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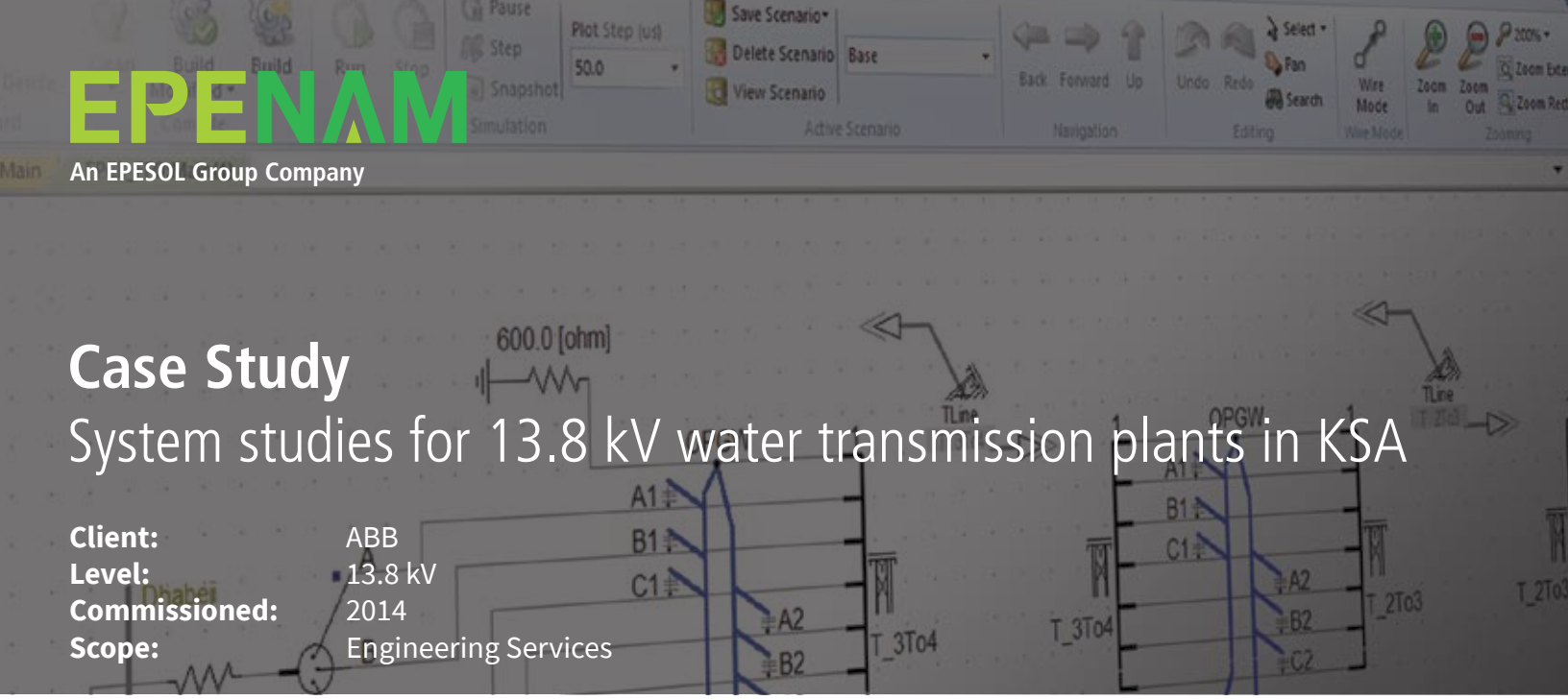

Case Study

System studies for 13.8 kV water transmission plants in KSA

Client: ABB
Level: 13.8 kV
Commissioned: 2014
Scope: Engineering Services

Introduction

Power system planning, design, and operation require careful studies to evaluate performance, safety, efficiency, reliability, and economics. These studies identify potential deficiencies and determine causes of equipment failure. Modern interconnected systems are complex, but efficient software and computations simplify the calculations.

The Yanbu – Madina Phase 3 Water Transmission System is an extension of the existing Yanbu – Madina Water Transmission System in the Kingdom of Saudi Arabia. It includes an extension of the system at the Yanbu Plant and five individual pipeline systems. The power distribution for these systems required the construction of 13.8 kV substations. The customer required EPENAM to conduct several regulatory studies on these substations for utility compliance and approval.

Problem Statement

The project involved constructing four substations: PS1C, PS2C, MPS, and MET & HPS. These substations were fed from 380/13.8/13.8 kV power transformers, 110/13.8 kV power transformers, or 13.8 kV cables installed in the pumping station area or nearby SEC grid stations. In total, these substations included 23 feeders rated at 13.8 kV. These feeders primarily supplied power to the MV motors of main pumps and to 400 V LV switchboards via distribution transformers.

The regulator required several studies on the MV switchgear/substations for compliance and approval, including:

1. CT/VT sizing and adequacy study
2. Short-circuit study
3. Relay coordination study
4. Insulation coordination study

Additionally, relay settings and parameterization were required for all these substations.

Solution

EPENAM provided a comprehensive solution for all these studies, combining its expertise in power system protection design and calculation. The insulation coordination study was of particular importance, determining the surge arrester ratings per IEC 60071 and IEC 60099. PSCAD software, renowned for its electromagnetic transient analysis capabilities, was used for this purpose. This tool facilitated the calculation of temporary overvoltage within the system under various operational scenarios and contingencies.

CT/VT sizing calculations were performed using the local utility standard TES-P-119.28 Rev-0, in addition to IEC 60044-1 and IEC 60044-6, with appropriate safety margins added for future adequacy.

Similarly, the short-circuit study and protection coordination were carried out using ANSI / IEEE C37 in ETAP software. Finally, relay settings and parameters were provided for ABB relays types REF 620, REM 620, REU 615, and RED 615.

Conclusion

EPENAM delivered a cost-effective one-stop solution to a quality-conscious customer using its offshore resources. This increased the project margin in a tightly budgeted MV project. The quality of the report and project handling was appreciated by the customer.

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