RISING SEAS AND ELECTRICITY INFRASTRUCTURE: POTENTIAL IMPACTS AND ADAPTATION OPTIONS FOR SAN DIEGO GAS AND ELECTRIC (SDG&E)

ABSTRACT

Rising sea levels pose a threat to California’s energy infrastructure and the coastal communities that it serves. To better understand this threat, this study analyzed the exposure of San Diego Gas & Electric Company (SDG&E) electricity assets in San Diego County to climate change-driven coastal wave flooding, tidal inundation, and coastal erosion. The study found that the greatest potential direct impacts are damage to four substations in the Mission Bay and San Diego Bay areas. By modeling the potential costs to customers from unserved energy due to service disruptions driven by exposed substations, this study found economic impacts could—under an extreme sea level rise scenario in the late 21st century compounded by a 100 year storm—range from $1.2 billion to $25 billion, assuming no adaptation actions are taken. Nearby communities could also experience indirect impacts if critical customers served by the substations—such as sewage pumping stations, hospitals, airports, and ports—are affected by outages. For other asset types, potential direct impacts are expected in the form of increased maintenance and repair costs.

The research team identified a range of potential adaptation measures to build resilience to potential impacts. The application of flexible adaptation pathways emerged through the study as the best approach to improve implementation of these measures in the face of future uncertainty. Rather than selecting adaptation measures based only on what is known today, flexible adaptation pathways help establish information that that should be tracked, termed signposts, to help navigate uncertainty, set thresholds that trigger adaptation actions, and determine if an adaptation plan is meeting its objectives. Using these pathways, four initial climate adaptation actions were identified for SDG&E: 1) enhance coastal storm prediction and response, 2) identify signposts and thresholds that indicate when the need for an adaptation decision is approaching, 3) conduct consultations with regional stakeholders to identify opportunities to improve community-wide resilience, and 4) improve and fine-tune cost-benefit analysis methods to increase accuracy and confidence in cost-benefit estimates that incorporate climate change.
HIGHLIGHTS

- Geospatial overlay analyses of SDG&E assets to climate-change-driven wave flooding, tidal inundation, and erosion found that thousands of electric substations, transformers, power lines, and other equipment are potentially exposed to damage under scenarios of sea level rise (SLR) of 0.5 and 2.0 m (1.6 and 6.6 ft.) for both annual and 100-year storm events. Most of the potentially exposed infrastructure is distribution infrastructure, rather than transmission infrastructure.

- The greatest potential direct physical impacts to assets are damage to substations in the Mission Bay and San Diego Bay areas. In these areas, four substations could be exposed to 100-year coastal wave flooding by mid-century, and 16 substations could be exposed to 100-year coastal wave flooding by the end of the century. If these substations were to be flooded with enough water to damage electrical equipment, substation service may be interrupted until flooding subsides and equipment is repaired. Substations are essential for providing service to customers, and temporary service loss of a substation could cause thousands of customers to lose electric service. For other asset types (e.g., underground duct banks, pole-mounted transformers, and others), potential impacts are more likely to take the form of increased maintenance and repair costs rather than widespread service disruptions.

- Because of the importance of substations to the distribution systems, the research team assessed potential economic impacts and general disruptions to other critical infrastructure in the community induced by loss of service from the potentially exposed substations. The assessment found that service disruptions could cost customers more than $300,000 under a 2 m (6.6 ft.) sea level rise scenario with periodic tidal inundation to approximately $25 billion for an extreme scenario of 2 m (6.6 ft.) of sea level rise coupled with a 1-in-100 year erosion and flood event. Furthermore, nearby communities could experience additional cascading adverse consequences if critical customers served by these substations—such as a sewage pumping station, a hospital, the airport and port, and a Navy yard—lose service.

- The “flexible adaptation pathways” approach, which refers to the implementation of adaptation over time to allow for the adjustment of actions based on new information or circumstances, emerged through the study as the appropriate framework for the utility to conceptualize adaptation actions, and to provide practical guidance to sequencing their implementation.

- Rather than predetermining a set of adaptation investments based only on what is known today, following flexible adaptation pathways will allow
SDG&E to make and adjust adaptation decisions as technologies, customer needs, climate change information, the economic and policy landscape, and other factors change over time in order to maintain an acceptable level of risk. For example, under one pathway, the utility might first enhance its existing coastal storm prediction systems to better prepare for coastal wave flooding and also incorporate future climate change projections to model future impact zones, and then decide which adaptation measure is most appropriate to reduce the associated risks; doing so would allow more efficient and effective adaptation than if adaptation measures were implemented without first having this more detailed impact modeling.

ACCESS
For access to the full report, please email Susan.wilhelm@energy.ca.gov

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