ACCEPTING SIMULATIONS TO REPLACE HIGH POWER TESTS

(AN IDEA FOR DEVELOPING COUNTRIES WITHOUT LABORATORIES)

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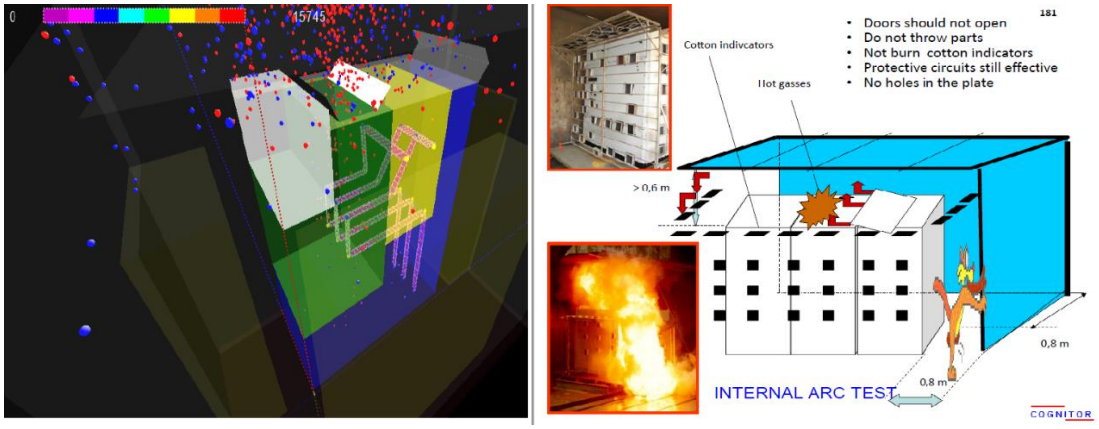

Summary

It is a well-known fact in world-class development banks such as the World Bank that the electrical industry, being the most organized of infrastructures, is the fastest way to increase the degree of development of countries. Basic electrification programs show this.

Imagine that you deploy in the country, focusing on the overall development and not just the individual investment, a testing laboratory able to perform high-power tests up to 250 MVA for 3 seconds, temperature rise tests up to 8000A, and, the most important, having a well-trained staff of 10 people. Train this team for, in addition to do the commercial tests, to have abilities to simulate such tests and to know concepts of equipment design. Create regulations to qualify and certify electrical products which clearly states "Do preferably in the country the tests that can be done in the country. Tests which cannot be done in the country may be replaced by simulations under clear rules and responsibilities"

This small-medium size laboratory would be affordably accessible to developing countries. It would be deployed in 3 to 4 years to be the master spring that, in less than 10 years, would consolidate a good electrical industry of line and substation components. It would need government support (only for regulations and technical standards) and local industry support (management and 70% of investment).

The new thing and key for the success is the short regulation and a technical standard to qualify, certify and to commercialize electrical products. The openings for the use of test simulations in substitution of real higher power tests would make the industry to move. Developed countries and those that already have laboratories would continue to use theirs. However, those in developing countries who would implement it would make a great leap in the size and quality of the electric industry.

I saw this movie before, and I can help to explain better each step. For the electric sector planners of developing countries, the reading of the brochure Cigrè 740 (2018) is a must. The title is "Contemporary Design of Low-Cost Substations in Developing Countries". Look in this summary and get the whole document in Cigrè site http://www.cognitor.com.br/brochurecigre740Resume.pdf

1. ACCEPTING SIMULATIONS TO REPLACE HIGH POWER TESTS

Hello, here is Sergio Feitoza writing you. In the 25 years working in the main Latin America laboratories (CEPEL), I saw the difficulties of the manufacturers in paying the high price of using the labs to achieve a test report informing that the equipment was approved according to international technical standards.

At that time, as a young engineer, I was used to saying that everything should be tested in the laboratory. I wanted to sell more services and the testing simulations tools were not as advanced as they are today. I began to study the concepts that I later used to create SwitchgearDesign software that simulates well the same tests I did there. So, today I can write that in many cases simulations are even better than real test, specially when the testing lab report do not state explicitly if the equipment was approved or not. Most of the users do not have knowledge to do this task.

In the 1970s and 1980s, I helped to design and deploy CEPEL's high-power labs (1350MVA) that are still the only ones in South America. I was the general manager and witnessed how their creation motivated the Brazilian electric industry to develop more and better products. When a manufacturer does a development aims, at the end of the process, be successful in type tests to get the test report.

I saw how products began to be produced in Brazil for lines and substations. From low voltage and 13.8 kV to large 500 and 800 kV disconnectors. I have tested many of these. This was only because the lab was near, in South America, and not in Europe or USA or Canada or Asia. When you go far to test substation equipment your costs include transportation, inspectors, etc… will be two or three times higher. In this condition you will do nothing, and the electric industry will not develop. I remember that It was like this in Brazil before CEPEL's testing laboratories. It is easy to see that the countries with the best electric industries have testing labs for decades (for example, Holland, Italy, USA, Canada, Japan, South Korea, Spain, Brazil).

The existence of the Brazilian labs made possible important R & D programs of national scope such as Proquip. This one greatly improved the quality of distribution networks and its equipment like transformers, expulsion fuses, and others. The 1989 revision of IEC60282-2 has been done based in the Brazilian technical standard originated from the tests and research in this program, for example for the aging of fuse-links. I know this because I proposed that revision to IEC and convened the IEC working group that did the work.

