



Goleta Load Pocket Community Microgrid & Direct Relief Showcase



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Mission

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

Renewable Energy End-Game

100% renewable energy; 25% local, interconnected within the distribution grid and ensuring resilience without dependence on the transmission grid; and 75% remote, fully dependent on the transmission grid for serving loads.

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 distribution grid area served by one or more substations – ultimately including a transmission-distribution substation that sets the stage for Distribution System Operator (DSO) performance.
- Ability to utilize existing distribution grid infrastructure to serve the Community Microgrid during broader grid outages
- High penetrations of local renewables and other distributed energy resources (DER) such as energy storage and demand response.
- Staged capability for indefinite renewables-driven backup power for critical community facilities across the grid area – achieved by 25% local renewables mix.
- A solution that can be readily extended throughout a utility service territory – and replicated into any utility service territory around the world.

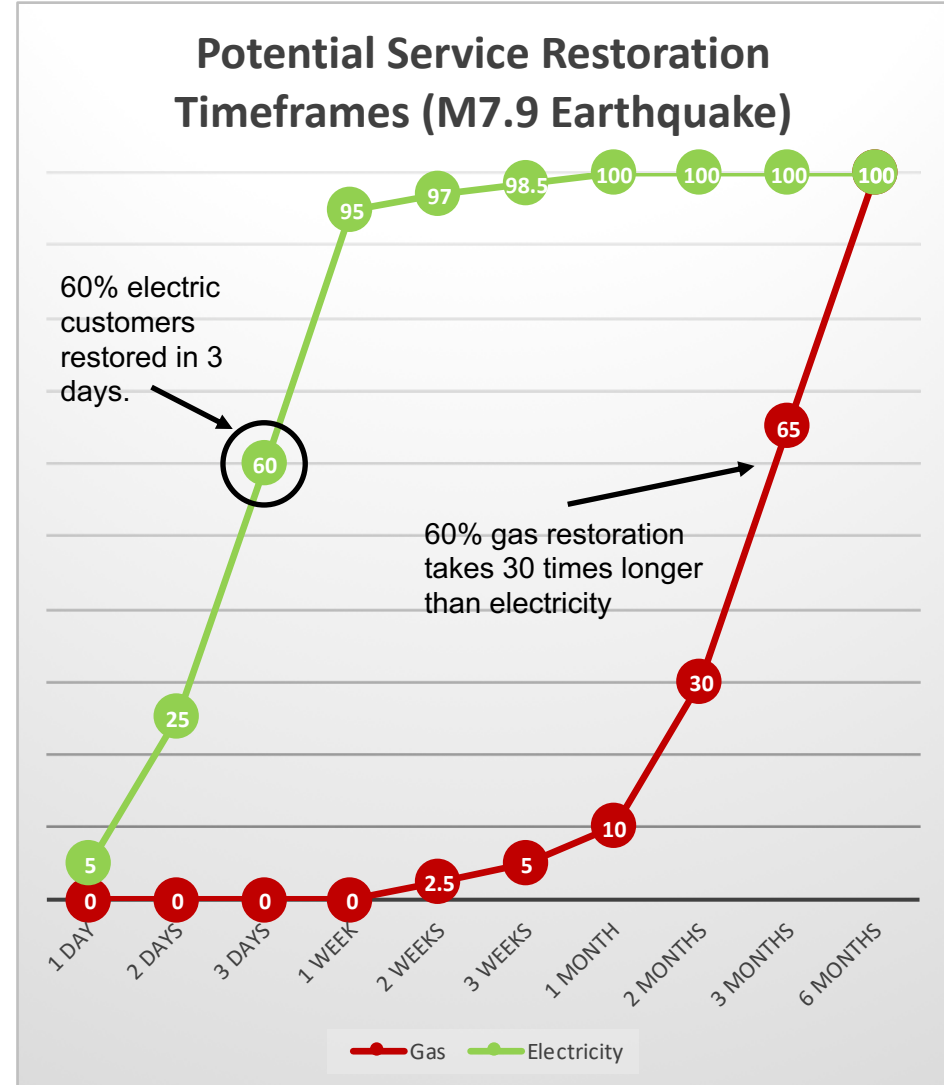


Natural gas infrastructure is not resilient

- **Assertion:** Gas-driven generation is often claimed to be resilient.
- **Reality:** Gas infrastructure is not resilient and takes much longer to restore than electricity infrastructure.
- **Threats:** Gas infrastructure can be flat-out dangerous and highly vulnerable to earthquakes, fires, landslides, and terrorism.



2010 San Bruno Pipeline Explosion



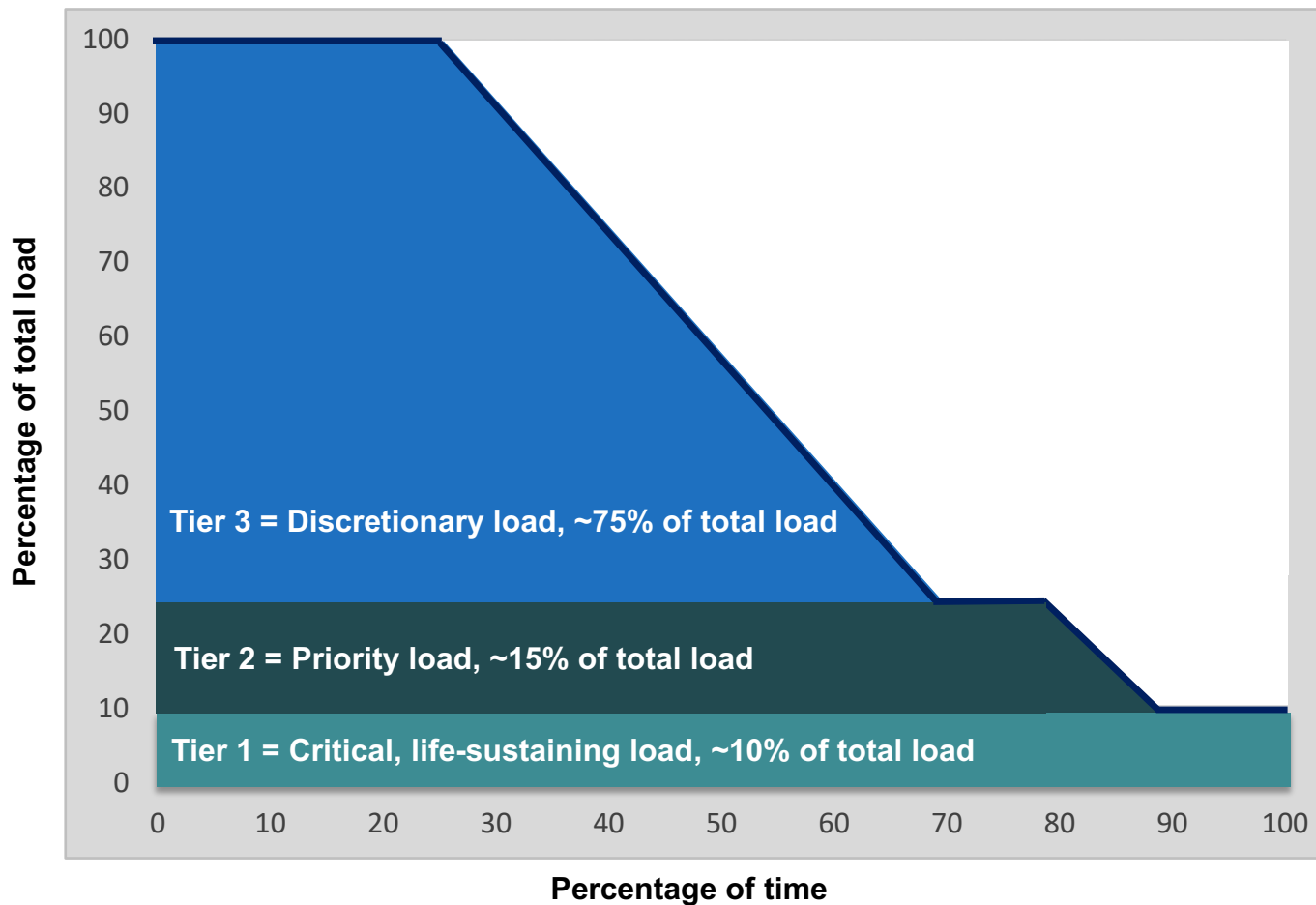
Source: The City and County of San Francisco Lifelines Study

