



Sistemas HVDC

SESIÓN 4 :

Lecciones aprendidas de experiencias reales en Sistemas HVDC

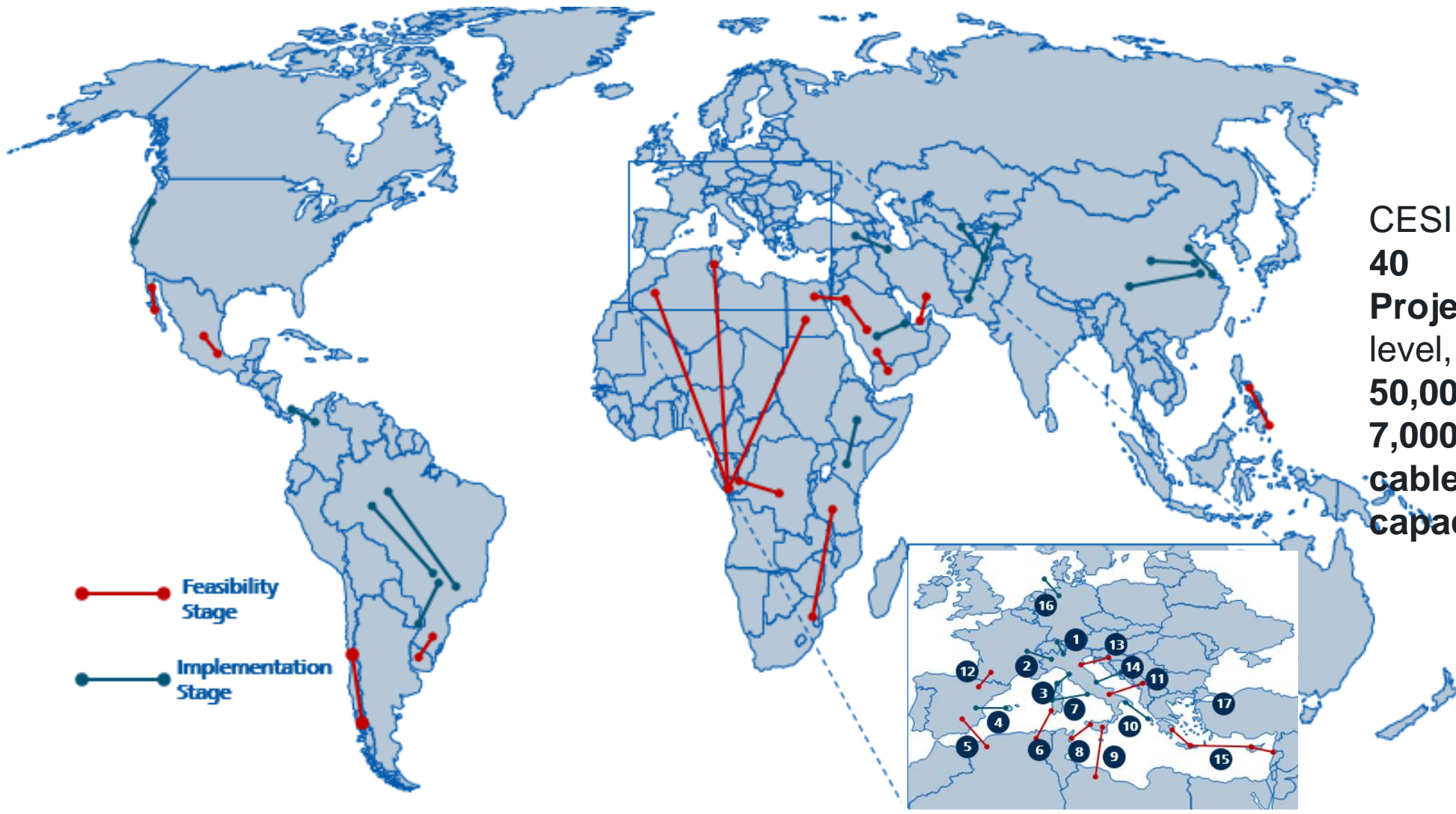
Experiencia en proyectos de HVDC: aspectos críticos y peculiares



