A NEW GRID DRIVEN APPROACH TO GUARANTEE RELIABLE COMMUNICATION DURING POWER OUTAGES

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ABSTRACT

Today a reliable and consistent energy supply is a matter of course in an industrialized society. Modern life is depending on electricity. It is only in the rare occasion of a power outage that households, companies and public institutions do recognize the profound dependence on electricity. Repairing power failures is a routine task for grid operators, but in the past communication with town mayor and the head of the district chief executive, local governments, police stations and Rescue Coordination Centres was a problem in such situations. The article describes a solution for improved communication during interruptions, the methods and components of the communication system and, the experience gained in real projects.

INTRODUCTION

By law German energy suppliers are obliged to work as reliably as possible and on a reasonable price level. Besides they must guarantee a consumer-friendly, efficient and ecological grid based supply of gas and electricity for the general public. And since the last years they are affected from the increasing share of renewable energy sources. But in reality power supply depends on many components. An essential base for a reliable energy supply is the grid. Exposed to varying temperatures, weather conditions and external influences power failures are not completely avoidable.

In the past, grid operators focussed on a quick re-establishment of supply after a power failure. The transmission of information about the power outage was often too late or not specific enough. Since some years the public interest in such interruptions has increased very much.

MITNETZ STROM is responsible for a distribution area of 25.800 square kilometres in Eastern Germany. It serves almost 2.600.000 inhabitants and operates 77.000 kilometres of cables and overhead lines (nearly 6.000 kilometres of which are high voltage lines of 110 kV). In this area a number of municipal utilities are working, partially using grid service from MITNETZ STROM such as grid operation, control, but partially operating fully on their own.

Some years ago during a cold winter period a short circuit in a 110/10 kV substation of MITNETZ STROM occurred. The 10 kV substation was consequently destroyed by short circuit. Its restoration was quite fast. Within 24 hours all customers were resupplied. So the operational processes were not the cause for criticism.

The problem was the lack of communication to local governments, police stations, fire brigades and Rescue Coordination Centres. They all assumed to be restored in supply after two hours. But it was not possible in this case of severe outage.

The public and the shareholders of the company, who are 40 % from the local communities, expected an improvement of this situation. They want earlier and more precise information about the outage and the ongoing process of restoration to set up needed measures to help people during the outage, for example give them warm food and beverages or prepare heated rooms for the people.

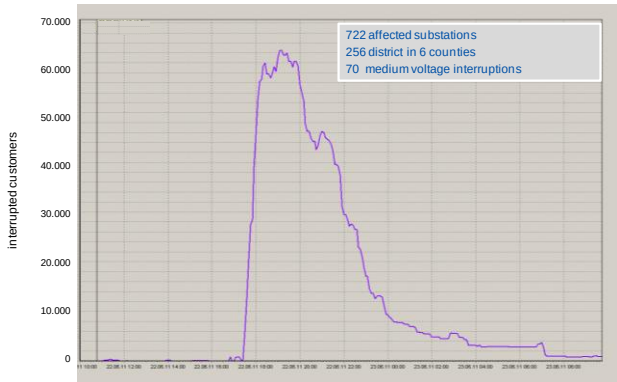

FIG. 1: INTERRUPTED CUSTOMERS AFTER THUNDERSTORM 2011

Figure 1 shows another example of an outage caused from a big thunderstorm in summer 2011. It shows a typical rapid increase of lost substations, in the maximum

up to 722 substations. In the peak of the storm front a lot of interrupted customers, mayors, managers in the Rescue Coordination Centers needed information in the same time. But on the other side it is a hard work load in the grid control center in this situation. For the employees of the grid control center it is not allow to inform all the interested parties individually.

WORKSHOP WITH ALL THE INVOLVED PARTIES

So a project was set up to develop a new concept of communication with all the organisations involved. First of all, MITNETZ STROM arranged tow one day security conferences with the ministries of Saxony-Anhalt, Saxony, Brandenburg and Thuringia, leaders of the Rescue Coordination Centres and the heads of fire brigades and police. The aim was to improve the knowledge of all organisations for a better communication during a power outage and develop a procedure for an information exchange between the organisations during an emergency.

The organisations had to introduce themselves and give information about their tasks and their emergency numbers. Some overlaps of tasks and responsibilities were recognised between the governmental level of the countries (such as Brandenburg, Saxony, Saxony-Anhalt, Thuringia) and the more local parties, such as Rescue Coordination Centres. Due to the overlappings the following process was set up with the local centres.

STRUCTURE OF THE CIVIL PROTECTION IN GERMANY

The structure of the civil protection in Germany is very complex. It is divided into the federal government level, the Federal Minister of the Interior, the federal state level and the administrative district level. Organisations such as THW (Federal agency for technical relief), fire brigades, Rotes Kreuz, Johanniter Unfallhilfe, BBK (federal office for civil protection and disaster assistance) show the variety of concerned organisations in Germany.

