Clean Coalition

Making Clean Local Energy Accessible Now

Community Microgrids

Optimizing Grid Integration of Energy Storage

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Clean Coalition (nonprofit) Mission

To accelerate the transition to renewable energy and a modern grid through technical, policy, and project development expertise

There are Three Vital Grid Services

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Service	Key to Delivering Service
Power Balancing	Capacity of real power (W)
Voltage Balancing	Location of reactive power (VAr)
Frequency Balancing	Speed of ramping real power (W)

The Duck Chart only addresses Power Balancing, but Distributed Energy Resources deliver unparalleled location and speed characteristics

Community Microgrids = the Grid of the Future

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A Community Microgrid is a new approach for designing and operating the electric grid, stacked with local renewables and staged for resilience.

Key features:

- A targeted and coordinated local grid area served by one or more distribution substations
- High penetrations of local renewables and other Distributed Energy Resources (DER) such as energy storage and demand response
- Staged capability for ongoing renewables-driven power backup for critical and prioritized loads across the grid area
- A solution that can be readily extended throughout a utility service territory – and replicated into any utility service territory around the world

UCSB Community Microgrid – Area Map

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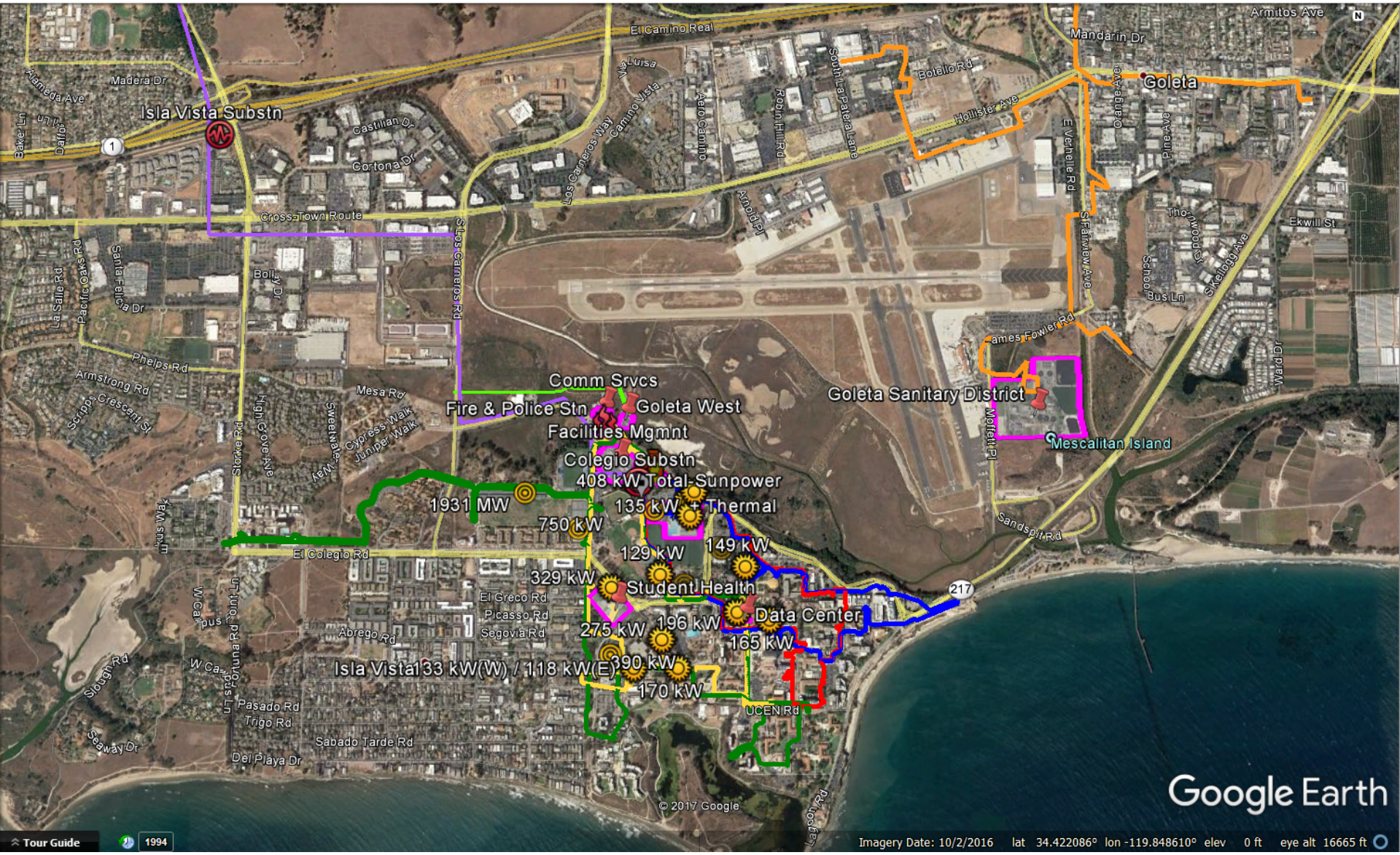