Value of Resilience (VOR) depends on tier of load

- Everyone understands there is significant value to resilience provided by indefinite renewables-driven backup power
 - But, nobody has yet to quantify this value of unparalleled resilience.
 - Hence, there is an economic gap for innovative Community Microgrid projects while learning is still in the early stages.
- The Clean Coalition aims to establish standardized [Value of Resilience](#) (VOR) for critical, priority, and discretionary loads that will help everyone understand that premiums are appropriate for indefinite renewables-driven backup power of critical loads and almost constant backup power to priority loads, which yields a configuration that delivers backup power to all loads a lot of the time
- The Clean Coalition's VOR approach will establish standardized values for resilience of three tiers of loads:
 - Tier 1 are mission-critical and life-sustaining loads, crucial to keep operational at all times, including during grid outages. Tier 1 loads usually represent about 10% of the total load.
 - Tier 2 are priority loads that should be maintained as long as long as doing so does not threaten the ability to maintain Tier 1 loads. Tier 2 loads are usually about 15% of the total load.
 - Tier 3 are discretionary loads make up the remaining loads, usually about 75% of the total load, and are maintained when doing so does not threaten the ability to maintain Tier 1 & 2 loads.



Percentage of time online for Tier 1, 2, and 3 loads for net zero solar + 2 hours storage microgrid at UCSB

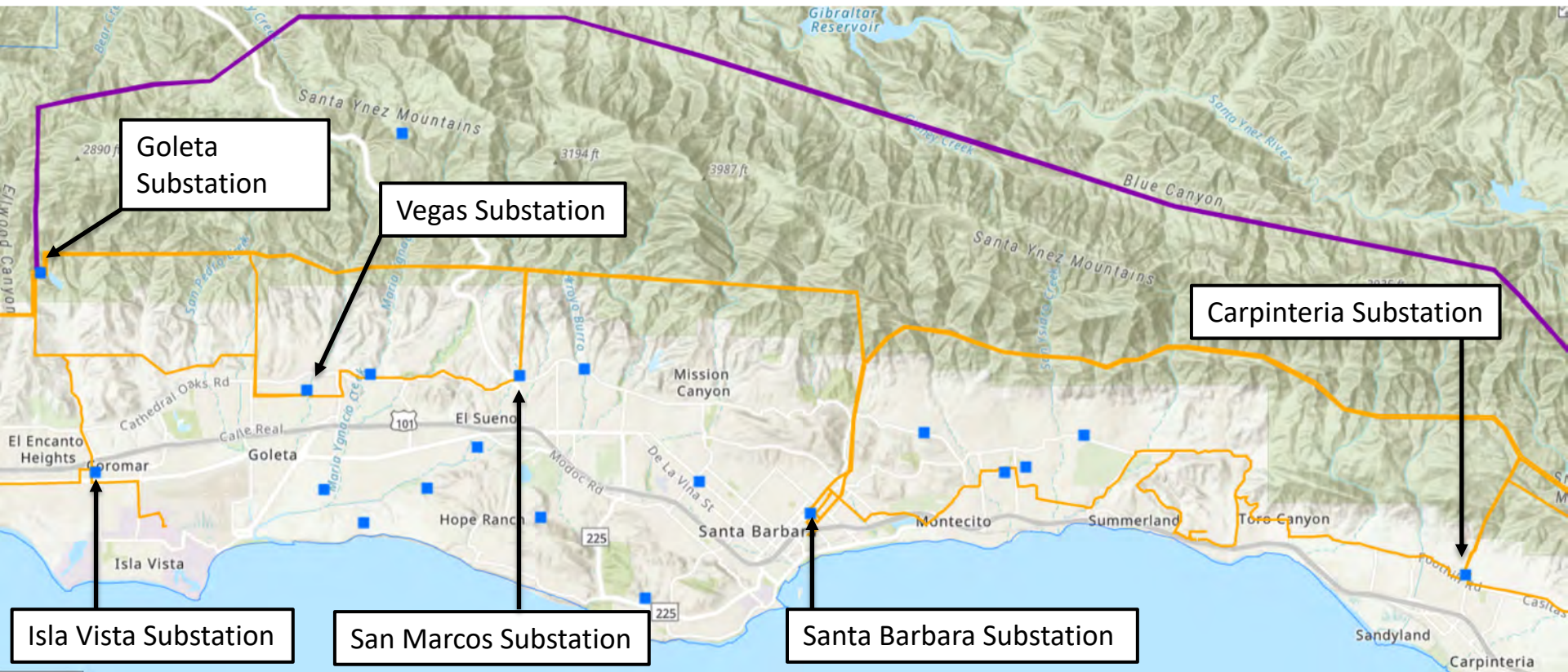


Goleta Load Pocket (GLP)

The GLP is the perfect opportunity for a comprehensive Community Microgrid



- GLP spans 70 miles of California coastline, from Point Conception to Lake Casitas, encompassing the cities of Goleta, Santa Barbara (including Montecito), and Carpinteria.
- GLP is highly transmission-vulnerable and disaster-prone (fire, landslide, earthquake).
- **200 megawatts (MW) of solar and 400 megawatt-hours (MWh) of energy storage** will provide 100% protection to GLP against a complete transmission outage (“N-2 event”).
 - 200 MW of solar is equivalent to about 5 times the amount of solar currently deployed in the GLP and represents about 25% of the energy mix.
 - Multi-GWs of solar siting opportunity exists on commercial-scale built-environments like parking lots, parking structures, and rooftops; and 200 MW represents about 7% of the technical siting potential.
 - Other resources like energy efficiency, demand response, and offshore wind can significantly reduce solar+storage requirements.



