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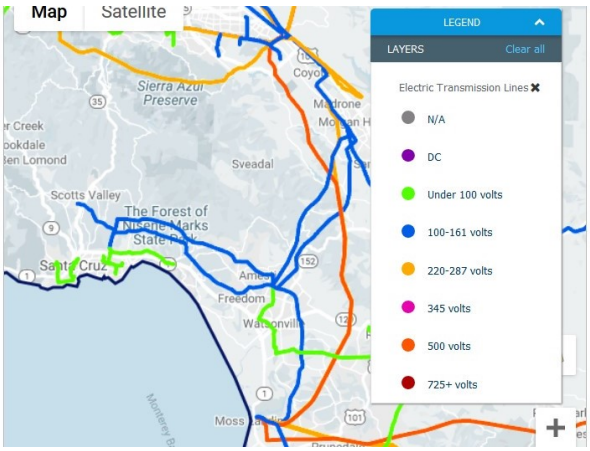
A Renewable Community Energy System for Santa Cruz

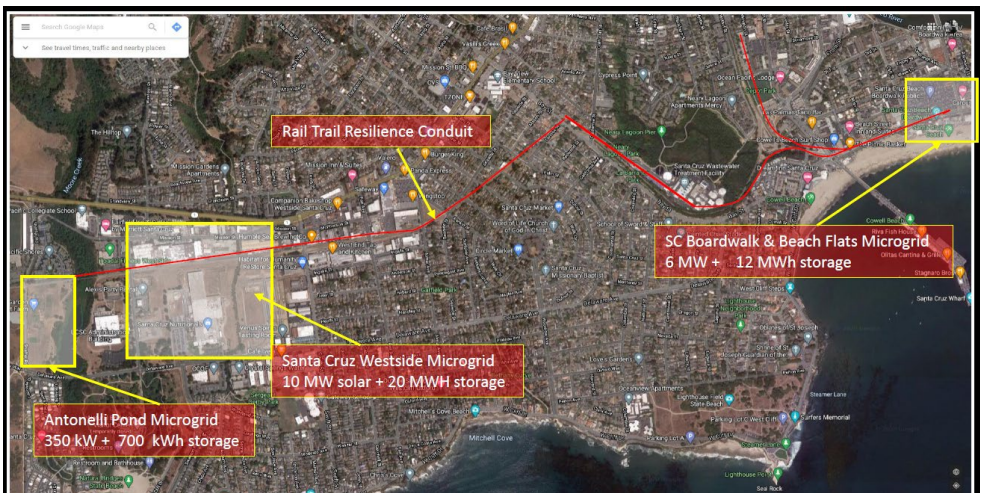
Proposal from the Sustainable Systems Research Foundation

The City of Santa Cruz is especially vulnerable to climate impacts on its power supply. It sits at the end of PG&E's high voltage transmission lines and, as a result, experiences more than its share of power fluctuations and outages. The wildfires and power blackouts of 2019 and 2020, and the rolling outages during the 2020 August and September heat waves, made clear that much of Northern California is at risk from such events. Such power shutoffs and the rising cost of electricity have disproportionate impacts, as well.



High Voltage Power Lines in Santa Cruz County

While the State of California and its investor-owned utilities (IOUs) are making serious efforts to address the unreliability of the power grid in their service territories, these do not at present extend beyond provision of emergency, diesel-powered generators for "resilience." Moreover, both the IOUs and the California Public Utilities Commission are seeking to quash initiatives to design and develop renewable community energy systems, which could provide local resilience, reliability, equity and climate action. Santa Cruz is in a unique position to build and operate such a system and to become a green lab for the rest of the state and the country. This document presents a proposal for such a system.



Elements of the SC Community Energy System

The Santa Cruz Community Energy System consists of four elements:

The Santa Cruz Westside Microblock is the core element in the system, consisting of a 10-Megawatt roof and ground-mounted solar microgrid and battery storage. It will serve light industrial buildings in an area bounded by the Mission Street extension, Natural Bridges Drive and Delaware Street.

The SC Boardwalk & Beach Flats Power Grid is a 6-Megawatt solar microgrid plus storage, built over adjacent parking lots, serving the Boardwalk and Beach Flats.

The Antonelli Pond Connected Community is a 500-kilowatt microgrid plus storage serving a planned community of new homes on property adjacent to Antonelli Pond. These homes will incorporate various smart building technologies and sensors and will be monitored for energy use and performance.

The Rail Trail Resilience Conduit is a buried power line running in the publicly owned Rail Trail right-of-way, connecting the three microgrid projects to essential facilities downtown.

As currently planned, this will be a fully-autonomous and islanded system, operating separately from the PG&E transmission and distribution grid, until such time as rules, regulations and financing options governing both installation and grid connections will be liberalized. The complete community energy system will be developed and deployed over a ten-year period.

The SC CES will proceed in four phases:

Phase 1 (2023-25): Solar panels and batteries will be expanded on the University Business Park (aka, the Wrigley Building) and its parking lots and installed on and

around Santa Cruz Nutritionals (Lipton Building). The two elements will be linked via a shared conduit.

Phase 2 (2023-25): Solar plus battery systems will be installed on the north side of Mission Street extension and connected to the Sandbar Solar system. Construction will begin on the Antonelli Pond development.

Phase 3 (2025-27): The Boardwalk and Beach Flats project will be built. The individual elements of the Westside Microblock will be connected. The Antonelli Pond project will be completed. All three will operate "locally."

Phase 4 (2027-29): The Rail Trail Resilience conduit will be built, connecting the three projects and extending to essential facilities downtown. If possible, a link to the PG&E grid will be turned on.

What will all of this cost? We estimate that the capital cost of the four components, including generation, batteries and new transmission lines, will be around $50 million although, without detailed design, planning, engineering and financial studies, however, it is difficult to be more precise. The landscape for such microgrids in California is changing rapidly and these changes may have significant impacts on costs. The table below provides a broad-brush description of the financials and economics of the community energy system as currently envisioned (more detailed calculations are available on request).

Project name	**Westside**	**Boardwalk**	**Antonelli**	**RT conduit**
Solar capacity (MW)	10	6	0.5	6 miles
Storage capacity (MWh)	20	12	1	NA
Lifetime	30	30	30	30+
Electricity production in Year 1 (kWh)	15,800,000	9,500,000	790,000	NA
Green bonds rate	2.5%	2.5%	2.5%	2.5%
Solar + storage capital cost	$2/watt	$2/watt	$2.50/watt	$1,000,000/mi
Total cap cost after credits	$22,750,000	$14,770,000	$1,260,000	$9,832,000 capex
Cumulative profit over project lifetime	$45,360,000	$25,515,000	$1,948,000	
Levelized Cost of Energy over 30 years (¢/kWh)	10.4	11	11.8	1.3 additional

These are simplified cases that do not take into account declining system efficiency, tariff increases over time, discount rates or distribution costs for feed-ins to the grid. Capital costs of solar plus storage are based on the average per megawatt 2018 cost for a "utility-scale" 100 MW solar and storage plant installed, rescaled to each system. **Source:** Ran Fu, Timothy Remo, and Robert Margolis, " 2018 U.S. Utility-Scale Photovoltaics-Plus-Energy Storage System Costs Benchmark," National Renewable Energy Lab, November 2018, at: https://www.nrel.gov/docs/fy19osti/71714.pdf (accessed September 12, 2020).