Energy in transition

AC-DC

Transmission lines

and substation accessories

sicame GROUP

Transmission

About us

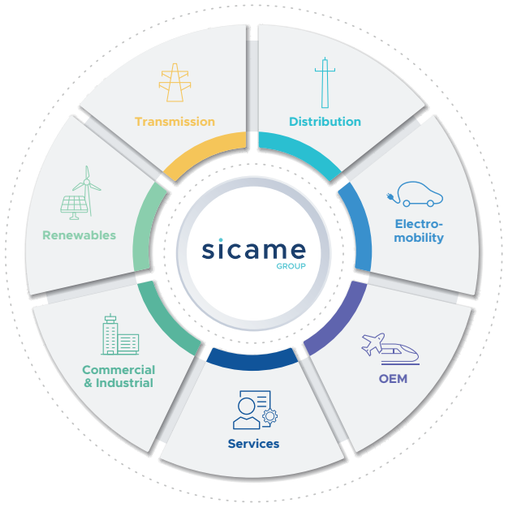
Sicame Group is one of the key players in the electrical equipment business worldwide. It has been able to adapt and develop to support the continuous evolution of electricity infrastructure in France and around the world, and become the largest independent entity in its sector.

A true player in the energy transition, it offers its customers new products and services to improve energy efficiency, deal with environmental risks and support the development of electric vehicle and solar power plant markets.

+65
years of worldwide success

567 M€
2023 turnover

3,600
employees



Our fields of activity

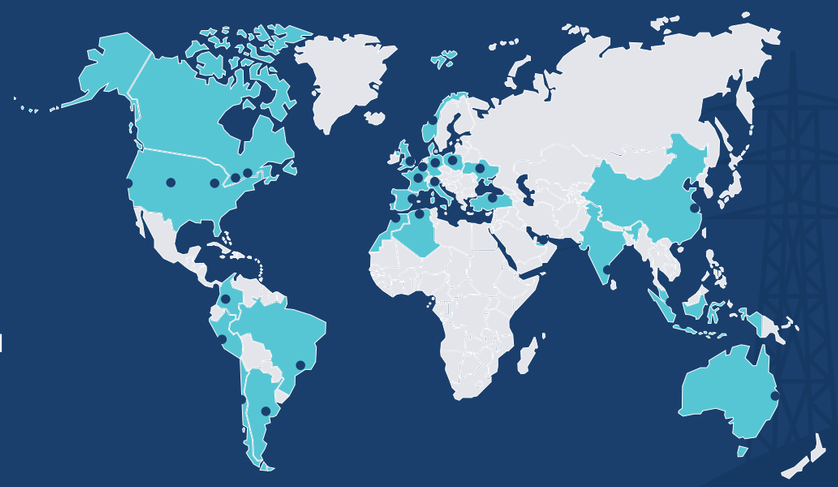
Sicame Group is specialised in **products and services** related to transmission and distribution of **electrical energy**, renewables, electro-mobility, safety equipment and industrial applications.

5 continents

26 countries

50 companies around the world

Products distributed in **157** countries



With decades of history and recognized expertise, the Transmission division is specialized in designing, manufacturing and producing comprehensive ranges of transmission lines and systems connectors, damping systems, hardware and most advanced substation fitting solutions, adapted to the most technical configurations such as 8-bundle spacer dampers, UHV HVDC connectors and innovative high temperature conductor's accessories.

Damping Systems

Aeolian vibrations and sub-span oscillations are the adverse phenomena induced by wind action that shall be controlled in order to safeguard the life of the transmission lines.

This is always the target of Salvi design of Damping Systems.

An overview on Salvi damping systems

Vibrations induced by the wind on single and bundled conductors generate undesirable and dangerous phenomena on the OHTL:

- Aeolian Vibration (Vortex Shedding)
- Wake Induced Oscillation (Sub-Span Oscillation)

They will be kept under control using a proper Damping Systems made by Spacer Dampers and Vibration Dampers.

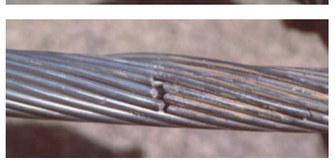
Aeolian vibration

Aeolian Vibration's effect is conductor fatigue. Fatigue is the result of a combined effect of alternate bending strain and of fretting among the single wires of the conductor (in HVTL stranded cables).

