

Q2.01: What are the challenges in the development of digital substations and how to address the problems caused by the digitalization?

Digital Substations are the enabling infrastructure to achieve all the advantages behind the digital transformation in power grids, since it is through the digitization and digitalization of primary devices that the quantity and quality of data will increase, allowing the creation of innovative solutions and deploy of different architectures, including virtualization.

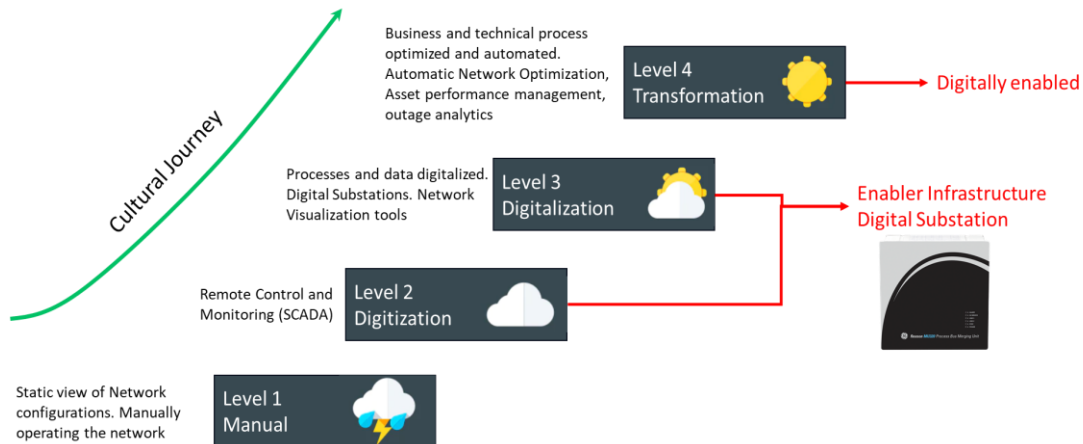


Figure 1 - Different levels in the journey of the digital transformation.

Considering all the advance of vendors and products and the consequential good results into real project implementations as example ISA CTEEP Digital Substations of Lorena, 500 kV & 230kV connected to the grid by 2021, the experience shows that the biggest challenge of digital substations is no longer the capability of the technology or the digital solution to achieve all the needed requirements, but rather is how to change the conservative culture to accept and probe the innovative solutions, which is specially understandable considering for power systems reliability is key.

There are multiple utilities changing their strategic plans to embrace digitalization and innovation as part of the energy transition, but it is still a challenge how is this culture spread among complex organizations. Are companies empowering their innovative personnel to work with their peers as advocates of digital substation solutions, allowing changes to happen more organically from a bottom to top approach?

Besides the general cultural challenges are also highlighted three major challenges that delays the widely acceptance for digital substations: Knowledge gaps, regulatory gaps, and needs for more tools and dedicated solutions.

Knowledge gaps are noticed in multiple teams giving that Digital Substations requires knowledge in domains that were not explored by formal educational courses until few years ago as OT network, Programming Languages, network protocols, and general digital algorithms. It is undeniable that all this knowledge is widely available in the literature through papers and books and in the industry through training courses, however the teams need to dedicate to absorb the knowledge and cover the identified gap, eventually with efforts dedicated to practical experience.

Regulatory gaps might not always be an impediment for a specific project, but it adds regulatory risks while analyzing a full change of strategy and new design standardization. Among others, the regulatory space must be clear to point out what will be the requirements with regards network topology, including allowed types of network redundancy; the requirements related to segregation of station bus and process bus; and what cybersecurity standards and procedures will be required.

With regards tools and dedicated solutions for digital substations, it is not yet clear and widely accepted a toolset tailored for substation needs. General network tools like Wireshark are still widely used even without being tailored for substation applications. Technicians and engineers are still metaphoric looking for their “multimeter” for a Digital Substations and dedicated network tools that can help them to understand their substations more easily.

To address these challenges the experience shows that the companies must push a strategic vision prioritizing digital transformation, empowering employees in all organizational levels so they can become the advocates for the needed changes, provide knowledge about digital substations to operation and maintenance teams, educating that the digital substations are not only more efficient, but also safer with regards electrical hazards. Partnerships and trials are ways to speed-up the knowledge transfer and create confidence in the digital substation solution. Utilities can rely on several vendors, that have extensive experience with digital substation products and projects, to partner into pilot projects and into help design the best solution for each need, including training and dedicated tools.



Figure 2 - ISA CTEEP visit to GE Digital Substation laboratory in Brazil.

Utilities more advanced with the digitalization process are also key to push evolution in the regulation. In Brazil the regulatory entity updated the rules to clearly accept LPITs and Digital Substations after the success of the Lorena DSS, being the first completely digital interconnected to the grid.

With regards dedicated tools, although it is still a challenge to have an accepted toolset, it is known that this is a growing area with a variety of solutions already in the market, but still with space for innovation with big players and startups.