According to the target of the federal structure in Germany, civil protection is regulated by the federal state level. Country-specific structures are found. Councillors and mayors of the counties held the main responsibility. In this field an ongoing change is observed, such as reorganisation of towns, communities and counties, in order to improve the financial situation and to reach bigger units. This ongoing concentration process complicates the solution of the task.

Rescue Coordination Centre

The Rescue Coordination Centres have a coordinating function in all disciplines of civil protection. Attending emergency calls, informing emergency services, warning the population and emergency management are the tasks of the Rescue Coordination Centres. In the distribution area of MITNETZ STROM there are 26 Centres in operating. Their integration into administrative structures is individually different.

FIG. 2: COORDINATING FUNCTION OF RESCUE COORDINATION CENTRE

Figure 2 shows the main tasks of the Rescue Coordination Centres. Due to cost aspects a concentration process is going on to reduce the number of Rescue Coordination Centres, which leads to an increasing responsible area. Because of this currently uncompleted process the Rescue Coordination Centres still distinguish themselves in their properties. In some areas fire brigades operate own control centres, too. So the discussion had to be held with very different types of centres, concerning their size, their tasks and human potential.

DEVELOPMENT OF A COMMON CONCEPT

The target of the project was to develop a transparent, target-group-specific and contemporary communication process. For this it was necessary to know what information is needed by the involved target-groups during an interruption. An automatic system without manual intervention was necessary for a target-group-specific preparation of information. Two target-groups were identified - Rescue Coordination Centres and municipal representatives. The result of the workshops was that the two target-groups need different information during an interruption. Further target groups are the internal information of the company, such as committees and managers, public relation office and other external interested groups, such as big grid customers.

A system named “PRONET SIS” filters the needed information out of the grid control system, which contains all information about planned and unplanned interruptions.
The developed system sends relevant information to the Rescue Coordination Centres by email. The data contain information about the incident, location, zip code and geographical data of the substation, internal information

about the affected power stations, number of interrupted customers and a link to google maps. The information is structured in such a way that rescue control centres (mainly the very big and advanced centers) can integrate the information directly into their information system, whereas the smaller control centers can use the information by activating the link to google maps.

Following each change of restoration process or additional outages a new e-mail is sent to the Rescue coordination centres; with the last information, which does not contain any more outage the centre has received the information that the outage is over.

Another group of customers for information are the town and local municipal mayors. So an extra workshop was set up for this group. Following the different structures and personal opinions, different expectations came up. The result of the workshop with the town mayors and local governments was that they all need specific information. Their requirements are related to the size of their town, their population density and to personal wishes.

Most towns and municipal administrations do not have a control center. So it was defined that mayors receive a Short Message Service (SMS) as soon as a certain number of interrupted customers is reached. Each mayor can defined the threshold number of affected customers and the duration of interruption. The SMS contains a phone number to contact MITNETZ STROM and get more and precise information.

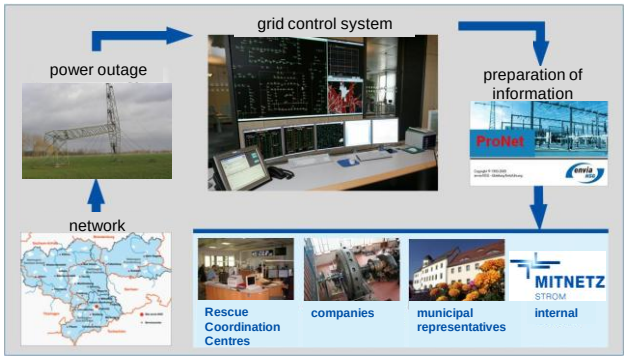

FIG. 3: COMMUNICATION PROCESS WITH "PRONET" AFTER POWER OUTAGE

Figure 3 describes the information process, starting with the planned or unplanned outage, through to information of the interested customer groups.

IMPLEMENTATION

After the advancement of the system and a test phase the roll-out started in the MITNETZ STROM-area. The roll out to all Rescue Coordination Centres was realised in 2011.
Up to now about 70 % of the Rescue Coordination Centres and municipal representatives in the MITNETZ STROM-area are using this report.

