Rio de Janeiro, February, 10 -2025

Subject: **PROPOSAL FOR CONSULTANCY ON SWITCHGEAR DEVELOPMENT (Design Review + Training + software SwitchgearDesign)**

To: **Client identification and contact name**

READ FIRST about our experience and things, we helped to do:
CV https://www.cognitor.com.br/Curriculum.html
... https://www.cognitor.com.br/HelpedToDo.pdf
Recent example of case of success: https://www.cognitor.com.br/ArticleIcel.pdf

Dear client,
This is a typical proposal for a consultancy service for switchgear manufacturers (MV / LV). The final product of this service include 2 products here named "Design Review + Training including a copy of SwitchgearDesign". Usually the equipment is switchgear, switchboards, panels, busducts of IEC62271-200 / IEC62271-307 and / or IEC61439-1/2.

When you clearly define the characteristics of the product you want to analyze I will update this document. For this moment, as I do not have your data, I will consider that your project is a typical "head" of a family of MV switchgear like 24kV-16kA$_{rms}$-1250A (or LV switchboard like 480V – 85 kA$_{rms}$ – 3200 A).

The products of our service are :

- **PRODUCT 1:**
  - DESIGN REVIEW for development and testing of your panel (to predict it will be approved in lab tests)

    OR
  - Analysis for the EXTENSION OF THE VALIDITY OF TEST REPORTS of an already tested equipment to an untested one of the same family - to avoid carrying out tests under the premises of IEC 62271-307.

- **PRODUCT2:**
  - TRAINING + COPY of software SwitchgearDesign. (Presential training)

Just for your reference, in the last 20years, I have been helping many manufacturers, all over the World, to develop substations equipment like switchgear, switchboards, electric panels, and busbar systems. Before, I worked 25 years in an electrical energy research center with a major set of high power, high voltage and other testing labs. I worked from doing tests to the general management of the 14 labs (high power, high voltage, Ex, EMC, mechanics, etc. Check my experience in the CV above. I can communicate in English, Spanish, Portuguese and +/- Italian and French. I can also work as a "Visiting Researcher" in companies outside Brazil (periods of up to 3 months) for special services like the implementation of patents, testing lab projects or elaboration of R&D strategic plans.

For switchgear like MV/LV electric panels, usually, after initial ideas and developments, manufacturers need to go to testing labs to do tests and receive a test report to use in commercialization. I give support in all the phases.

At first, I do a design review focused in avoiding that your equipment fails in the lab tests. A complete type test for a MV / LV electric panel may cost USD 40.000,00 to 80.000,00. A complete design review with experience plus virtual tests and suggestions for design improvements costs around 10% of these values.

After the training you will very possibly do similar design reviews alone, without needing me. This is mainly because, based on a long testing and design experience I developed the unique virtual testing software SwitchgearDesign to simulate the more expensive lab tests It is easy to use with a 2-days training and very useful to assess and to improve the design using less materials.

So, the main service is a design review PLUS a high-level training on how to verify and improve this and future designs. In the training your team will learn how to use the software tool. Usually, after the training you will not need consultancy services anymore because will be able to do the design reviews by yourselves.

WHAT IS THE "DESIGN REVIEW" (product 1) ?

First, the customer sends me the switchgear basic drawings with geometries, materials of the bars and enclosure, types of insulators / supports, normal and short-circuit currents and voltages. I review the design by simulating each test with SwitchgearDesign. I verify whether the design is suitable to pass in the tests or whether modifications are needed. If the design need improvements, we propose changes and optimizations. Sergio Feitoza (me) is the author of SwitchgearDesign software. I developed it after working 25 years designing, doing tests, operating, and managing CEPEL's testing laboratories (high power, high voltage, EMC, materials, Ex…) the largest in South America. Check below, links about the validation of the simulations (tests of temperature rise, short time currents and crest (electrodynamic forces and superheat), internal arc overpressures) and more. Check also the links for many articles written by me as well as CIGRE publications and IEC documents in which I am co-author.

