Continuous Improvements applied to the Quality of the Technical Services in EJESA

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1. INTRODUCTION

The process of transformation of the Argentine Electrical Market started in 1992. Produced a radical change in the way to give the Electrical Energy Distribution to the Public Service.

This activity historically was in the hands of the State (Provincial as well as National). It passed to private investor groups in its majority.

As it expected these groups started to apply profitability and efficacy criteria like in any other productive activity waiting for a proper profit for the invested capital.

The revenue values are set in the Concession Contract their increment in these values generate fines these ones work as signals for the orientation of the investments.

Well the quality investments are not related to the increment of the sales so most of the time the profit value is null or negative.

In this scenario it is very important to analyze exhaustibly the statistics and the failure rates in order to direct with precision the investments to those installations which their marginal contribution to the indexes of interruptions have more relative weight.

In that line the Jujeña Stock Company works with the continual improvement criteria analyzing the failure statistics supported by informatics tools that allow us to determine indicators with different criteria like failure index due to the Distribution Management or Failure index due to the lack of investments in the installation.

2. Company Description

The Jujeña Stock Energy Company is in charge of the distribution and the commercialization of the Electrical Energy in the entire territory of the Jujuy Province

Jujuy is located in the North of the Argentine Republic and its borders are Bolivia to the North, Chile to the West and Salta in the South and East part.

The granted area have a surface of 22,060 km2, with more than sixty cities, towns and locations. They are grouped in thirteen Departments. The Company is divided in six Administrations due to administrative and operative reasons. The most relevant details are listed in Table 1

<table>
<thead>
<tr>
<th>Administration</th>
<th>Granted Surface in km2</th>
<th>Customers Quantity</th>
<th>LMT Quantity (km)</th>
<th>LBT Quantity (km)</th>
<th>SET's Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>San Salvador</td>
<td>1.772</td>
<td>64.126</td>
<td>455</td>
<td>1.000</td>
<td>608</td>
</tr>
<tr>
<td>San Pedro</td>
<td>5.943</td>
<td>15.539</td>
<td>612</td>
<td>329</td>
<td>345</td>
</tr>
<tr>
<td>Perico</td>
<td>1.764</td>
<td>15.270</td>
<td>586</td>
<td>362</td>
<td>579</td>
</tr>
<tr>
<td>L.G.San Martín</td>
<td>2.612</td>
<td>15.828</td>
<td>393</td>
<td>303</td>
<td>267</td>
</tr>
<tr>
<td>Tíscar</td>
<td>3.712</td>
<td>5.484</td>
<td>412</td>
<td>190</td>
<td>309</td>
</tr>
<tr>
<td>La Quiaca</td>
<td>6.257</td>
<td>6.099</td>
<td>649</td>
<td>176</td>
<td>253</td>
</tr>
<tr>
<td>TOTAL</td>
<td><strong>22.060</strong></td>
<td><strong>122.346</strong></td>
<td><strong>3.068</strong></td>
<td><strong>2.360</strong></td>
<td><strong>2.361</strong></td>
</tr>
</tbody>
</table>

3. Rules of the Public Service Quality and Sanctions

All the norms referring to the Quality Service and Technical products are stated in the Annex II, Sub-Annex 3 of the Concession Contract such as the profit values for the stages and the allow tension ranges. The organism responsible to revise the fulfillment or development of the contract is the Superintendency of Public Services (Su. Se. Pu.)

4. Technical Service :

Calculus of the Indicators of Quality of the Technical Service

From the beginning of Stage II (December 1998) up to the end of Stage IV (November 2004) The Technical Service Control is done with the “average customer” criterion. The install power today is 1.8 KVA/customer (This results from the division of 223,379 KVA by 122,346 customers).

To obtain the grade of fulfillments in the service quality. It is registered the KVA out of service of the MT/BT transformers of each interruption (maintenance failure or interruptions), it is calculated two indicators per KVA install and for the type of installation at the end of each semester control.

These are the indicators for external interruptions (The Company’s MT Installations.

The out of service installations from the distributor due to interruption in the distribution system are also registered (LAT 132 KV from the Main Distribution System), In the SADI (LAT of 5000 KV in the Argentine Interconnection System) and in the generation.

These determines the indexes of external interruptions.

