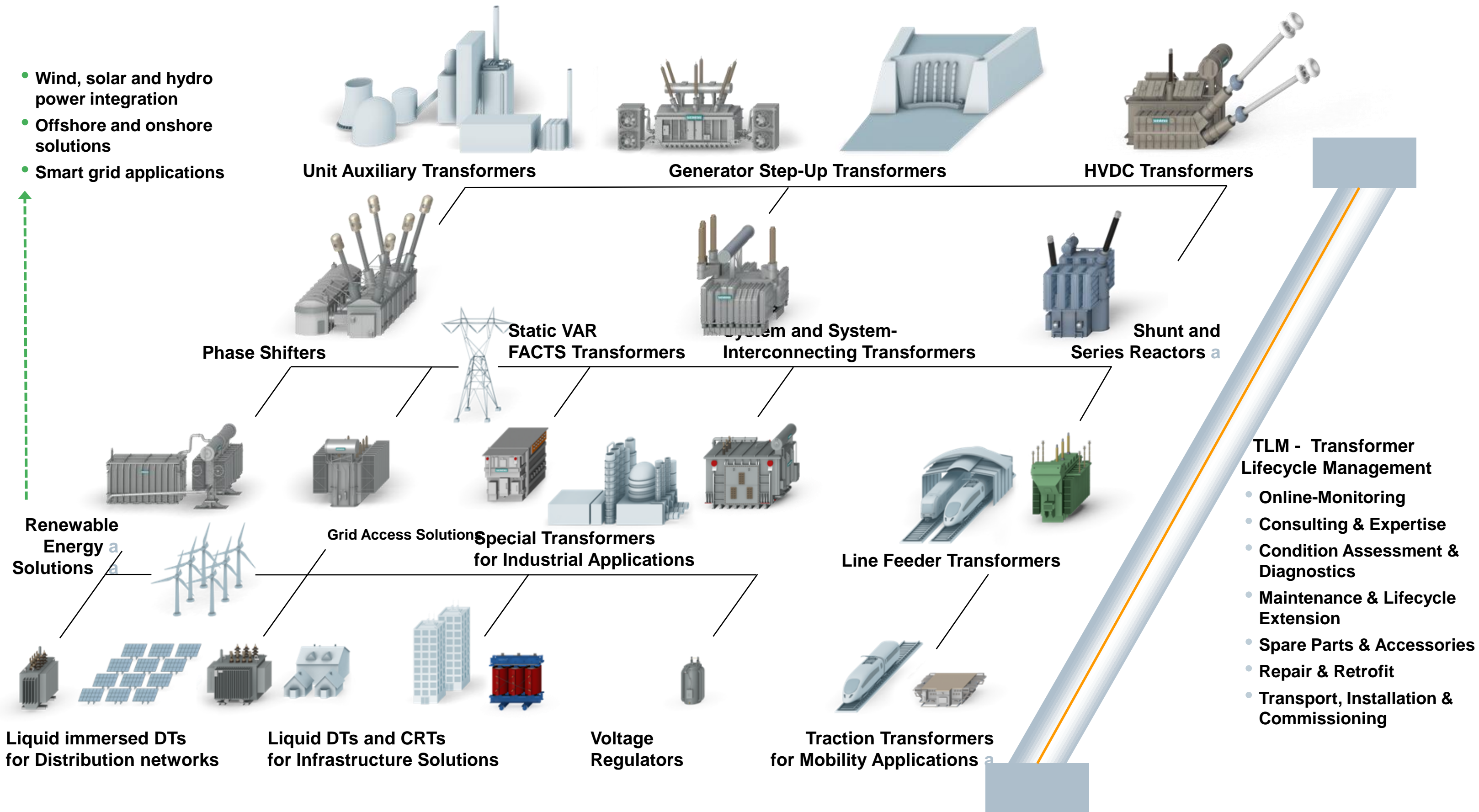
Electrification

Automation

Digitalization

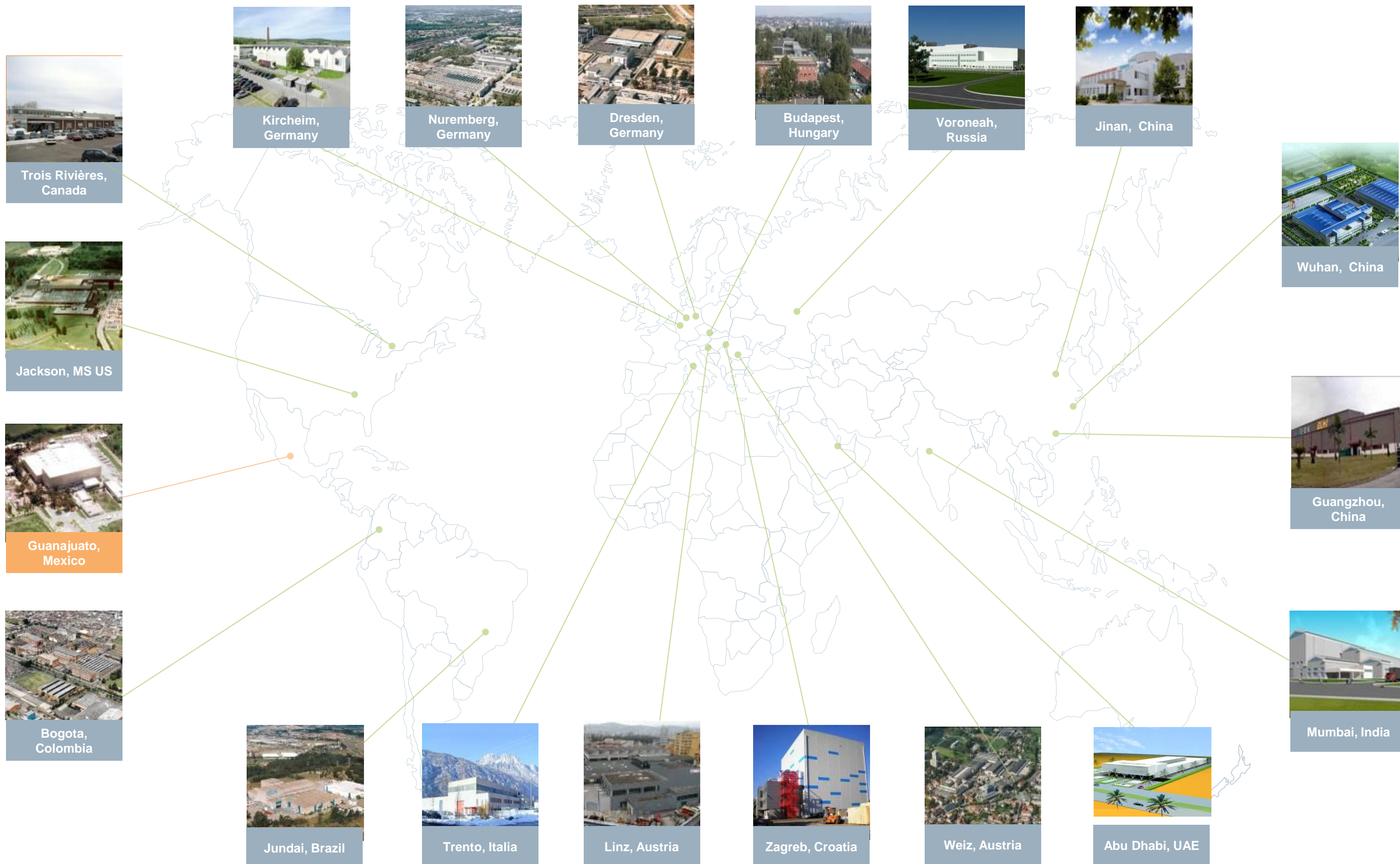
# Siemens Transformers at all Levels of Transmission and Distribution

