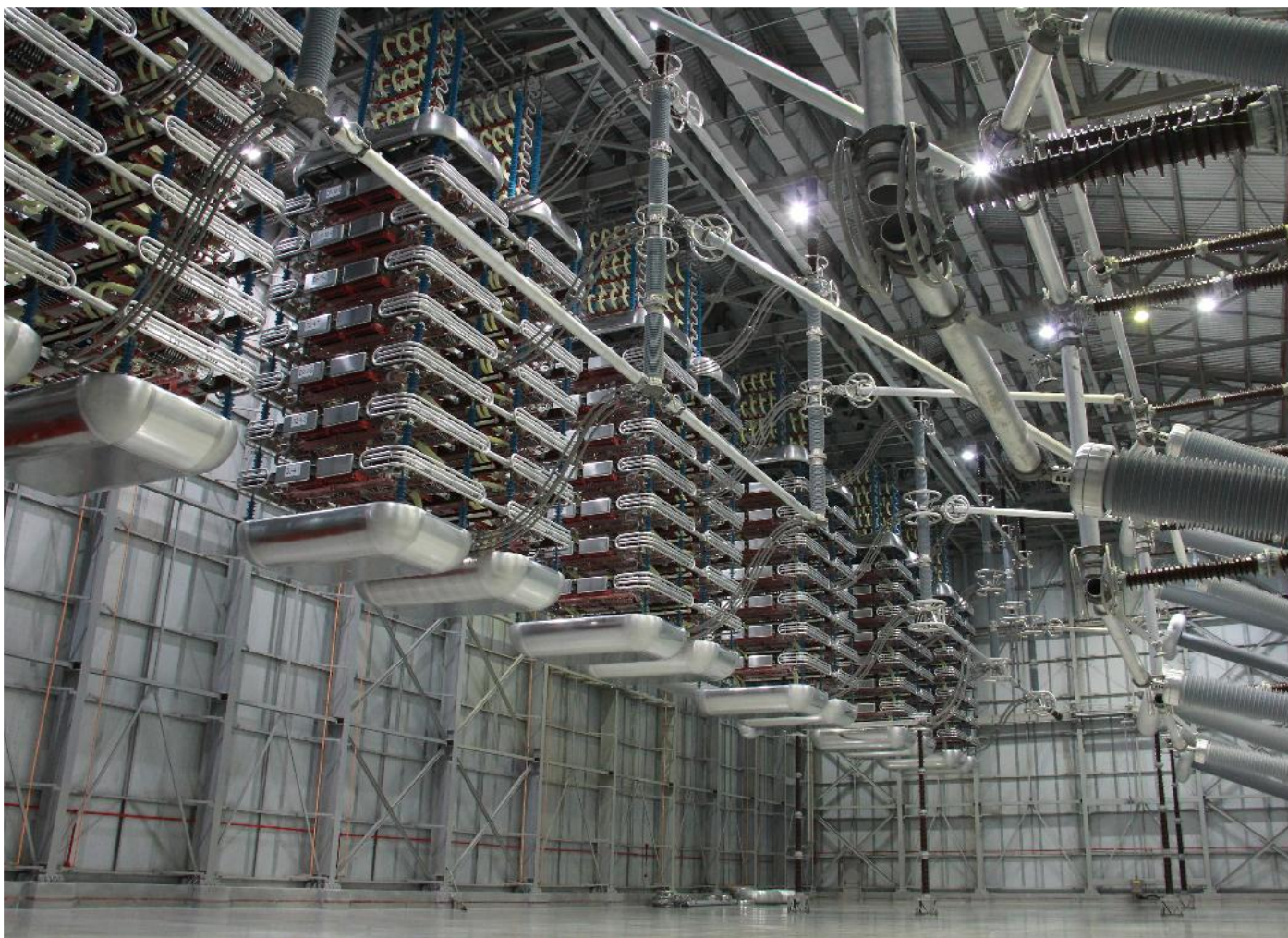


Rio Madeira

The World's Longest Transmission Link

GE technology helps to build the world's longest transmission link transporting Amazonian hydropower resources into Sao Paulo region.





2,386 km of HVDC lines to limit the impact on the Amazonia

Customer Challenges

Brazil is one of the largest producers of hydropower in the world, trailing China, with more than three-quarters of its electricity coming from hydropower.

Sustained economic development has significantly increased Brazil's energy demand, with projections of an 80% rise between 2013 and 2035. To meet the energy needs of a growing population, and to ensure the success of its energy outlook, Brazil predicts a significant investment. Hydropower, meanwhile, remains the country's dominant source of energy.

The majority of the hydroelectric potential lies in the Amazon River basin in the north, while the concentration of electricity demand spans across the eastern coast of Brazil.

