

Question 3.1:

- What are the criteria to decide between STATCOM and SVC in your network/country? Do STATCOMs and SVCs have a comparable performance regarding RAM in your network? Do they require the same or similar O&M practices?

CONTRIBUTION: Criteria for choosing between Transmission SVCs and STATCOMs in Brazil

The Brazilian Interconnect Power System (BIPS) is expanded based on transmission auctions in which reactive power compensation equipment is offered as a solution for BIPS voltage control. Therefore, SVCs or STATCOMs are defined by the Power System Expansion Authority (EPE) and are further studied for integration by the Brazilian System Operator (ONS).

Nowadays SVCs are defined as the **reference alternative** for transmission auctions. However, STATCOMs can be also offered as long as they fulfill all the technical requirements and have equal or better performance than SVCs. So far most of the Brazilian bidder's decisions have been to choose SVCs due to some reasons explained as follows.

- Higher nationalization of SVC components when compared to STATCOM.
- Good experience with SVCs in Brazil regarding component replacement, degraded modes, reliability indices, and performance.
- Some issues with the only STATCOM in operation in Brazil.
- Nowadays statistics about STATCOM performance only (RAM), in general, are scarce.
- Bidders in Brazil don't want to take further risks regarding STATCOMs.

BIPS has a fleet of 42 SVCs and just one STATCOM as depicted in Fig. 1.

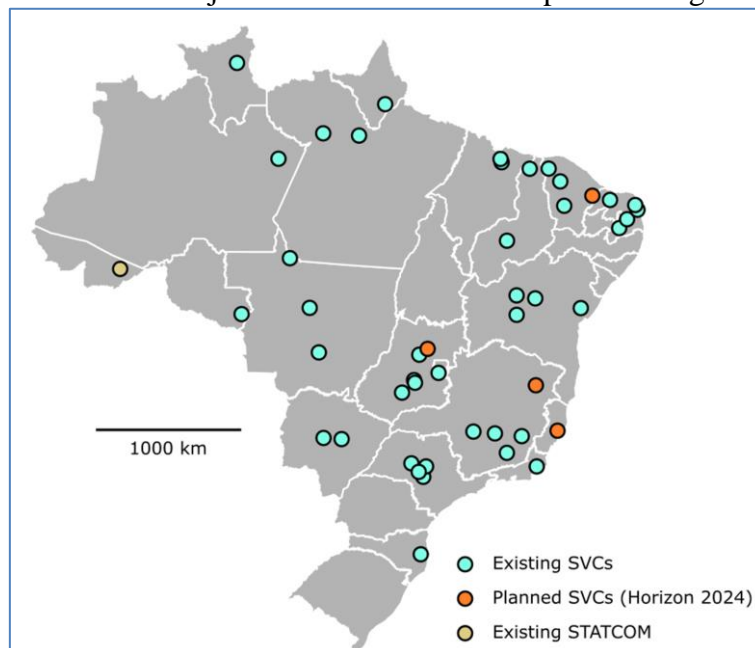


Figure 1 – Brazilian SVCs plus Rio Branco STATCOM

Actions are in progress to foster fairer competition between SVCs and STATCOMs in such a way as to adapt the auction technical documents to allow the STATCOM also to be a **reference alternative**. This will de-risk STATCOMs as a solution to be adopted in the transmission auctions and will promote further competition between STATCOMs and SVCs.

It is worth mentioning that the reactive power support equipment rating in Brazil is usually asymmetrical, i.e. capacitive range is about 50% higher than the inductive one. Typically a good example is an SVC rated at -150 Mvar (capacitive) to +300 Mvar (inductive). Fig 2 shows the V-I characteristics of SVC, STATCOM, and Hybrid STATCOM.