- Wind, solar and hydro power integration
- Offshore and onshore solutions
- Smart grid applications



# Siemens Transformers

## Global footprint of 19 locations



# Siemens Transformers

## 2 of CRT factories into the largest market USA





# Siemens Kirchheim/Teck–Germany Center of Competence

GEA FOL - Cast Resin Transformers

# Subdivision Distribution Transformers: Kirchheim, Germany (“DK”)



**SIEMENS**

## Products

- GEAFOL<sup>®</sup> cast-resin transformers of all types up to approximately 50 MVA and 52 kV



**Approx. 300 employees**

**Annual production capacity of approx. 8,000 MVA**





**SIEMENS**

# Siemens Transformers Mexico STM Guanajuato, Mexico

# Factory Profile

The plant in Guanajuato supplies the North, Latin America and other world markets with power and distribution transformers.



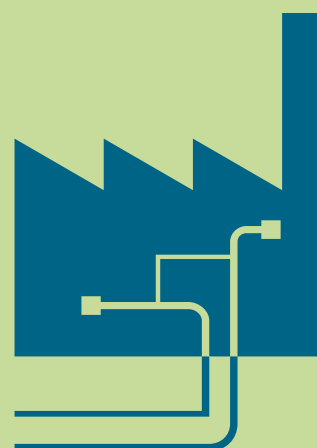
Located in the center of Mexico, Guanajuato is a beautiful colonial city with a rapid and easy connection through the Bajío International Airport (BJX)

# Facts

- Total area of **603,000** sqf
- Production area of 132, 000 sqf
- **450** employees
- Privileged Geographically location
- Multiple Logistics options
- Truck cargo bay
- Annual Capacity of **12,000** MVA/year



# STM Facts



## Factory Facts

- Total area of **647sqm**
- Production area **300 sqm**
- **70** employees
- Privileged Geographically location
- Multiple Logistics options
- Truck cargo bay
- **Planned capacity 2,000 MVA Annually (Expansion Project)**
- Serving the NAM markets



# Siemens CRT : Cast-Resin Transformers

Cast Resin Transformers Mexico portfolio is as follows:

