OPEX REDUCTION IN MONITORING MV COMPENSATED NETWORK PARAMETERS

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ABSTRACT

Clever Asset Management requires innovation in both the technological and operational fields. This paper describes the success story of a Design-to-Cost (DtC) activity that has resulted in an innovative device, based on recent patents, useful for the monitoring of MV compensated networks.
Within the Design-to-Cost methodology, cost models have been used to project the cost early on in the development cycle, allowing an optimal trade-off between the cost objectives and the product functions.
The safety issue, considered since the early stage, has also contributed to the optimal result, both in simplicity and cost, besides the safety goal.
In addition to the operational improvement, the financial impact is also underlined.

INTRODUCTION

Since 2000, Enel Distribuzione started the neutral compensation program on MV network. Presently, the majority of the MV busbars are compensated by automatic tuning inductors (“mobile” Petersen coils) or fixed tuning inductors (“fixed” Petersen coils).

The fixed coils are approximately 25% of the total coils installed, but their number is going to increase significantly within the end of the program. The tuning of these coils is performed manually via the execution of an earth fault and measuring the actual fault current. The coil inductance is then manually set according to this measure and kept until the network extension remains constant.

According to a recent more restrictive norm, the Distributor is obliged to perform annual or more frequent measurement of the earthfault current.

In order to face the new, increasing demand, the Engineering Department studied a new solution for cutting the associated maintenance costs.

REFERENCES

[1] Albert Leikermoser; Francesco Ortolani, "New techniques for compensated networks: tuning the Petersen coil, determining the network parameters and performing earth fault current prediction and reconstruction" - *CIRED2007 Conference* – paper 0120

[2] Francesco Ortolani, Albert Leikermoser, "Neutral compensation and network monitoring – Test field experience in determining resonant point and homopolar parameters with active and passive pulse injection" - *CIRED2009 Conference* – paper 0554

GENERAL DESCRIPTION

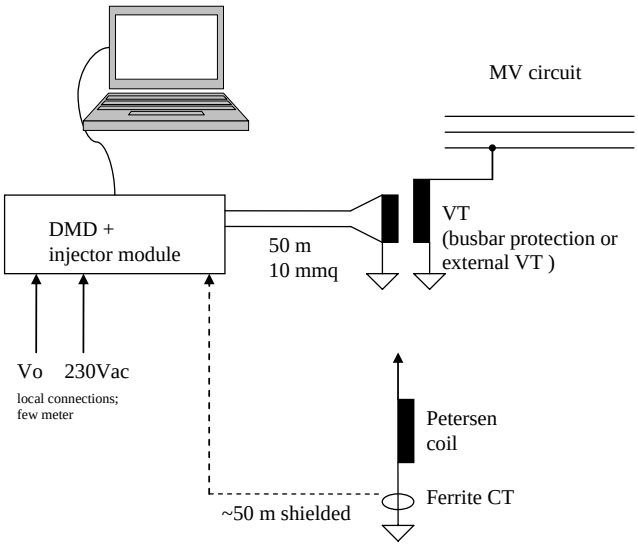
In 2006 an innovative method for the estimation of the grade of detuning was developed by ARS company [1] [2]. The method is able to calculate the degree of detuning of the coil, regardless of type, and the capacitance of a network connected to it just stimulating the system by a Dirac-like pulse.

The development of the device has been conducted in cooperation with the engineering department, the procurement department and with the manufacturer, being developer and owner of the patents.
The innovative method invented by the manufacturer for monitoring and assessing the detuning and the main parameters of a compensated network was the starting point for assessing the network conditions. The new insights obtained through this method turned out to be an extremely appropriate basis for the design of a new device fulfilling the operative needs and reducing the expenses at the same time, reviewing and improving the consolidated operative process.
At first, safety requirements and other functional constraints represented tough obstacles for the design but, eventually, the new device produced a safe, outstanding performance, being a cheaper solution as well.
Therefore, clever asset management can also be seen as a safety tool, as it reduces the “on field” operation, preventing or reducing risk exposure.

FROM INVENTION TO INNOVATION

The invention, patented some years ago, was the base for developing a new product suitable to fulfil new requirements imposed by the norm.
At the time of the invention, a campaign of field test activities took place demonstrating the suitability on real environment. In spite of the relative roughness and limits of the prototype, excellent results have been obtained, better than expected.
The new requirements coming from the operation have been examined by the engineering department and translated to a preliminary specification for a new device.
At the same time the economical impact of maintenance activity was estimated in order to define a general frame for the Design-to-cost activity.

The detailed costs were defined and a first budget for the project was drawn.
From that point on, the direct interaction with the manufacturer took place.
It must be stressed that it was a real interaction, which was not a bare price negotiation, but a real Design-to-Cost methodology application.
All the themes were considered, ranging from the essential function, the desired functions and the safety issues. From the first, relatively expensive and complex system, we reached the final design, implementing a new patent (a further innovation) and a very important simplification of insertion scheme, reducing the cost, improving the testing performance and operational safety. The detail of activity and the technical results are not reported here because exceeding the scope of the paper. An insight can be derived from the insertion scheme and the pictures of the device.



COSTS AND SAVINGS ESTIMATION

The evaluations was carried out estimating:
- the cost of the current field activity necessary for the execution of manual measurement of the fixed coils;
- the cost of the field activity necessary for the execution of the above task with the aid of the new equipment
- the presumed initial cost of the new equipment.

The current manual activities performed in the field, mainly within the HV/MV substation, consisted in:
- Disconnection of the initial section of a MV line coming out of substation;
- Preparation for testing (earthfault measurement);
- Test execution;
- Restoration to the situation of normal operation;

It was evaluated, as a first approximation, equal to 3 hours for 4 people and estimated as € / plant / year, according to the hourly rate for the interventions.

The adoption of the DMD equipment limits the activity only in substation, in this case, the activity consists of:
- Preparation of the test;
- Test execution;
This resulted in a reduction of either the testing time (from 3h to 2h) and the staff involved (from 4 to 2 people). and the overall cost reached one third of the previous example.

The difference of the two costs was multiplied by the number of the fixed coil, assuming annual check frequency.

This was the starting point for defining the initial budget along with the definition of the number of devices necessary for the given territorial organization (22 devices).

From then onward, the DtC activity started and after successive refinements the final contract was signed at less than half the starting budget.
It must be stated that this activity was pretty articulated and produced two additional patents from the manufacturer side.

The final result produced no loss of functionalities and even simplified both the device and the connection scheme.

The functionality associated to the instrument gave more detail of the network due to the richness of information .

THE FINANCIAL VIEW

From a financial point of view, the introduction of the new devices represented:
- a reduction of maintenance costs
- a switch of expenses from OPEX (operational expenses) to CAPEX (capital expenses) bringing the following advantages:
  - o EBITDA increment
  - o reduction of man hours (head count)
  - o fiscal advantage in conversion of maintenance costs into investment expenses
  - o regulatory advantage in case of RAB or in-tariff investment remuneration

It must be noted that the last to items represents an real economical value that can enlarge the budget for a project

CONCLUSION

The evolution of the invention up to the innovation was a very gratifying experience, stimulated by new needs and fostered by the asset management concept.
The impact of the innovation brought by the activity has been:
- technical stimulus and better knowledge of the network
- improved performance
- safety increase
- economical and financial improvement