Grid modernization saint lucia

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Nestled midway through the Lesser Antilles — the emerald arc of the Caribbean islands — the island nation of St. Lucia is situated farther out to sea than any neighboring island but Barbados. It is located squarely within Hurricane Alley, the belt of warm water that spans the Atlantic between the Tropic of Cancer and the Equator. Within this belt, hurricanes spawn, gather strength, and barrel westward across the Caribbean and onward.

Such storms show every sign of continuing. St. Lucia is now one of many island nations drawing attention in world forums to the fact that large storms are becoming increasingly frequent, more powerful, and deadlier because of global climate change and the warming of the oceans. St. Lucia Electricity Services Ltd. (LUCELEC) is the country’s vertically integrated electric utility and sole provider of power to the island’s 180,000 residents and 300,000 annual tourists. It faces a challenge familiar to many electric utilities, but with greater urgency and higher stakes: how best to strengthen its T& D systems to withstand stronger, more dangerous, and more frequent storms, and how best to allocate resources to ensure value for money.

These urgent initiatives take place in the context of broader ongoing policy and strategy questions at the national level, such as how best to decrease reliance on imported diesel fuel for generation, integrate privately managed sources of generation, and determine what role renewable energy (including wind, solar and geothermal assets) will play in the generation portfolio and broader economic, consumer and market initiatives that support commercial, residential and industrial markets in St. Lucia.

Established in 1964, LUCELEC has provided power to the island’s growing economy for nearly 60 years, helping to make possible the country’s incredible economic growth led by tourism and agriculture. The country is 100% electrified, with 72,000 customers. LUCELEC’s generation portfolio consists of 86.2 MW of generation, a 66-kV transmission backbone and seven distribution substations that supply power to 32 distribution feeders running at 11 kV. The T& D systems are largely overhead, with some key segments recently placed underground. Utility poles are a mix of wood and reinforced concrete poles.

In late 2022, LUCELEC worked with POWER Engineers Inc. and its partner K& M Advisors LLC to establish risk metrics and identify a portfolio of ranked projects with the potential to improve resiliency and reliability in the face of strengthening storms.

Grid reliability and grid resilience are related but different. Grid reliability is clearly understood and measured, as established by IEEE 1366, the well-known standard for power distribution reliability indices used by the electric power industry for decades. However, building consensus on a precise definition and metric for resiliency has been an industry challenge for many years that may not yet be fully resolved. In general, resiliency is specified in terms of prevention, recovery and survivability. Many definitions conflate resilience

with reliability or provide notional directives while failing to establish metrics.

J.D. Taft of the Pacific Northwest National Laboratory stated in a paper, the Electric Grid Resilience and Reliability for Grid Architecture: “Reliability measures are not useful for quantifying resilience. Resilience is in large part about what does not happen. Grid resilience is the ability to avoid or withstand grid stress events without suffering operational compromise or to adapt to and compensate for the resultant strains so as to minimize compromise via graceful degradation.”

LUCELEC and POWER Engineers began their collaboration by reviewing the nature and frequency of previous outages, characterizing the technical, commercial and economic consequences of different outages and damages to grid infrastructure. Team leads from the utility’s engineering, construction, customer care, distribution grid planning and generation groups provided data and insights as well as recommended project priorities worth considering. Given the many technical and climatic challenges the utility faces, two factors bode well for LUCELEC: It is financially self-sustaining and profitable, and its technical teams are highly competent with excellent firsthand experience.

One challenge confronting not only St. Lucia but many electric utilities worldwide: The majority of the world’s distribution systems were built decades ago. The construction standards were less stringent than today’s standards and developed in the context of smaller, less-frequent and weaker storms. Like the rest of the Caribbean, St. Lucia finds itself needing to establish improved construction standards that correspond to Category 5 hurricane wind loads. This has important economic consequences for utilities and their customers, as reinforced utility poles can mean billions of dollars in investment.

LUCELEC and POWER looked at reinforcing key segments of the utility’s grid, including feeders supporting key customers, important segments of the cross-island transmission backbone and distribution lines that had shown proclivity to damage in previous storm events. The teams examined not just material design requirements but also improvements to foundation design to reduce vulnerability of utility poles during landslide events stemming from heavy rain. Having well-developed construction, operations and maintenance standards that are reviewed and updated regularly is essential in helping a utility provide resilient service to its customers during these types of events.

POWER and LUCELEC then reviewed the existing maintenance programs in place. Vegetation management is at the core of every electric utility’s success. Trees, branches, and debris can all be blown onto lines during storm events, causing short circuits, breaking insulators, and simply downing lines. While LUCELEC records do show tree branches and fallen trees continue to cause challenges, the team’s joint review of the maintenance being undertaken on a continuous basis revealed LUCELEC had a maintenance and vegetation management program in place sufficient to meet the needs of the utility.

The review of maintenance and inspection led to an interesting opportunity to make recommendations for pole inspection. Thorough inspection of distribution poles is an arduous, expensive and time-consuming task that challenges even large utilities. The challenge is greater in tropical nations like St. Lucia, where the humid,

maritime climate means faster and more aggressive degradation of untreated wood due to humidity, rot, and wood-boring or consuming insects like termites.

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