

## UTILITIES RESPONSE TO EXTREME CONDITION EVENTS – EDP DISTRIBUIÇÃO CASE

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### ABSTRACT

*During extreme meteorological events, utilities are tested and their readiness and level of preparation for this kind of scenarios is essential for the way they perform in these situations. Crisis actuation plans are tested and field crews and dispatch centre operators are taken to their limits. Communication reliability and the capacity of the supporting systems (SCADA, OMS, GIS, WFM, etc...) to deal with massive information and to be an effective help in these situations is a key issue.*

*Throughout this paper are described the reasons that motivated a serious reflexion in EDP Distribuição, (the Portuguese Distribution System Operator) about the company's operational performance in those days and the measures that were put into practice after that.*

### INTRODUCTION

Localized in Southwest Europe, Portugal is a country with a temperate weather, by nature, and extreme weather events are rare. Nevertheless, in the last couple of years occurred weather disturbances that, by their abnormal magnitude and level of devastation, brought some concerns to EDP Distribuição, the Portuguese Distribution System Operator. After a strong effort in the 70's and 80's to establish a network that could supply energy to the whole country, the last 20 years were dedicated to the successful improvement of the reliability and quality of service provided to the Portuguese costumers. The followed path granted EDP Distribuição a solid public image. The Portuguese Medium Voltage network is currently composed of 80% of overhead lines, therefore, a very exposed network to all the exterior phenomena. By all these reasons, arise today new factors that contribute to a new approach to these critical periods. Despite they occur in a low number of days throughout a year, they motivate:

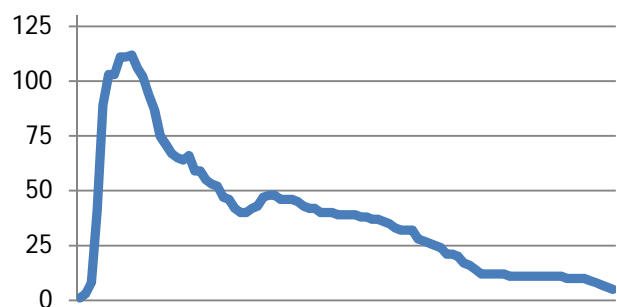
- a strong degradation of the public image of the company and dissatisfaction of the affected customers;
- extra pecuniary penalties due to clients that were affected during long periods of time, according to the Portuguese regulatory legislation in the energy sector;
- a strong degradation of all the indicators that measure the quality of service provided by the company;
- electric energy not sold ;
- financial costs caused by the destruction of the network assets and subsequent reconstruction;
- costs of extra-time of all the personnel involved and those motivated by the third-party extra-effort, among other intangible damages.

### THE TRIGGER: DECEMBER 23, 2009

In the last days of December of 2009 a rare and extreme meteorological event affected a reduced area of the Portuguese west coast, hitting with special intensity a dozen of municipalities above Lisbon, the country's capital.

Known as an *Explosive Cyclogenesis*, this weather phenomenon brought winds with a speed above 220km/h that spread destruction in this region and had a strong impact in the electric and telecommunications structures. The inability of the national authorities to predict that event, together with the fact that it occurred during Christmas season, motivated that this would become a major challenge for EDP Distribuição, in its effort to quickly restore electric energy supply to near 400.000 customers affected by the outages that were motivated by the enormous damages suffered by the electric network, along with the public pressure that this specific season of the year amplifies.

In a area with less than 2500km<sup>2</sup> (Portugal is about 93000 km<sup>2</sup>), in a short period, there were 180 tripped feeders, most of them with damages that impeded the restoration of energy supply to the customers.



*The blue line indicates, throughout time, the number of simultaneous tripped feeders. Most of them with damages and therefore affecting clients, in the hit area. The horizontal scale represents 4 days.*

There was an immediate reaction of the whole structure of the company in order to face this huge number of outages.