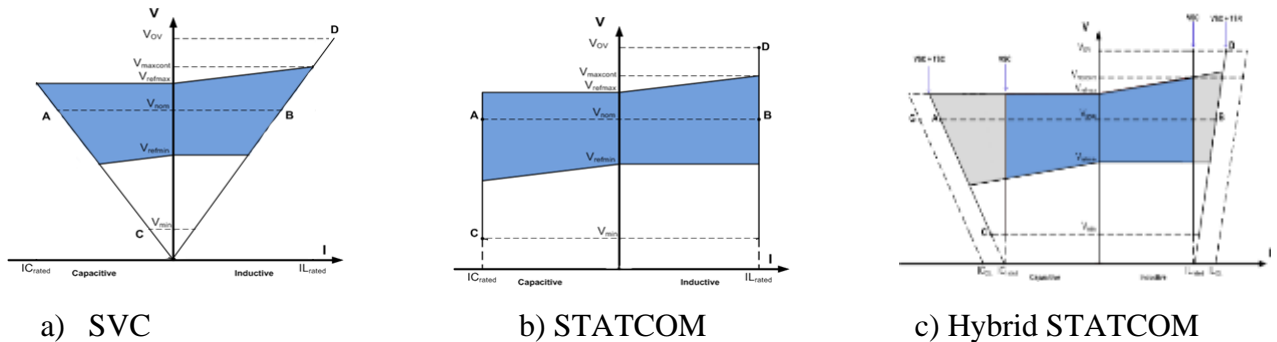


Figure 2 – V-I Characteristics of SVCs, STATCOMS, and hybrid STATCOMS

Auction Technical Documents will accommodate both technologies in search of more competitiveness. According to some manufacturers, the most cost-effective is the pure STATCOM when compared to the Hybrid STATCOM of the same dynamic rating, as shown in Fig. 2. Some suggestion points follow.

- STATCOMs are also being analyzed to be also a **reference alternative** in the same way SVCs are nowadays.
- According to some manufacturers, for instance, a ± 300 Mvar STATCOM may be competitive with a ± 300 Mvar SVC (2 TCRs +2 TSCs+ HFs, regular configuration in Brazilian transmission auctions).
- Asymmetrical output ranges may not be the best cost-effective solution to solve reactive power compensation issues. This usually leads to SVC-based applications. Note that STATCOMs are inherently symmetrical.
- Power loss requirements are met by both technologies.
- RAM requirements are being carefully established for SVCs/STATCOMs (availability $\geq 99\%$, STATCOMs IGBT submodules redundancy $\geq 10\%$).
- Low voltage ride-through capabilities are proposed to be differently specified.
- The overvoltage inductive cycle is the same for both technologies, as shown in Fig 3.

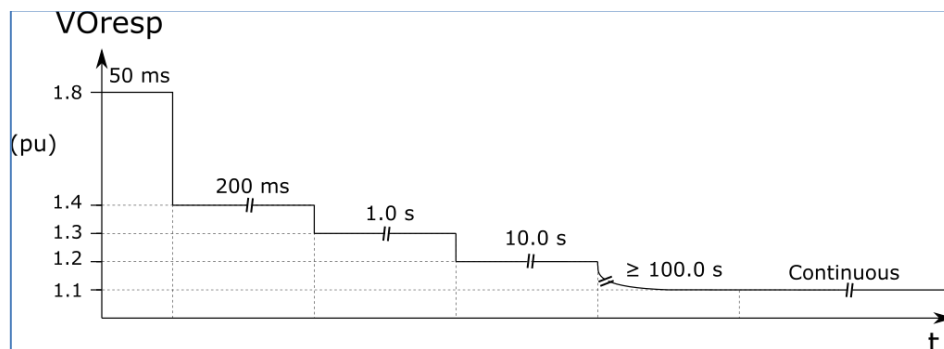


Figure 3 – Overvoltage inductive cycle for SVCS and STATCOMS

One can summarize these issues in the following conclusions:

- Technically speaking STATCOMs are superior to SVCs (LVRT, faster response time, usually no HF, smaller footprint, etc.).
- According to some manufacturers, STATCOMs with the same rating of SVCs may be competitive with SVCs, e.g. ± 300 Mvar STATCOM vs. ± 300 Mvar SVC (2 TCRs+2TSCs+HF).
- Efforts are being made to turn the transmission auctions more competitive between SVCs and STATCOMs.
- System overvoltages impact more on costs for STATCOMs than SVCs.
- Auction technical documents need to be adapted to STATCOMs.
- Transmission investors will tip the balance towards the best cost-effective solution.