



A blue banner with white text. The text reads: "Power Electronics & Energy Conversion Workshop", "August 2-3, 2023", "8:00 AM MT – 5:30 PM MT", and "Albuquerque, New Mexico". The background of the banner shows a blurred image of a power plant or industrial facility.

Electrifying Everything – Total Cost Impact on the Grid and How Storage can Mitigate Impacts

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Background on Issues



A little about Quanta Technology

- Quanta Technology is an independent technology, consulting, and testing company providing business and technical expertise, advanced methodologies and processes, to utilities and others in the power and energy industries.
- Quanta Technology is a wholly-owned subsidiary of Quanta Services, Inc. (NYSE: PWR). Quanta Services is a \$24 Billion dollar company with over 40,000 employees that safely provides engineering, procurement, and construction (EPC) services for comprehensive infrastructure needs in the electric power and oil & natural gas industries.

Challenges to “Electrifying Everything”

Studies are showing enormous infrastructure build-out Needs Across the U.S.

- \$50 Billion for California distribution grid investments by 2035 to accommodate electrification
- \$38 Billion to \$52 Billion for BG&E Infrastructure Upgrades to meet decarbonized initiatives
- \$60 Billion for Massachusetts EV Impact and fully eliminating natural gas

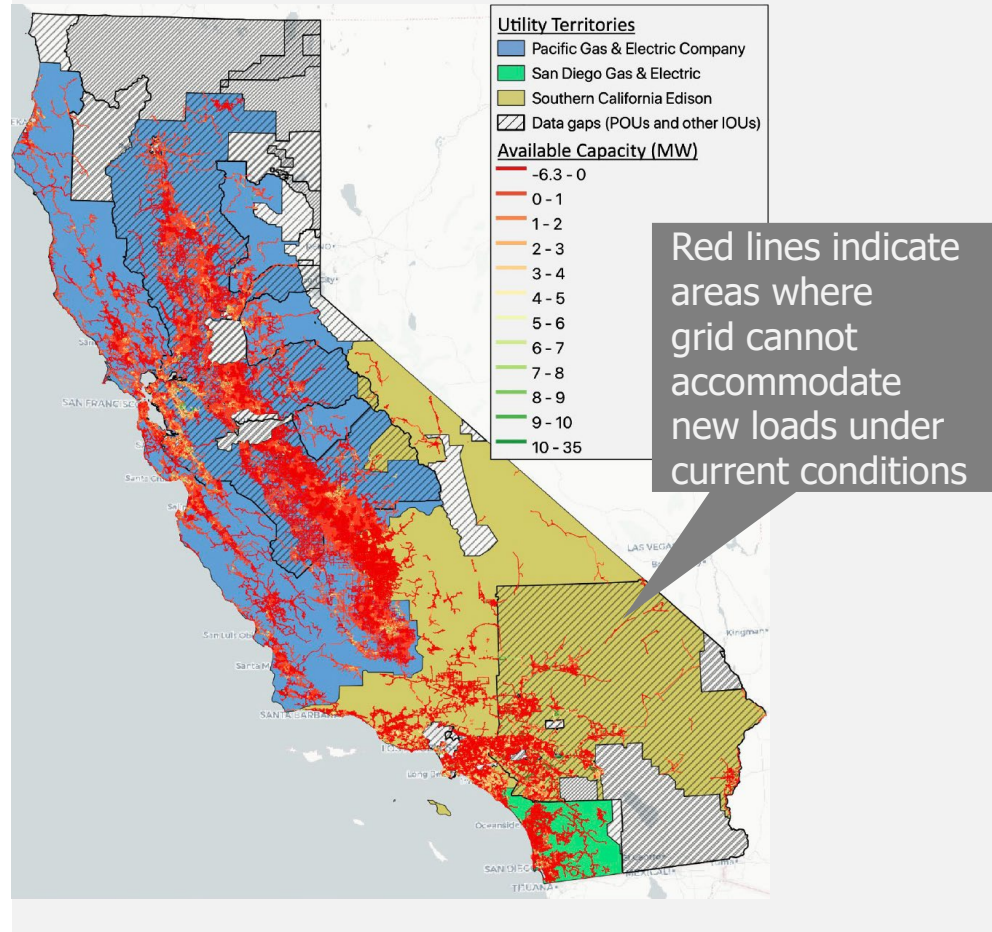


Heavy-duty Chargers can be 150X the size of light-duty vehicle chargers and diesel engines account for most harmful emissions impacting society.