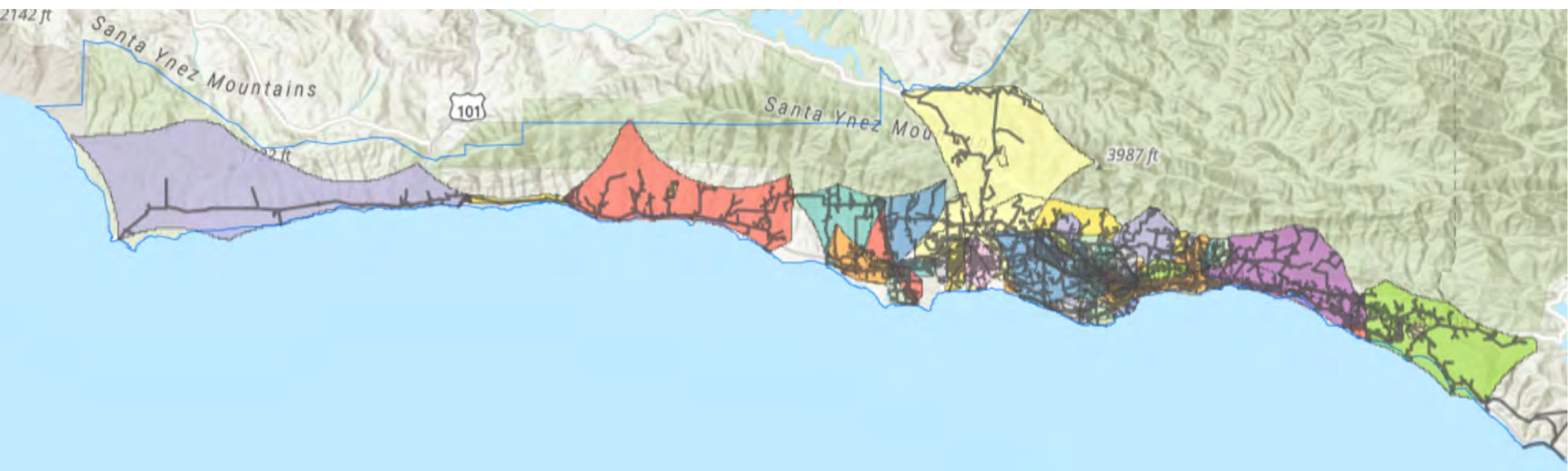


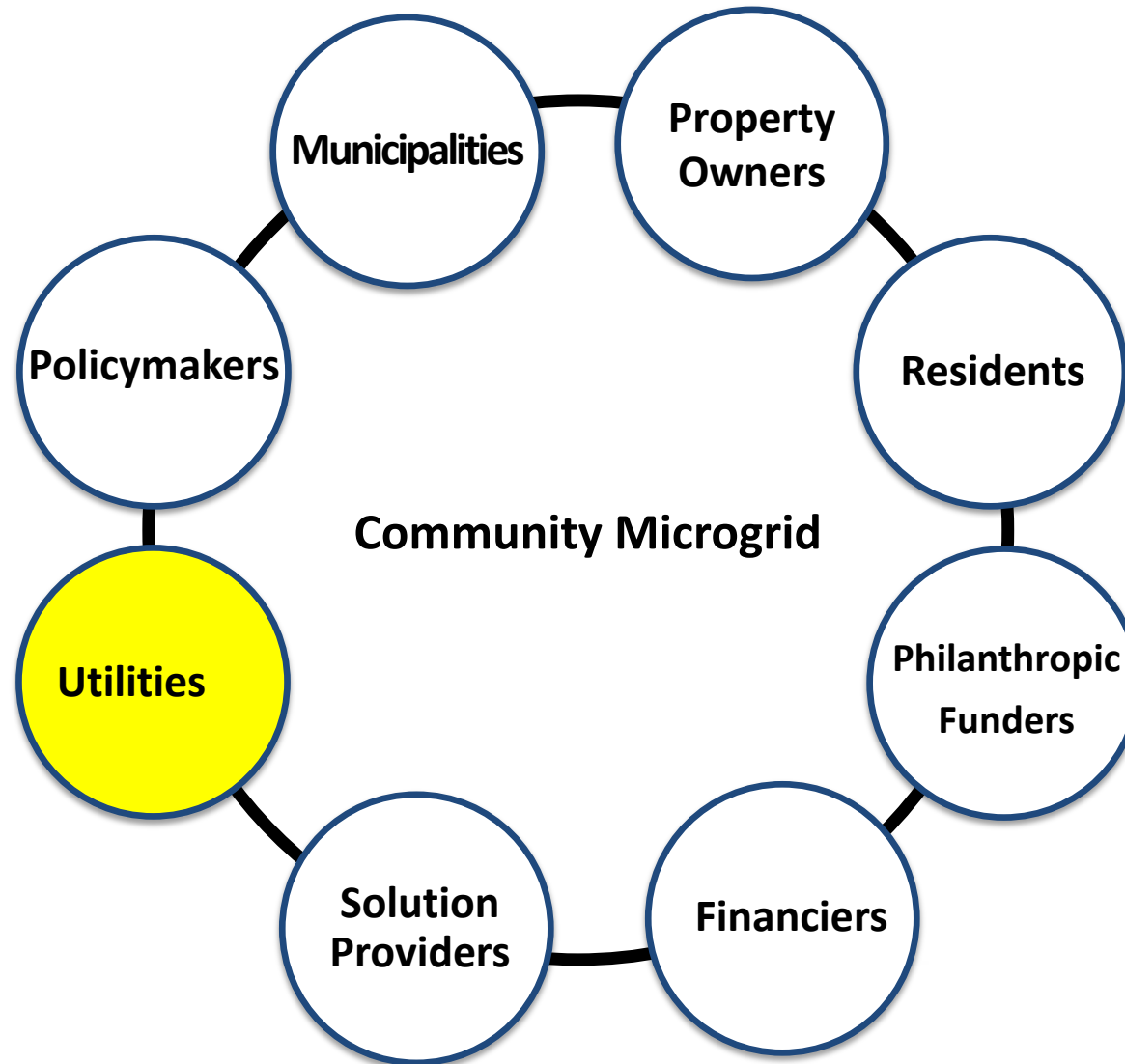
Table VI-10
Final Selection Set to Solve LCR Need