Fretting causes the generation of micro-cracks which, depending on the strain level, may cause failure of the single wires and finally of the conductor.

Aeolian Vibration can occur on single and bundle conductor configuration.

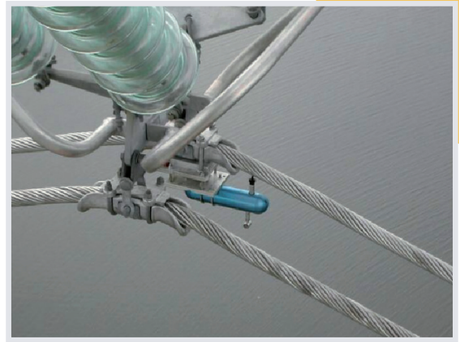
When	Single & Bundle
Caused by	Vortex shedding
Winds	Moderates
Amplitudes	Small (up to one cable diameter)
Frequencies	5 – 100 Hz
Effect	Fatigue (bending + fretting)
Controlled by	Vibration Damper – Spacer Damper



Analytical evaluation

Damping Systems design

An optimum Damping Systems is designed evaluating the two vibration phenomena (Aeolian and Sub-Conductor vibration) on the OHTL, by means a damping study, carried out with a validated software.



Input data

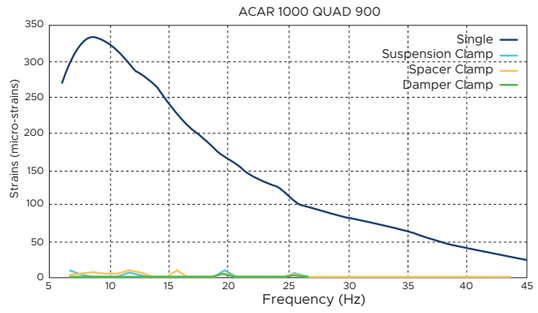
Type of conductor (stranding, diameter, mass per unit length)

- Bundle spacing in inches or mm
- Tensile load at the coldest period of the year
- EDS
- Span lengths (presence of long spans)
- Type of terrain
- Maximum wind speed
- Type of spacer dampers
- Number of spacer dampers
- Staggering of spacer dampers

Damping systems validation

The validation of a Damping System is carried out with measurements performed by Salvi equipment and personnel on the site ie (FIELD TEST).

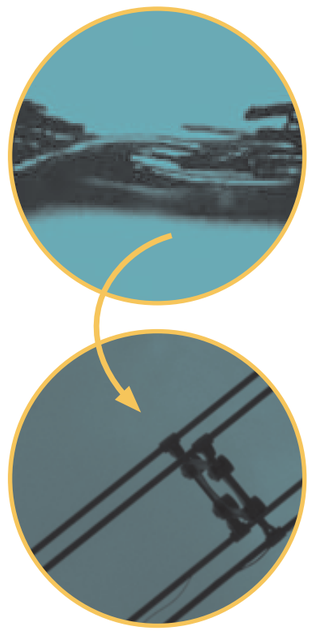
Such tests verify the real level of vibrations compared with evaluation at the design stage with the analytical method ie (DAMPING STUDY).



Sub-span oscillations

- Occur only on bundle conductors with at least one couple of sub-conductors with one in the wake of the other.
- It is an instability phenomenon due to the coupling of bundle vertical and horizontal modes of vibration.
- Sub-span oscillations may cause sub-conductor clashing with possible conductor breakage.

When	Bundle
Caused by	Wake effect
Winds	Medium / High speed (V> 10 m/s
Amplitudes	High (up to conductor spacing)
Frequencies	0,7 – 2 Hz
Effect	Clashing – Clamp bolts loosening
Controlled by	Spacer Dampers staggering



Different clamping solutions

Require different requirements based upon:

- International recommendations.
- Utilities standards.

Salvi can supply solutions with all possible combinations:

- **Locking Systems**
  A - Bolted clamping design
  B - Preformed clamping design
  C - Boltless clamping design
- **Clamp Types**
  A - Cantilever clamp
  D - Inverted clamp
- **Coupling Types**
  A, C, D - Metal – Metal
  B, E - Rubber Liner

Two to eight bundle spacer dampers

The range of Salvi SD covers all possible applications: Voltage up to 1.200kV Bundle Spacing up to 1.200mm – Any conductor types (ACSR, AAC, AAAC, ACAR) and clamping solutions.