California charging needs, modeled – significant grid upgrades needed to accommodate EV charging needs



Significant portion of California grid cannot accommodate new load



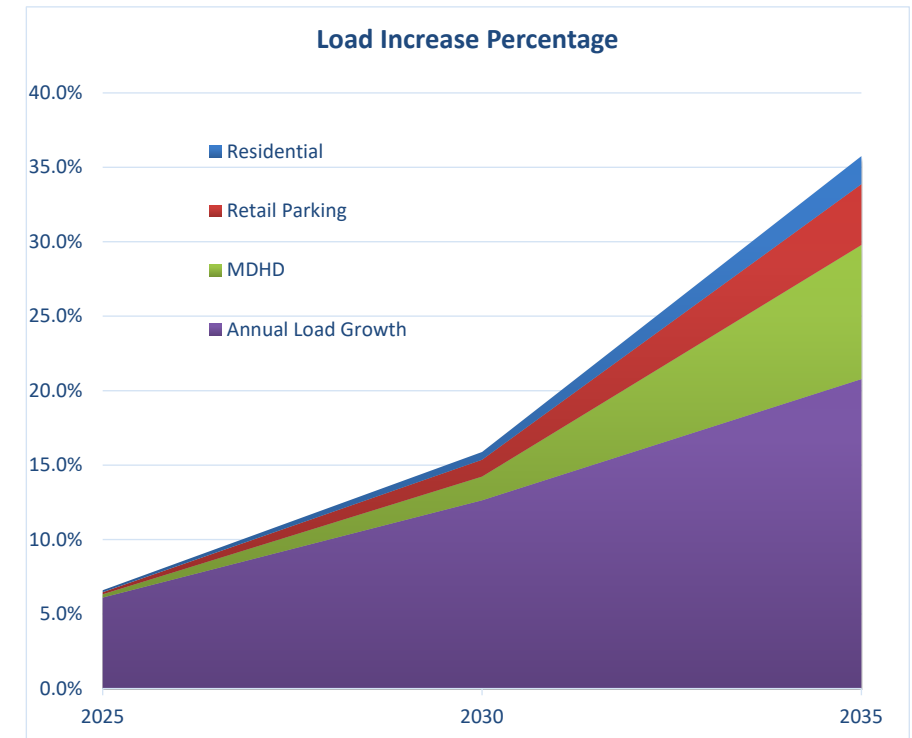
Estimated ~5,000 DCFC chargers needed across California to support regional mobility





The Challenges are not limited to Electric Vehicles

- Utilities are beginning to lump together decarbonization, electrification of transportation, and electrification of building technologies as well
- New EV Loads are coupled with “organic” growth at a utility to assess the impact on the utilities’ grid
 - Chart on the right shows impacts of “organic growth” along side transportation electrification of vehicles classes – organic growth is driving increases
- Findings show assets at risk of overloading – but how to manage the cost of mitigating issues?
 - Because organic growth is also occurring, initiatives such as managed charging will not suffice as EV charging isn’t cause of all growth
 - In this case, in the first 10 years, managed charging programs will not stem the growth impacts that utility will be experiencing