Power Rating

**500 kVA – 3.5 MVA**

Voltages

**Up to 34.5 kV**

Material Windings

- **Aluminum**
- **Copper**



**SIEMENS**

# GEAFOL<sup>®</sup> and CARECO<sup>®</sup> Cast-Resin Transformers

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# GEAFOL & CARECO

**G** = **G**ießharz (Encapsulado)

**E** = **E**poxid (Epóxica)

**A** = **A**luminium

**FOL** = **F**olie wicklung

---

**CA** = **C**ast

**RE** = **R**esin

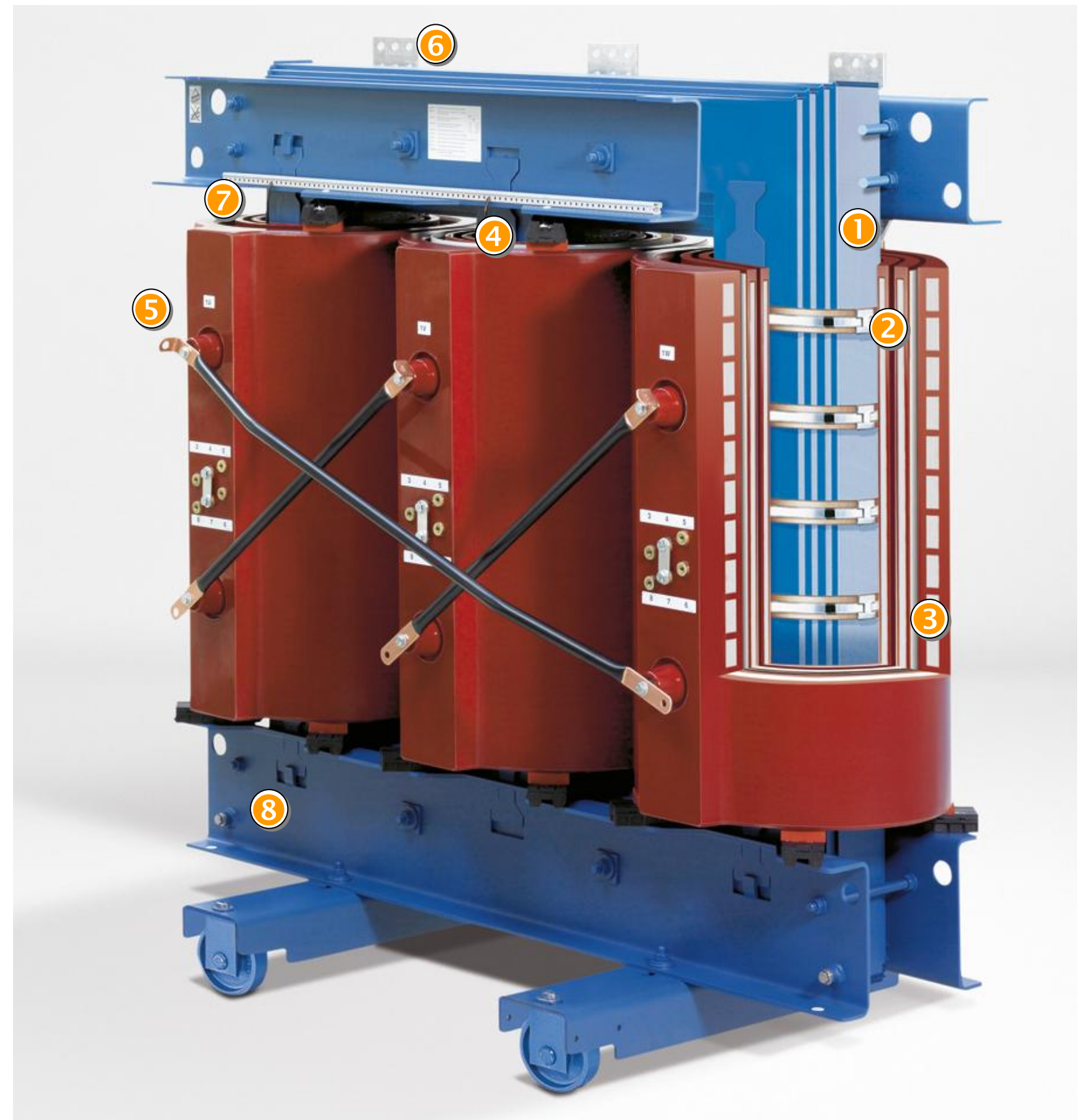
**CO** = **C**opper





# SIEMENS Cast-Resin Transformers Inside – Main Components

- ① Three-limb core
- ② LV winding
- ③ HV winding
- ④ Insulation cylinder
- ⑤ HV terminals
- ⑥ LV terminals
- ⑦ Resilient spacers
- ⑧ Yoke clamping frame and truck



