A NEW PARADIGM IN CENTRALIZED OPERATION OF PORTUGUESE HIGH VOLTAGE ELECTRIC NETWORK

Fernando Miguel SOUSA
Energias de Portugal – Portugal
fernandomiguel.sousa@edp.pt

António LEITÃO
Energias de Portugal – Portugal
antonio.leitao@edp.pt

ABSTRACT

With the continuous increasing of Distributed Generation, we urge to pursuit new solutions to monitor and control the electric network. This paper will present not only the main features of the state of the art GENESys that is operable from de Control Centre at Portuguese Dispatch Centre but also new ideas and innovations to meet this challenge. Since 2004 to 2010 the Portuguese DSO, EDP Distribuição (EDPD), customer per employee ratio has improved from about 1,0 to 1,7 and the electricity distributed per employee almost doubled during the same period. By the end of 2010 there where, in Portugal, more than 6 million electricity clients, 400 HV/MV Substations, a HV and MV network with more than 82000km and almost 140000km at LV.

Also, EDPD is the third largest renewable energy operator in the Iberian Peninsula and the third largest global player in wind energy, through the EDP Renewables (EDPR).

INTRODUCTION

Distributed Generation (DG) has increased since 2002[3], and in 2010 there were 6GW of installed capacity in our network - more than 33% of all installed capacity power in mainland.

There are two Control Centres (CCs) for the HV Distribution Electrical Network, each operating for a determined geographical area. These facilities are strategically located in two distinct places with the ability to backup one another.

The main activity for each CC is to monitor and operate the network into each area of responsibility in real-time.

Among other activities, each CC has the mission of allowing the unavailability of infrastructure equipment (for maintenance purpose), which is one of the top requirements for reliability of the electric network.

EDP Distribuição is focused in promoting and adapting to the new challenges created by the surge of micro generation and new eletroproducer centres, mainly DG.

Nowadays the weight of DG in the electric distribution system is so significant that affects all procedures in CC from equipment unavailability concerning congestion management to reactive power control which is reflected in tariff, passing thru voltage regulation, wave quality and frequency.

Also DG has a great impact in exploitation criteria [2]. For instance, should one decide to have closed loops between two different EHV/HV Substations (TSO) in order to have less energy losses or because of the great impact of DG, in the DSO side, the protection system cannot be configured properly for all possible closed loops?

The next example illustrates a network area were the installed capacity of DG (251MVA) is predominant over Load (104MVA).

A full loop [A]+[B] between two different EHV/HV Substations (TSO) was found to be profitable (lower Joule losses), more reliable for the network, and would increase the DG flow capacity. But the full loop [A]+[B] is not possible in terms of protection system selectivity.

The protection system selectivity criteria it is only achieved with one option [A] or [B].

The closed loop [A] is more profitable then [B], increases network reliability and is feasible in Protection System, being therefore the selected solution.
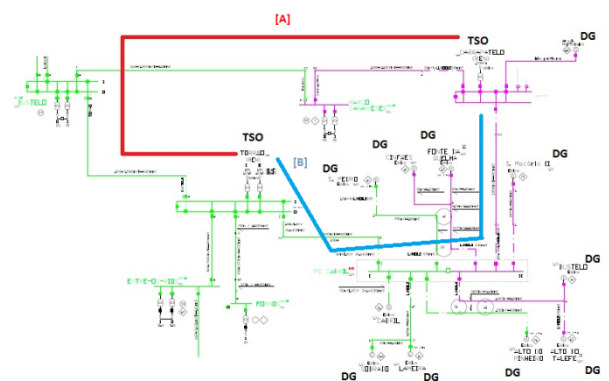
STATE OF THE ART

Nowadays, a new generation SCADA/DMS (Supervisory Control and Data Acquisition/Distribution Management System) is used by each CC: GENESys.

This system, developed for EDPD by EFACEC, allowed EDPD to decrease the number of operation control centres and increase the efficiency of each CC.

With GENESys one can control all the equipment, monitor the power flow and the effects of DG in the Network in real-time. GENESys also integrates

technical geo-referenced information (SIT) of network components which, with de DMS functions supported, enables the management of the entire EDPD's HV and MV network.