During more than four days, all the organization struggled to restore the medium voltage supply in any way they could, and the efforts in the low voltage network went far beyond that period. Personnel in the field and in the dispatch centres worked incessantly, until the limit of their strength, to accomplish this hard task.

After realizing the magnitude of the whole events and how the entire company worked to manage it, several unanticipated problems began to emerge and it was noticed that there were inadequacies in the usual procedures and methods of organization to face this kind of scenarios.

### KEYWORDS: “BE PREPARED”

As consequence of these events, a deep analysis was made in several perspectives and led to objective actions in different time frames.

### Crisis Operational Actuation Plan revision

*Crisis Operational Actuation Plans* (COAP) are an important piece in the whole response effort of the companies to critical situations. They define the actions regarding the management of human and material resources and the way the whole company is organized in these situations.

The events of December led to the re-analysis of the whole principles of the existing plan and brought objective actions explained throughout this paper.

In order to increase the effectiveness of the response in critical situations, EDP Distribuição’s COAP defines 3 growing states of criticality:

- Alert
- Disturbed
- Emergency

The Alert phase is the state that can make the difference when critical situations arise.

Based in several kinds of criteria, the activation of this first phase motivates a high level of readiness of the all structures involved in the response to adverse situations.

Although there is no effective mobilization of resources, all the means and personnel that will be involved are ready.

The criteria that lead to activation of alert state have been improved in different ways in the last months, but there are two specific measures that should be mentioned:

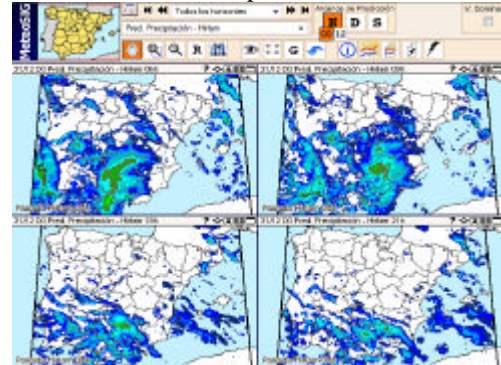
#### **Achieve closer relations with the local, regional and national authorities for civil protection**

These authorities follow permanently the evolution of weather forecasts and, with a privileged relation with the weather national agency, they gain a critical insight that is fundamental when it comes to the desirable precision of forecast. Today this relation is permanent and triggers instant alerts for any situation that motivates concern. In addition, the information exchange in other vectors has become more fluid.

#### **Dedicated weather forecast tool**

EDP Distribuição now subscribes the service of a company specialized in forecast and weather information.

This way, the company has permanent access, via internet, to weather information, from immediate data to long term forecast, for a diverse series of variables such as wind, thunderstorms, temperature, etc..



Weather forecast tool

### **Broaden the current third-party contracts**

Nowadays, most of the efforts of repairing the damages in the network rely in external service providers. It is therefore imperative that their response and level of readiness is aligned with EDP Distribuição’s posture in this matter. This approach led to the definition of specific procedures, adequacy and availability of resources that must be followed by third party partners, giving emphasis to the alert state, where their behaviour is part of the whole effort of the company to guaranty a highly efficient response to extreme condition events, since the first moment.

### **Training**

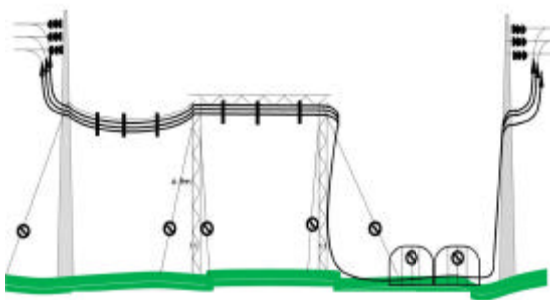
A well known practice of preparation is training. Training promotes the creation of specific routines in the involved personnel, tests the ability of systems to deal with these kinds of situations and, prematurely, detects further improvements in the procedures of interaction between the various departments and entities involved. EDP Distribuição has followed lately a model of wider simulacrum which led to a more global and realistic recreation of facts. All the involved departments still have their chance to test their own functioning, but the test of the interaction between all departments, entities, crisis cabinets, among other participants, is privileged and thus proved to be a key factor in the approach to this training model.