UCSB Community Microgrid – Phase 1

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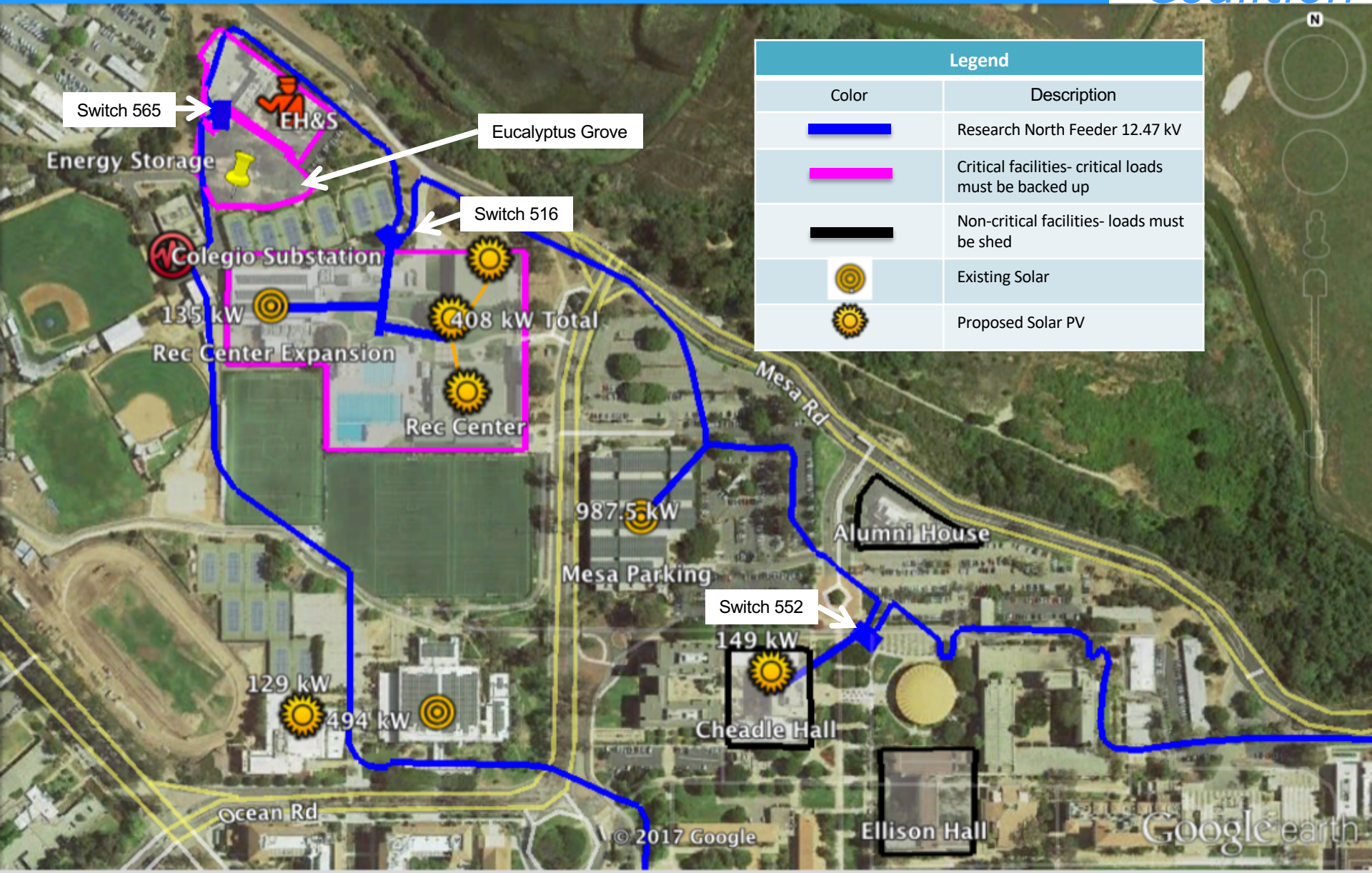