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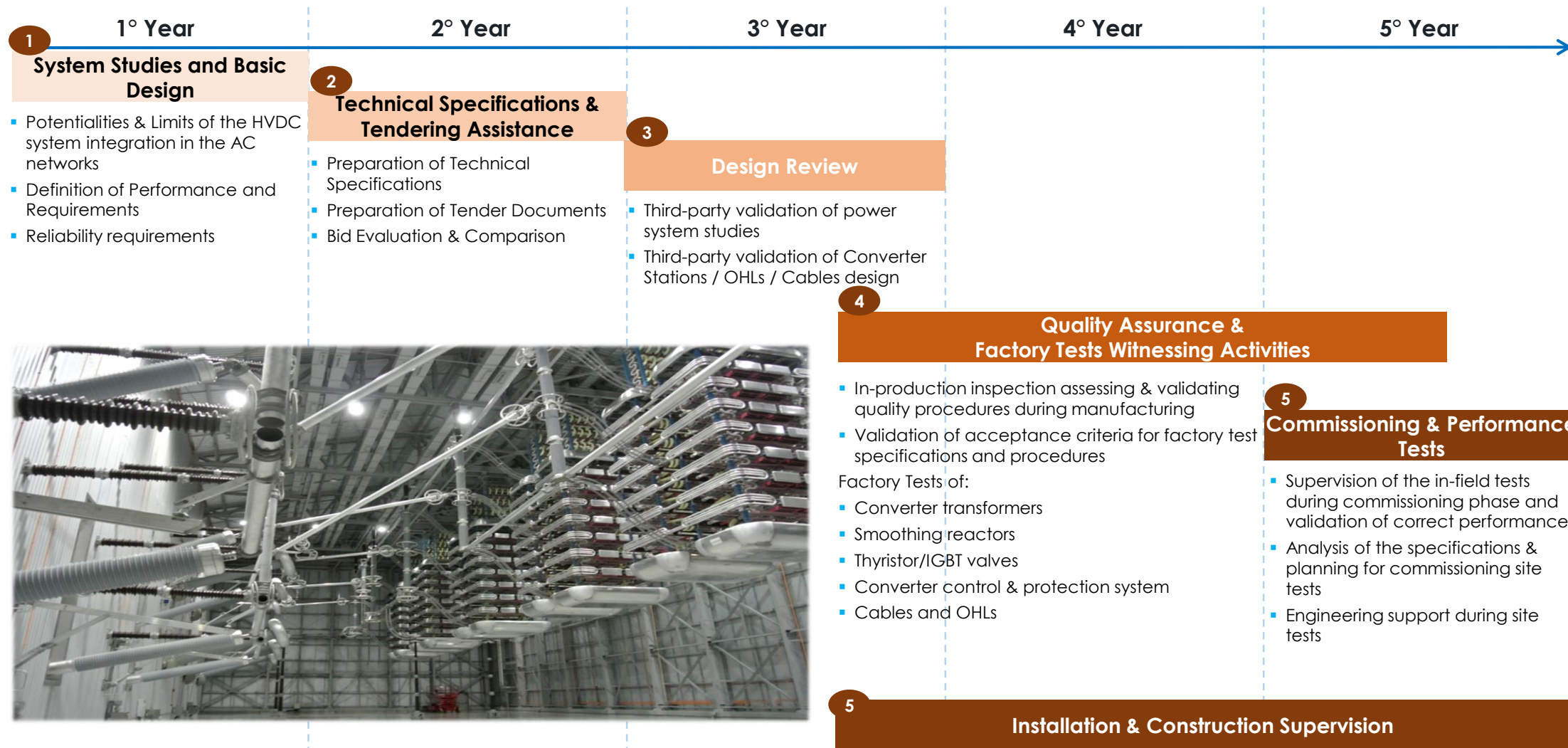


CESI HVDC Experience



CESI has performed **around 40 HVDC Consultancy Projects** at the international level, including more than **50,000 km of overhead lines**, **7,000 km of submarine cable** and **50 GW of installed capacity**

