7 No-Fail Tips to Optimize the Grid | Aclara Blog

Grid optimization means improved reliability, fewer outages, reduced losses on the system and more. It's about running systems more efficiently.

If you looked up the word "optimization" in the Merriam-Webster online dictionary, you'd find a definition sure to make engineers smile: Optimization equals "an act, process or methodology of making something as fully perfect, functional or effective as possible."

Of course, utility engineers and manager would want that for the distribution systems they operate.

More important, however, is the fact that grid optimization is fundamental to achieving a bigger imperative that utilities now face. That imperative is grid modernization, an effort we must all undertake to meet the demands of tomorrow's power system and its users.

The big picture

To better understand grid modernization overall, let's start with a broad definition. The U.S.

Department of Energy offers a list of must-have items for the modern grid. It includes support for sustainable renewable resources, as well as greater resilience and reliability, enhanced flexibility, and affordable power to help maintain economic prosperity.

For Aclara, a division of Hubbell Utility Systems, grid modernization starts with distribution optimization. But what does this mean? There are no widely accepted industry standards for defining distribution optimization, but any efforts should:

- **Maximize system utilization and minimize network losses.** "While the U.S. electric transmission and distribution system is among the most efficient in the world, roughly 6 % of total generated electricity is lost in the system," noted a 2016 study by researchers at the Department of Energy's Pacific Northwest National Lab. In other words, there's room for improvement in system losses.
- **Extend the life of distribution capital assets.** Overloaded transformers and other grid devices experience shortened asset life. When utilities can see loading versus device ratings, they can right-size equipment and avoid premature equipment failure.
- **Minimize operating expenses.** It's much less expensive to fix a potential problem before people start calling the utility because the power is out. When system operators proactively find and repair failing grid components, they avoid customer outages and overtime charges that often result when crews are dispatched to an emergency rather than just a daily maintenance call.
- **Maintain acceptable power quality and adequacy of supply**. These are the two jobs an electric utility cannot shirk: Deliver enough power to meet demand, deliver it with enough quality to not damage customers' equipment.

So, how do you optimize grid infrastructure? Here are seven tips that can help:

1. **Power factor correction:** The lower the power factor on a distribution system, the more inefficiently the real power – power that does actual work – is being delivered. In other words, low power factor means utilities must deliver more power, which means an increase in current on the lines. "The inefficiencies associated with low power factor require larger power plants and bigger transmission lines to generate and deliver the higher currents," noted an article in Renewable Energy World.
2. Phase imbalance **and loss reduction:** Even if a utility's A, B and C phases are completely balanced coming out of the substation, plenty of conditions can push them out of balance. Among them are level unequal system impedances, an unequal distribution of loads and even bad connections. When phases are imbalanced, line losses result.

3. **CVR, Volt/VAR optimization:** Utilities that aren't doing conservation voltage reduction or CVR are likely missing out on an opportunity. Here's an example of potential savings from a small public power utility in Tennessee. This utility serves some 30,000 customers and operates 1,500 miles of line. When the utility implemented a CVR project, it was able to achieve an average monthly savings of nearly $70,000 while reducing average peak by more than 5%.
4. **Demand response and load control:** Remember the discussion of load factor above? Load factor is average load divided by peak load, so reducing peaks will result in a higher, improved load factor. Demand response allows utilities to reduce peaks by incentivizing customers to shift or curtail energy use.
5. **DERs, storage, load shifting:** Distributed generation reduces distribution and transmission costs and line losses. Often, though, it comes onto the grid via variable renewable resources. Storage resources can help balance the grid when intermittent generation was due to weather or nightfall. Load shifting is another way to incorporate more renewables without adding grid assets.
6. **Real-time, predictive detection of equipment failures**: Predictive maintenance can help utilities control repair expenses, reduce outages, find and eliminate impending faults and monitor asset performance. These activities enhance reliability and efficiency of system operations.
7. **IIoT (industrial internet of things) devices and sensors:** Traditional data gathering at a utility has meant employing a labor-intensive and time-consuming process sending crews down the line to measure current and voltage across different points on the system. The system worked when all the power delivered to a feeder came from the substation. It *doesn't* serve utilities well now that power is being injected onto circuits through distributed generation. Today, utilities need to apply IIot devices that can help utilities collect critical data quickly.

See more, do more

Adding devices such as smart grid sensors and a variety of capacitor banks to the grid will support many of the seven optimization ideas noted above. For instance, smart grid sensors enable situational awareness because they give engineers and accurate look at voltage and VAR profiles throughout circuits. Asynchronous zero-close capacitor switch technology, on the other hand, can add capacitance in sensitive areas where it's crucial to minimize power quality issues that capacitor switching operations could cause.