The expressions for the calculus for the quoted indicators are defined as followed:
Fmik = Σ(kVA_{FS})/kVA_{INS} (1)

(1) Average frequency of interruption by KVA installed.

These parameters represent the quantity of interruptions seen by the average customer in the studied area and the considered period. It showed the confidence of the system in the environment reflecting the level of investments in the nets.

T_{TIK} = Σ(KVA_{FS} * T_{FS}) / kVA_{INS} (2)

(2) Interruption time by KVA installed

It represents the total time of interruption seen by the average customer in the studied area and the considered period of time.

This index is related with the level of means, human resources and materials to used with the system.

There are exceptions in the number of interruptions for example the ones of less than three minutes interruptions are not included, also the ones caused by accident or unforeseen circumstances and for the external installations now a days the ones produced by minimum frequency are not count.

When the indexes set in the Concession Contract increment it is determined the unsupplied energy.

ENI(kWh)=(F_{MIK} - F_{MIKub})/F_{MIKreg} * T_{TIKreg} * 28.300 (3)

(3) If F_{MIK} is exceed

ENI(kWh)=(T_{TIKreg} - T_{TIKub}) * 28.300 (4)

(4) If T_{TIK} is exceed

The coefficient 28,300 is discriminated according to the consumption in each type of installation.

The Su, Se, Pu, work is based just in the control of the given data and the terms. These make us to invest a lot of time revising data of interruptions (KVA out of service and how long do the interruptions last).

5. Indexes of frequency and time of Internal Interruptions

5.1. 5.1 Underground Urban
Never the less will need to have into account that the majority of the Underground Distributors are today at the end of their useful life. That is way it is expected that (The rate of failure grows around 40% in the last year) of these actives that will bring with them an increment of the frequency see graphic 4, classification of interruptions by motives

GRAPHIC 4 – Classification of interruptions by motives

5.2. Aerial Urban

For the urban installation cases the frequency of interruption has been reduce in 57% from the beginning of EJESA up to date the index has only been over passed by in a semester as you can appreciate it in the graphic 5.

GRAPHIC 5 - Frequency of Interruption in Underground Installations

In the improvements of the frequency the investments have a great incidence, because they take the nets that are most immune to the environment where they are placed. For example the main cause of disconnections are the atmospheric charges that can be controlled by the installation of dischargers and also the installation and improvements of ground discharge and the ice from the guard feeders of 33 KV among other. See graphic 6

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GRAPHIC 6 – Classification of Interruption by Motive

Respected to the time of interruptions, it is noticed a diminution in the index of 67% (as you can see in the Graphic 7) From there we can imply that the resources provided are adequate for the exploitation of the system and the distribution arrangements are the right one but never the less there is still a margin for improvement.

The program disconnections to do maintenance take part in the indexes of interruptions started on 01/12/2000 so it was necessary to arrange them very carefully to avoid growing the indexes. For the 1st and 3rd semesters that are the one that involve the summer period (December – may). The programmed cut off that can produce interruptions in the system are restricted. Keeping the based without penalty for the forced interruptions.

GRAPHIC 7 – Time of Interrupted Installations Aerials Urbans.

Any way this incidence of it can be reduce implementing the maintenance with life lines. The interruption causes by branches are possible to control with a management of trees plan and in the places that this alternative is hard to apply we can change the nets designs working with protected conductors for example.

It is very important to be careful not to over pass the set profit value from the contract.
Because when the calculation of the no provided energy is done the coefficient that is used in that equation is 20,679 the highest of the three types of existent installations.

5.3. Rural Aerial

For the rural installations the frequency has been reduce in a 63% and as the same as the aerial urban installations. The investments has a big incidence but even though we over pass the profit value in three semesters. As you can appreciate in Graphic 8.

The interruption indexes are higher for the rural installations this is due to the own characteristic of the nets. Very long lines of 33 KV with radial exploitation that feed a reduced station of low power, and distributors of 13.2 KV also with a considerable length.

In their way the lines run through zones full of trees and are expose to the contact with branches and the falling of trees too.

Also area of agricultural activity (sugar cane and tobacco plantations) where the installations are affected for example by the burning of the canes and eventually contact with agricultural machines.