UCSB Community Microgrid – Phase 1 + 2

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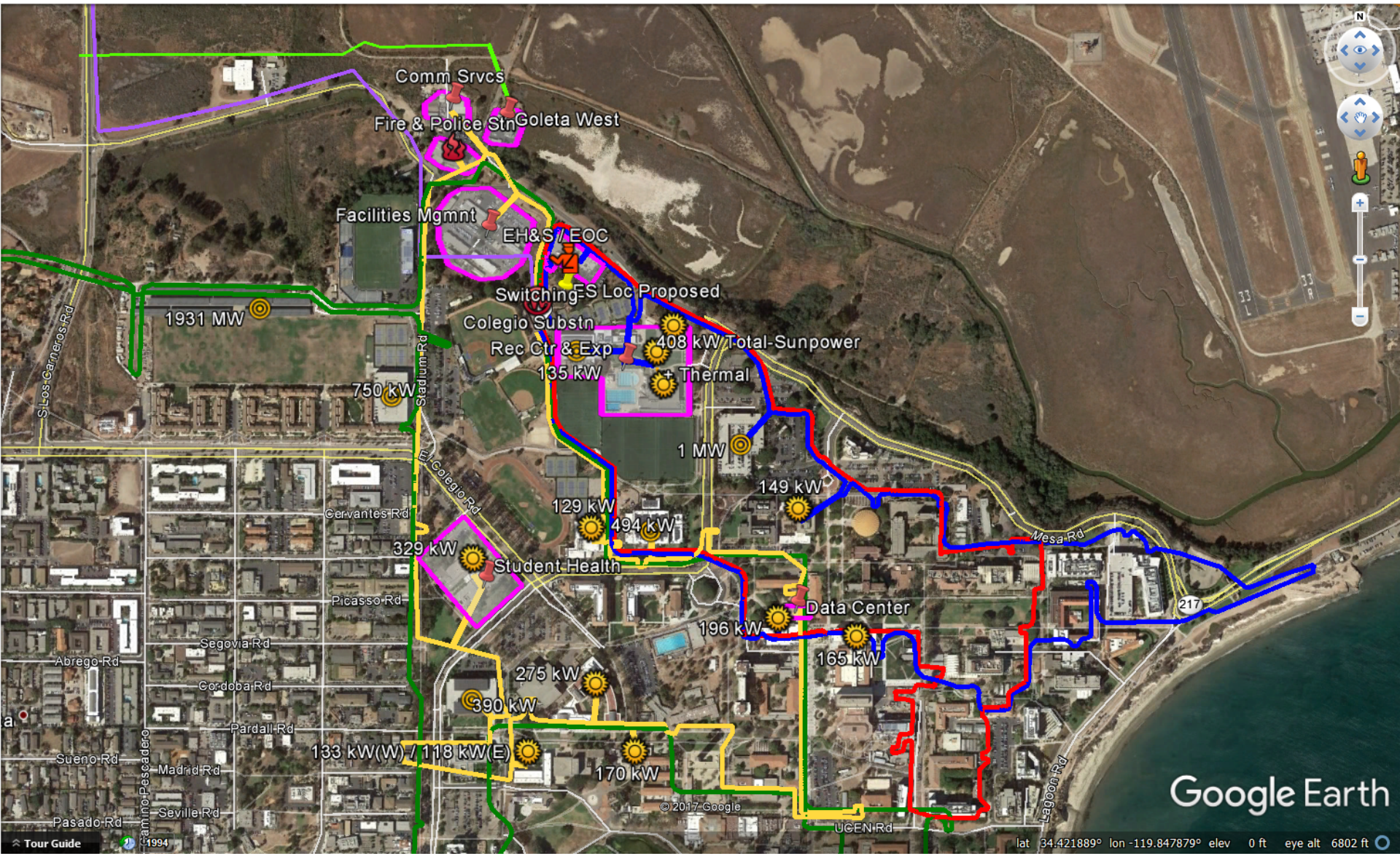
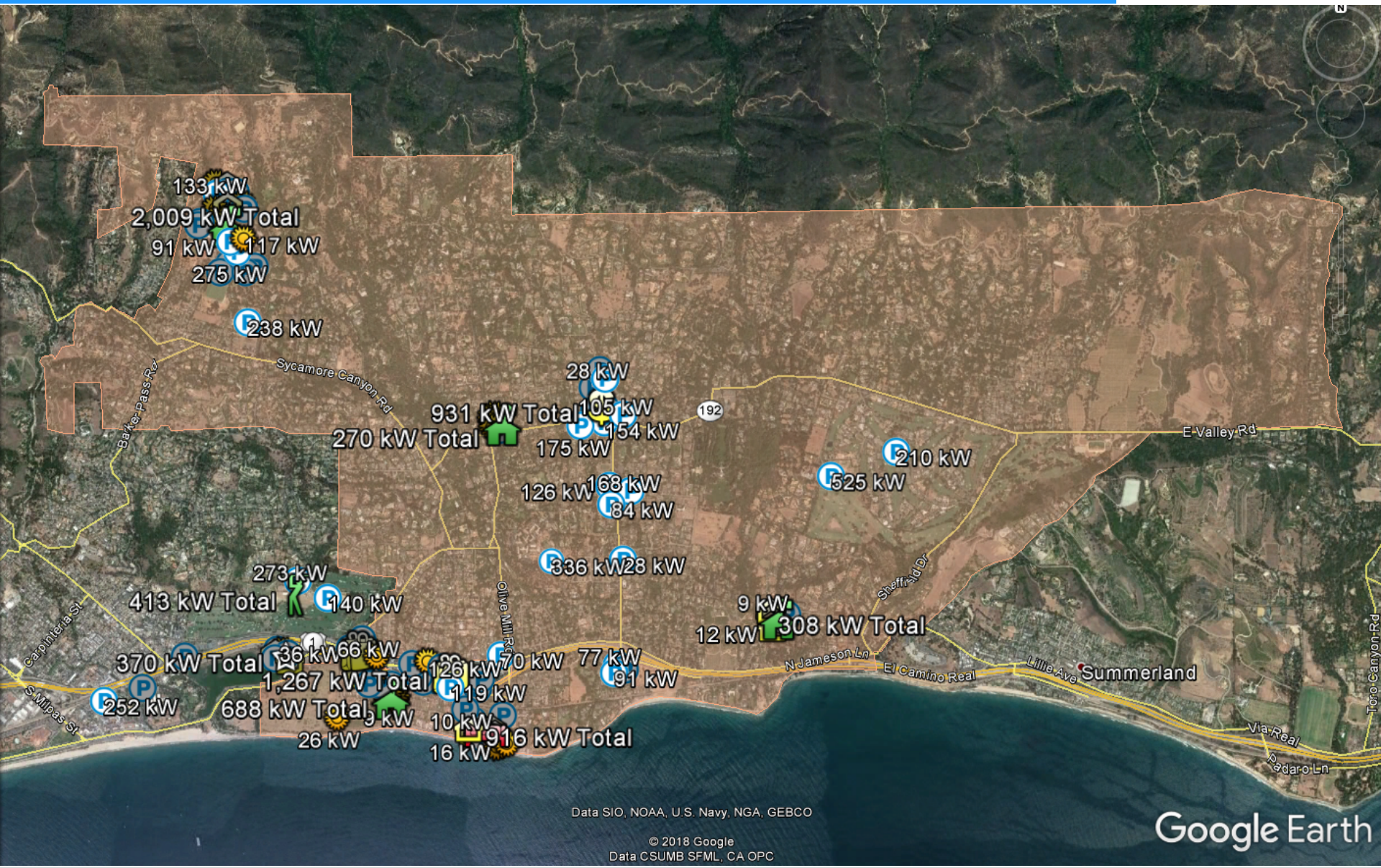
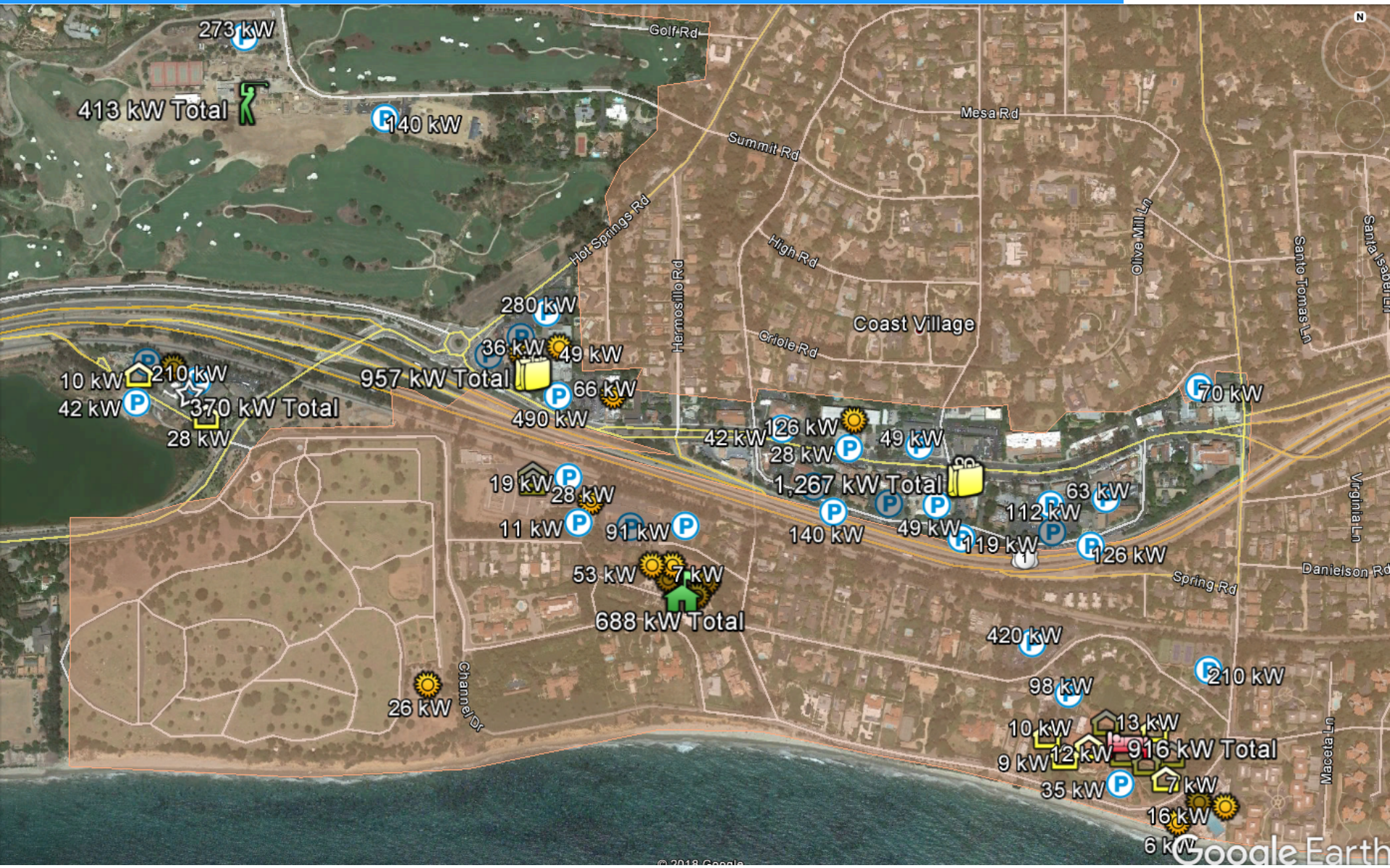