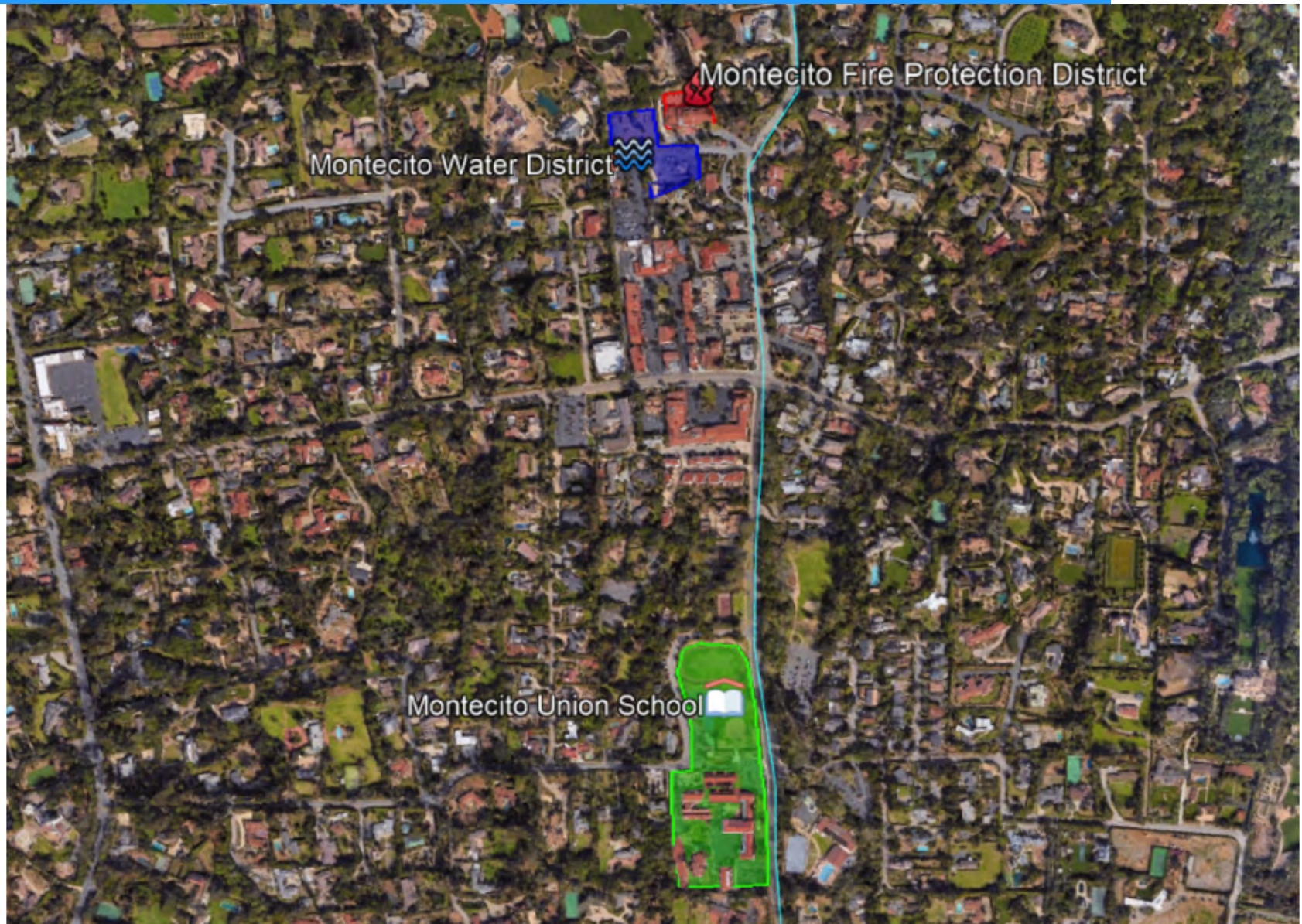
Bidder	Project	Resource Type	Location	Capacity (MW)	Average Capacity Price (\$/kW-mo)	Commercial Online Date	Regulatory Approval Mechanism
Swell	SC/G	BTM-DR	S & G	14		January 2021	ACES AL
E.ON	Painter	ES-RA Only	G	10		March 2021	ACES AL
Strata	Saticoy	ES-RA Only	S	100		December 2020	LCR Application
Able Grid	Silverstran	ES-RA Only	S	11		March 2021	ACES AL
Ormat	Vallecito	ES-RA Only	G	10		December 2020	ACES AL
AltaGas*	Goleta	ES-RA Only	G	40		December 2020	ACES AL
Enel	Hollister	ES-RA Only	G	10		March 2021	ACES AL

Source: SCE LCR RFP April 22, 2019

280 MWh (70 MW x 4-hour) of energy storage has been formally proposed by SCE to the CPUC for siting within the GLP, with online dates by March 2021