# GEAFOL Cast-Resin Transformers Standard Housings – the Inexpensive Solution

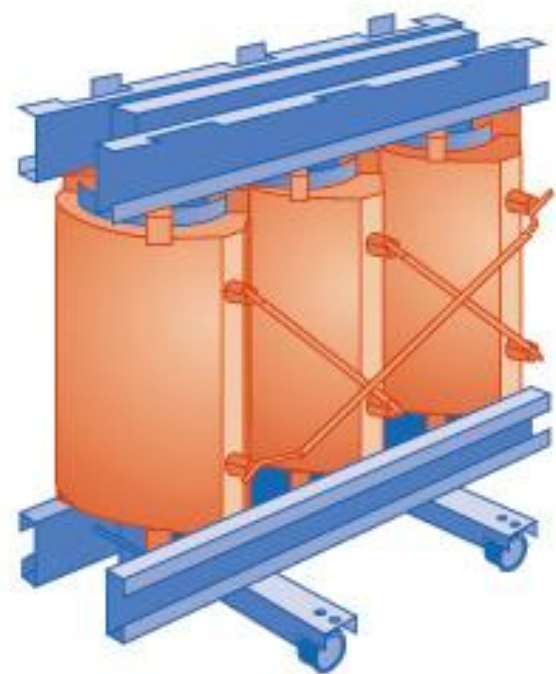


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Indoors

Indoors

Outdoors

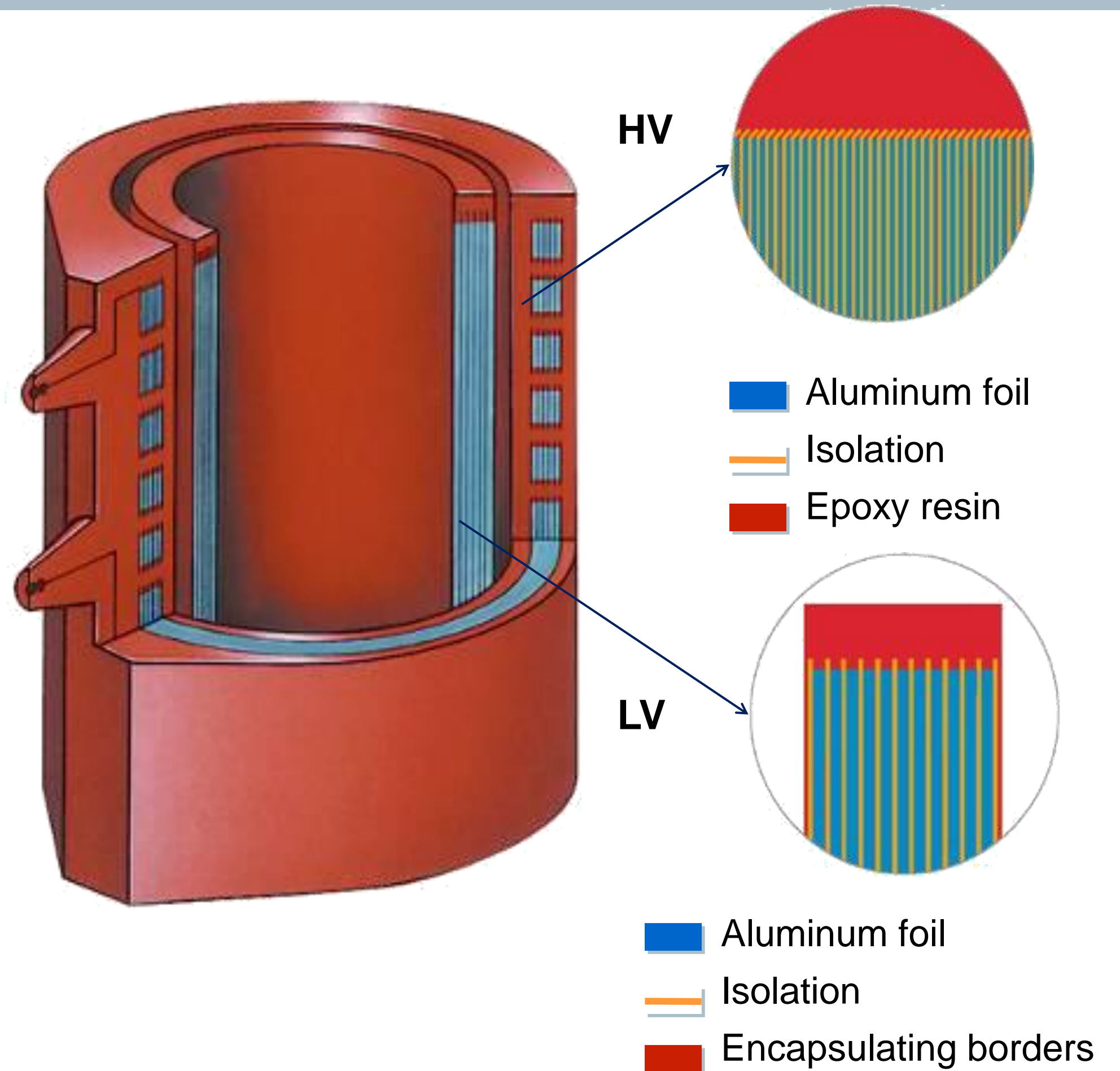
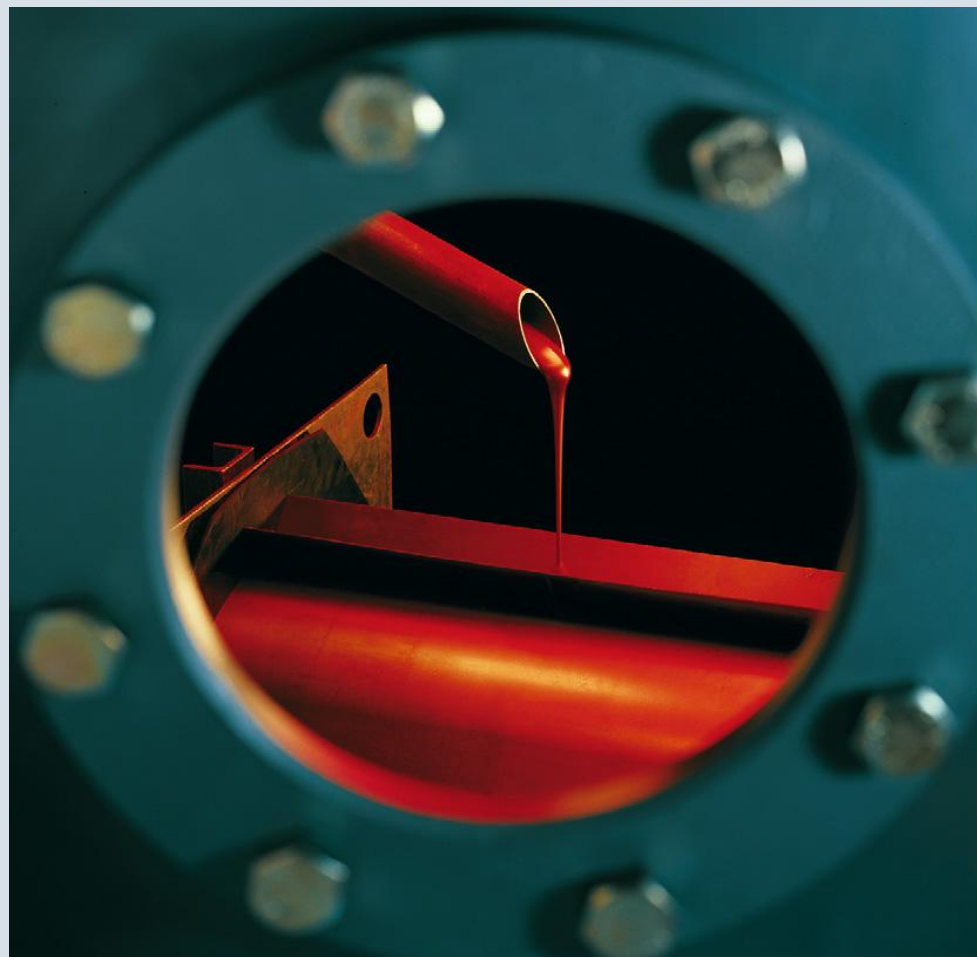


NEMA 1

NEMA 1

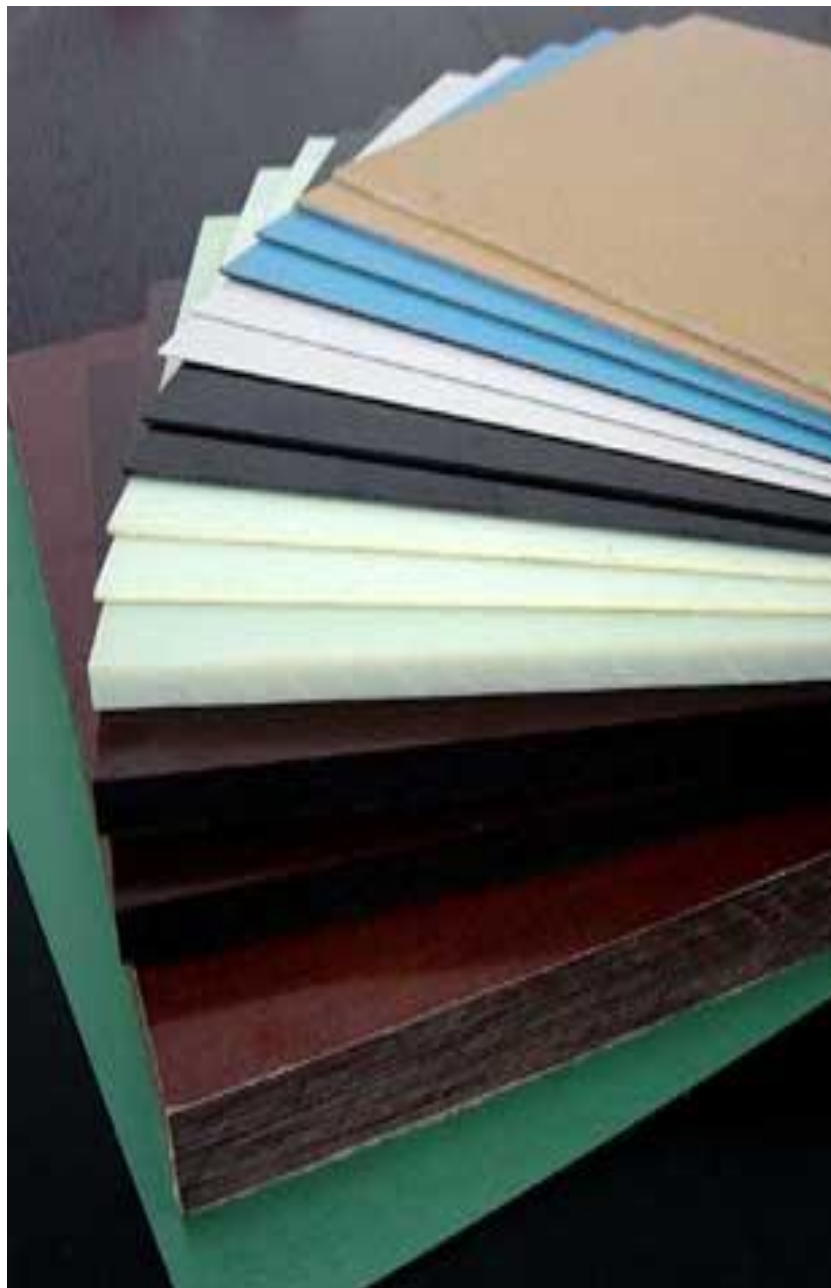
NEMA 3R

# Winding Technology (HV)



## Winding Technology (LV)

La cintas de aislamiento PrePreg's se curan a cierta temperatura y velocidad controlada en los bobinados de BT y con esto se controla la estabilidad mecánica de la bobina así como aislamiento eléctrico.