Impact will not be Limited to Only Major utilities

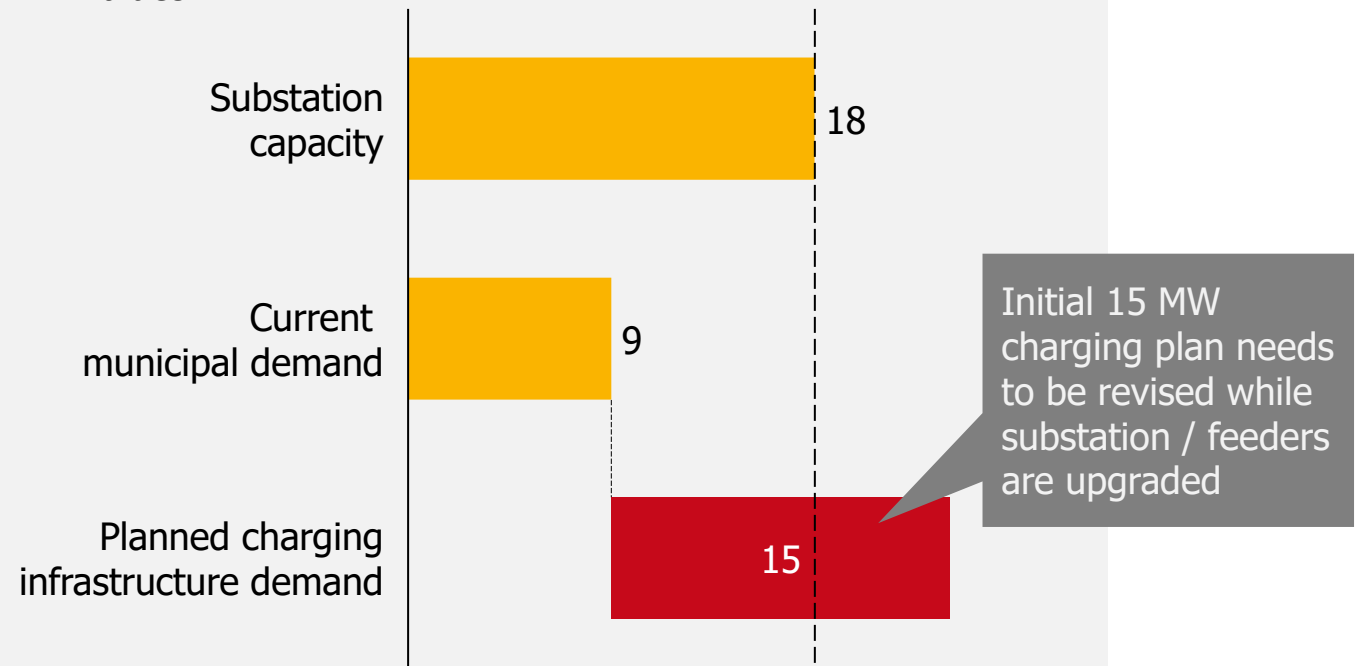
- Example: In this case, the expected load was targeted at 15 MW – the rural town that the solution was targeted at had an overall load of 8 MW.
- The strategy on electrifying this “trucking route” not only needs infrastructure approach, but affordability and cost are just as large an issue for supporting the load

Fleet transit stops are often located in rural areas with legacy infrastructure



Many of these locations often lack necessary infrastructure to enable electrification

All values in MW

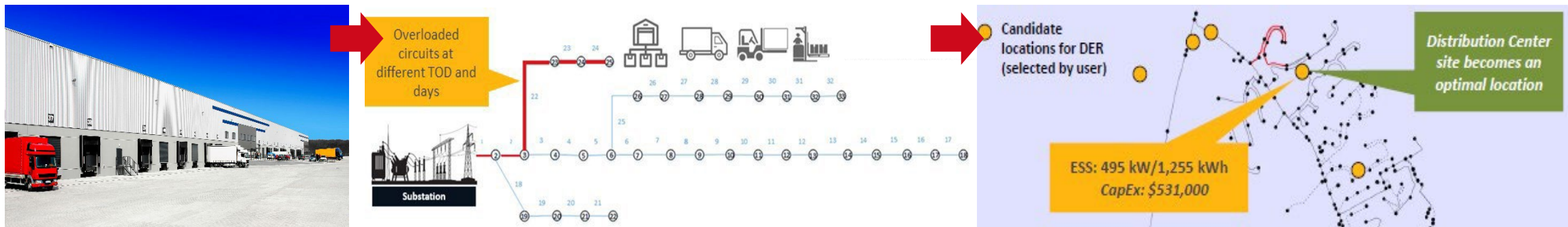




Storage Can Be Used to Mitigate These Issues:

Tapping into Grid Edge DER May play a Greater Role due to Cost Rather than Performance