HVDC Project Processes





System Studies and Basic Design

Correct Preliminary Design Will make easier the Development of the project implementation



Main Problem:

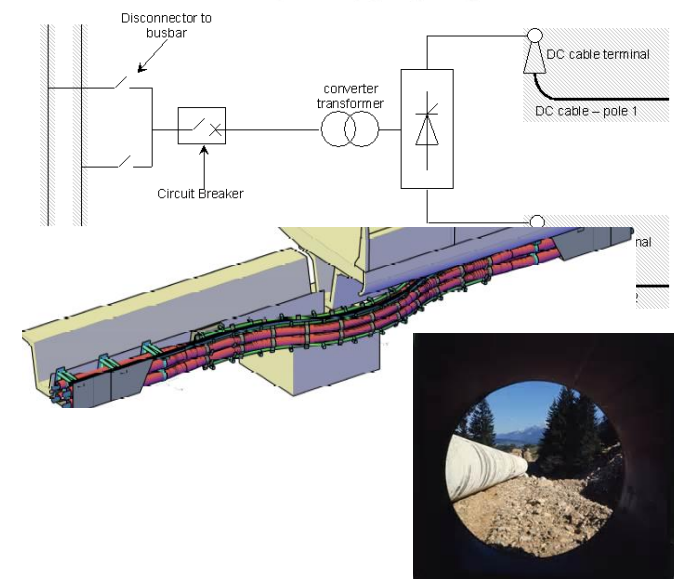
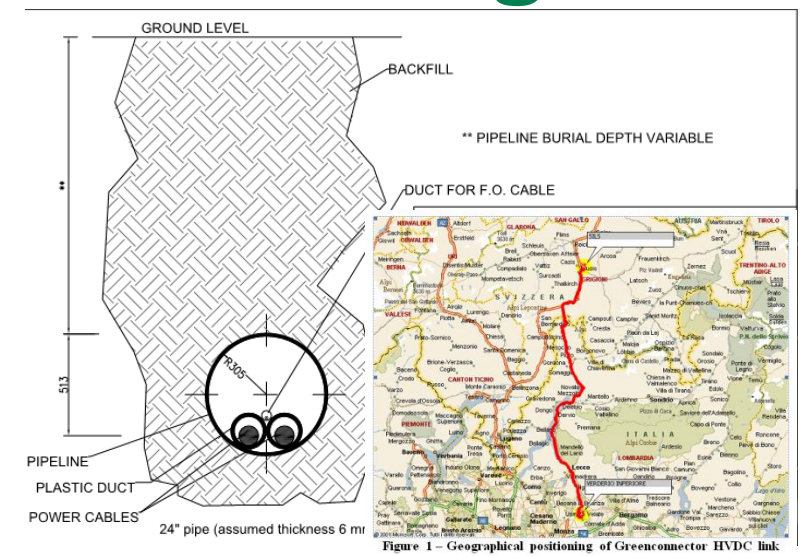
Right of way

The two projects suffers big difficulties to determine a feasible routing due to the high crowding of the possible route and the consequent problems with environmental permits.

Solution:

Design of undergrounded lines using:

- Available Rail Ballast for IT-FR link
- Dismissed pipeline for IT-CH



System Studies and Basic Design

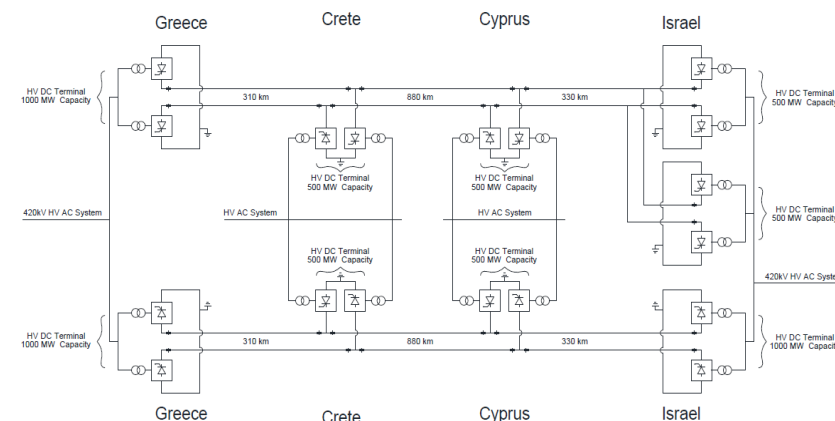
Close cooperation with manufacturer is a key factor to make possible and to optimize the project