> Interesting to see that, because someone had, years before, the long-term vision to deploy an electrical testing lab, in a country without a tradition in electrical networks, suddenly an unknown young engineer was influencing what would be written in a standard IEC used worldwide. This case is to be understood by government planners of developing countries wishing to leave the bands of darkness (Cigrè 740 brochure). That young engineer is now 64 years old and proposes simulations to be formally accepted to replace some high-power tests.

There was a positive impact on the national system of technical standards (Cobei/Abnt) and certification (Inmetro) that were consolidated. The standards system was much better when the government was in the front line of it, but even after it had left, it works. Technical standards and certification need the finger of government to represent the taxpayer's point of view. Otherwise, the processes have only the manufacturers' vision. It is so today even in the IEC where the big multinational manufacturers predominate in dictating what will be realized. For example, a rule to replace laboratory tests with simulations, which would be good for developing countries, possibly will never be proposed by the multinational's large manufacturers and large testing laboratories.

The focus of this article is to show an idea for developing countries that do not have testing labs. The idea is that, more than implanting one small-sized laboratory, say 250 MVA like mentioned above, to formalize a regulation that state "Do laboratory tests when it is possible to do in the country and accept simulations to replace the tests when you cannot do the tests in the country ". I hope that my 25 years of laboratory, 20 of simulations and participation in IEC and Cigrè working groups bring credibility to what I write here. I would like to read the opinions to the contrary, especially of those who have nothing to gain with the growth of the electrical industry in developing countries. Discussion brings light.

I work all over the world using simulations to predict what will happen in the tests of internal arc, temperature rise, short circuit, and its electrodynamic and thermal stresses and others. Using simulations, we can fine-tune project details to be approved in the tests at the first trial. In more than 95% of the cases, the results of the simulations are confirmed in the real tests.

The CIGRÉ international group WGA3-24 has published the brochure CIGRÈ 602 (2014) - "Tools for The Simulation of Internal Arc in T & D Switchgear". Experts from all the world participated and confirmed that the results of the simulations are very close to the test results. I worked in the WG and co-authored it. We are concluding in WG A3-36 of Cigrè a similar book for tests and simulations of temperature rise.

In the brochure Cigrè 740 (2018) "Contemporary Design of Low-Cost Substations in Developing Countries" we also discussed the theme and there are several references to the simulations in Chapters 5 (Equipment Selection) and 12 (Training and Development). Incidentally, this is the only book I know, focused on developing countries, which has a whole chapter on "Substations Training and Development." It addresses strategies to get companies to become more efficient and competitive.

2. THE IDEA FOR COUNTRIES LACKING TESTING LABORATORIES

The idea follows what I participated and witnessed in Brazil, but with a much smaller testing lab and adding the concept “Accept Simulations and Not Only Laboratory Tests”. It starts by implementing a small-medium size test laboratory able to do high power tests up to 250 MVA for 3s, temperature rise up to 8000A and, much more important, having a team of 10 people well trained for, in addition, to do well the commercial tests, to know how to make simulations of the same tests and to know the concepts of equipment design. It is not difficult to do this. I did it before.

Such a laboratory is much less expensive than a 750MVA one and would be affordably accessible to developing countries. It would be deployed in 3 to 4 years aiming to be the master spring for, in less than 10 years, consolidate a healthy electrical industry of line components and substations.

It would be essential to have government support (only for motivation, regulations and technical standards) and local industry support (management and around 70% of the investment). The return for the investor is not big but is acceptable. The return for the country economy through the electric industry is at least 100 orders of magnitude higher.

The “government task” would be to coordinate the preparation of a regulation and a technical standard with clear rules to qualify, certify and marketing electrical products with explicit openings for the use of simulations of high power tests, instead of actual tests when it is not possible to do the tests in the country. The concept would be “Do preferably in the country the tests that can be done in the country. Tests which cannot be done in the country may be replaced by simulations under clear rules and responsibilities”. The operation and management would be a task for the private electric industry but taking care of maintaining the “neutral – third part” characterization. It is possible to achieve this.

Developed countries and those that already have laboratories would continue to use their own labs and rules. However, those developing countries implementing the idea would make a big leap in quality by creating conditions and motivation for something that goes far beyond the view of rich countries that everything should be tested in the laboratory.

The typical high-power laboratory of the near future let’s say 7 to 10 years from now will be a mix of relatively small physical installations with high-level simulation rooms. Laboratories that do not realize this in time will simply close the doors. Many already did this in the last 25 years.

A good idea has been used in recent years in a South American country that does not yet have high power testing laboratories. It has been made explicit and permitted that, under certain conditions, specified in an official regulation, equipment may be marketed, for a transitional period, replacing test reports issued by test laboratories with reports of test simulations. The initiative is giving positive results in the development of the local electric industry. It is a reference initiative for other countries where there is a lack of resources to build costly laboratory facilities. The very development of the industry will create the conditions for a future physical test laboratory.

An important issue is to create a technical reference standard on “Simulations”. In this article of 2011, you may read the path of stones "A Standard of Use of Simulations of Tests to increase the Competitiveness of the Electrical Industry"
http://www.cognitor.com.br/Article_Competitivity_Eng_04102011.pdf

3. CONCLUSION

Well, here is the idea. In my travels around the world applying training, lectures, and consultancies I could identify around 10 countries in Latin America, Africa, and Asia which are ready for implementation of this type of initiative.
I hope that somehow this text can help to motivate them.

If developing countries improve the planet improves and we avoid the end of humanity to which we are moving fast.

For the electric sector planners of developing countries, the reading of the brochure Cigrè 740 (2018) is a must. The title is "Contemporary Design of Low-Cost Substations in Developing Countries”. Look in this summary and get the complete book in Cigrè site
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