= within the GLP





Upper Village Community Microgrid block diagram

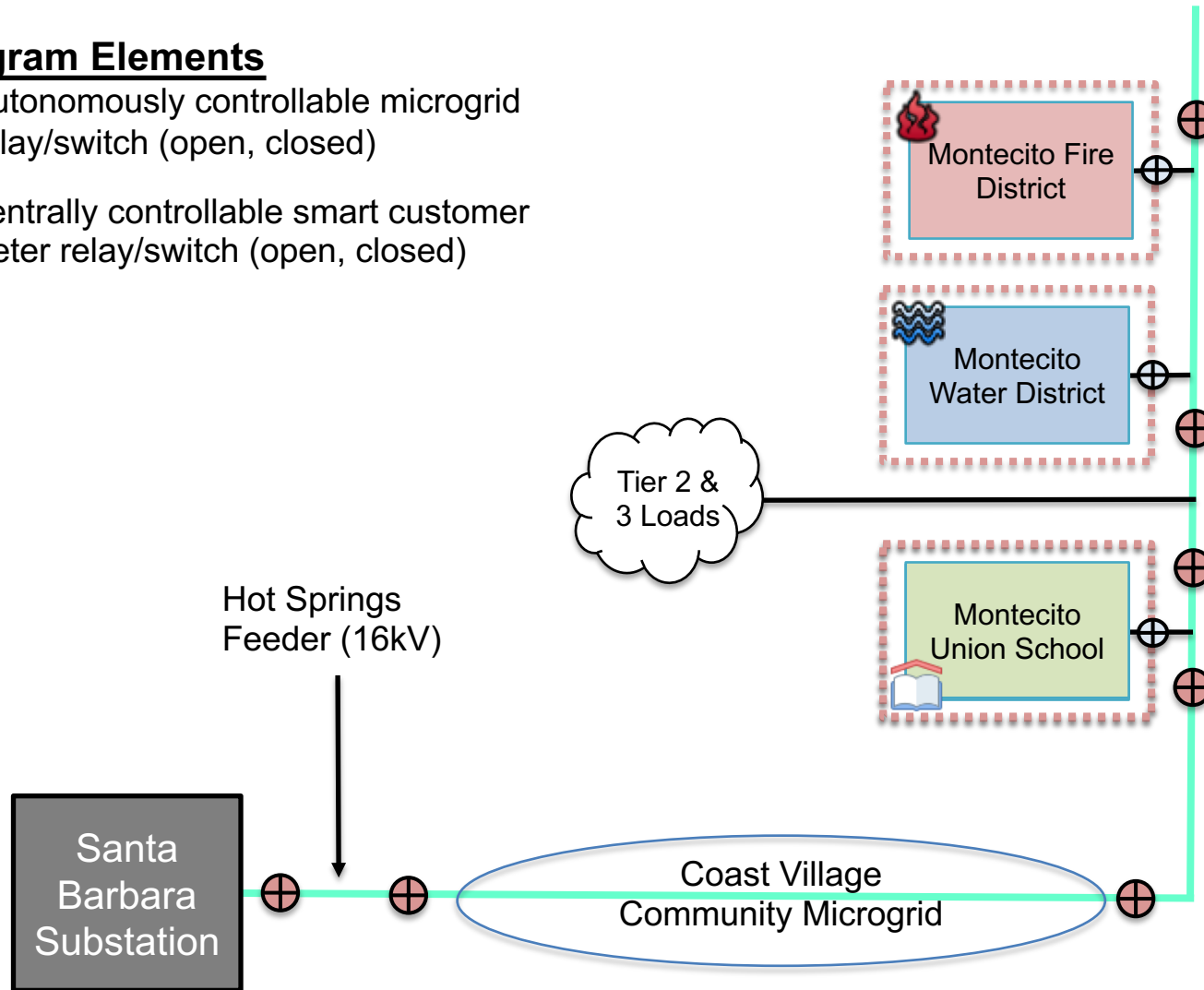
Diagram Elements



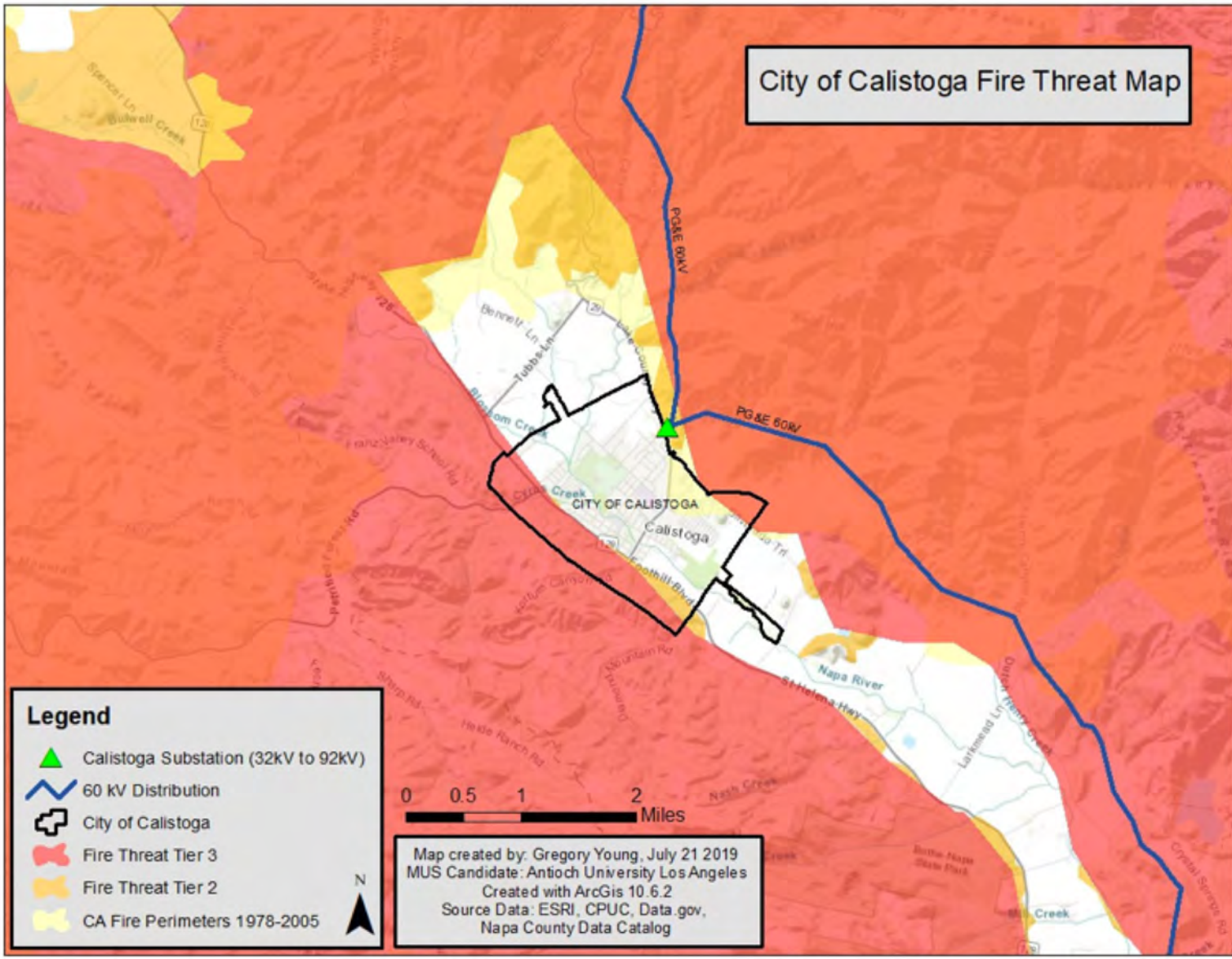
Autonomously controllable microgrid relay/switch (open, closed)



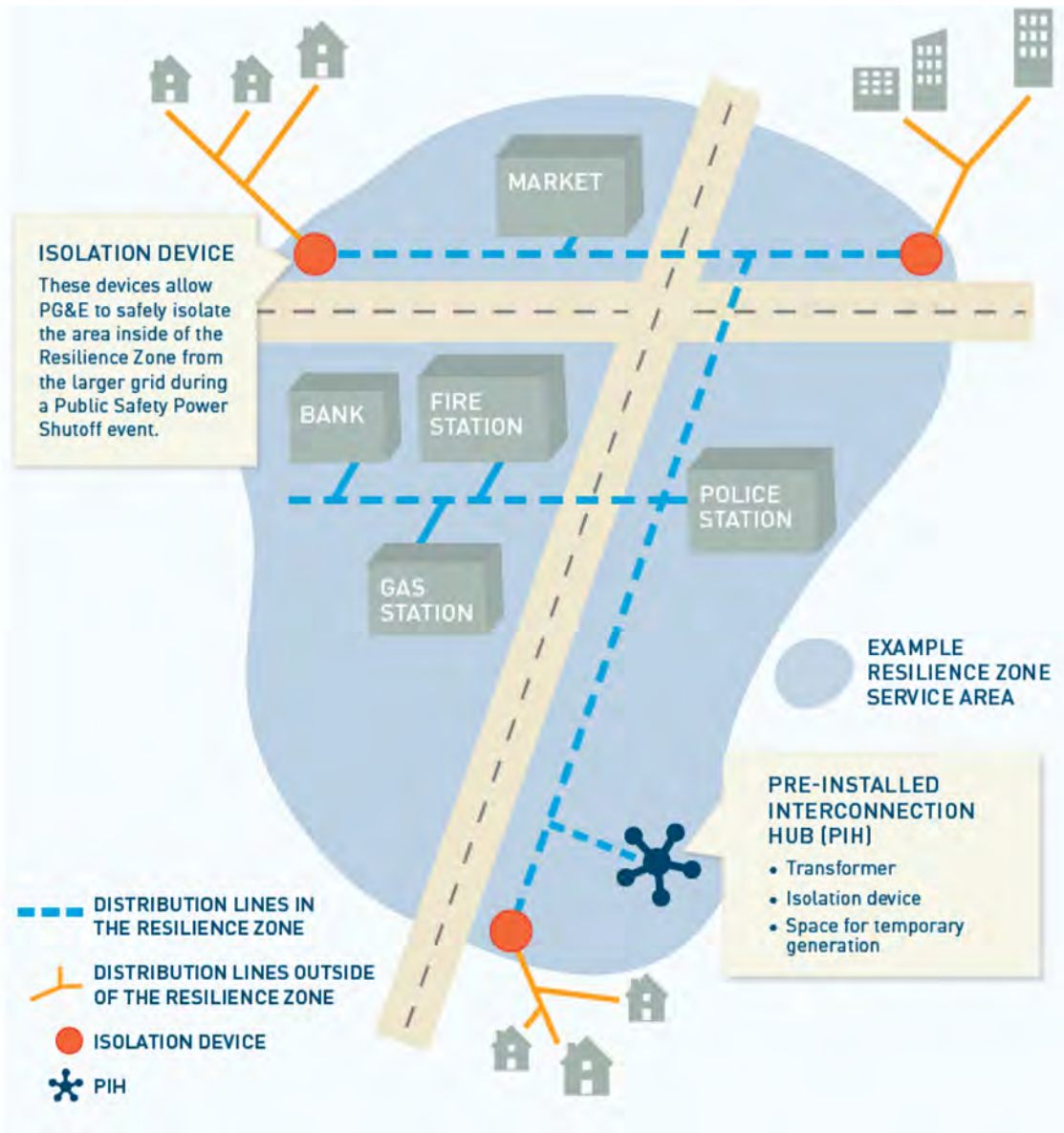
Centrally controllable smart customer meter relay/switch (open, closed)



City of Calistoga area & fire threat map



PG&E Resilience Zones = Community Microgrids



- PG&E is planning for a Resilience Zone powered by 7 MW of diesel generators.
- These diesel generators could be replaced by local solar and storage.