## Winding Technology (LV)



### Material:

- Aluminum Foil

### Isolation

- Pre-impregnated Resin isolation



# Siemens Cast-Resin Transformers : Inside – Main Components

## Global Standards :

CSA.C9.02

ANSI / IEEE.C57.12.01

IEC.60076.11.2004

EN.50541.1

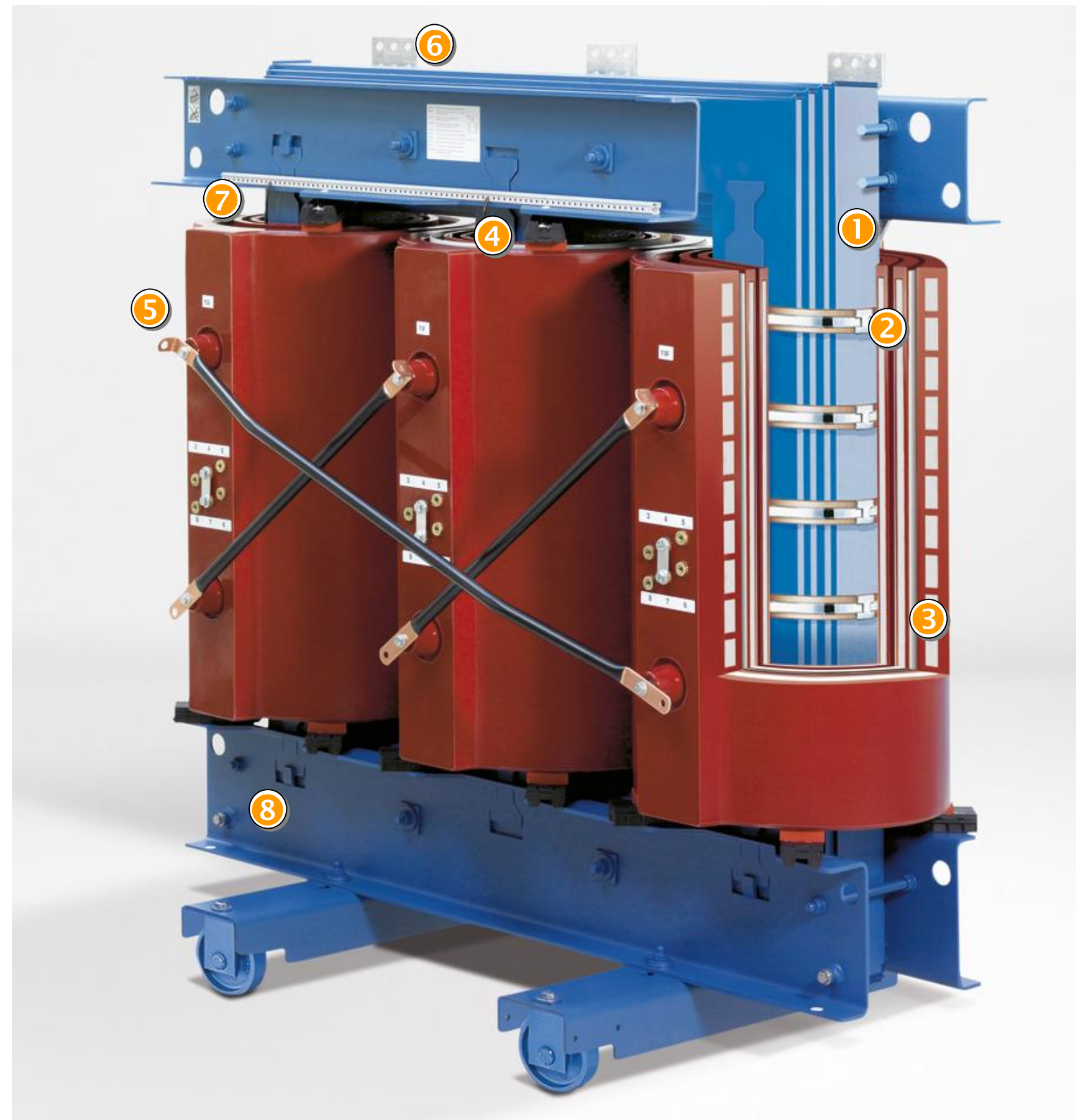
UL Listed

## Mexico

NRF-048-PEMEX-2007

NMX-J-351-ANCE-2005

GNT-SSIME-E020-2007.



# GEAFOL® y CARECO® Transformadores moldeados en resina Características y beneficios



SIEMENS



**Seguros,  
Rentables,  
Robustos**



**Bajo  
mantenimiento**

**Económicos**



**Compactos &  
con diseño  
modular**

**Bajo impacto  
al ambiente**



# GEAFOL<sup>®</sup> and CARECO<sup>®</sup> Cast-Resin Transformers Features and Benefits at a Glance



**SIEMENS**

## Safe, Reliable, Robust

- **Manufactured since 1966**
- **More than 100,000 units installed worldwide**
- **High Transient Voltage withstand capability**
- **High Overload capability (up to 150%)**
- **Free from partial discharges (2 x normal)**
- **Harsh Environments**

## Low Environmental Impact

- **No flammable liquid**
- **Low noise level**
- **Flame-resistant and self-extinguishing**
- **Recyclable**

## Economical

- **Easy to close-couple connect to gear**
- **No special equipment rooms or Fire Protection needed**

## Low Maintenance

## Compact & Modular Design



GEAFOL® y CARECO® Transformadores casteados en resina:  
Estandares  
IEC 60076-11 – Transformadores casteados en resina



SIEMENS



Tipo clima considera las clases de temperatura ambiente más bajas:

C1 – C2

Tipo de ambiente considera

- humedad
- condensación
- contaminación

E0 – E1 – E2

Tipo resistente al fuego considera consecuencia de incendio clases:

F0 – F1

**GEAFOL cumple con las más altas clases C2 - E2 – F1**

# Manufacturing



SIEMENS



# Test Laboratory

- Test Bay :  
Routine test for Dry type distribution transformers.
- Transformer **design** as per :  
IEEE, IEC, NMX , CSA
- AC Test Set 100 kV – 40 kVA.  
Haefly 210kJ
- Induce test and PD measurement  
with sensitivity < 2 pC
- Test capacity up to 35 KV & 4 MVA
- All the Systems and Instruments  
calibrated / Calibration Program.



