Medium Voltage Distribution Automation

Objective:

Implementation of Fault Location, Isolation and Service Restoration (FLISR) and remote control for underground and overhead Medium Voltage (MV) lines for some European utilities.

Solution:

Ring Main Units (RMU) and Load Break Switches (LBS) were equipped and/or upgraded with new RTUs capable of collecting V and I measurements from new LPVTs and LPCTs.

Company Overview:

The customers were two different European utilities with operations in several other European and non-European countries, one of them is amongst the world's 10 biggest electricity utilities.

They both have tens of thousands of secondary substations (a.k.a. Distribution Transformer Stations) on its MV lines ranging from 6kV to 36kV (both underground and overhead) in the European country where these projects took place.

Along its history, the companies have installed a variety of RMU models with different switchgear and insulation technologies. This means that they have a very diverse installed base of RMUs regarding insulation technology, number of MV lines, possibility of motorizing the switchgear etc. while the newest RMUs that they plan to install should be fully automated.

Following regulatory requirements, the companies realized they had to install devices for smart metering in every secondary substation, so they decided to leverage on that to build a truly smart grid by taking the opportunity to also automate the MV distribution network.

Customer Requirements

The main requirements for the solution were:

- ➔ Maximization of service availability for consumers by implementing FLISR schemes and gaining observability of the MV network.
- ➔ Strict observance of the existing safety requirements
- ➔ Reduction of outage-related regulatory penalties, with special focus on service restoration within 3 minutes.
- ➔ Cost-effectiveness
- ➔ Adoption of a standardized solution for a diverse installed base of RMUs
- ➔ Ease of deployment, operation and maintenance
- ➔ Introduction of MV PLC technologies

Application and Implementation

Some caution is necessary when integrating voltage and/or current measurement devices (such as LPVTs or LPCTs, for instance) in an RMU in order to ensure that safety is not affected. This is especially important for voltage measurement in field-retrofits which should not compromise the guarantee of the switchgear vendor.

From the point of view of the commissioning, we should bear in mind that the whole installation procedure should be designed for fast and safe installation and later operation. It is therefore that none of the selected devices needed any site calibration and site operations were minimized.

The solutions can be classified in three groups:

- Solutions for the automation and monitoring of **GIS RMUs**: PLUGSENS LPVTs are used in these installations with symmetrical, DIN-

C type T-connectors. For current measuring ARTECHE offered several options including conventional VTs, LPVTs or RGW.PSI split-core Rogowski coils.

The introduction of MV PLC / BPL communications was especially challenging in this environment given the space constraints and the lack of a dedicated MV connection point. ARTECHE's PLUGCOM product family integrates both a voltage sensor and a capacitive coupler in a single compact device that allows the utility to overcome these challenges.

The intelligence for the automation of the RMU is provided by ARTECHE's adaTECH FRC (Feeder Remote Control) device. For non-motorized RMUs requiring only monitoring capabilities, adaTECH FRM is used.

- Solutions for **AIS RMUs**: UNDERSENS LPVTs are the most usual choice due to their size and reliability. Current measuring and IEDs do not differ from the GIS scenario.
- Solutions for the automation of **Load Break Switches in Overhead lines**: For voltage measurement either OVERSENS voltage sensors or conventional VTs can be used. The most usual choice for current measurement is using conventional MV CTs.

  The intelligence for the automation is provided by an adaTECH OSC (overhead switch controller).

BENEFITS

Thanks to the introduction of these ARTECHE products, the Distribution System Operators were able to implement Fault Location Isolation and Service Restoration schemes that enabled them to dramatically reduce OPEX and to benefit from CAPEX savings.

OPEX reduction was achieved thanks to:

- -35% penalty costs related to outages: non-recovered power 3 minutes after the outage was approx. 65% before the project and 45% with the new solution
- -25% staff costs

CAPEX:

- Approx. 30% savings thanks to both CAPEX deferral enabled by extended asset lifetime and CAPEX savings thanks to IEDs integrating several functionalities.