Main Problems:

Deep Water, I/O Multiterminal

This ongoing feasibility study, is aimed to develop the Natural Gas reservoir discovered in this area of Mediterranean sea and lower the cost of electric energy in the two islands. Solution for the cable laying and for the control of a real multiterminal HVDC link have to be studied together with the cable and Converter station manufacturer.



New high deep cable (3000m)



Solution:

Under detailed study:

- The best solution to manage the multiterminal load control (LCC vs VSC, advanced control techniques, etc.)
- Together with the main cable manufacturer studies are on-going to improve cable technology and laying techniques.

Technical Specification



Main Problem:

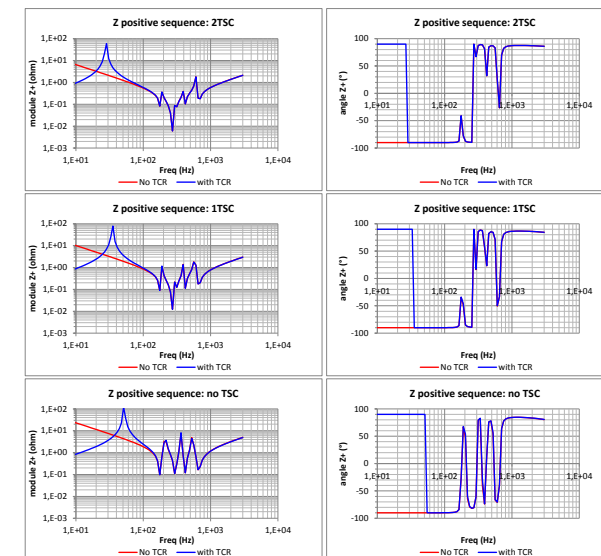
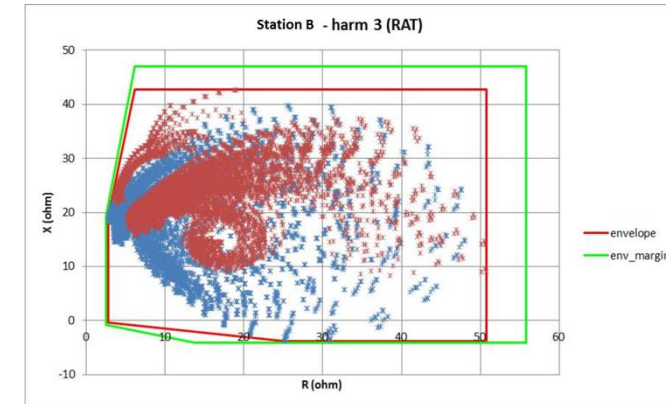
Power Quality due to harmonic pollution

Saudi electrical system is characterized by an unbelievable number of FACTS (more than 100 SVCs in operation) and with one HVDC links in operation and others in construction or planned for the next future.

Solution:

Development of new models and methodology to:

- Models that allow a detailed evaluation of the interaction between SVC and HVDC
- Precise definition the Harmonic Impedance envelope that allow the Technical/Economic optimization of the filter along the link life
- Right filter design with no extra cost for over-sizing



Design Review



Main Problem:

Coordination with Rio Madeira 1 HVDC link

The Rio Madeira evacuation system is done by two HVDC “almost parallel” HVDC links develop by different providers.