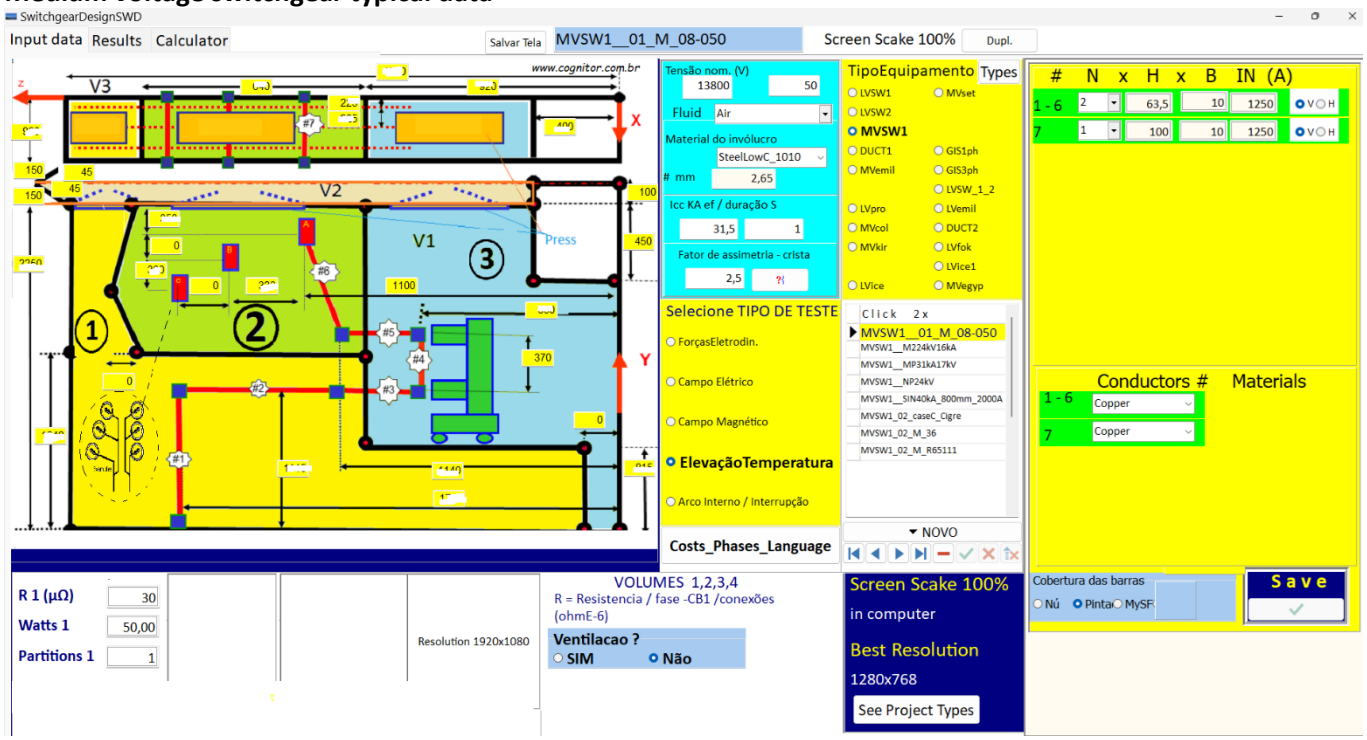
The Design Review is also applicable to whom need an "extension of the validity of test reports" under the premises of IEC TR 62271-307. I am coauthor of this IEC document, knowing well how to use the rules of the tables to do a transparent and reliable 3rd part assessment. You will save money by avoiding future laboratory tests.