Salvi expertise in R&D, design & test has and continues to assist Engineers, Consultants and Utilities globally, with new types of spacer dampers for all type of configurations.

Delta / Triple bundle

Diamond bundle

Asymmetric shape SD

Twin bundle

Hexagonal bundle

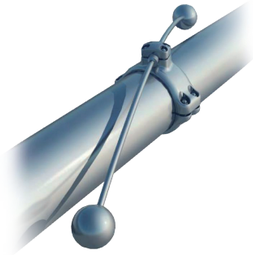
Torsional absorber SD

Octagonal bundle

Quad bundle

Vibration Dampers (VD)

In order to satisfy several demands of the market, our range of VD is very wide. It includes models with galvanized steel or melted Zamac masses and models with galvanized steel or stainless steel messenger cable.



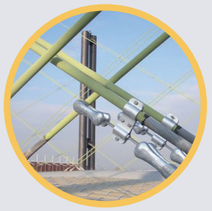
Special products

Salvi is also specialised in executing projects which have a high technological content which requires a highly qualified internal organisation, cutting edge laboratory equipment and a strict collaboration with Research Centres and Universities. Few examples are shown hereunder.

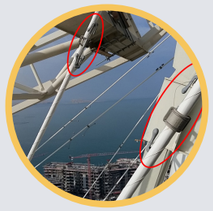
London Eye (U.K.)

London Eye (U.K.)

Braga Stadium (Portugal)



Benetton Factory (Italy)



Dubai eye (Emirates)

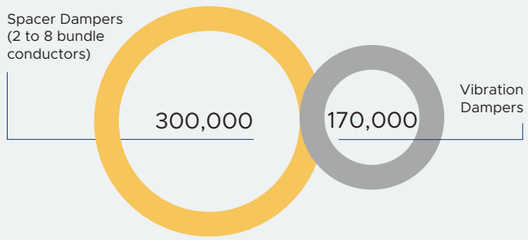
Manufacturing tests

The following tests performed on Spacer Dampers and Vibration Dampers are carried out in our laboratory:

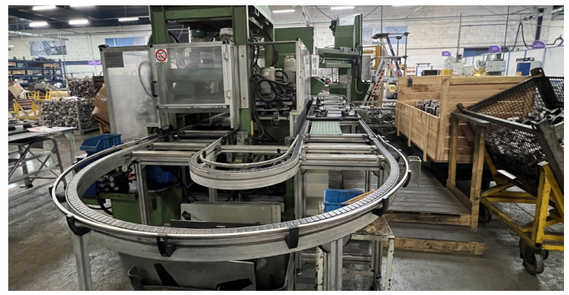
- Fatigue test
- Simulation of short circuit
- Slippage of clamps
- Verification of damping performances

Complete assembly of spacer dampers and Vibration Dampers is carried out by Salvi with automatic assembly lines.

Annual production capacity.



Spacer dampers automatic assembly line



Vibration dampers automatic assembly line

HTLS

High temperature
low sag cable line hardware

Since 2001, Dervaux has been working closely with the French electricity grid (RTE: Réseaux de Transport d'Electricité) and other major Utilities, to successfully qualify HTLS conductor sets and accessories.

