

# GCCIA Gulf Interconnector Project

First HVDC scheme in the Gulf countries



THE GCCIA (GULF CO-OPERATION COUNCIL INTERCONNECTION AUTHORITY) IS AN ORGANIZATION FORMED IN JULY 2001 IN ORDER TO CREATE AN INTEGRATED AND SUSTAINABLE ECONOMY AMONG THE GULF COUNTRIES. THE AIM IS TO LINK THE POWER GRIDS OF THE SIX MEMBER STATES SO THAT RESOURCES CAN BE SHARED.

## Customer situation

The GCCIA made an agreement to build an interconnection between Saudi Arabia, Bahrain, Kuwait, United Arab Emirates, Oman and Qatar to give an opportunity to trade energy and reserves between the networks for the greater benefit of the region.

chronous AC connection was impossible. The only solution was an HVDC interconnection.

The HVDC interconnector is the first ever to be built in the region, and is located adjacent to the existing Saudi Electric Company Al Fadhili 380 kV substation.

The three back-to-back substations will connect the 60 Hz, 380 kV AC with the 50 Hz, 400 kV AC systems. All three back-to-back substations will be built at the same location and constructed simultaneously under one contract. Each substation can operate autonomously or in a co-ordinated manner.

## THE PROJECT

The project is being carried out in three phases:

**Phase 1:** By 2008, interconnection of the North Grid, using an HVDC back-to-back interconnector.

**Phase 2 and 3:** Completion of the remaining AC interconnection to UAE and Oman.

One of the main functions of HVDC is to constantly look for the occurrence of a power generation loss in the interconnected networks. When a loss of generation is detected, the HVDC link injects power into the system and, through the use of frequency control, restores the system to normal conditions.

## WHY HVDC?

HVDC is used where connection by AC transmission is not economical due to the distance, or impossible due to asynchronous frequencies.

Because Saudi Arabia's network operates at 60 Hz and its Gulf neighbours are at 50 Hz, a syn-

## AREVA T&D SOLUTION

AREVA T&D was awarded this \$205 million contract to supply the 1,800 MW HVDC back-to-back link configured as three separate 600 MW substations. AREVA T&D is also responsible for the control and protection of the entire GCCIA network, including the Load Dispatch Center.



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## AREVA T&D's solution, continued

The heart of the installation is the latest version of AREVA T&D's HVDC thyristor valve: the H400. These greater power density valves use series-connected, fully protected thyristors, each with 8.5 kV rating and 125 mm diameter. The thyristors are controlled by AREVA T&D's industry leading Series V digital control and protection system, offering fully redundant operation, including monitoring and alarm capabilities.

### KEY FEATURES

The HVDC back-to-back control system is able to detect a loss of power generation and inject power into the system from the other side of the link until the frequency recovers to a stable level. Up to 600 MW can be injected into the system in deficit within 1 second, and 1,200 MW within 5 seconds to allow fast recovery.

### ENVIRONMENTAL CHALLENGES

The Gulf environment, which is very hot, dry and dusty, involves new challenges for AREVA T&D.

The converter station is in a sandy desert. The air quality in the hosting hall must be of high quality for the HVDC valves.

AREVA T&D will use different techniques to reduce dust in the vicinity of the valves. Valve air conditioning will operate as a closed-circuit. Top-up air will be heavily filtered before use. Valve hall pressure will be maintained slightly positive in order to prevent the ingress of contaminants during sand storms.



Finally, the cooling equipment will be one of the largest ever constructed because of the +55° C ambient temperature and the absence of raw water for cooling. In this solution, parallel cooling of the thyristor levels is required to meet the operating temperature limits.

Each converter station will consist of:

- > 380 kV and 400 kV AC switchyards with harmonic filter bays
- > 380 MVA Converter Transformers
- > Thyristor valves and controls
- > Harmonic filter bays
- > Civil Works
- > Cable connection to existing and new substations



### CUSTOMER BENEFITS

- > **Generating capacity is reduced in each system thanks to the ability to share spinning reserves.**
- > **The exchange of energy will reduce costs for each participant.**
- > **The system reliability will be increased, especially under emergency conditions.**

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