The sequence of the work from the review to the final tests: after reviewing the design, the customer usually produces the equipment prototype and goes to test it in the laboratory. My work does not include witnessing the lab tests. I will be available to clarify doubts between the end of the design review report and training up to the time of the tests (if within 4 months). Sometimes, before and during tests you will need to discuss with laboratory staff, for example, the interpretation of test results or methods that may make the test more severe or onerous than it should be. In addition, it is necessary to define well what should be included in the test reports to avoid future tests, by using the premises of IEC62271-307.

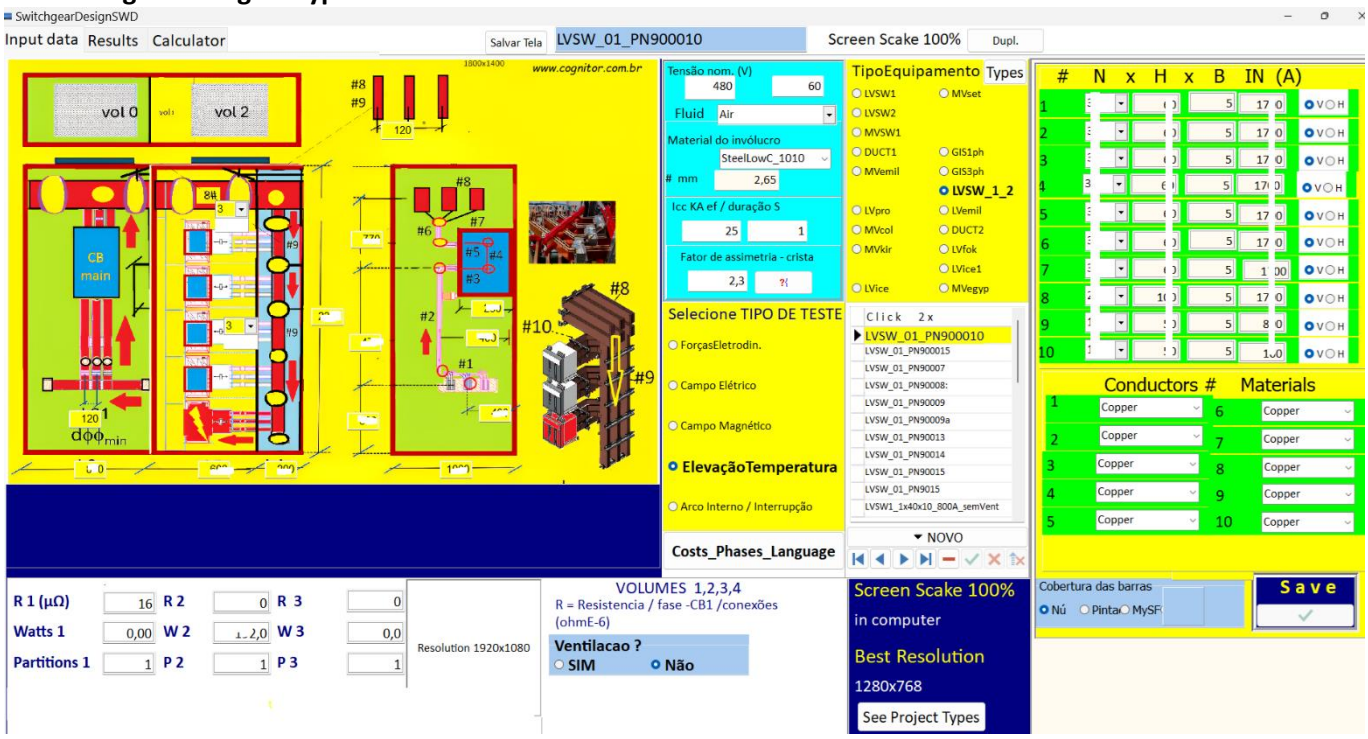
The final Product 1 is a detailed "Design Review Report" with a focus on "passing the tests". Includes a high-level analysis and suggestions from this consultant (see link of a typical report at the end of this text). As said, alternatively, the product may be an "Extension of the Validity of test reports" by IEC62271-307. In our 25-year history of doing this type of analysis, the probability of succeeding in tests is greater than 95% (but not 100%).