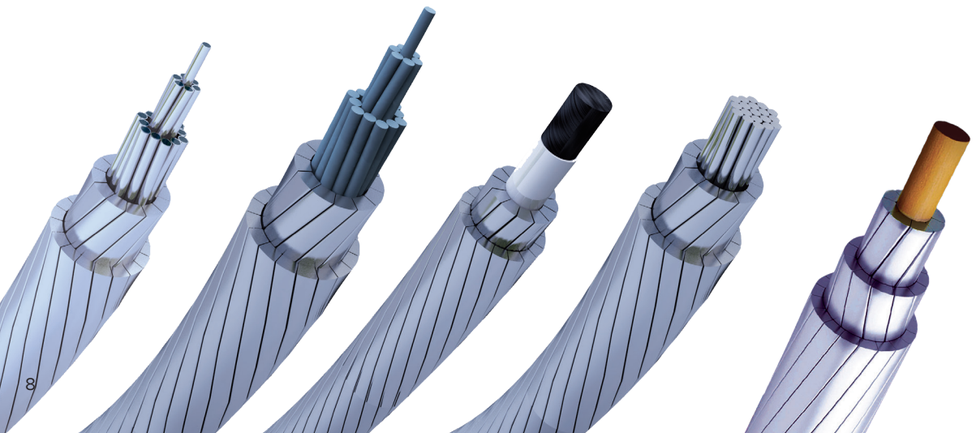
Dervaux has confirmed for many years now, its strong technical capacity to design line hardware suitable to the HTLS conductors characteristics requirements:

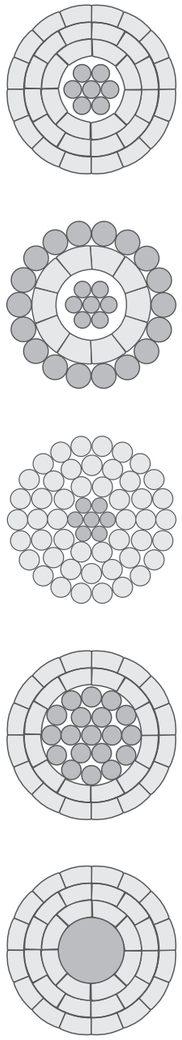
- Maximum operating temperature (up to 250°C).
- Fully annealed aluminium for conductor strands.
- Gauges according to the required outputs.

We are qualified by most part of cable manufacturers either type of HTLS conductors, ACSS, Invar, Gap, carbon core and Metallic matrix type.

These specific conductor characteristics require the study and qualification of line hardware that result in safe, durable installations, whether new or existing lines.

This design results in good conductivity, good mechanical characteristics, and a low conductor sag.



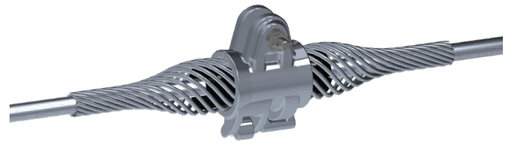


Accessories

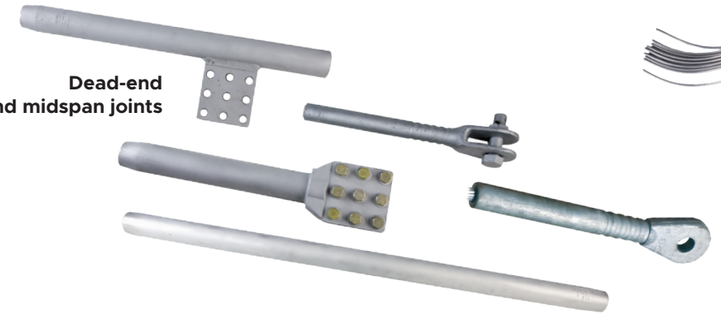
Our offering includes a complete range of suspension, anchoring, and connection accessories for poles.

CTC GLOBAL ACCC® Conductor APPROVED

Dampers

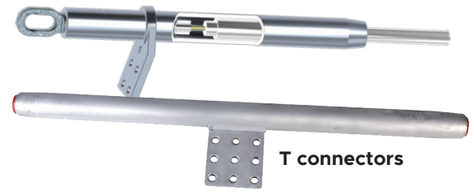


Suspension clamps



Dead-end and midspan joints

Helical products



T connectors

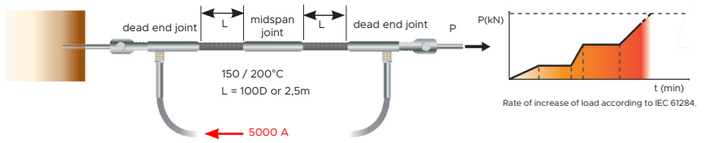
A testing laboratory able to characterize
and qualify HTLS conductors & accessories

Our Transmission has test resources among the best, which means that low sag / high ampacity conductors and accessories can be fine-tuned and qualified. These studies and trials are performed according to the power, environmental, and configuration parameters of the line to be fitted.

