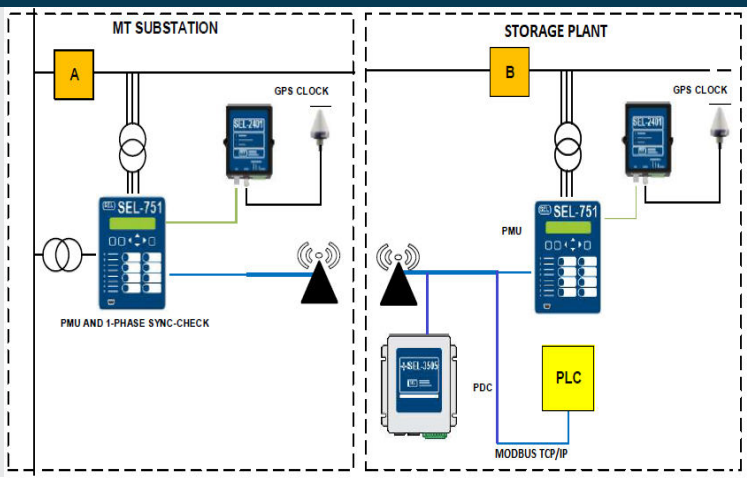
SUCCESS CASE 13.2024

Island Synchronization

SOFT TRANSITION FROM A BESS ELECTRIC ISLAND TO GRID SERVICE AND ISLAND SYNCHRONISATION



THE CHALLENGE

When a network incident occurs in those areas of the electricity grid where a **battery energy storage system (BESS)** is available, an **electrical island** is activated. During this time, the BESS is responsible for maintaining the voltage and frequency in the island, although the service is frequently coordinated with local renewable generation plants to extend the duration of the service as much as possible.

Normally, **when the network connection is restored, the network voltage waveform phase is not synchronized with that of the island**. Therefore, before attempting the transition from feeding with the BESS to feeding from the grid, the operation of the BESS must be adjusted to synchronize the two waves. The objective is that neither the customers nor the generation plants suffer from a service interruption.

THE SOLUTION

To solve this challenge, i-DE installed a **grid-island synchronization system**. Considering that the electrical island can be created by opening any of the switches between the BESS and the main substation, it was decided to take the measurement (**voltage waveform phase)** at the substation as a network reference.

Hence, the system takes samples of the grid voltage at the primary substation, labels them with a time stamp and, finally, sends them to the BESS, so these can be compared with an equivalent measurement of the voltage in the island. The control system then adjusts the operation of the power electronics of the BESS to synchronize both voltages and, when this is done, it informs the Distribution Dispatching Center operator to close the breaker that will connect again the island to the network.

MAIN ACHIEVEMENTS

- The system has been **used successfully** on many opportunities.
- The solution has been **extended to other BESS** developed by other manufacturers and integrators.
- The algorithm achieves an adjustment that is precise enough to ensure that the **wave recorders do not detect the island-grid transition in 98% of the cases**.
- **Generating plants** do not detect the transition and consequently, they **do not disconnect from the grid and continue producing energy without interruption**.
- **Customer service is not interrupted**, and customers do not perceive the island-grid transition.
- With this method it has been possible to **synchronize two independent BESS islands** and join them without disturbances. In the area of Rascafría, characterized by a double circuit, the planned installation of a large BESS was replaced by a set of two smaller twin BESSs to take advantage of the flexibility provided by this solution.

KEY SUCCESS FACTORS

- **Expert integrators.** The personnel in charge of the integration must know the BESS control systems well enough to be able to modify the code without altering the normal operation of the BESS.
- **Reliable and performant telecommunication channels**. Remote areas often do not have telecommunications coverage adequate for sending reliable information and with low latency. For the control system to be effective, an abundant and continuous quantity of samples must arrive without delay to the comparator. Hence, the solution depends on the reliability and characteristics of the telecommunication channel.
- **Robustness of the solution.** In addition to the presented hardware and software solution, the system is equipped with an additional control algorithm so that, in the event of failure of the measurement or telecommunication equipment, the operator can still carry out the synchronization operation successfully.