To start the project, drawings that are detailed enough to perform the analysis are necessary. The main data required are the dimensions of the bars and their path, as well as the dimensions of the depressurization openings and ducts, plates used and other data that allow filling in the data as in these two examples (one medium voltage panel and one low voltage panel). Several data are intentionally omitted.

Medium voltage switchgear typical data



Low voltage switchgear typical data



The reference values for the tests are as follows (e.g. for a 24 kV panel):

a) Rated voltage (Ur); 24 kV
b) Short time withstand voltage at industrial frequency = 60 kV
c) Impulse withstand voltage = 125 kV
d) Rated frequency (fr); 60 Hz

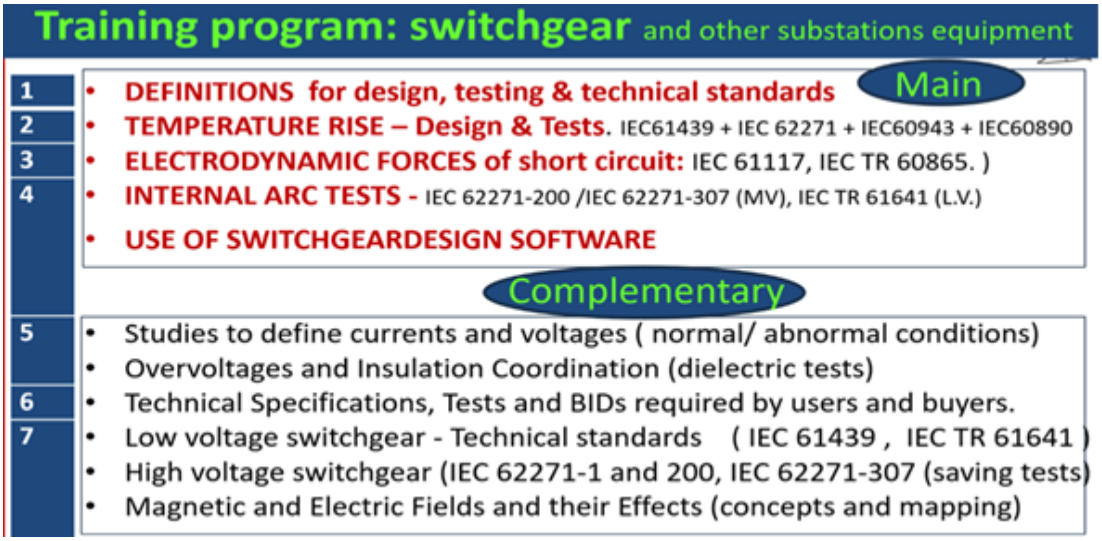
e) Rated permanent current (Ir): 1250 A
f) Short-time current (Ik) and internal arc current: up to 16 kAef
g) Peak value of short-time current (Ip): 2.6 x 16 kA
h) Rated short-circuit duration (tIk): 1 s

The design review include the following types of analysis:
• Calculation and simulation of electrodynamic forces (short-circuit) and internal arc withstand to overpressures,
• Calculation and simulation of temperature rise and attendance to the technical standard limits.
• Analysis of the most appropriate design for the future extension of the test validity to other applications, voltages and currents (IEC62271-307)

If the company has already performed some of the tests mentioned above on similar equipment (with few modifications), it can be avoided to repeat costly tests if the concepts of IEC62271-307 are applied. In this case, the reports of the tests already performed are useful for this analysis. IEC 62271-307 was created precisely for this purpose and this consultant Sergio Feitoza Costa is a co-author of this IEC standard.

WHAT IS THE "TRAINING" (product 2) ?