Solar Siting Survey (SSS) for Montecito



Montecito Community Microgrid map view



Montecito Community Microgrid block diagram

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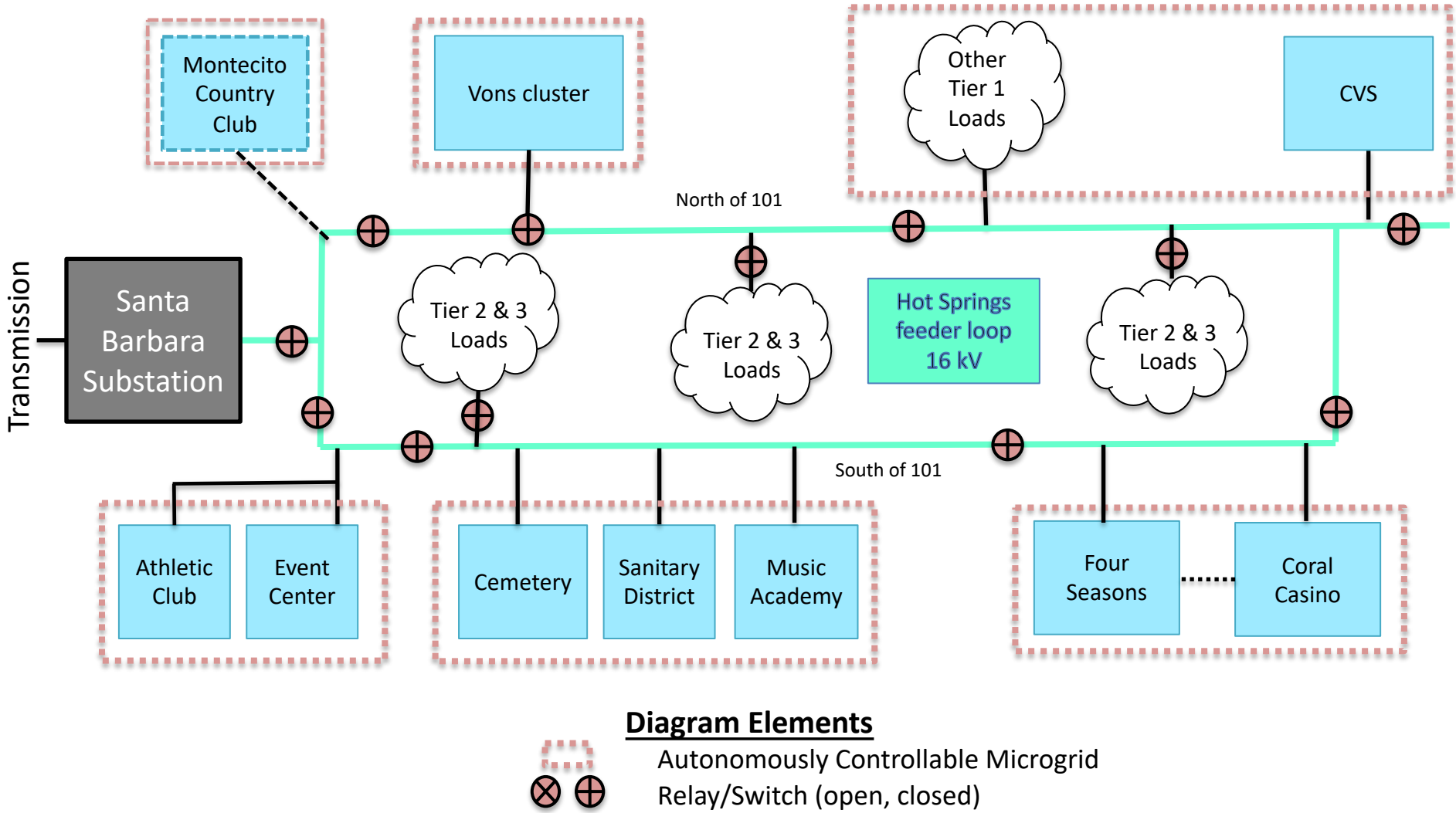
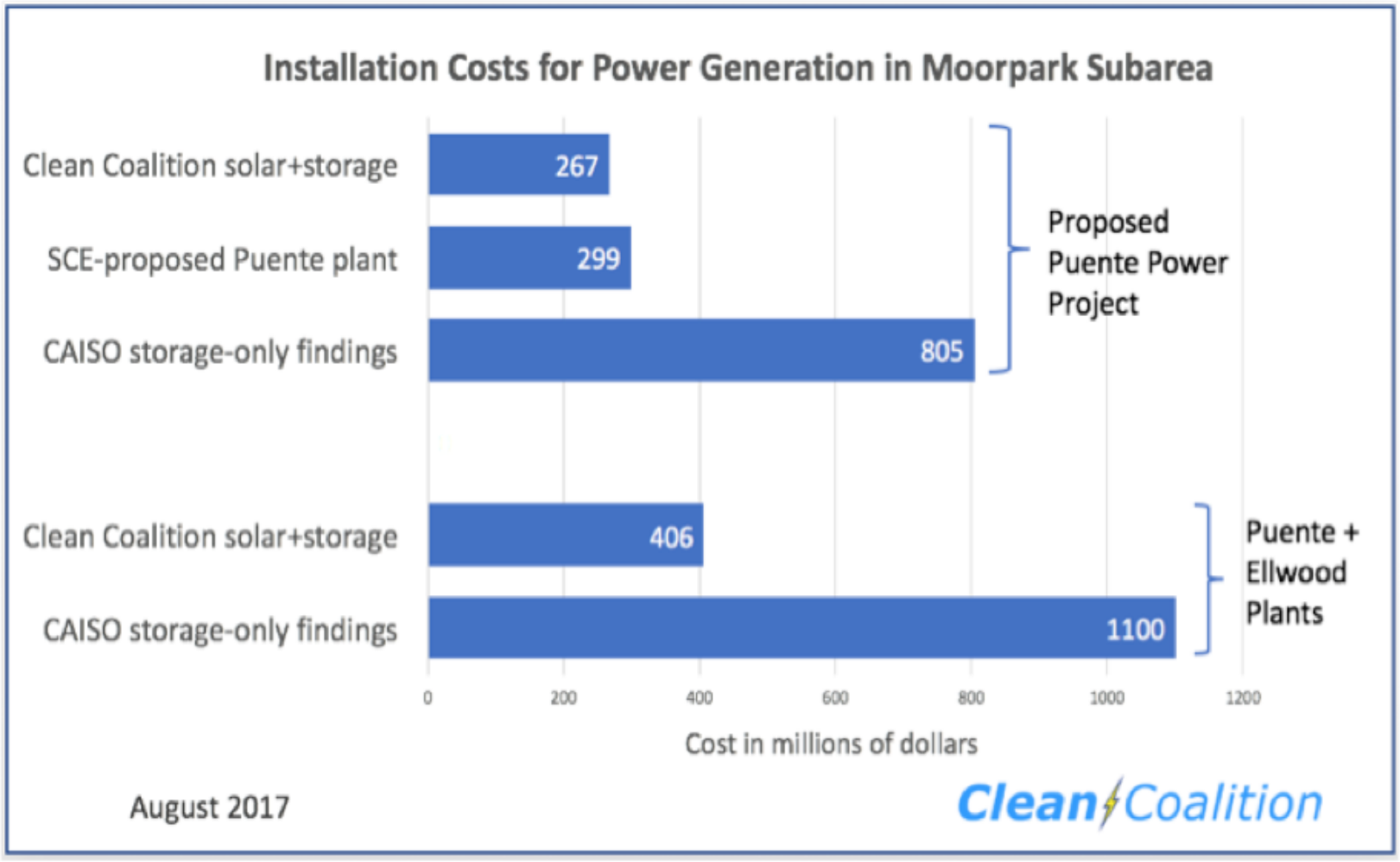