The tests comply with the requirements of standard IEC 61284*:

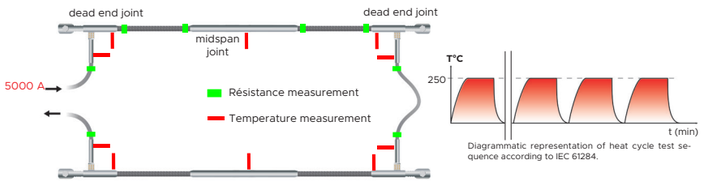
*Tests compliant with the specifications of each country can be performed by the Sicame Group Transmission Laboratories.

High temperature tensile bench test



Rate of increase of load according to IEC 61284.

Heat cycle test at 250°C



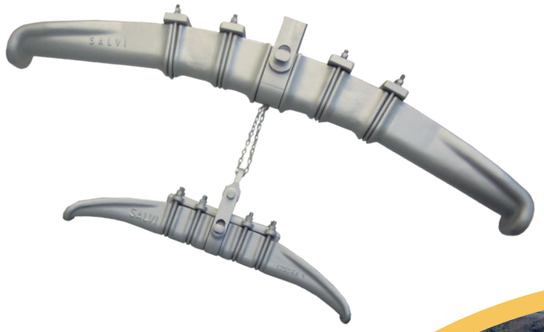
Diagrammatic representation of heat cycle test sequence according to IEC 61284.

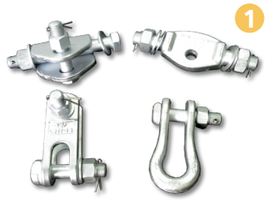
Hardware, fittings & OPGW

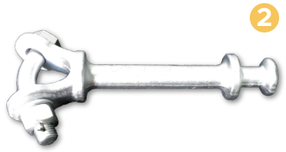
In order to offer the most complete, technically compliant and customized solution,
Salvi always takes into consideration the following parameters and electrical phenomena:

Design parameters

- Geometry information of each assembly
- Special requirements in terms of material
- Different attachments to tower 1
- Hot line maintenance capabilities 2
- Use of Corona Rings and relative characteristics 3
- Type of preferred suspension clamps 4
- Type of preferred conductor terminals
- Electrical clearances
- Standard or high temperature conductor
- Environmental conditions affecting type of galvanizing (standard or heavy)
- Electrical and Mechanical performances requirements
- Type of transmission line: AC or DC Power Supply







Main electrical phenomena

Corona effect:

It is essential in the design and drawing of various components to have corona free insulator strings and to this purpose suitable corona protection devices, if needed, are also designed to minimize:

- audible noises and colored sparking that on the long run could damage hardware and insulators,
- power losses,
- radio frequency noises.

RIV effect:

Radio Interference is associated with the pulsating modes of corona discharges and, if not controlled, radio frequency noise causes serious electromagnetic interference to communications systems in the vicinity.

This effect therefore is a consequence of corona effect that being properly controlled by Salvi design, as stated above, also radio interferences, if any, are negligible.

Short circuit currents:

Short circuit currents link to direct lightning effect on line or switching in substation can impact installation with strong energy effect.
This electrical discharge is managed by design made by Sicame, we can assume the integrity of string hardware and safety of overhead line during these critical phases. The design of products limits the warming of products and facilitates the electric discharge to limit impact on material.

Substation connectors & accessories

High voltage connectors

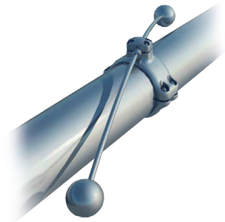
Wide range of high voltage connectors for substations up to 1200kV AC & 800kV DC. Application in AIS and GIS substations, FACTS, pantographs, circuit breakers, HVDC converters.

- According to NEMA CC1, IEC and BS standards.
- Type test as well corona and mechanical simulation reports available.
- Cable range from Ø16 to 50mm, busbar and studs from Ø30 to 350mm. Nema pad sizes and post insulators supports 76/127/225mm.

Busbar vibration damper

Guaranteed and patented solution to dampen vibration in busbars, avoiding unexpected damages and black outs in the substation.

Different designs available to fit various applications and busbar dimensions.