In this spirit of “being prepared”, other measures were taken that deserve to be emphasized, and are related with a better actuation on the field, in the effort to a quicker restoration of energy supply, in a preventive or corrective way:

- **Increase the availability of emergency generators, along with LV/MV mobile power transformers that can supply an island of MV/LV substations** – It is usual that during de network damage repair phase a group of MV/LV substations will be out of service for a long

period, until the reparation is done. Increasing the availability of emergency generators is fundamental. Solutions that can feed, when possible, an MV island through a LV/MV substation are also being carried out.

- **Mobile DC supply solutions** – DC Supply plays a critical role in the regular operation of some of the network facilities and communication structures. In the event of a DC fail in one of these installations, DC Supply solutions must be available in a fast and reliable way.
- **Work along with mobile communication suppliers (mcs) in order to increase their autonomy in critical situations** – Mobile communications play a decisive role in vocal communications and MV remote switching operation. In the events of December 2009, the absence of energy in some communication facilities of the mcs motivated unexpected difficulties. Therefore, a taskforce between *EDP Distribuição* and its mcs has been created in order to identify the critical facilities and the mutual procedures to address in critical situations, along with solutions of access to alternative communication networks in order to overcome these difficulties.
- **Solutions that can, in a temporary way, bypass the unavailable assets of the damaged network.** - By means, e.g., of the employment of flexible cables, new provisional solutions are being created to overcome situations where repair time is very long. Hundreds of meters are expected to be bypassed in order to achieve a fast solution to broken conductors in a long extension.



*Faster solutions to quickly solve critical problems*

- **Fast solutions for broken or fallen poles, in order to achieve a fast establishment of the damaged overhead lines** – In situations of critical damages in the network, the fallen or broken poles are one of those that take longer time the repair. *Fast pole repairing kits* are being successfully tested, and, though they lead

to a provisional solution, it tends to be a significant improvement in the quickness of regular energy supply.



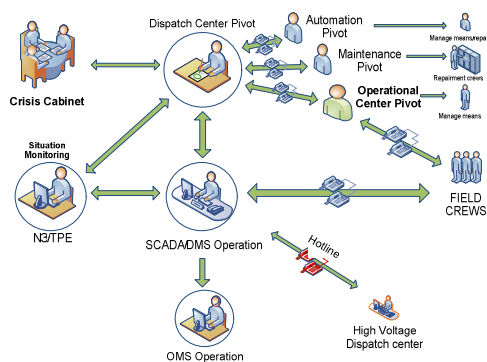
*Solution for broken poles*

- **Re-evaluation of the current practices in vegetation maintenance in high and medium voltage overhead lines** – In strong wind conditions, vegetation maintenance plays a critical role and is often responsible for serious damages in the electrical networks. The relationship between utilities and the landowners where overhead lines are established isn't always an easy task to manage. The effort of keeping thousands of km of overhead lines free from vegetation risks won't be successful without achieving a more comprehensive and effective mutual relation.

### **Organization of dispatch centres and field workforce in critical situations**

The regular organization of HV/MV/LV dispatch centres won't necessarily guarantee an effective performance in critical situations, nor will a simple addition of personnel to these centres bring that desired efficacy. In these critical scenarios, dispatch centre operators deal with massive quantities of information, coming mostly from SCADA systems. They have to operate simultaneously these SCADA systems and Outage Management Systems (OMS), among others, while they manage the communications with field crews, take decisions in order to quickly isolate the damaged network and register all the switching operations, among other relevant tasks. Meanwhile, **Field Operation Centres** were created to coordinate locally the working force, responsible for repairing network damages and manage the adequacy of switching crews that operate in the field. They are in constant contact with Dispatch centres. While the activities of operators in dispatch centres are segmented, the communications to the Field Operation Centres are managed in background by a, so called, pivot, that interacts with those operational centres, easing the communication from the "front men". In the OMS operation, a interface connecting SCADA/DMS and OMS systems brought a faster customer allocation and less need of human intervention in these situations.