Community Microgrids obviate gas peakers

- Thanks in part to our analysis, California regulators have rejected Ellwood and signaled their intent to reject Puente as well
- “Let’s take this opportunity to move the Oxnard community into the clean energy future — which is here already.” *Carmen Ramirez, Mayor Pro Tem of Oxnard*
- Significant opportunity to leverage this work to prevent future new gas plant proposals across the country

Community Microgrids cheaper than gas peakers

- Leveraging our technical and economic expertise, the Clean Coalition conducted an analysis to determine the viability of solar+storage as a better alternative



Community Microgrids cheaper than transmission

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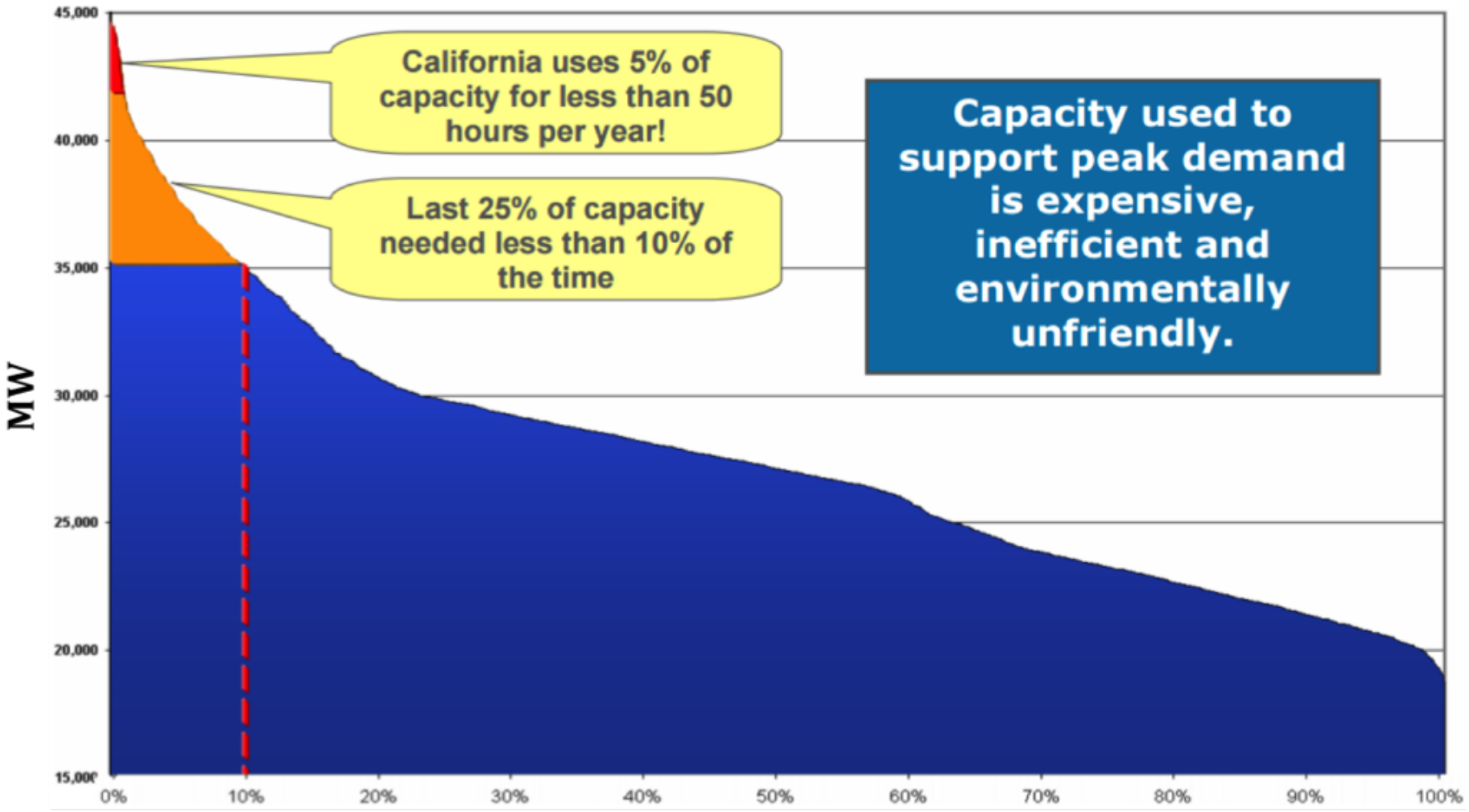
Transmission Grid Load Duration Curve