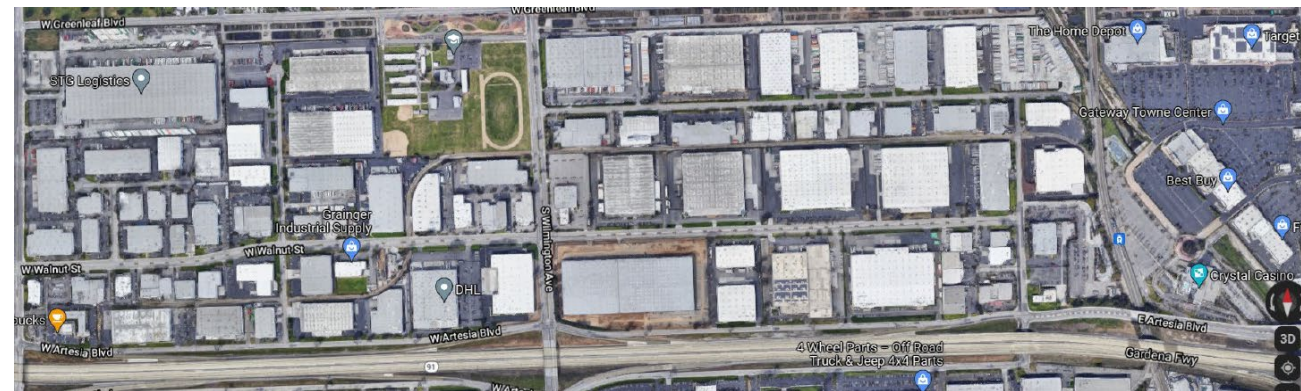
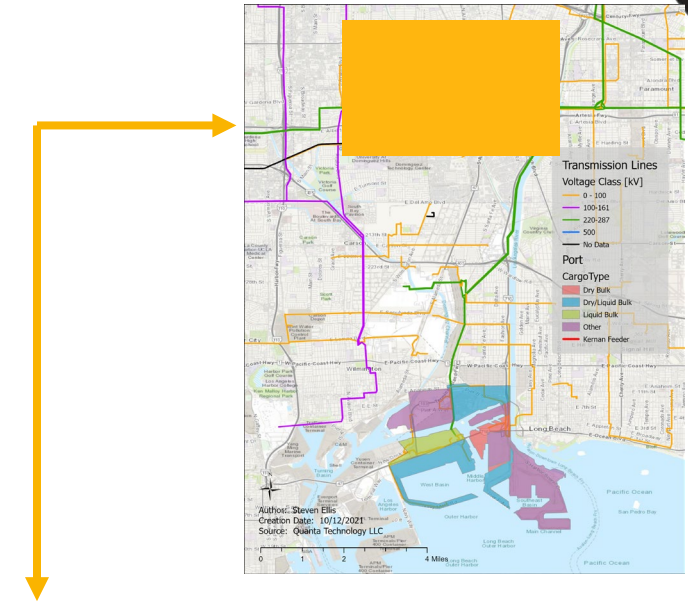
- DER solutions are better suited to accommodate the decentralized Freight Supply Chain that is likely to unfold with port electrification
- The main challenge with loads concentrating at a single site is how to back up the load, mitigate the load, or ease pressures that we are seeing on the grid?
 - The loads can be too large to be effectively served by storage if too concentrated
 - Trucking facilities naturally decentralize with electrification, making deploying solar and storage potentially viable at the site itself
 - The photos shows the stresses on the grid the facility causes as well as the ability of DER to mitigate, in this case, in sizes that will not be overwhelmed by the magnitude of the site and are very deployable today



