Resiliency Planning at the Zero-emissions Seaport of the Future

By Christine Houston

The Port of Long Beach is the second-busiest port in the U.S., handling $200 billion in goods in 2018. As you might think, moving all that cargo requires power. While we were not impacted by the highly destructive wildfires that many local governments in California contended with in late 2018, our marine terminals experience a dozen or so grid outages each year. These outages range from approximately 30 minutes to a day or more in duration and have various causes, from planned outages to transformer failures to accidental and unfortunate encounters between electrical infrastructure and very large vehicles.

The Long Beach Board of Harbor Commissioners has adopted the most aggressive emissions reduction goals in the country; if we meet these goals, every marine terminal here will be zero-emissions by 2030. To accomplish this, our cargo-handling equipment must be powered by electricity. We believe most of this power will come from the utility grid. We can generate a small portion onsite, but implementing sufficient renewable energy is challenging due to a shortage of space for solar equipment, and poor wind resources. Fully electric marine terminals will quadruple the Port's power demand. This impacts all other electricity users and makes our marine terminals vulnerable to a single point of failure – a grid outage. This conundrum is pushing the Port to explore new innovations that harness the capabilities of sophisticated software and controls that can mitigate some of the increased demand as well as better utilize solar power and battery storage – including the batteries that will run our cargo-handling equipment – to bolster resilience.

Diesel generators currently provide minimal backup power for operations buildings and computer servers, but these, too, will be vulnerable in a long-term outage or natural disaster. Grid outages already cripple seaport operations since ship-to-shore cranes and refrigerated container yards are already electrified. A one-day outage can cost a single, large container terminal to suffer upwards of tens of millions of dollars in lost work hours and perished cargoes. Those losses are then transferred to consumers, including consumers in California where approximately 40% of our imports end up.

The amount of electricity that a zero-emissions seaport will use is staggering and the problem of resilience will require integrated systems that facilitate a number of power strategies. The key to integrating these strategies? Microgrids. These resilient systems are popping up all over the country as a means to provide reliable energy in the face of extreme weather events, an explosion in on-site power systems such as rooftop solar panels and power walls, and increasing power demands from electric vehicles large and small. Microgrids can "island" from the utility grid to provide electricity in times of emergency, but more often than not stay connected to modulate power demand which reduces stress on regional grids.

At last count, California already led the nation in deploying microgrids for local government facilities, according to Navigant Research. If one includes microgrids also deployed by businesses, military bases, universities and utilities, over 100 such systems have been successfully developed. With proposed utility programs to shut down high risk areas of the state during high winds and resulting heightened wildfire risk, interest is growing in microgrids among the more than 338 water districts and 275 fire districts that pepper the state. (There is a total of 11 harbor districts in California.)

The Port of Long Beach is developing a microgrid that will enhance the resilience of its critical security facility, the Joint Command and Control Center. The project will help us understand how to maintain operations during outages, reduce pollution from back-up diesel generators, and alleviate stress on the utility grid by providing support services such as demand response. Schneider Electric, a global energy technology company, is providing sophisticated microgrid controls to achieve long-term islanding by integrating new energy features -- a solar array, advanced stationary batteries and a mobile battery unit to

our grid-tied site. The mobile battery unit is particularly noteworthy since it will be mounted on a wheeled chassis and can be moved by heavy-duty vehicle to provide power in other locations.

Significant funding -- $5 million -- for this project comes from the California Energy Commission. Without state support, this project would not move forward now. Outside funding to demonstrate cutting-edge technologies is critical to local governments, where there is little appetite for financial risk. The project is designed to be cost-effective and replicable across any facility with a central headquarters and distributed energy resources, including seaports, airports, rail yards, wastewater treatment plants, landfills and other critical facilities. The demonstration should also show that microgrids can be cost effective by allowing solar power that is generated during the day to be used in the evening, when electricity rates are the highest. But we suspect that the true value will relate to the hard-to-quantify value of resilience against a major power disruption.

The Port of Long Beach is committing to an electrification strategy that will encompass technologies that don't even exist yet. Moving forward with a microgrid – to demonstrate a flexible and nimble network that can accommodate a diversity of potential energy resources – helps California's citizens lead the way in proving that environment and economy are not diametrically opposed.

Christine Houston is manager of sustainable practices at the Port of Long Beach.