Possibly, the most important part of the consultancy work is this training, unique in the World, in which you will learn or review the concepts behind each of the high power / high voltage tests. Understanding these concepts means to be well above the average designers knowledge. Learning this your mind will be more open for challenging tasks like developing innovations and new solutions. When reading this training program, please remember that you may choose the points that, along thee training, will be given more emphasis and points that are not of your immediate interest. The training program is in section 4 of https://www.cognitor.com.br/trainingENG.pdf



The training is a face-to-face / presential / "In Company". Each participant receives a copy of the SwitchgearDesign software and learn how to use it. Presential training is recommended because it is much, much more productive than web training. Web training only yields sufficient results when the attendee has good experience in project concepts and is fluent in the language (e.g. English). If you have any doubts about these two aspects, do not request the Web training. Remember that the impact of this training on your company will last for many years, generating significant savings and increasing knowledge and business. Just 1-day avoided from high-power tests in laboratories pays for the entire service. If you do not yet have this perception, it is better not to do the service for the moment.

If you decide on the Web training it consists of 4 sessions of 3,5 hours each, covering the use of the software and main engineering concepts about the tests that can be simulated. The client provides the form of connection via the Web, generally using tools such as Teams, Skype, Zoom, Google Meet or similar.

In the case of PRESENTIAL training it lasts 2 days (2 x 7h). The training program includes the contents of the Table 1 and Table 2 below. It is carried out in installations provided by the client, usually with up to 14 participants. It is the best option for who want to go deeper into the concepts of substations and to upgrade the technical team level.

If you want to check whether the speaker's pronunciation is easily understandable, there are videos of parts of the training on the website www.cognitor.com.br and in the links below .

The supplied version of the software copy is the full DESKTOP VERSION, in the occasion of the training. It is provided with no future maintenance commitments, other than providing the same copies as provided in the training. If there are updates and you contact me, I will be pleased to send the update at no cost. However, I do not have time to follow up to let you know that an update has been released.

Shortly before training I deliver a copy of the software installer file (.exe) with installation instructions. Just to be clear, as is customary in the supply of software, the source code, prepared in Delphi language, is not provided to the client. It is understood that the customer, upon receiving the copy, agrees to use the software for services of his own company and that will not pass it on to third parties without a written authorization from COGNITOR.

LECTURER: The training is presented by me, Eng. Sergio Feitoza Costa - Diretor of Cognitor (CV above).

SEQUENCE OF EVENTS:
The most frequent sequence of events is like in this table. Other options may be discussed.

1	Authorization of the work and purchase order or small contract including receipt of drawings and technical information for the calculations (Payment of 40% of the total value)	+1 day
2	Preparation and submission of the draft of the "Design Review Report"	+20 to 25 days
3	I send the software and installation instructions PLUS the preliminary design review report	+ 32 days
4	TRAINING	+/- 35 days
7	Emission of the final "Design Review Report" and payment (60%) for the services.	+ 40 days
8	End of the service but I remain clarifying doubts up to the realization of tests in the testing laboratory	

PRICE, VALIDITY AND PAYMENT CONDITIONS: The proposal is valid for the beginning of the work in up to 90 days. The total price, non-negotiable, is:

Design Review + PRESENTIAL Training including a copy of SwitchgearDesign

Case by case but in the order of magnitude of USD 8500,00

Design Review + WEB Training including a copy of SwitchgearDesign

Case by case but in the order of magnitude of USD 6000,00

(**): For PRESENTIAL trainings, in addition to the price mentioned above, the customer is responsible for the voucher with 3 to 5 hotel nights, air ticket (flights in economic class, seats pre-booked and times chosen by the lecturer) and airport - company - airport transfer. These items must be supplied in advance by the customer. The customer is responsible for the infrastructure (location and equipment). It is necessary to have only a multimedia

projector, whiteboard to write and that the participants have, for their use, desktops or notebooks where the software will be installed.