Correct protection coordination and operation procedures required a lot of time after the commercial operation

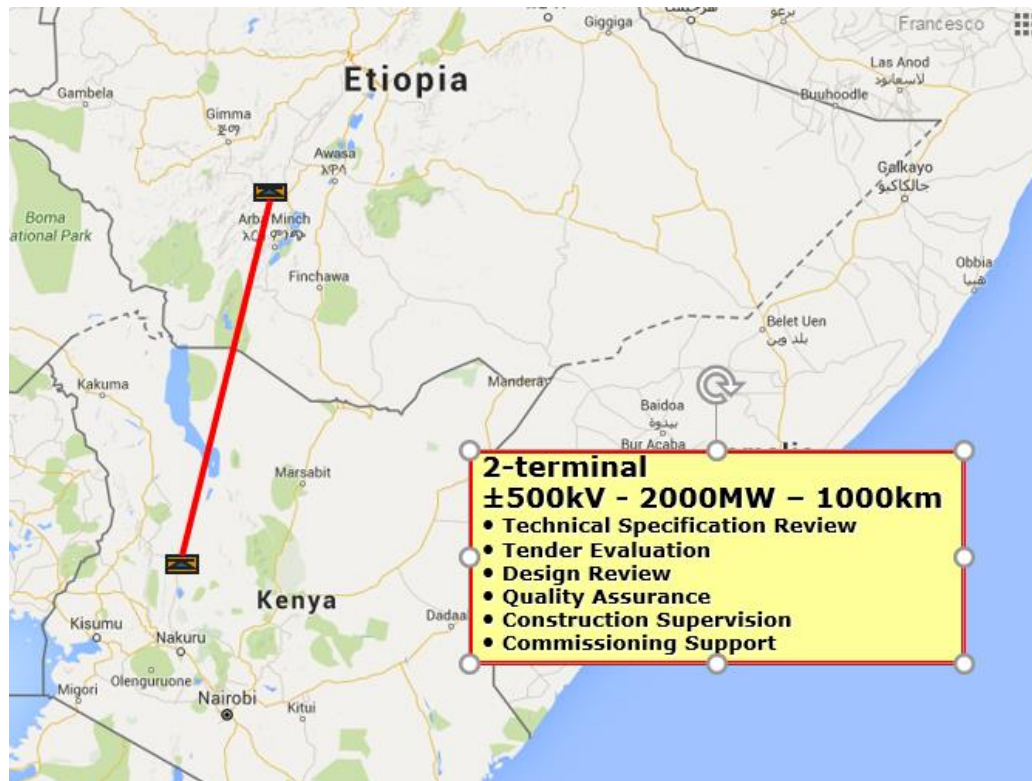


Solution:

Development of detailed model and studies with Real Time Simulator in early stage:

- Models that allow a detailed evaluation of the interaction between the two links
- Precise sizing of protection equipment and protection coordination
- Easier definition of operational procedures and reduced time for C&P systems set-up

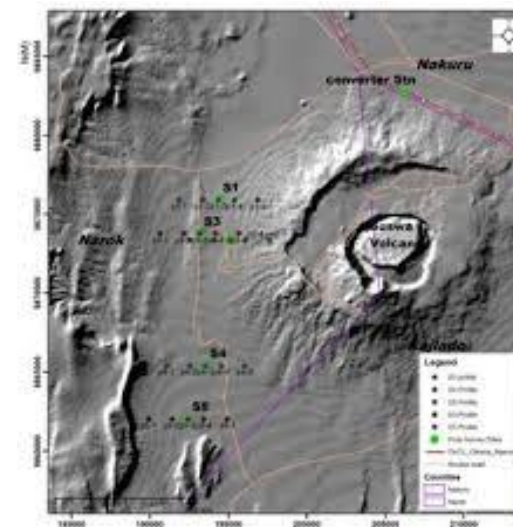
Technical Specification



Main Problem:

Complex environmental and logistic conditions

The Ethiopia-Kenya HVDC link is developing in one area with, political, geophysical and logistic not easy conditions.



Solution:

Design of the line adapted to the different conditions and proper lots organization:

- Design of tower families adapted to the very different soil/ground condition
- Detailed study of electrodes
- Split in six construction lots and close follow-up of the contracting and implementation phases

Gracias



Vigilada Mineducación