Source: PG&E, Jul2019

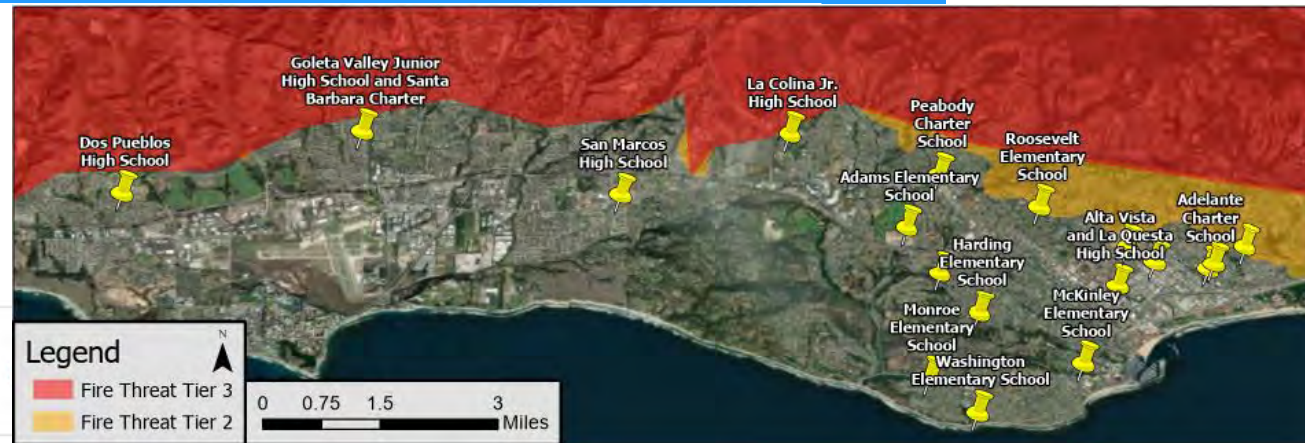


- Seamless grid isolation switch that islands the Community Microgrid without any electricity service interruption to any of the 20 customers.
- 2 MW of solar and 8 MWh of storage that are DC-coupled front-of-meter (FOM). The FOM solar+storage assets are owned by the Redwood Coast Energy Authority (RCEA), a Community Choice agency.
- 250 kW of behind-the-meter (BTM) solar.
- Bank of 8 Level-2 EV charging ports in a BTM configuration that is load controllable, including sheddable.
- Full PG&E control of the distribution grid at all times.
- All RCAM assets, both FOM & BTM, controlled by asset owners during normal grid operations and by PG&E for master control during Community Microgrid islanding operations.
- New tariff and business model innovations.

Solar Power World

TOP SOLAR CONTRACTORS

SOLAR+STORAGE



Clean Coalition helps Santa Barbara Unified School District start massive solar microgrid initiative

By Kelsey Misbrener | December 18, 2019

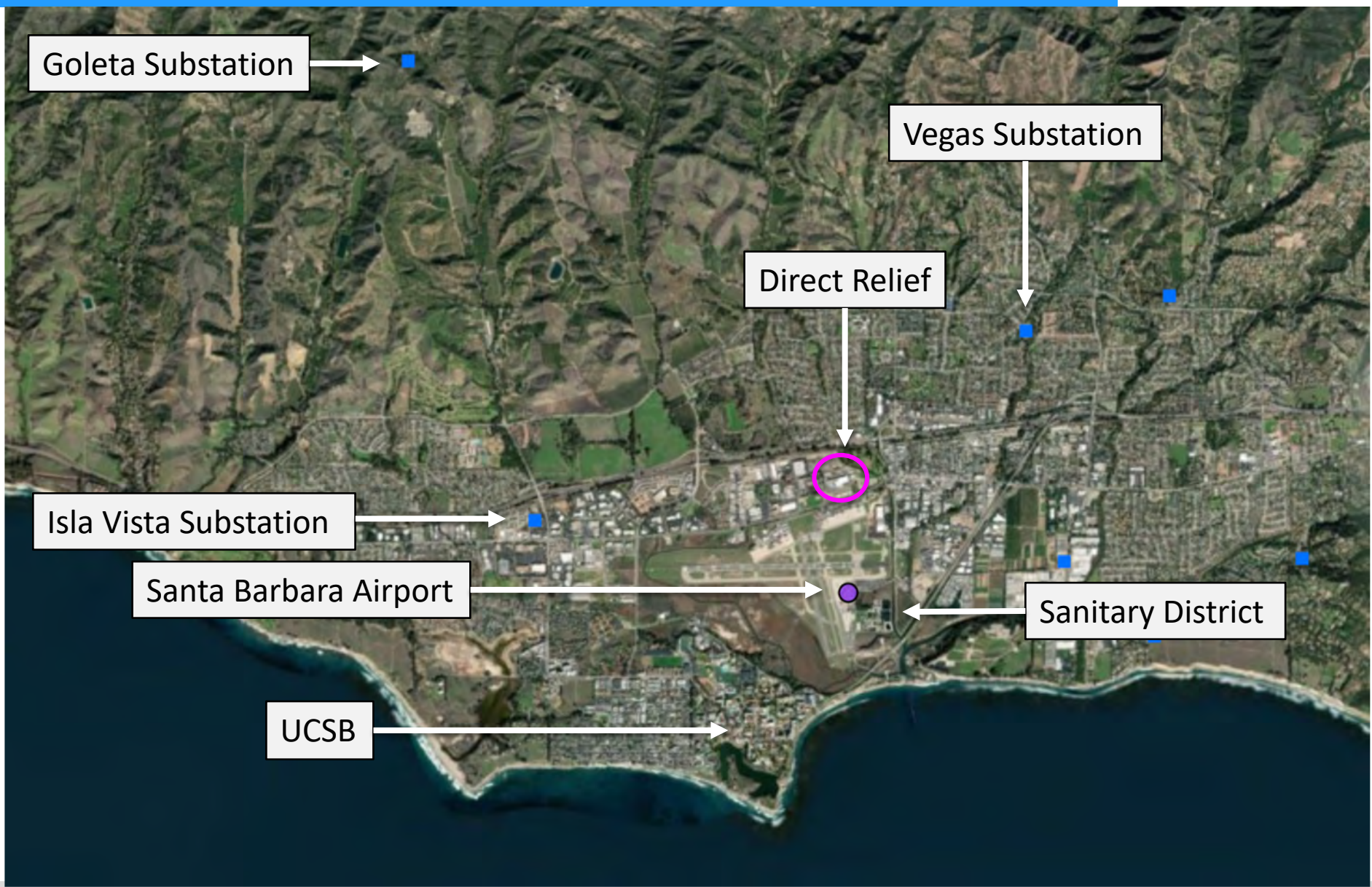


The Santa Barbara Unified School District (SBUSD) has unanimously approved an ambitious initiative with the Clean Coalition, a nonprofit organization, and Sage Energy Consulting to stage solar-driven microgrids and electric vehicle charging infrastructure (EVCI) at schools throughout the District. The microgrids will feature solar and energy storage that can provide long-duration resilience, along with EVCI that supports District staff and students during the day — and provides overnight charging options for neighbors who have challenges installing electric vehicle chargers where they live.