# Tests :

## Distribution Transformers acc. IEEE.C57.12.01

### Routine Tests IEEE.C57.12.01

- 1 Winding resistance on rated voltage
- 2 Ratio tests on rated voltage
- 3 Polarity & Phase relation
- 4 No-load losses & excitation current
- 5 Impedance Voltage & Load Loss
- 6 Applied voltage
- 7 Induced voltage
- 8 Partial discharge test

### Type Tests

- 1 Lightning impulse
- 2 Heat run
- 3 Audible Noise level

### Special Tests

- 2 Short-circuit withstand test
- 3 Endurance vibration test

# Quality Certifications

**ISO  
9001:2008  
Certificate**

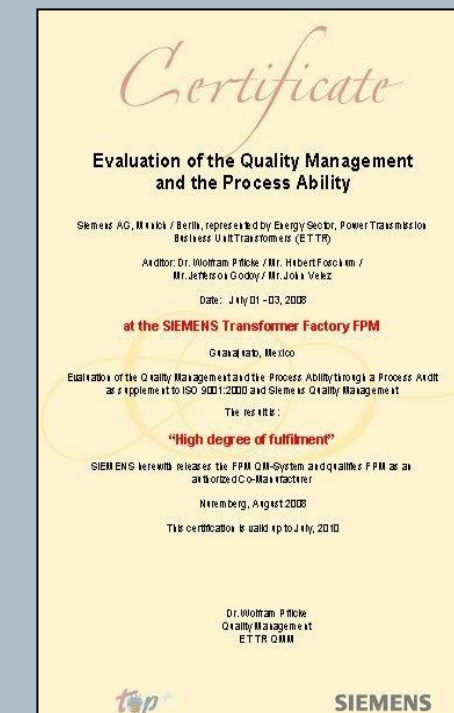
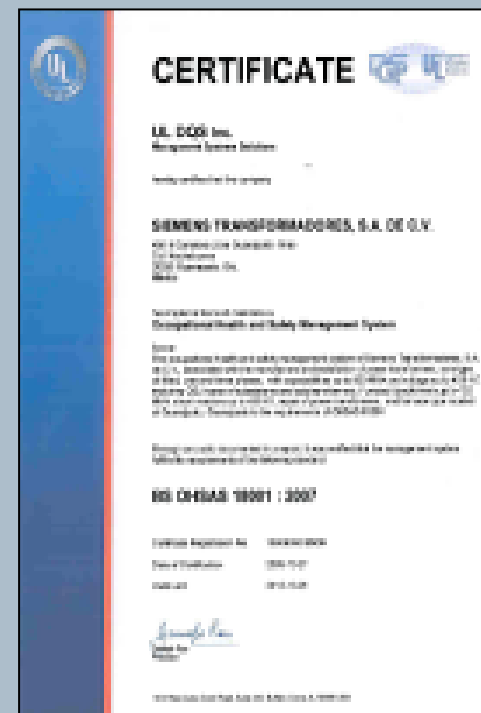
**OHSAS  
18001:2007  
Certificate**

**ISO  
14001:2004  
Certificate**

**ISO/IEC  
17025: 2005  
Test Lab  
Certificate**

**Siemens  
Evaluation  
of Quality  
Mgmt and  
Process  
Ability**

**CFE-LAPEM  
Quality  
Certificate**



# Logistics - Specialized transportation system

- Siemens has a integer and long term experience in logistics for Mexico, USA and Canada for all kind of transport system.
- Personal supervision during transit from Guanajuato to US border.
- GPS monitoring system.
- Personal assistance on the MX-US border crossing/clearing.
- Transformer and accessories are dispatched using single platform as preferred solution.
- External wrapping (shrink-wrap) is used on the main tank in order to avoid damages and external pollution.