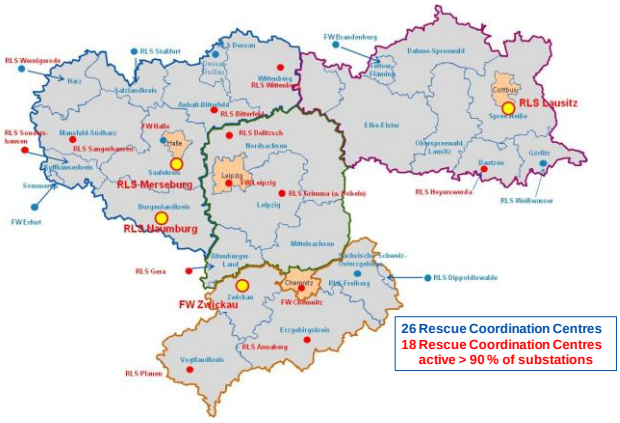

FIG. 4: ROLL-OUT OF THE RESCUE COORDINATION CENTRES IN THE MITNETZ STROM-AREA

Only those control centres outside the grid area, which cover only a small portion of the grid, are not involved in the process. That implies that more than 90 % of substations are represented in the system.

EXPERIENCES OF THE "RESCUE COORDINATION CENTRE LAUSITZ"

With a size of 7.200 square kilometers the "Rescue Coordination Centre Lausitz" (RLS) is the largest operational centre concerning the responsible area of MITNETZ STROM. It is located in Cottbus, Brandenburg. The RLS is a result of a concentration process of Rescue Coordination Centres within the country Brandenburg. It is responsible for the coordination of 34 ambulance centres, 78 ambulance cars and 632 voluntary fire companies with 1086 fire engines. The rescue organisation operates an advanced system of a telecommunication grid, repeaters and sirens. In case of planned outages the system only displays the affected substation but sets no alarm.

In the past they received information about planned outages only by daily newspaper. Information about planned outages were given to customers and household in the affected streets from MITNETZ STROM, but were not sent to other interested parties. So the RLS was alarmed by the information of their telecommunication substation. A hectic research about cause and measures started in each case and several telephone calls were needed.

The RLS uses the information about planned and unplanned interruptions in their own IT-system (MS sharepoint system) and sends this information to all 63 telecommunication substations in their responsible area. Their own IT-system contains a physical map of their responsible area and card shows for example the switched

off substations. The information is necessary for the maintenance of their infrastructures. The information is taken to analyse the influence of planned outages and can give answers to phone calls from the people in their area.

During major outages a contact partner helps to understand the situation in the electrical grid and sets up the needed measures within the rescue control centre. Another benefit of the ongoing joint work is the better understanding of internal process of the other parties and the better knowledge about the relevant persons.

Another example of use is shown in figure 5. It shows the representation of planned outages in the low voltage grid in the GIS (geographic information system) of the RLS Zwickau, another big Rescue Coordination Centre in Saxony. As a rule, that following an outage of a substation an area of 500 metres radius may be affected, they draw a circle with a radius of 500 m around the affected substations. This helps to identify telephone calls to the interruptions.

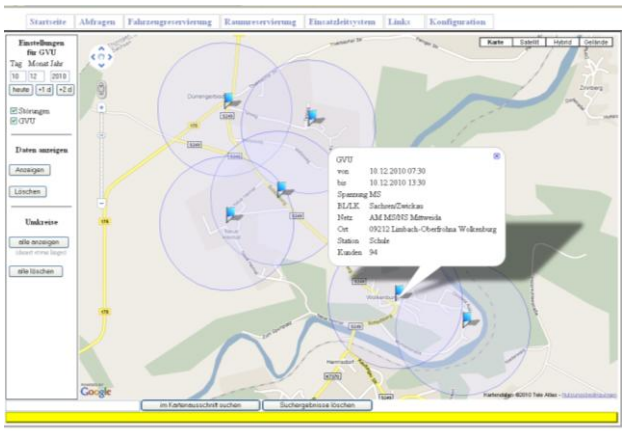

FIG 5: THE USAGE OF THE INTERRUPTED INFORMATION IN THE OWN IT-SYSTEM OF THE RESCUE COORDINATION CENTRES

For the future it is planned to integrate the foreign information into a country-wide information system to represent them in a RLS-GIS-System and thus to have quicker use of information.

EXPERIENCES OF TOWN MAYORS WITH THE RECEIVED INFORMATION

In the past interruptions of customers due to outages or planned reasons were not known by town mayors. They did not like to be called from inhabitants and asked about the reason of the outage, without being able to answer the questions. The town mayors use the received information to brief their citizens on an outage and to answer questions from people in their town. So the negative impression of an outage can be transformed into positive experience of care.
Now MITNETZ STROM gets often a positive statement from mayors in the press.

EXPECTED DEVELOPMENT FOR THE NEXT YEARS

The process of communication during interruptions is a positive achievement for all parties involved. People in the company received information about outages. This process has been extended to Rescue Coordination Centres and municipal representatives. The cooperation with all people involved is a continuous process.

At this time each customer can get individual information about the outage he is affected by, by entering his zip code on the website of MITNETZ STROM.

Further customer groups may be identified, such as telecommunication companies and big industrial grid customers.

In the future it will be possible to use social networks, such as Twitter and Facebook for the communication of electricity outages, possibly in two directions: to gain information about outages and to distribute information.