Deckers has 2+ MW of more solar siting potential



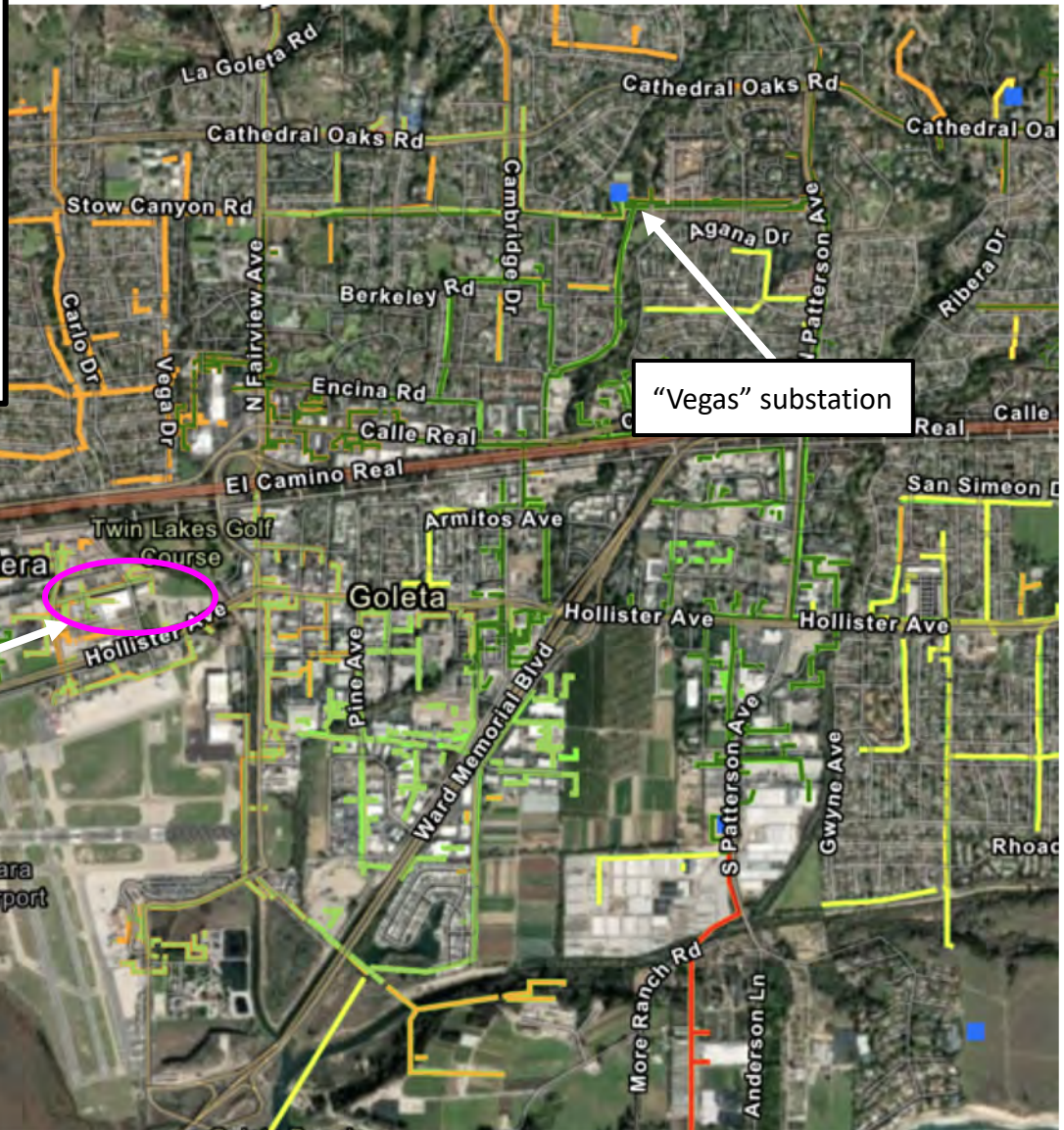
Direct Relief & SBA grid area



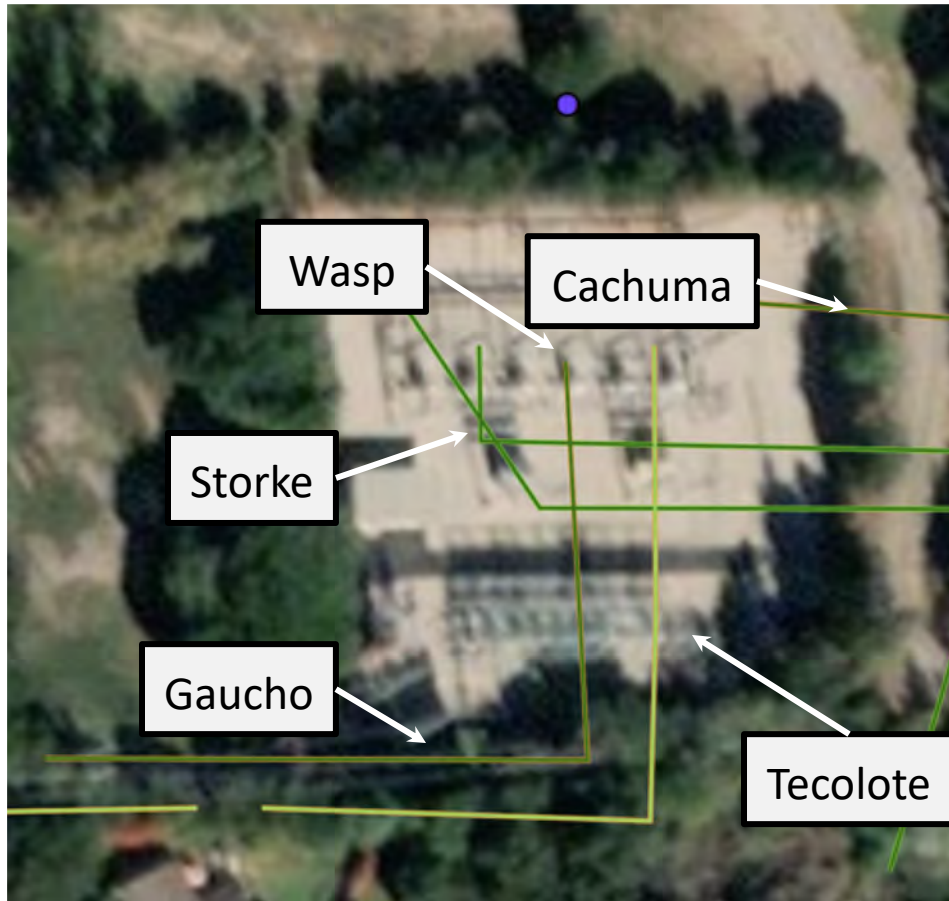
Vegas Substation - Serving Goleta and Noleta

Vegas Substation serves much of the City of Goleta and Unincorporated Santa Barbara County. Vegas's circuits, including "Wasp", "Storke", "Tecalote", "Cachuma", and "Gaucha" stretch from the top of the Santa Ynez Mtns. to the ocean and power the airport, Old Town, and the commercial and residential areas between Turnpike and Las Carneros.

Direct Relief is on the Gaucha circuit.



Direct Relief (middle of the Goleta area of the GLP)



(1 of 1)