Anyway the principal cause of interruptions is the atmospheric charges. These can be reducing with the increment of investments. See graphic 9.

GRAPHIC 8 – Frequency of Interruptions of the Installations of Aerial Rural

The time of interruptions has been reduce to a 56% since the beginning of EJESA up to date, even though there is still a wide margin for improvements. See Graphic 10.

GRAPHIC 10 – Tiempo de Interrupciones instalaciones Urbanas Aéreas.

5.4. Externals

As it was mention before the distribution is also responsible for the interruptions in its own installations. Provoked by the going out of service of the external installations (Transport System by the main distribution in 132 KV and SADI) Up to Date the only exception that exist are the interruptions by minimum frequency beside the ones less than three minutes.

Taking into account the first and last semester the frequency has been reduce in a 17% but there isn’t any remarkable tendency to go down. Besides it shows a mark tendency of seasonal variation where comparable semesters have a very similar indexes.

As you can see in the Graphic 11 the profit values were over passed in two semesters.

GRAPHIC 11 – Frecuencia de Interrupciones instalaciones Externas

It is important to underlined that in the situation where EJESA finds in the MEM (at the end of the interconnected system) each going out of the service with connections the SADI.

It contribute a unity to the frequency because the power out of service is all the power install (without the isolated system of La Quiaca).
The time of interruption is kept low during 2 hours per semester. See Graphic 12.

For be able success whit exit, the volume of information, will be necessary to disposer of adequate informatics’ tools, as e system whit GIS support, where the operator enter the interruptions and maneuvers, but can not modify the value of power installed, unless someone with authorizations. From this way we have an strict control of the changes of dates.

We need to outstand that the GIS is implemented at the actuality, only we need tools of operation and quality.

The register of the installations dates, is not a small theme. Require a big compromise of all the administrations, that. Are the ones that have in charge and modified the installations.

Is also important, that the System support the version target, this is, that maintains the history of the net thought the landmarks, the ones that can be recuperated (consult) whenever is necessary.

Another crucial aspect is the totally integration of the Systems SCADA, QUALITY, GIS, Commercial, Reclaims, etc. we need to take the best level of automatization, that means that, the manual engrossed dates are the less. All the informatics’ Systems must have sincronized the time bass, for that at the instant at the production of the event must been registered at a uniform way at all of them.

Also must be realized an intensive capacitating plan, having account that this stage of capacitation. Involve to more empress stamen. As: Customer attention, call center, emergency guard, dep. The service Quality, etc.

Actually we work with an informatics service that is a date base of interruptions, the main mistake is that we cannot keep in the net history.

That means that if you need to know how was configured the system at a date determinate, is almost impossible rebuild the configuration, because that each time is reached the Pot. of a point of transformation, you loss the anterior.

For save this situation we have backup of the bases of sets dates, but this are out of the system (excel charts) and are accessible for every body. The controls don’t exist and the security at the hand dated.

6. Administration of the Information

Each administration is in charge of the records of the events of the Primary Distribution System.

The role of the Department of the Quality Service in relation to the fulfillments of the concession contract it control the information that come in each administration and the daily channels are done as well as the one by semester and the exceptional and we do the administration of the programs cuts out.

7. Failure Analyses

With the purpose to work with the criteria of the continual improvements. We formed the committee of Failure Analyses and it is form by the Chief of Exploitation, The Quality Chief and the Administrator, The Technical Chief and the Distribution one too.

This group meets every three-month in each administration and the failures are analyzed in a certain period looking for the origin or the cause of them. We make diagrams for solutions and also guiding the investments.

Then after a while we analyzed the effectiveness of those solutions and we repeat the cycle.

8. Quality of Service at the V Stage

The 01/12/2004 started to measure the quality of served to final customer, is to said that we take all the interruptions, from the AT level to the final customer.

We estimate at the first approximation that is going to control about 2000 interruptions bay semester (actual situation) to about 8000 (included the interruptions from the BT network).
• If prorogate the IV Stage, could be poster gate the inversions getting busy, only the more urgently case.

10. REFERENCES

✓ Anexo II, Sub Anexo III. Normas de Calidad del Servicio Público y Sanciones. Contrato de Concesión Empresa Jujeña de Energía S.A.
✓ Información del Dpto. Calidad de Servicio de Ejesa.