DG IMPACT IN OPERATION

A simple network reconfiguration, involving DGs, due to maintenance purposes, will influence the balance of Power Factor and can cause penalties to the DSO. The operator uses wind power forecasts to minimize the constraint impact. This information will allow the operator to decide which network configuration best fits the production forecast and the network unavailable equipment.

Wind Forecast (ENERNOVA)
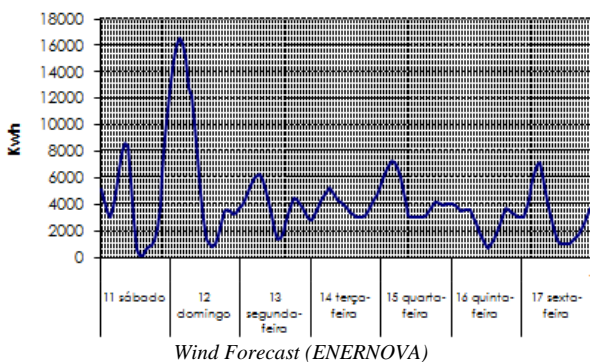
As soon as the system receives real-time information that a limit in reactive power balance is about to be reached, an alarm will sound and the CC operator can take action in order to find an answer to that problem, such as switching on or off Capacitor Banks elements available preventing the DSO penalties.

Network operation can sometimes rely on DG contribution to guarantee network security and quality of supply, but still not entirely. In schedule maintenance procedures (equipment unavailability) which involve long length lines and considerable load, to prevent low voltage values and even more severe losses and congestion , the operators will count on DG contribution (if present) to enhance the network performance: DG with benefits. Still if the DG fails to comply with the expected forecast, due to a malfunction for instance, the operator must cope with it and perform a backup plan.

SCADA INTEGRATION: TSO – DSO

To better control the power flow between EDPD and Redes Energéticas Nacionais (REN) - the Portuguese TSO, an interconnection between SCADA systems was developed (GENESys and REN's SCADA). This shared information is very important for minimizing the consequences of the increasing DG on both sides of the grid.

With this ability not only a more efficient real-time operation can be accomplish but also more accurate studies of the electric network behaviour can be made when influenced by a strong DG integration.
The ICCP allows both DSO and TSO access to relevant information in order to guarantee the network security and quality of supply.
In this case the DG connected to the TSO EHV/HV substation

belongs to the DSO system. The ICCP allows the DSO the access to specific real-time data, before only available in the TSO-SCADA.
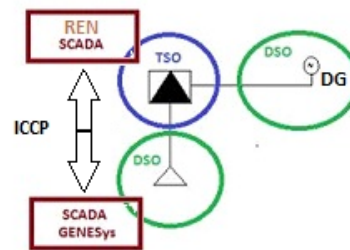
Not only the DSO can use this information to control in real time the reactive power flow in interconnections, preventing penalties payment, but also the TSO can use this information to ensure continuous network reliability.

The evolution of ICCP module and its integration with SCADA is still in progress.

INOVATION

The SCADA operating tool has evolved from just a control tool (SCATE X) [1] to a more complex yet simple one and with abilities far beyond control (GENESys).
Also, thru the monitorization of the protection system one can access fault distances, aiming Maintenance

Teams to intervene more efficiently.

The integration of all these variables in just one operable system is therefore a goal that is constantly sought and has become more achievable with GENESys.

The urge for distribution network predictable models with Advanced Metering Infrastructures in real time is a near to get evolution for SCADA/DMS utilities.

InovGrid project [5] is a response of EDPD to these trends, namely with the implementation of:

- o Smartmetering equipment;
- o SmartGrids;
- o Microgeneration

With InovGrid, Advanced Metering Infrastrutures were implemented.

InovGrid project is taking place with great results in the city of Évora and this field-test will enable to evaluate InovGrid's benefits and test its concept.

As human oversight of the process is essential, one must train accordingly, and therefore training models in SCADA/DMS are also being perfected.

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