

# Paris Session 2022



## Concerning scope to refurbish HVDC from another vendor

B4 – DC SYSTEMS & POWER ELECTRONICS

PS1-3 – HVDC Refurbishment: Question 1.6

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# Concerning scope to refurbish HVDC from another vendor

In Brazil we have two HVDC projects that are scheduled for refurbishment, Furnas (Itaipu) and Garabi (Argentina – Brazil):

Itaipu 2x 3150 MW ± 600 kV B1 1984, B2 1989

Garabi 2x 1100MW 70 kV B-t-B G1 2000, G2 2002

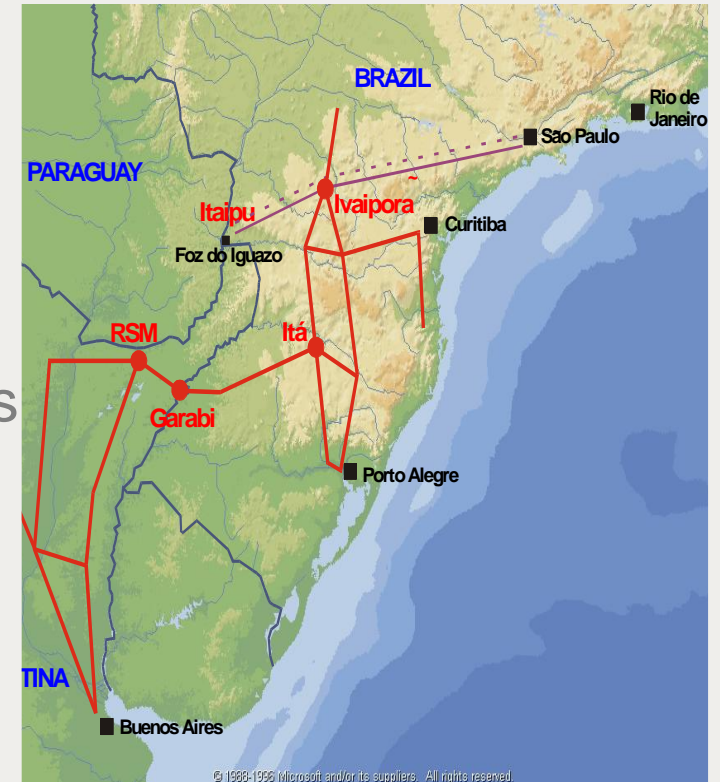
Both are 50/60 Hz converters, but Itaipu has two lines.

Itaipu has maintained a good reliability record:

- No significant refurbishment except reform of transformers
- The age of the equipment endangers future performance

Garabi, while newer, uses fully digital controls:

- Spares are a problem, including for equipment
- The original concession is ending



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**In Itaipu the age of the equipment, gives a wide scope for refurbishment.**

The intention is to replace all controls, but to refurbish only one of the two bipoles.

This ensures satisfactory performance of Bipole 1 and gives spares for Bipole 2.

This scope removes the obstacles for a third party supplier of the refurbishment.

**In Garabi, refurbishment is replacement of selected individual equipment.**

This limited scope of refurbishment reduces the volume of work for the supplier and increases the interface difficulties.

These interfaces (I/O) with the control equipment include measuring devices, status of switchgear and notably with converter valves.

This is further complicated by the use of CCC technology for the converters.

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## Conclusions

- Refurbishment of HVDC links may give a valuable increase in RAM (Reliability, Availability, Maintainability) performance of older systems, as well as economic returns from the life extension.
- A large scope of refurbishment encourages third party suppliers. 25 to 35 years for most equipment, with only digital C&P having a notably shorter time.
- Outage time during the implementation and commissioning - a larger scope may help if space is available for execution with the original equipment still operating.
- The retention of some equipment will increase the difficulties for a third vendor due to interface protocols.
- Open-source interface protocols between major blocks of control and protection hierarchy would greatly facilitate refurbishment.