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SC B3 – Substations and electrical installations
PS 3 – Integration of Intelligence on Substations
Q 1 – What are the benefits of digital solutions like IoT-sensors, machine learning, artificial intelligence, drones, robots etc for substation life cycle from planning to maintenance ? Which measures are necessary to increase the acceptance of intelligent IoT-based power equipment in substations ?

Improving Condition-based Maintenance through Cooperative Data & Insights Partnerships

What can be expected by digital solutions in the short- and in the long term? Regarding the immediate effect of amending substations by (more) sensors, increased transparency on the real-life equipment's "health" is gained. This may include measuring temperatures or pressure values at positions not directly related to the stable operation of the substations. Otherwise, such data would be critical and required anyway for the purpose of control & protection. So the topic is all about using new sensors and/or using existing data in a new context, namely condition monitoring (CM), in order to bring added-value to TSOs and Operators. In the long run, actual benefits are given by improved service operations, such as e.g.,

- pre-warnings on arising issues & prioritized list of tasks for maintenance
- aligned spare parts management
- minimization of downtimes (shorter campaigns)
- extension of maintenance intervals & equipment lifetime
- savings on overall lifecycle costs (e.g. 25+ years lifespan)

All of this characterises an improved form of condition-based maintenance (CBM) that is enabled & supported by means of digitalization and smart analysis. As a matter of fact, such efforts will most quickly pay off when comparing estimated savings in OPEX costs especially for remote and unmanned stations (e.g. offshore platforms).

For an effective realisation of these expectations, it is important to highlight that a cooperative approach between solution providers (e.g. EPCs/OEMs) and "system users" (e.g. TSOs/Operators) is required over the whole lifecycle. Starting with the tender phase, iterations and exchange with experts from both sides are required to find the setup best tailored to the specific plant (e.g. regarding also redundancy concepts and other boundary conditions). Moreover, chosing a proper CBM system along with the data storage concept and its actual usage ("Who? How? When?") is crucial for the life-long collection of CM data. We are convinced that this data needs to be made accessible to the solution providers / original EPC in a defined way to share experience from the field.

Regarding the question of acceptance, there are henceforth three aspects to note:

(i) Collaboration projects are required in order to tackle specific, smaller use cases, thus providing a joint view on feasibility and benefits by both TSOs and EPCs

(ii) Acceptance will always depend on the actual "usefulness" of the data, i.e. its ability to predict future behaviour from historic data (and prevent outages etc)

(iii) IT security plays an important role and is still the main driver preventing further use of Cloud-based services. Hence, solution providers need to respect concerns by TSOs and are asked to offer “on-premise” solutions local to the station

A recent pilot project with one of Europe’s leading TSOs serves as an example for such a “Data & Insights Partnerhsip” and is based on a retrofitting for the cooling system of an existing substation. Additional sensors for monitoring vibrations on the motor/pump combinations are employed here, collecting high-resolution data that is further processed on site. As agreed among the partners, the CM data will be shared with experts from both TSO and OEM and joint workshops will foster common understanding and provide opportunities for new modeling & evaluation methods. This emphasizes once more that sharing data is key to a joint learning and will ultimately bring benefits for all parties.