The purchase order or simplified contract must be issued before the start of the work. Payments must be made by bank transfer to [redacted]. PayPal may be eventually used if previously agreed.
Yours Sincerely
Sergio Feitoza Costa – Director
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THE LINKS TO THE PAGES AND VIDEOS, INCLUDING THE TYPICAL REPORT AND "USING SWITCHGEARDESIGN",

- Typical "Design Verification Report"" (older model) :

https://www.cognitor.com.br/TR_000_10_ENG_Standard_2013.pdf

- Typical Design Review Report for IEC 62271-307 (under request after the start of the consultancy work):
- Video describing the software SwitchgearDesign (not updated but the essential points do not change). https://www.youtube.com/watch?v=I2kROAX5Ajc
- Training program presented in Tables 1 and 2 of the PDF https://www.cognitor.com.br/trainingENG.pdf
- Video (from 2020 not updated): https://www.youtube.com/watch?v=3expB4wHiCM
- Validation of software SwitchgearDesign https://www.cognitor.com.br/TR_071_ENG_ValidationSwitchgear.pdf
- Articles for free download https://www.cognitor.com.br/Downloads1.html

REFERENCES

[1] **IEC TR 60943:1998** - Guidance concerning the permissible temperature rise for parts of electrical equipment, in particular for terminals. Issued by IEC Technical Committee TC 32.

[2] **CIGRÈ BROCHURE 830 (2021)** – "SIMULATIONS FOR TEMPERATURE RISE CALCULATION". (Sergio Feitoza Costa is co-author)

[3] **CIGRÈ BROCHURE 740 (2018)** Contemporary design of **low-cost** substations in developing countries.

[4] **Article "TEMPERATURE RISE LIMITS OF IEC 61439-1** : unclear values distort the LV switchgear market. (May,12, 2023) - http://www.cognitor.com.br/IEC614391Table6.pdf

[5] **IEC62271-307 (2015) -** High-voltage switchgear and controlgear - Part 307: Guidance for the extension of validity of type tests of AC metal and solid-insulation enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV.

OTHER USEFUL REFERENCES

[6] **Article "METAL FOAM in SWITCHGEAR, switchboards & bus ducts**
http://www.cognitor.com.br/switchgearmetalfoam.pdf

[7] **ENVIRONMENTAL EFFICIENCY CERTIFICATE OF ELECTRICAL PRODUCTS (KG/MVA): TECHNICAL STANDARD & DEMO PROJECTS MANAGEMENT)**
http://www.cognitor.com.br/demo1certificate.pdf

[8] **SUBSTATIONS & LINES INNOVATIVE PRODUCTS. SMALL R&D CENTRES + TESTING LABORATORY**
https://www.cognitor.com.br/demo2Lab.pdf

[9] **ENVIRONMENTAL EFFICIENCY CERTIFICATE of electrical products (kg/MVA) . Draft of a technical standard**
http://www.cognitor.com.br/EnvironmentalEfficiencyCertificate.pdf

[10] **CIGRÈ BROCHURE 602 (2014)** Tools for Simulation of The Effects of the Internal Arc in T&D Switchgear,

[11] **IMPROVEMENT OF QUALITY OF ELECTRIC SYSTEM INDEXES:**
https://www.cognitor.com.br/IEC602822sugestionstosc32afrombrazil.pdf

[12] **Free book by Sergio "RENEWABLE ENERGY + ENVIRONMENTAL EDUCATION TO TRY TO SAVE THE PLANET"** https://www.cognitor.com.br/educationfortheplanet.pdf

[13] **Free book by Sergio "SWITCHGEAR, BUSWAYS & ISOLATORS & SUBSTATIONS & LINES EQUIPMENT"**
https://www.cognitor.com.br/Book_SE_SW_2013_ENG.pdf

[14] **Free book by Sergio" PROJECT SAVE RIO IN 10 YEARS:**
https://www.cognitor.com.br/saverioENG.pdf

[15] Visiting researcher training: https://www.cognitor.com.br/trainingENG.pdf

[16] Other reference articles free downloads https://www.cognitor.com.br/Downloads1.html

