Sierra leone data center energy storage

Power lines downed by hurricanes and wildfires. Power outages during heat waves leave millions to suffer in darkness. Our newsfeeds explode with these scenes almost daily. From generation, to transmission and distribution (T& D), to end-user demand, no part of the electricity grid is immune to the impacts of climate change. Power system operators around the world are racing to build system resilience to climate change. But how?

To protect the systems they manage, utilities and grid operators first need to know which hazards could harm them. Tools that model potential climate change scenarios and identify specific risks and impacts can help them build models to pinpoint these hazards, but accurate models depend on data. Whether it''s data on wind speed and precipitation in coastal areas where hurricanes are growing more intense, data on temperature and drought where wildfires are becoming harder to fight, or data on how many customers are plunged into darkness during a power outage and how that power is restored, enhancing climate resilience is a continual risk management process that depends on data.

Strengthening power system climate resilience also requires investment in infrastructure. Deciding when and where to invest though is complex, even more so in countries or geographies where local data is scarce and risk assessment depends on an ability to work with global data and climate change models.

To assess climate change risk and recommend adaptations, Tetra Tech evaluated the vulnerability of each part of the country''s power system based on a set of criteria that define exposure, sensitivity, and adaptive capacity. Once the vulnerabilities of a specific infrastructure were identified, Tetra Tech defined and prioritized the adaptation options to address the potential risks to that infrastructure.

Using historical and projected climate data from the World Bank Climate Change Knowledge Portal, Tetra Tech modeled two climate change scenarios: a moderate one (SSP2-4.5) and a severe one (SSP5-8.5). Parameters included average annual precipitation, largest five-day cumulative precipitation, maximum temperature, and number of hot days (T > 35?C). For a granular assessment of climate change impacts, Tetra Tech used the climate projections tool from the ECOWAS Observatoryfor Renewable Energy and Energy Efficiency.

These efforts resulted in a snapshot of two climate change scenarios in Sierra Leone. In Scenario 1 (moderate / SSP2-4.5), precipitation will increase across the country between 2030 and 2070, mainly in the northern and southern regions. In Scenario 2 (severe / SSP5-8.5), precipitation will decrease slightly between 2030 and 2050 and temperature, number of consecutive dry days, and number of hot days will increase for the whole country, with intensity varying by region.

For each scenario, Tetra Tech counted flooding, landslides, wildfire, and sea level rise as general risks for infrastructure projects and avoided high-risk areas for site selection and T& D routing. Specific risks included technical energy or efficiency losses for all generation, transmission, distribution, and national dispatch center projects. For lower-risk locations suitable for new infrastructure, Tetra Tech assessed the climate change impacts by type of project and region. Tetra Tech then prioritized adaptation options based on criteria related to costs, benefits, and feasibility of implementation, and defined the design parameters by impact and project.

The study"s resulting recommended adaptations for Sierra Leone"s power grid based on potential climate change impacts include:

The stakes are high, with power system stability in Sierra Leone entwined with economic and national security. Extreme weather events can increase the financial risk to utilities by contributing to sharp fluctuations in demand for electricity, which affects operational costs. What"s more, enhancing the resilience of existing assets can be expensive. Decision makers struggle to calculate the return on these investments because the impacts are typically realized only when a major event threatens the reliability of service. The integration of climate change considerations into the design of future infrastructure investments can help minimize those financial risks, even when hard to quantify.

For Sierra Leone, the Power Sector Infrastructure Feasibility Study will bolster plans to safeguard the stability of the country"s economy by helping decision makers protect the electricity grid in the face of unprecedented climate change challenges.

Dean Gluckman is an electrical engineer at Tetra Tech and has 17 years of experience directing the implementation of clean energy transmission and distribution programs. He has managed more than 15 large power infrastructure projects across 10 African countries with a capital expenditure of over $1 billion. Dean has expertise in the design, specification, and project management of transmission and distribution power lines, distribution substations, and tariff and interface metering. He has worked on feasibility studies and conceptual designs and is familiar with aspects of the electricity supply industry, including power system studies, energy storage, hydrogen, renewable energy, and network planning.

Rodrigo Chaparro is a climate change expert at Tetra Tech with more than 20 years of experience implementing cost-effective solutions that promote growth with minimum climate impact. He has deployed risk mitigation instruments for energy investments, financing mechanisms for decarbonization projects, and technical and policy solutions for renewable energy and energy efficiency applications. Rodrigo has managed major initiatives from multilateral banks, the U.S. Government, the United Nations, and Japanese and Danish aid agencies. At the Inter-American Development Bank, he led the implementation of the Energy Savings Insurance Program and supported the design of new loans and technical assistance in sustainable transport and battery energy storage.

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