By truck



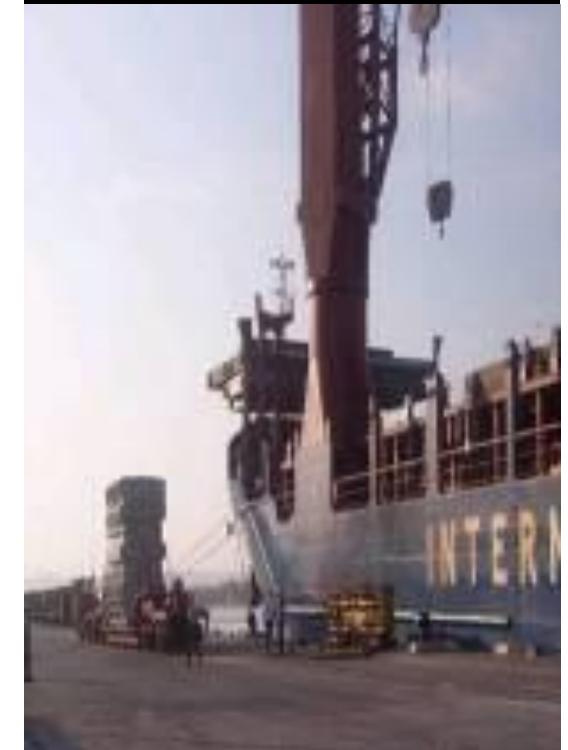
By barge



By train

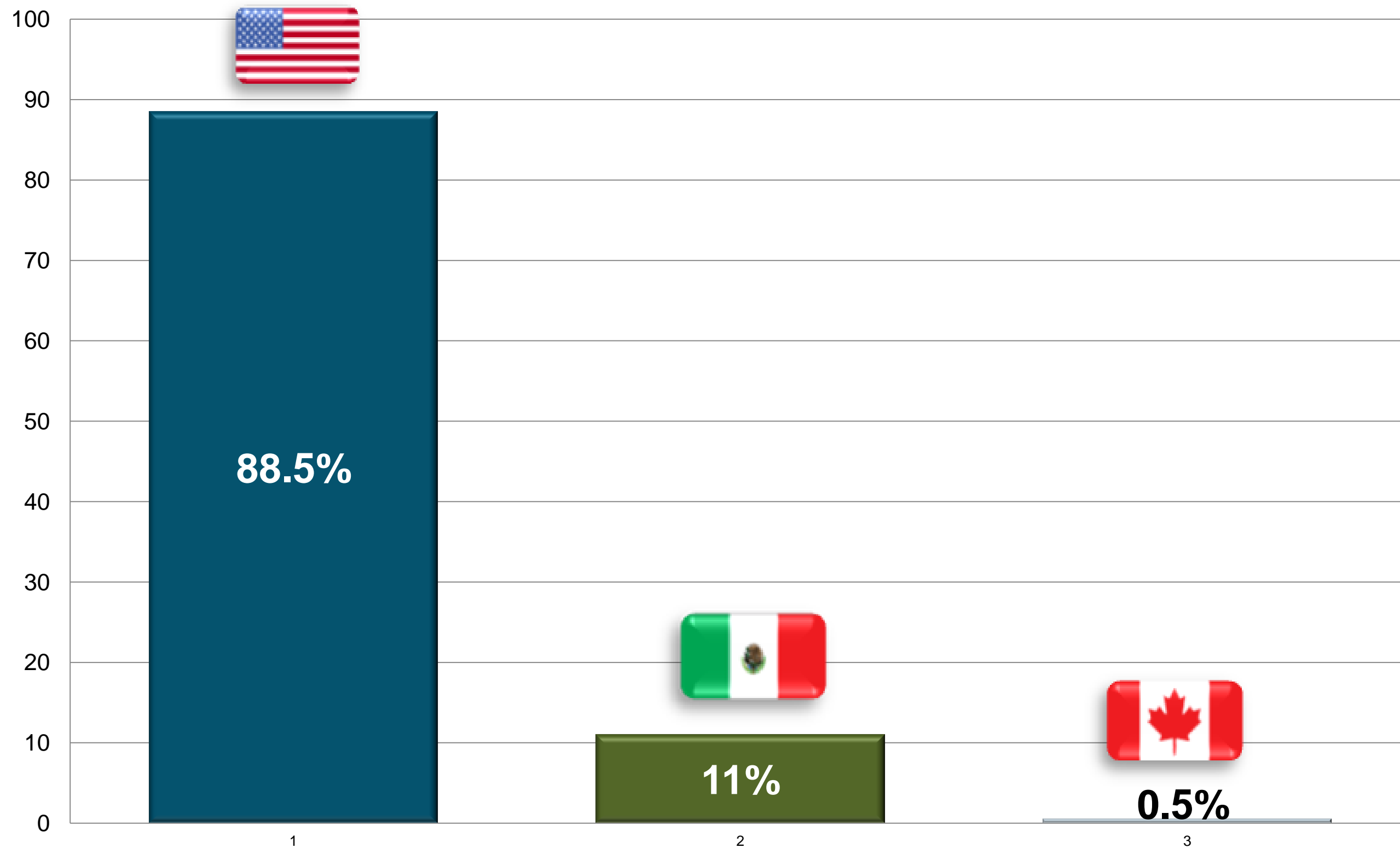


By vessel



# Our Experience

Total units delivered: 2070 (2011-Presente)



# Our customers - we have their trust

## MEXICO

## USA



## CANADA





# Some Installation Examples

# Cast-Resin Transformers Office and Residential Buildings



SIEMENS



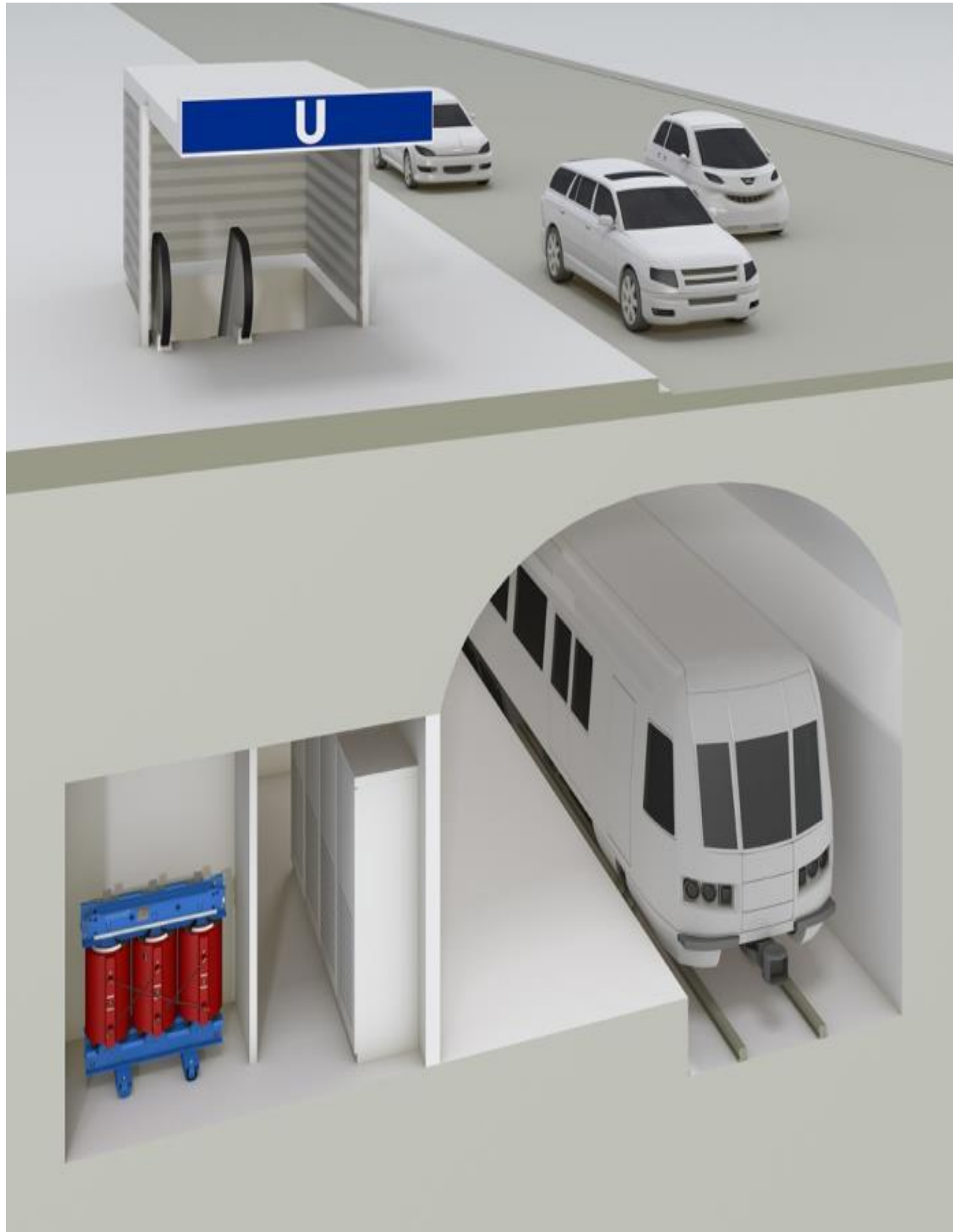
# Cast-Resin Transformers People Movement - Major Airports



