ABSTRACT

To improve their operation efficiency, personal productivity, attention to clients and enhance supply quality, Luz y Fuerza del Centro (LyFC), the utility that supplies electric service to Mexico City, its conurbation area and neighboring cities, began at the end of the 90’s to develop the Management Distribution System (SAD), with support from the Electrical Research Institute (IIE). The main goal of the SAD is integrating in a single system, the execution of the main activities of distribution electric power process. This paper presents different aspects of the SAD, its conception, its data base, its functionality inside the LyFC and the strategy development to get the information of each one of the electric devices installed on its distribution network, to validate this information, after digitalize in the SAD, and finally to maintain the information updated.

INTRODUCTION

LyFC, the utility that supplies electric service to more than five million users that represent a superior population to twenty million residents in Mexico City, its conurbation area and neighboring cities; therefore its distribution system is complex and extended, is composed by close to 120 distribution substations and close to 1200 feeders (23 kV). To facilitate the management of the distribution system, LyFC is divided in five Distribution Divisions, which are divided in Distribution Regions.

The development of the SAD defined the beginning of a modernization process in the utility, not only the development of systems but the form daily work, which implied a change of mentality.

LyFC and IIE finished in the year 2000 the first version of the SAD, which is a group of systems that operates in harmonized form, with unique and shared databases, to allow the optimization of the processes of Distribution Management. The nucleus of the SAD is constituted by its database, integrated by the System of Geographical Information (GIS) of Intergraph and for the database of attributes of the electric devices of the distribution system. Around this database has been developed and incorporated all the necessary and existent applications, such as planning, operation, construction and analysis of the distribution systems that will allow to carry out a better Distribution Management in LyFC.

SAD OF LyFC

SAD is an integrated system designed to support all the processes related with the distribution system. The concept of the system covers planning, design, construction, operation and maintenance of the distribution system; and also induces and supports management with other external areas of the utility, such as commercial and financial. Therefore, the SAD provides information updated and manages the main activities related with the distribution system, at the same time that allows unifying criteria and proceeding of design, construction, maintenance and operation.

The integral concept of the SAD provides the appropriate tools to give support to all relative tasks to the distribution system; therefore its impact in the utility is strategic, because it enhances supply quality and improves attention to their clients.
exchanges of information among the different users in the utility, just as illustrated in Figure 1.

SAD database allows consultation and keeps updated all the graphic and alphanumeric information of the distribution components in the network. This database is developed on an AM/FM platform, using Intergraph’s Geographical Information System for the graphic subsystem, Oracle database for the alphanumeric subsystem and to assure the consistency among the graphic and alphanumeric information, Intergraph’s Framme was selected.

SAD Database has the information requirements for diverse functions in the different distribution areas, the main characteristic of the database is unique, which facilities its control and keep information updated.

Figure 1 illustrates the different areas and how the concept SAD is integrated. These areas require the database of the SAD, its nucleus, to carry on their tasks, activities and processes. The next list shows the main activities of the operation and engineering that actually use the information of the database of the SAD:

**Distribution Operation:**
- Work Orders
- Distribution Network Analysis.
- Disturbances
- Licenses
- Automation

**Engineering:**
- Load flow calculations
- Short Circuit Calculations
- Capacitor Allocation
- Feeders Reconfiguration
- Protection Coordination.

In the next two years the following activities will be incorporated to the SAD:

**Planning:**
- Long Term Planning Studies to Distribution Substations.
- Spatial Demand Forecast to long and short term.
- Load Growth Factors Evaluation.

**Projects:**
- New services
- Design Feeders.

**Commercial:**
- Remote measurements
- Illicit allocation
- Distribution Management Transformer

**FUNCTIONALITY OF THE SAD**

The functionality of the SAD is represented in Figure 2. The Regions of LyFC get the information from field by work orders carried out on the network distribution. Therefore, each Region has the responsibility to obtain and keep the database information updated caused by modification or expansion in the distribution network. Hence, each Distribution Division integrates the information from its Regions; finally the personnel in charge to integrate the Database of the five Divisions of LyFC are Automation and Systems Management. The electrical information integrated in the Database is actually used by engineering applications and control and operation of the network. Therefore, there are two important tasks in the SAD, to keep the integrity of information updated and to define the responsibilities of each distribution area in the utility.