Adjustable connector

Elbow connector allows connections of aluminum tubes from 60º to 180º. This solution avoids bending or welding busbars in the substation and makes installation work faster, easier and more cost effective.

Research & development

SBI's engineering Team have acquired internationally recognised expertise in customized substation configuration design, enabling us to provide full technical evaluation for:

- Corona and thermal simulations
- 3D designs
- Laboratory Testing
- Antivibration studies
- Identification of UHV performance factors
- Investigation of new materials
- Exploration of new designs

Laboratory testing & Industrial manufacturing processes

High temperature low sag cable line hardware

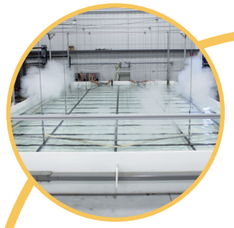
Laboratories capabilities worldwide

- Certified laboratories
- State of art equipment
- 3rd party services
- Expertise
- University partnership

Tests and R&D

Our transmission laboratory is assisting both design activities and product verification. in the design stage it is supporting the technical department in its activity of research and development while in the product verification stage all quality control mechanical verifications and tests are carried out including batch acceptance tests.

We can perform also independent tests under accreditation or not for third party (cable manufacturers, utilities ...). Test bench systems have flexibility to meet specific requirements.

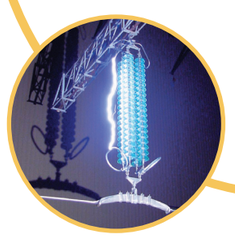


Components mechanical tests:

Are performed at our laboratories worldwide that are fully equipped for all kind of destructive and non-destructive tests.

Full scale mechanical tests:

We are also capable to carry out full scale mechanical tests in independent and accredited laboratories so as to verify the real mechanical behavior of the full strings.



Electrical tests on complete strings:

RIV and Corona, Power Arc and Short Circuit are carried out in independent laboratories according to international standards and prescriptions of project technical specifications.

Manufacturing

Manufacturing activities are carried out in our factories directly or through our sub-suppliers and partners whithin Sicame Group.

- Manufacturing processes excellence centers.
- Interconnected supply chain among business unit net work.
- Complete manufacturing processes inside business unit.

cofrac ESSAIS
COFRAC ACCREDITATION ST-ETIENNE LABORATORY

Services and IoT solutions

With a dedicated IoT team, Sicame Group is willing to impulse new generation of SmartGrid products communicating to a global IoT platform

Today our Transmission benefits from this technological advance and proposes connected solutions dedicated to transmission lines specific issues. Our partners will save time and gain peace of mind knowing that our IoT solutions will facilitate daily monitoring and maintenance actions, and guarantee a high quality electrical service for the final user.

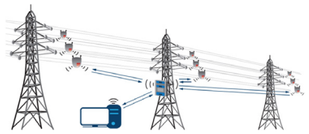
- Monitoring, Analysis and Data Management
- Software / Mobile Application
- Multiple features

Analysis
- Vibration Analysis
- Staggering scheme
- BOM

Monitoring
Temperature or resistance
Monitoring of
- HTLS transmission line
- Substation connectors

Management
Asset management of
- iDERPACK
- Transformer Oil

Services



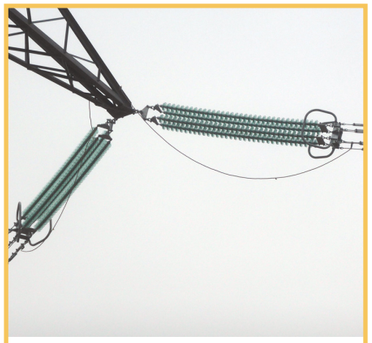
Sicame IoT platform

for complete Energy Business

Communicate with your Transmission Line
- Reliability
- Availability
- Maintainability
- Safety

Features

Main projects, customers and partners



AEP - Fort Wayne Extension project 765kV A.C.
Single circuit with six bundle 170km line spacer damper and hardware & fittings.

