Small-size High Power Testing Labs & Low-Cost Substations

(an idea for the new moment of the electric industry)

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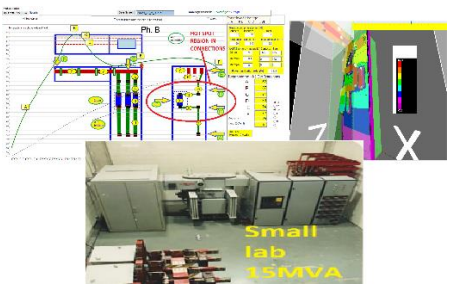

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1. Introduction

This article is an extension of previous “Accepting simulations to replace High Power Tests in countries far from testing labs”. In addition, I described my view about the future of the big high-power testing labs in a recent video . Check both in these links:

Article: http://www.cognitor.com.br/SimulationsReplacingTests_2019.pdf

Video: https://www.youtube.com/watch?v=qHZ1uuDYQeE&feature=youtu.be

These texts are focused in planners of the electrical sector, associations of manufacturers of the electric industry, testing laboratories, certification companies and regulatory agencies,

2. The idea in few words

Note: The term LV means Low Voltage and MV means Medium or High Voltage systems.

The electrical industry is frequently the most organized of infrastructures of a country. It is demonstrated that improving it help to increase the degree of local development.

The brochure Cigrè 740 (2018) - "Contemporary Design of Low-Cost Substations in Developing Countries” includes a rare medium- and long-term vision about some of these aspects. If you wish to receive a 5 pages summary made by me, write me informing your email. I am one of the coauthors of the brochure.

The faster catalyst for moving up the electric industry of a country is having, nearby, a "high power testing laboratory (HPL)". The reasoning is in the previous article. However, the implantation of a 750 or 2500 MVA HPL involves investments of 50 to 100 million American Dollars. Few are constructed because there are much more attractive investments. Whoever did labs in the last decades is already attended. Anyone who has not done it will hardly invest in creating a large, high-power laboratory

This idea is for countries with lack of testing laboratories but wishing to make a positive leap in the electrical industry. There are at least 10 countries in Asia, Africa, and Latin America at this stage. The concept is:

a) To deploy a “small-size” testing laboratory able to perform high-power tests up to some 200 MVA (3 seconds) and temperature rise tests up to 10.000A.

b) To have in the lab a well-trained staff around 10 people, able to do, in addition to the commercial tests, to simulate tests and having sound concepts of equipment design.

c) To create a local regulation to qualify and certify electrical products which clearly states, "Do lab tests that are possible to test in the country and use test simulations to replace tests that cannot be done in the country".

d) To implement R&D projects to demonstrate to the electrical sector actors that simulation results represent very well the results of (many) expensive laboratory tests. Use the “small-size” testing lab to do the validation tests.

With a “small” lab properly designed (I did this before) you can do:

- Short time current tests up to 65 to 200 kA for low to UHV equipment, depending on the size.
- Temperature rise tests up to 10.000A or even 25.000A
- All LV internal arc tests and breaking tests and some internal arc MV tests.

Before doing the new “small” HPL you should clearly define the scope of the regulation for the qualification of the products. Regulations to accept simulations to replace high power tests shall have openings to evolve and to be improved to reflect the experience gained in their use. This may even mean to evolve to the point of allowing complete replacement of certain tests by simulations. The temperature rise tests are very near to this

The idea of using simulations does not encompass to replace lower cost tests. For these, the idea is really to do real test. Examples are IP degree, IK, insulation and dielectric tests, mechanical operation, incandescent wire. The idea is to simulate only the expensive high-power tests that are not possible to perform in the country.

Simulations to replace tests are a new thing all over the World. The world reference in this area are the work of the international Cigrè (WG A3-24, WG A3-36 and concepts of WG B3-43). The WG A3-24 (internal arc) and WG A3-36 (temperature rise) have made complete validations involving experts from many different countries and tests in major laboratories in the world like (see brochure Cigrè 602/2014).

For short circuit tests (electrodynamic forces and other effects) the possible validations are against calculation methods in IEC standards (see this report issued in 2014

https://www.cognitor.com.br/TR_071_ENG_ValidationSwitchgear.pdf)

The investment in our “small” 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 some government support only for regulations and technical standards. The idea is to finance the deployment through investments by the local industry (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 up.

3. Conclusion

Well, here is the idea. It is not something difficult to achieve. I saw this movie before, and I can explain each step of my experience in seminars and lectures. Other article about this theme are available in the “Publications” area of the site https://www.cognitor.com.br give more detail