**STRATEGY TO IMPLEMENT THE SAD IN LyFC**

LyFC and IIE finished in the year 2000 the first version of the SAD, which implied a considerable labor; however such effort can be considered minimum with the effort required to get the information of each one of the electric devices installed in its distribution network, to validate this information, after digitalize in the SAD, and finally to keep it updated; it was estimated that the cost of this effort represented 80% of the total cost of the project and 20% was spent on hardware and software developments; for this reason LyFC utility considered necessary to develop proceedings that allowed integration database with reliable and information updated; with validation processes that assured the quality required in this information, facilitated unified approaches and procedures among personnel in different Distribution Regions and Divisions of LyFC; consequently three proceedings were developed, called Instructions of the SAD:
A. Instruction to get the electrical and geographical information of the devices installed on the electric network, called: ITLV.

B. Instruction to digitize in the SAD, the actual information and change generated by modification and expansion of the distribution network of LyFC, called: ITDV.

C. Instruction to keep the information updated in the SAD, called: ITAV.

Instructions take into account the following aspects:
- Definition of the task of each one personnel involved.
- Recognition of experience of the personnel involved.
- Clear definition of the responsibilities and each personnel involved.
- Clear and simple descriptions to carry out each task.
- To provide advanced formats and evaluation of each task realized, with the goal to improve the productivity of the personnel involved.
- The Instructions were developed taking account the principles of quality management systems.

A. Instruction to get the electrical and geographical information of the devices installed on the electric network (ITLV)

ITLV Instruction to get field information of each electric device installed on its distribution network, and a validation process that guarantees the quality of the information.

Therefore, in this Instruction is established the methodology of how the distribution feeders should be traveled to get its geographical trajectory, the location and the information of each one of the electric devices or components installed in each feeder of LyFC. This process is carried out for two workers, where one of them gets information of electric components and provides verbally this information to the other worker, which registers the data of each electric component in the respective formats and traces the trajectory of the feeder in a plane. This work is illustrated in Figure 3.

B. Instruction to digitized in the SAD, the actual and modification distribution network of LyFC (ITDV).

This instruction defines digitization process in the SAD; starting from information obtained in field by the ITLV Instruction and information generated by modifications and expansion of the network obtained with the ITAV Instruction. The validation process has the goal to guarantee a digitalization without errors, with which one will be able to guarantee that the information to reside in the SAD is reliable, updated, and of quality. Figure 4 shows a digitalized process in a Region of LyFC.

The information to digitize in the SAD is the trajectory of the feeder that was drawn in a plane and the information contained in the formats of each electrical devices installed to install in the distribution network.

C. Instruction to keep the information updated in the SAD (ITAV)

Instructions with the goal maintain updated the information of the distribution network originated by modifications and expansion of distribution system. This instruction has a validation process that guarantees the quality and integrity of the information to be supported in the database of the SAD.

Figs 5: Instruction to keep updated information of the SAD (ITAV) in the Toluca Division of LyFC.
The distribution network of LyFC is changing daily for the different internal processes, for example: new users, installation of transformers, new feeders, etc. This Instruction has the goal to obtain and guarantee that the generated information of these processes is obtained with quality and after digitized in the SAD, what will allow assuring information updated of the database of the SAD. Figure 5 illustrated this process in the Toluca Division of LyFC.

CONCLUSIONS

In this paper the conception of the SAD, its composition system areas, its database and the functionality inside LyFC has been presented. SAD has been considered as a strategic project in the utility, for the diverse areas that integrate it and its functionality; however, this work would not be complete without the SAD Instructions, those which were the strategy that LyFC uses to assure the quality and the maintenance update information of its distribution system, it also allowed it to unify approaches, increase personal productivity (technicians and engineers) in the 17 Regions of Distribution of LyFC, it is easy said and summarize this goal, but it was reached keeping a strict revision of the Instruction Application and an intense Training Program.

REFERENCES