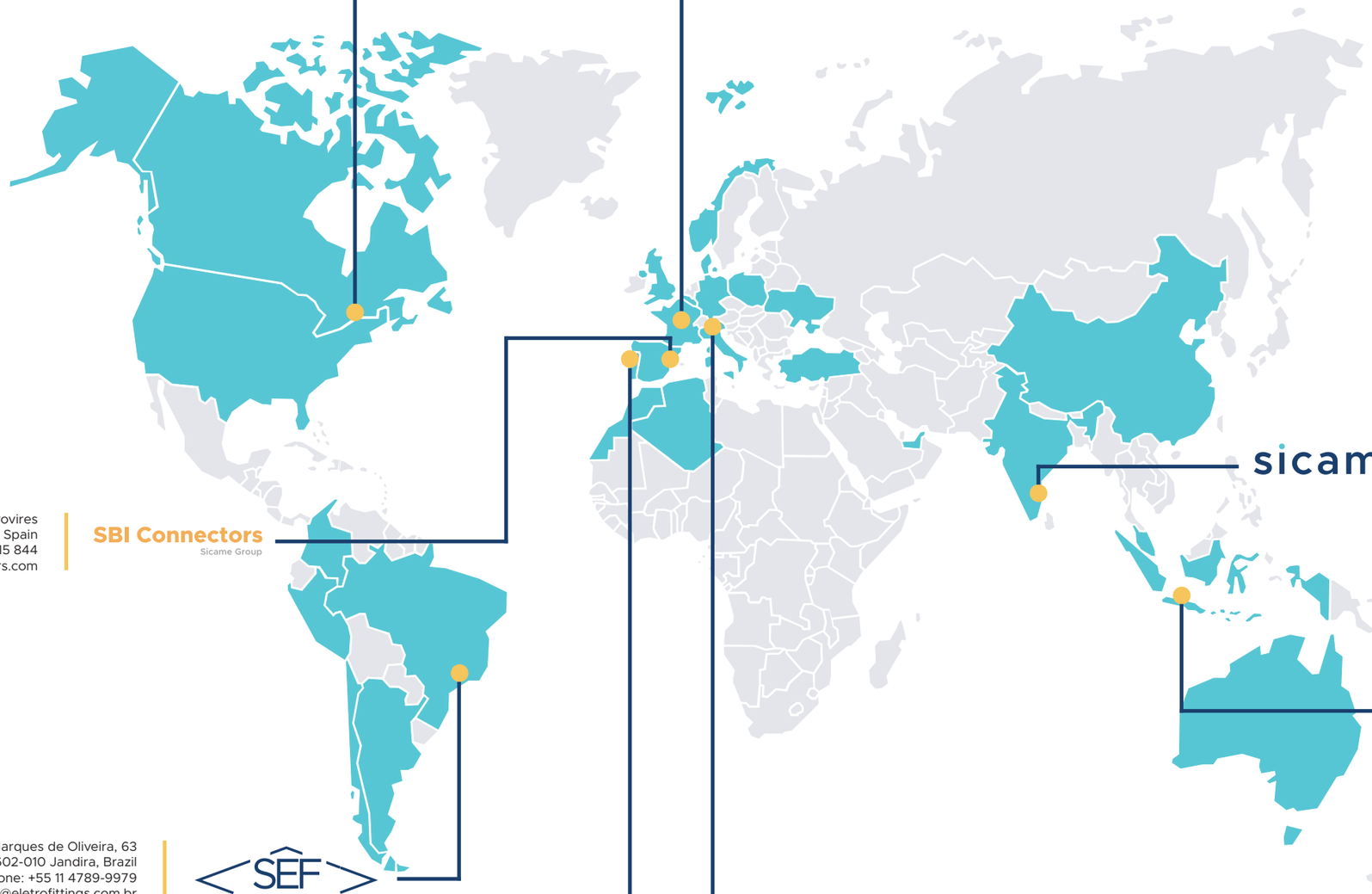
Tennet project doetinchen - wesel
Wintrack project line 380kV spacer dampers.

Sigdo Kopper LAT 500/220kV Mejillones - Cardones
900km line four bundle hardware & fittings and spacer dampers.

BC Hydro - North Transmission Line (NTL) 287kV twin bundle 325km Line
Hardware & fittings and damping system.

GS - IRRQAA BSP Arabia
380kV Line 180km hardware & fittings and damping system.

Bangladesh - Patuakhali - Gopalganj
Transmission line 400kV four-bundleTL HTLS ACCC conductor.



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