Interaction structure of MV Dispatch Centres in crisis situation

### Creation of a software tool that can be a source of information to several levels of decision

In critical situations, to gather information from different departments, relative to resources in the field (own and third-party), affected clients, number of outages, forecast of energy reposition, emergency generators in use and available, most affected municipalities, among other information, is a difficult task. For this special purpose was developed a software tool, that can be accessed by the different levels of the company and that aggregates all this information, in order to give a clear view of all the events that are taking place. As soon as the involved departments introduce all the data that they are responsible for, all this information is available in the crisis cabinets, in the administration board and, most of all, in the media relations cabinet.

### Relations with media

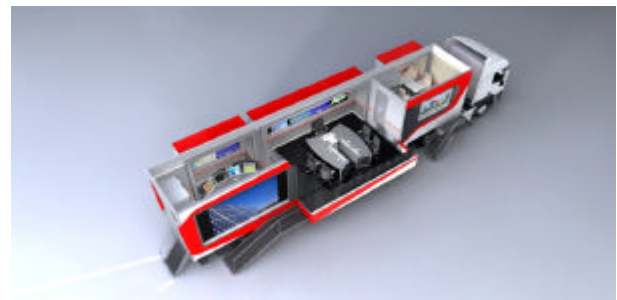
Even in odd situations, customers tolerate the lack of energy for some time, after which the impatience comes up and media bring it up to the public. In these situations, an objective and effective action in relation to the media is indispensable. Among others, the above mentioned software application is, therefore a very helpful tool in the effort of giving the media a clear picture of what is going on, the efforts that are being done and what the forecasts are.

In a more long-term perspective, other steps are being taken in order to achieve the desired improvement in the response to critical situations:

- *Optimization of the planning criteria for the Medium Voltage network, namely, the re-evaluation of maximum feeder length and maximum Installed Power X n° of MV/LV substations per feeder;*
- *Re-evaluation of the performance of the current workforce management tool in critical situations;*
- *Re-evaluation of the current criteria applied to critical assets and infrastructures*
- *Re-evaluation of the current level of performance in the connection between the*

*EDP's Call-Centre and the HV/MV/LV Dispatch Centres.*

- *Analysis of the behaviour of the metal and concrete poles during the last storms and re-evaluate the specifications in use nowadays.*
- *Study of the creation of an on-the-road dispatch, consisting of a truck with a multi-function purpose, which can be used to manage the network and work as an operational or media centre near the affected areas.*



Multi-purpose truck – presence in affected area

## CONCLUSIONS

Although no utility is permanently dimensioned to work under exceptional peaks of outages, its level of preparation will determine the way the company will perform under extreme conditions. This level of preparation unfolds in many dimensions. The most relevant advices should be:

### Before

**Foresee**, in the most precise way, the weather conditions that may put the network at risk. Based on this, **mobilize the company and third-party partners to an "alert state"** that can quickly deploy an effective action to face the events. A proper **Crisis Operational Actuation Plan** should be carefully prepared to precisely define the articulation of the whole efforts. Broad **training**, involving each player is a proper method to test the behaviour of all before things happen.

### During

**Be provided with prompt solutions**, although temporary, to act in the field and reduce repair time, along with alternative ways to supply energy to the clients. **Critical assets** and the reliability of the **communications** should be well safeguarded. **Media** plays an important role in these situations and must not be undervalued. The company must have accurate and objective figures to give a clear picture of the dimension and efforts being carried out. His version and image must be well preserved.

### After

Analyse as deep as possible the whole events and learn from them. There is always something to improve. After all, the next storm can be on its way.