CV Sergio Feitoza Costa https://www.cognitor.com.br/Curriculum.html

Things Sergio helped to do http://www.cognitor.com.br/HelpedToDo.pdf

Site https://www.cognitor.com.br

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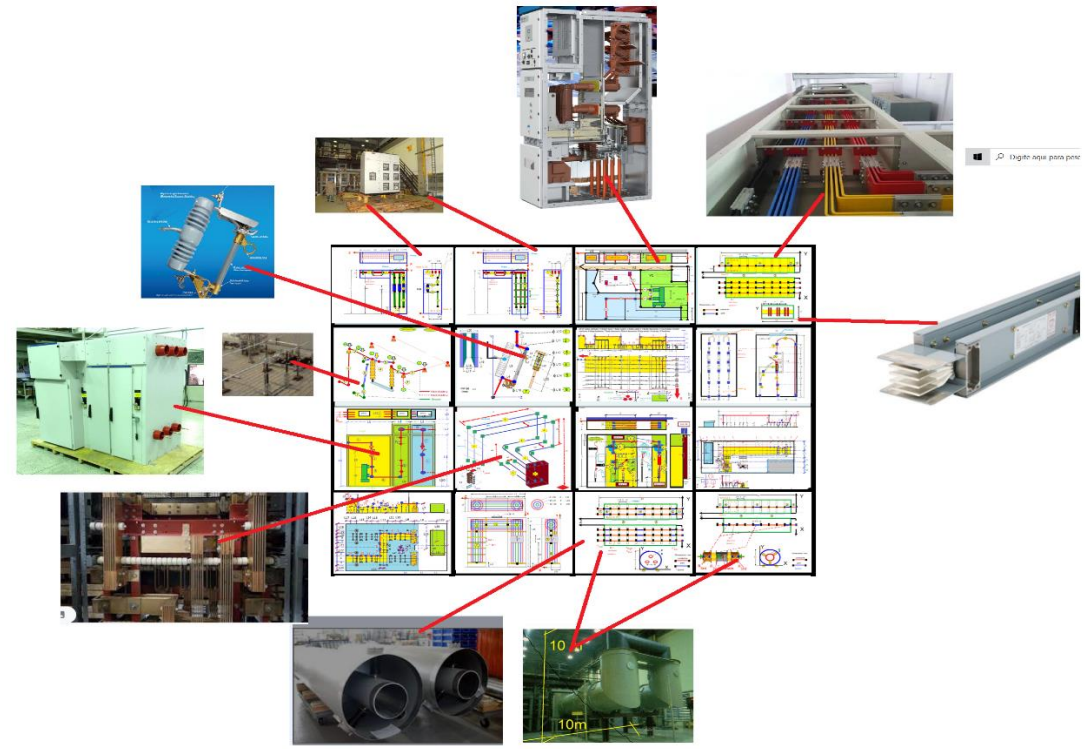
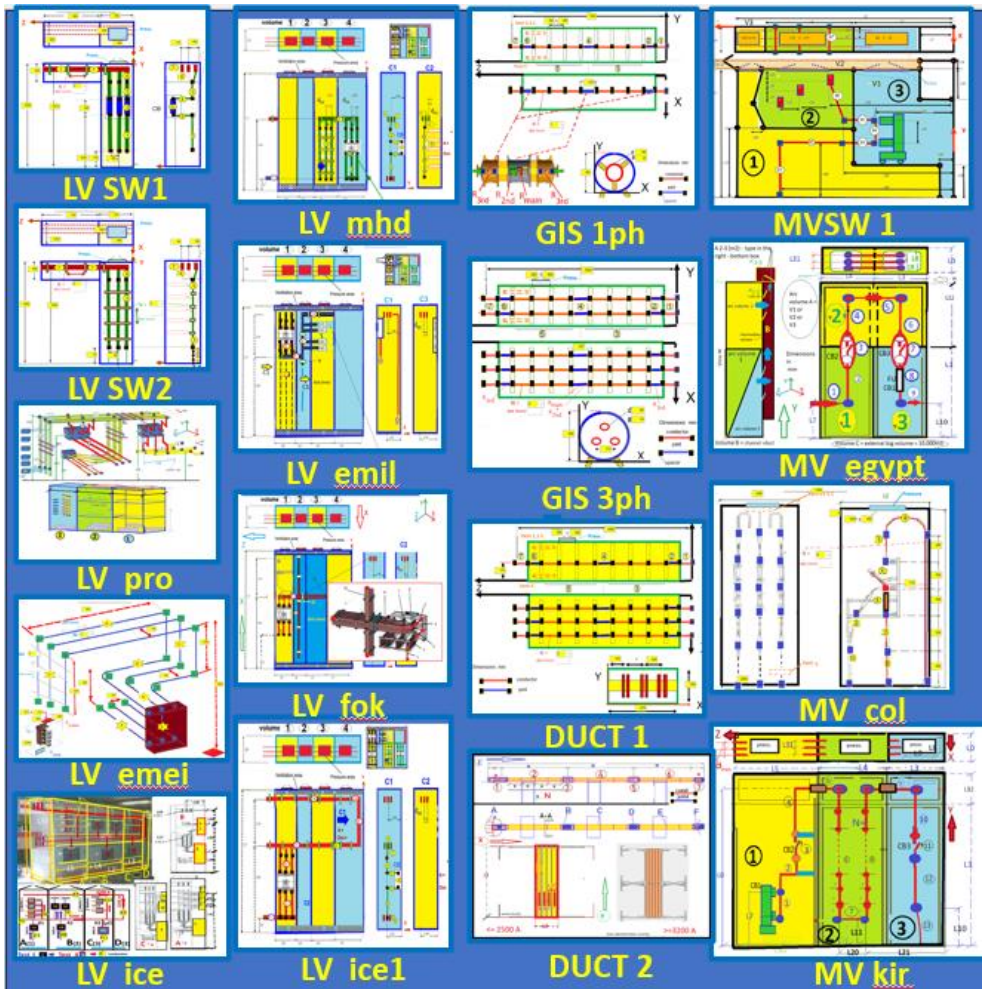
Linkedin profile (30K followers) : linkedin.com/in/sergiofeitozacosta

