Storm Hardening Capabilities

Over the last ten years, Quanta Technology consultants have led the industry in the study of strategies for infrastructure reinforcement for the purpose of reducing damage from severe weather and shortening the restoration time following weather damage. These concepts, known collectively as "storm hardening," are not new to the utility industry. Recent public and regulatory pressure; however, arising from extended restoration times following major weather events, has caused an interest by utilities in examining broader storm hardening strategies that incorporate varying elements of distribution grid design, operation and maintenance. Quanta Technology's efforts in this arena have been widely documented.

In the past, it was not deemed economical to design transmission and distribution systems to withstand major weather events such as hurricanes, linear wind storms and ice storms. The expectation was that utilities would be prepared for timely customer restorations and repairs. Today, expectations have changed and utilities are increasingly being expected to "harden" their system so that less damage occurs during such events. Efforts to harden the electricity grid must focus on two complementary and balancing elements: adaptation and survivability.

- **System Adaptation** – Preventing future damage due to extreme weather may require changes in assumptions, design standards, equipment specification, construction guidelines, maintenance and inspection procedures, "flood proofing" critical facilities or the use of innovative approaches and/or technologies.
- **System Survivability** – Survivability during and after an extreme weather event entails the ability to maintain some basic level of electrical power functionality to the communities. This necessitates some level of "resiliency" in the supply. Resiliency encompasses protection, switching, vegetation management and other measures. It also includes requirements associated with timely and accurate communication to customers.

Quanta Technology has helped many utilities address nearly every aspect of this complicated endeavor. Our extreme weather hardening projects are customized based on specific customer needs. Typical storm hardening engagements include some or all of the areas described below:

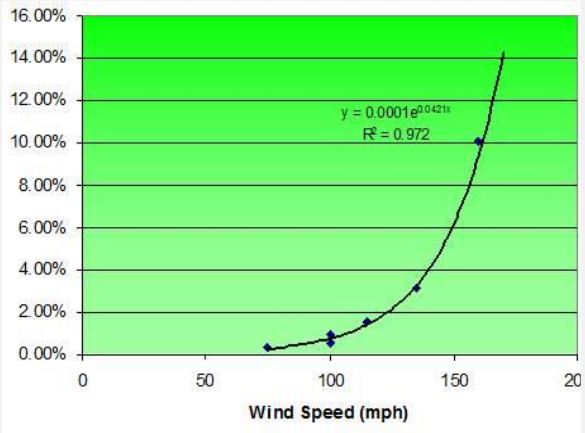
Post-Storm Audit

After a major storm, utilities are often the focus of media and regulatory investigations. This is complicated by the fact that system restoration and repairs have often been completed before storm damage data collection has been considered. Our experts have performed independent post-storm audits for many utilities and for a variety of weather events. Often, we are able to counter many of the negative accusations while simultaneously identifying opportunities for improvement in data collection, storm response and hardening.

System Hardening

System hardening is denoted as activities which make electric Systems less susceptible to damage during major storms. This includes issues related to trees, pole strength, pole loading, small wire issues, flood-related issues, underground conversion and many others. Our experts have helped many utilities quantify the benefits of potential hardening options so that they can be applied in a targeted and cost-effective manner. Most often this includes:

1) a short-term plan to address critical issues and gain hardening experience, and
2) a long-term hardeningroadmap which systematically addresses the entire system over time.



System Resiliency

System resiliency includes activities that allow a system to decrease the number of customers who experience interruption during major storms, allowing for faster restoration. System resiliency includes hardening, but also includes issues such as line switching, automation, right-of-way access, restoration sequencing, inventory management and contractor management. A goal of a resilient system is to "bend" rather than "break" when a major storm strikes. This approach is also similar to system hardening.

Capital and O&M Spending Optimization

Hardening measures need to be analyzed in two areas: 1) cost versus reliability and 2) risk versus reliability. The cost analysis should include the required amount of spending necessary to optimally achieve various levels of hardening according to an overall hardening roadmap. These costs include capital, operational and maintenance improvements, as well as development of equipment replacement criteria and roadmap.

Storm Modeling

Storm modeling is becoming increasingly important for both storm operations and hardening efforts. When a storm is approaching, system modeling can estimate the type, amount and locations of damage so crews can be stocked and pre-dispatched. During hardening and resiliency efforts, storm modeling helps to identify the most cost-effective ways to achieve specific hardening and resiliency goals. Quanta Technology has extensive experience in the area of electric utility storm modeling.

Expert Witness Support

It is not uncommon for utilities to receive a large amount of negative publicity during and after a major storm. This can result in regulatory hearings, mandated investigations, difficulties in cost recovery, and problems with rate cases that include hardening and resiliency spending. It has proven helpful in these situations for utilities to retain independent experts to provide written and oral testimony. Quanta Technology consultants have successfully provided expert witness support for utilities in the areas of storm damage and storm hardening.

Training

Quanta Technology is one of the few organizations in the world which offers training course material in electricity infrastructure storm hardening. Hardening is also included as a standard material in our reliability courses. Typical subjects covered include: weather modeling, failure modes, hardening tactics, resiliency tactics, vegetation management, extreme wind ratings, failure rate models, cost-to-benefit analysis and developing a hardening roadmap.

Quanta Technology performs hardening assessments in a manner that delivers the utility options in order to achieve the most effective desired outcome for that company and its operating environment. Our storm hardening experience is extensive and our approaches are proven, but at the same time flexible. We consider each new situation as a unique opportunity.

With leading industry consultants on the subject of asset management and aging utility infrastructure, as well as detailed utility engineering knowledge and experience, Quanta Technology can provide capabilities that address both the strategic and tactical needs of the project. Finally, we have the expertise and resources to provide regulatory support as needed to explain and justify a hardening strategy. With experience in Florida, Texas, Washington, Missouri and Massachusetts, we have been engaged with regulators in various elements of storm management and have been successful in all venues of presenting a reasonable and prudent approach to utility storm issues.

For additional information regarding Quanta Technology's Asset Operations capabilities, please contact Carl Wilkins, Director of Asset Operations at (919) 334-3092 or cwilkins@quanta-technology.com.

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