The Challenges Multiply as the Number of Facilities Electrifying Grow



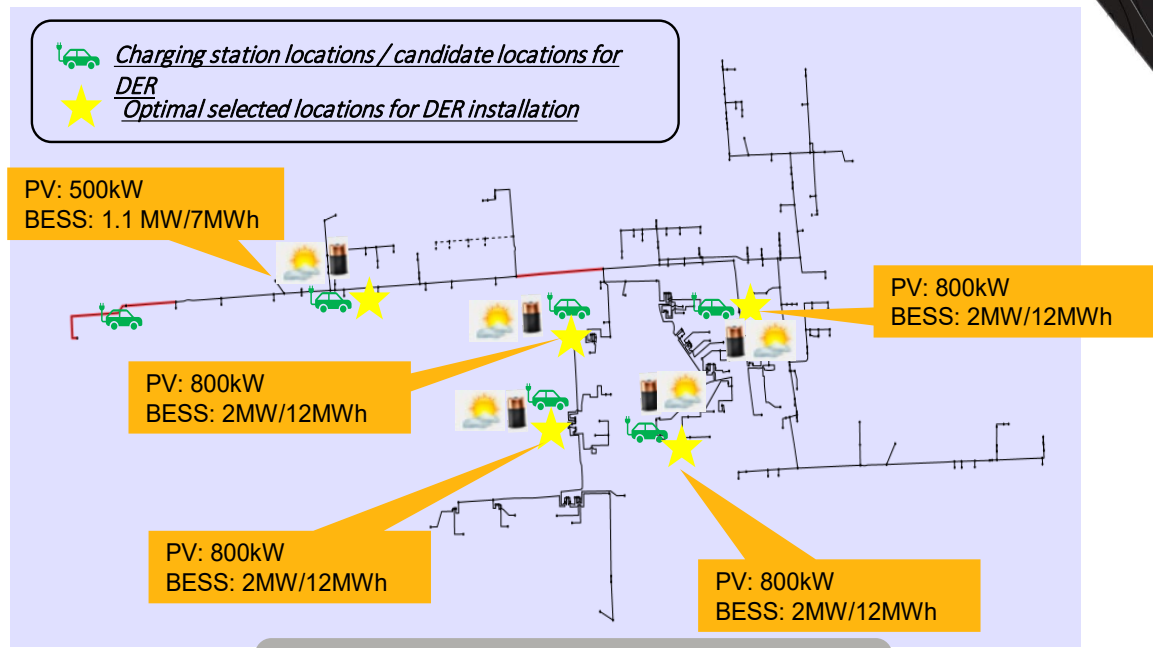
- Tools allows the same process to be scaled to cases where there are multiple facilities electrifying
- Example shows of a specific feeder and substation that is being impacted by activities at the Port of Long Beach in California
 - Electrification is already occurring at the port; however, drayage trucks and distribution facilities supporting the port will also electrify outside the facility.
 - The facilities around the port “house” the trucks supporting the port and will require charging. The routes, distances, and duty cycles are well aligned to electrification
 - Takeaway is that it isn’t one facility – it is 20-30 facilities potentially electrifying their trucking fleets with fast-chargers. Also, loads appearing outside large facility infrastructure
- Energy Justice transforms EV load impact from a load problem to an emission problem as well
 - Heavy-duty vehicle fleets are often located in less affluent areas, Emissions have an outsized negative impact on these communities
 - Quanta Technology has developed a tool that can monetize the cost of these impacts on specific communities





Evaluating Mitigation via Infrastructure Upgrades, Reconfiguration, and DER

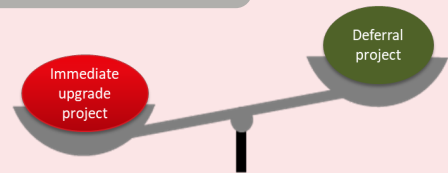
- In this case, the Tools examine multiple-fleet facility charger loading to determine optimal DER deployment
- This “Feeder” level approach allows the utility to make the use-case of DER/BESS, a traditional upgrade, or a hybrid combination
- This case shows that despite “spreading” DER/BESS and limiting its size, the traditional upgrade is still the cheaper option
- Tools provide transparency to utility next steps
- The monetized benefits determined by DERVT created by relieving feeder violations the tool can create incentives to deploy DER



- *Total overload in all 3 lines: ~17MW*
- *Estimated upgrade cost: \$14M*

BCA:

- Cumulative benefit: \$ -9.6M
- Net present value of benefit: \$ -4.8M



Negative benefits: Deferral project is not cost effective