Some SwitchgearDesign models





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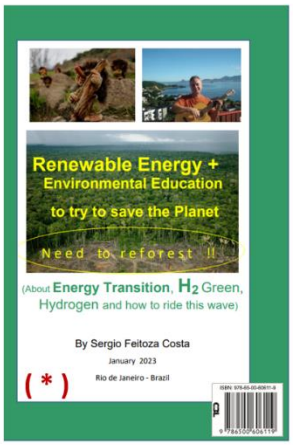
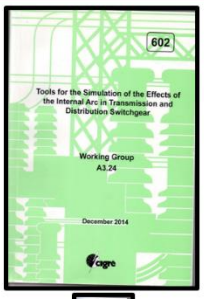
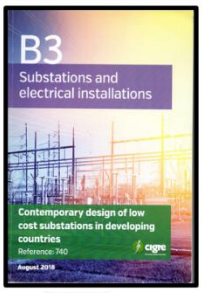
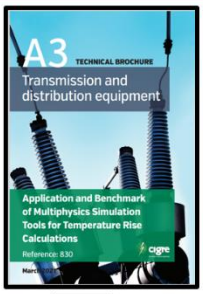
Some training bibliography (Sergio Feitoza Costa is author or coauthor)









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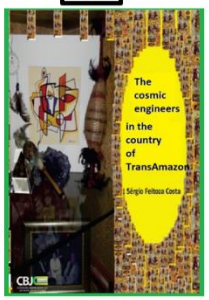

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