SIEMENS



# Cast-Resin Transformers People Movement - Underground rails



# Cast-Resin Transformers “Transrapid” Magnetic Levitation Trail



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# Cast-Resin Transformers in NPP's Nuclear Power Plants



SIEMENS



# Cast-Resin Transformers Marine Solutions

## Crane ships

transformers below deck  
power for the drives of the  
7000-ton cranes



## Ice breakers

Canadian ice breakers and  
oil drilling ships e Arctic  
Ocean can also stand up to  
extreme cold and are not  
susceptible to corrosion by  
salt water.



## Platforms

Further platforms with  
GEAFOL transformers are  
being built.



# Cast-Resin Transformers Off-Shore and on-shore Windparks



SIEMENS





# Cast-Resin Transformers In Data Centers



SIEMENS



TECENT in Shenzhen/Wuhan and Chengdu



Microsoft data centre in Singapore > 100 units

# Transformadores encapsulados GEAFOL Lugares de reunión,



SIEMENS

Museo Mercedes Benz de Alemania



# Transformadores encapsulados GEA FOL

En instalaciones deportivas Westfalen Stadio colocaron 4 transformadores tipo GEA FOL en alemania



# KIA MOTORS MEXICO





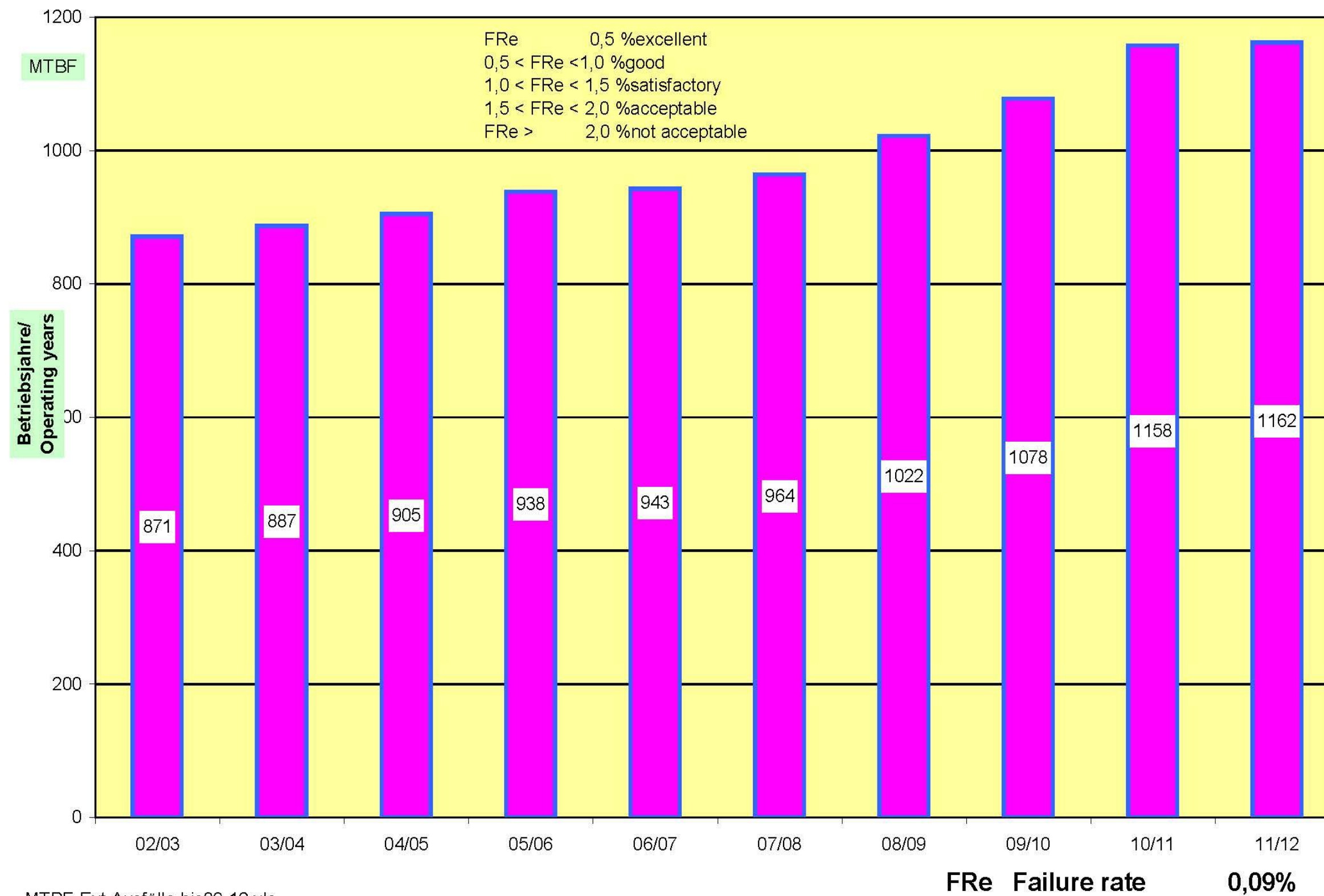
# PEMEX CACTUS



# MANITOBA



# SIEMENS GEAUFOL MTBF 2012 MEAN TIME BETWEEN FAILURES



MTBF-Ext Ausfälle bis09-12.xls



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[www.capacitor.com.mx](http://www.capacitor.com.mx)



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[summaa@summaa.com](mailto:summaa@summaa.com)  
52 (55) 5243 9127 / 28

**Thank you !!!**