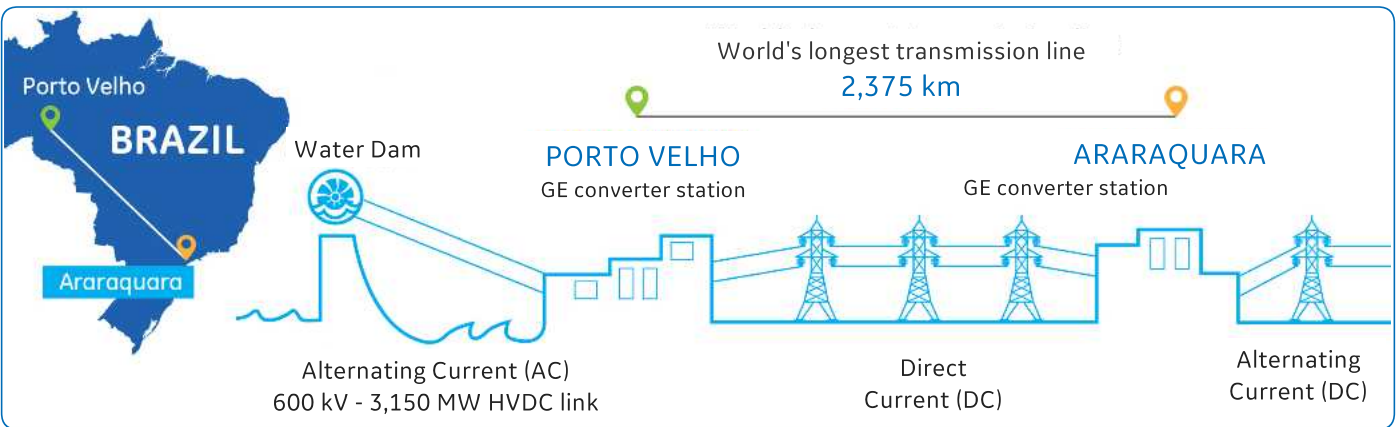
IE Madeira consortium successfully won the bid for the concession license to build and operate the HVDC link, transporting Amazonian hydropower resources into Sao Paulo region for the next 30 years.

Project Overview

Country:	Brazil
Project:	Rio Madeira Bipole II
Customer:	IE Madeira (Interligação Elétrica do Madeira)
Technology:	High voltage direct current, line commutated converter (HVDC LCC)
Scope:	2 bipole line-commutated converter stations, including converter transformers, thyristor valves, AC and DC equipment (filters, reactors, switchgear, etc.), control and protection, erection supervision and commissioning, and 1 year operational support
Rating:	3150 MW, ±600 kV
Length:	2,386 km
Commercial Operation:	2017 - 2018

HVDC Key Benefits

- Efficient transmission of electricity over long distances
- Fast, accurate, fully-controllable and measurable power flow
- Economical means of accessing remote hydropower resources, with no CO₂ emissions



Rio Madeira Project Overview



The Solution

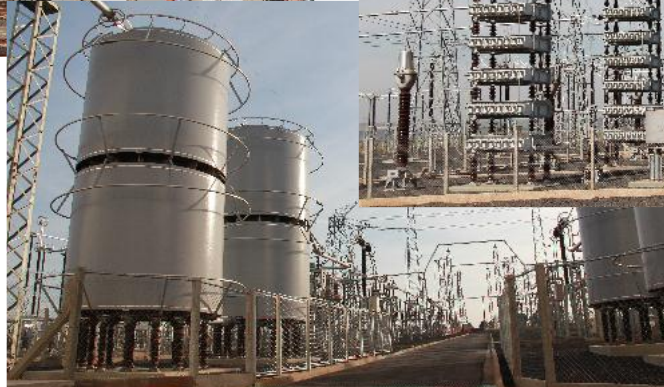
Building Brazil's Energy Backbone

In 2009, GE was awarded the contract by IE Madeira to design and deliver a High Voltage Direct Current (HVDC) system that has become the world's longest transmission line at 2,386 km.

This project is connecting the Rio Madeira hydropower complex in northwest Amazon region to south-eastern Brazil, where power consumption is booming.

The Rio Madeira hydropower complex consists of two power plants, Santo Antonio and Jirau. The new transmission system integrates both plants, with run-of-river design and GE's low head turbines, so that 6,300 MW of power are transported via two bipolar transmission links across the country to Sao Paulo state.

GE has built Bipole II of this project, with a transmission capacity of 3,150 MW at a DC voltage of ± 600 kV.



A Low-Carbon, Environmentally-Friendly Solution

Brazil is host to the largest number of Clean Development Mechanism projects in Latin America. The Amazonian rainforest, a biodiverse system of flora and fauna, remains of crucial importance to the economic stability of South America and is strictly protected.

GE's line-commutated converter HVDC solution is designed to reduce carbon footprint while integrating distant large-scale renewable energy resources. HVDC systems reduce transmission footprint by a factor of 3 compared to traditional alternating current systems for the same quantity of transported energy, using less circuits and therefore fewer and smaller towers to reduce the impact on the environment, especially the fragile Amazonian ecosystem. Lower transmission losses also help to reduce wasted energy.

GE began site works in 2011, bringing technology not just within Brazil but also from all over the world. The Porto Velho converter station in the Amazon is situated in Pantanal swamps, making up the world's largest tropical wetland area in Brazil; this increases the challenge of maneuvering heavy equipment, such as high voltage converter transformers.



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Rio Madeira project picture source: GE with the approval of IE Rio Madeira

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Imagination at work