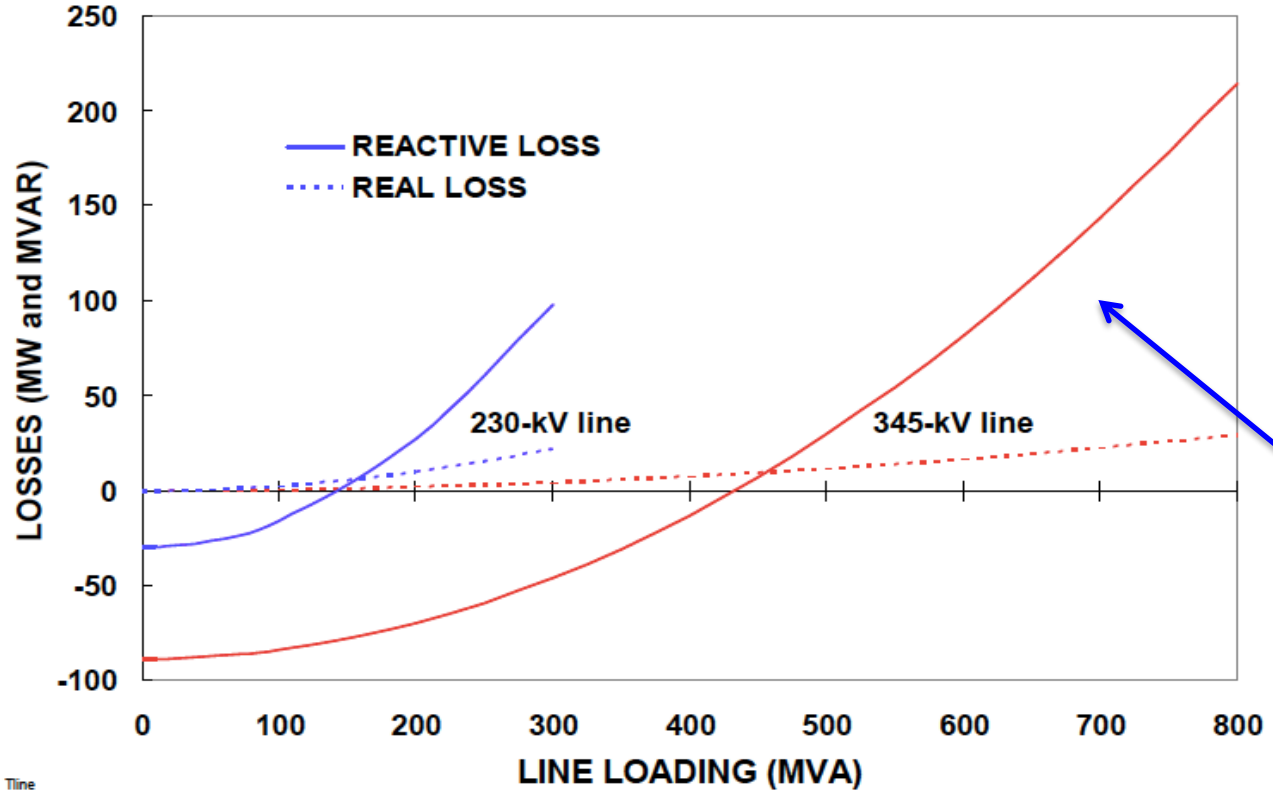


Source:
PG&E Demand Response Programs: An Overview, November 17, 2009

Distributed Voltage Regulation – Location Matters

"The old adage is that reactive power does not travel well."

Oak Ridge National Laboratory (2008)



T&D lines absorb 8-20x more reactive power than real power.

Prevent Blackouts: When a transmission path is lost, remaining lines are heavily loaded and losses are higher.

Figure 1-1. Transmission line absorption of reactive power.

Source: Oak Ridge National Laboratory (2008)

Replace SONGS with Local Solar+Storage

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VS

$80 million
2 Synchronous Condensers
San Luis Rey Substation
450 MVAr
(minus line losses = **300 MVAr**)

600 MW of local solar+storage with advanced inverters oversized by 10% set at 0.9 Power Factor = **300 MVAr**

CAISO proposed 320 MW DG solar + 580 MW storage = **900 MW** **(plus 1,400 MW of nat gas)**

EV Charging Infrastructure with Local Balancing

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Peek at the Community Microgrid future

Ecoplexus project at the Valencia Gardens Apartments in SF. ~800 kW meeting ~80% of the total annual load.