Substations

Information

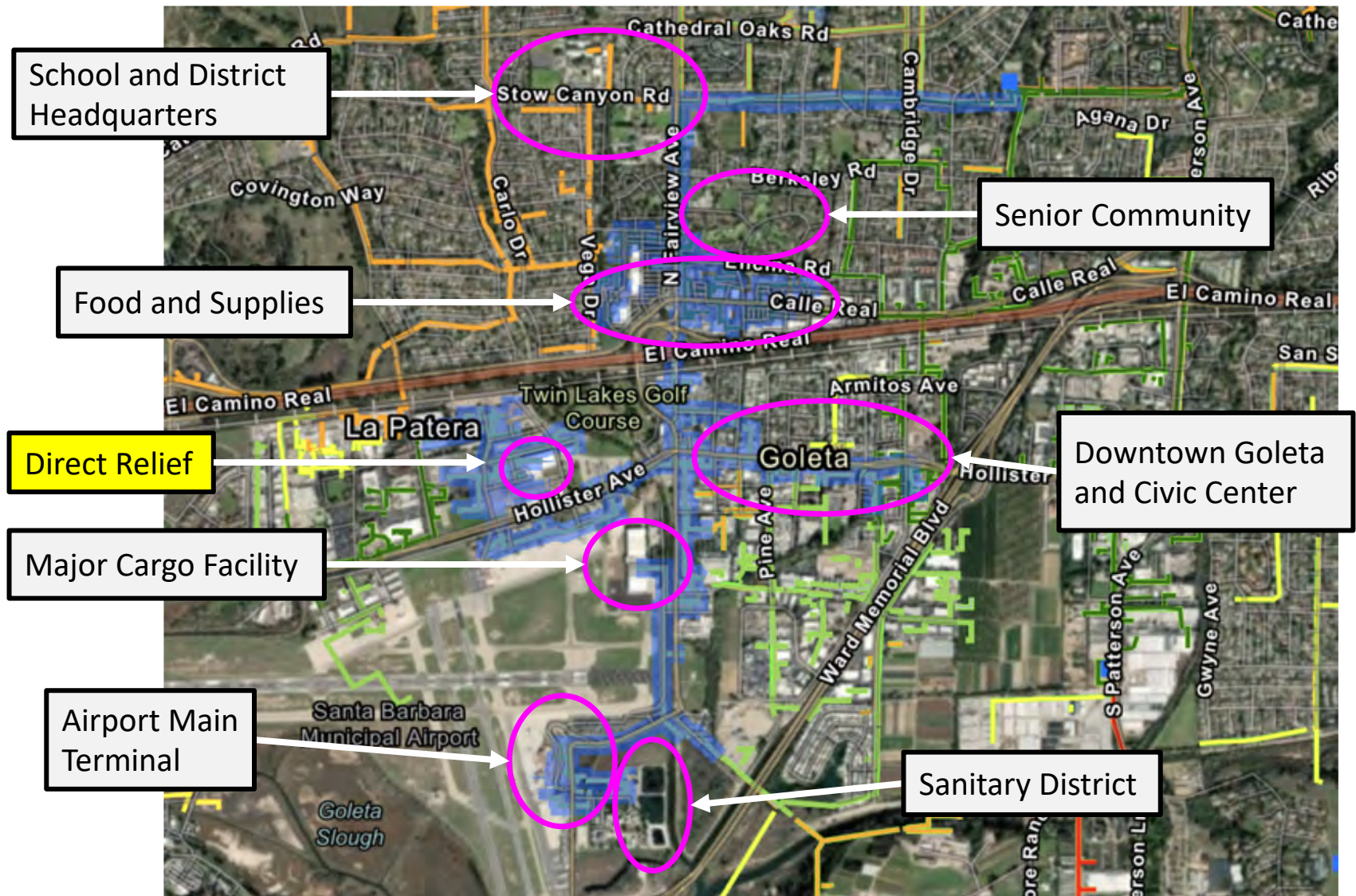
Substation Name	Vegas
Substation ID	704
Substation Type	D -- Distribution
System Name	Goleta 220/66 System

Existing Generation (MW)	5.24
Queued Generation (MW)	0
Total Generation (MW)	5.24
Projected Load	38.4
Penetration Level	22.01
Maximum Remaining Generation Capacity (MW)	41.95
Note	Interconnection studies in this area have identified adequate deliverability.

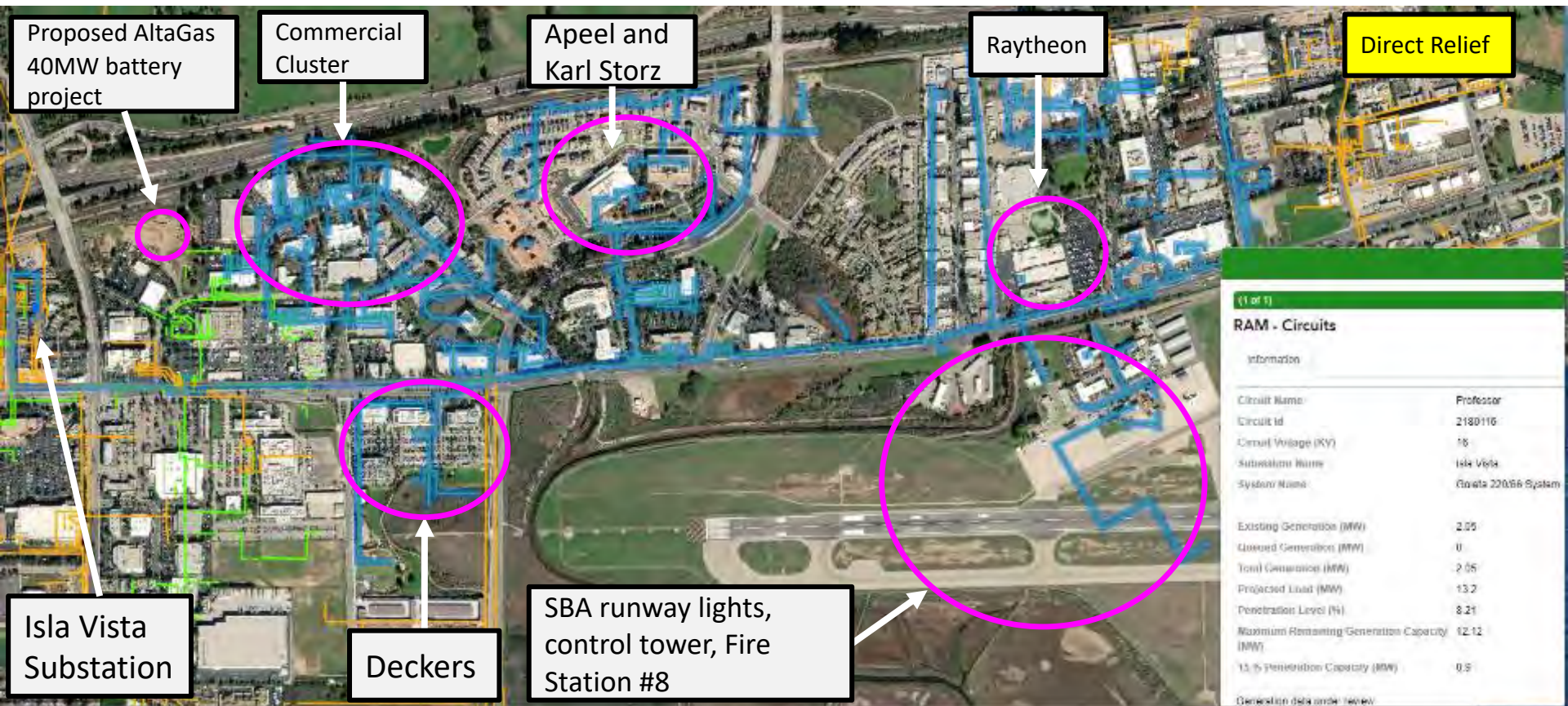
Generation data under review

The Vegas Substation powers multiple feeder circuits across the Goleta Load Pocket. Currently **5.24MW** of generation is connected to these circuits. Another nearly **42MW** of additional generation can be connected to the Vegas Substation.

Gaucha Circuit powers many critical facilities

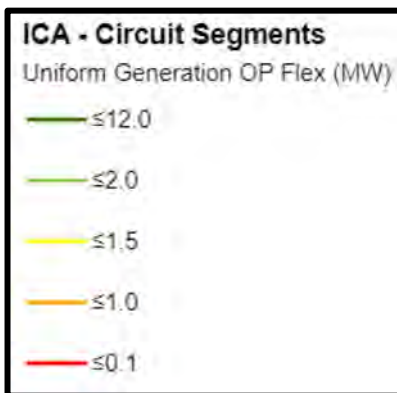
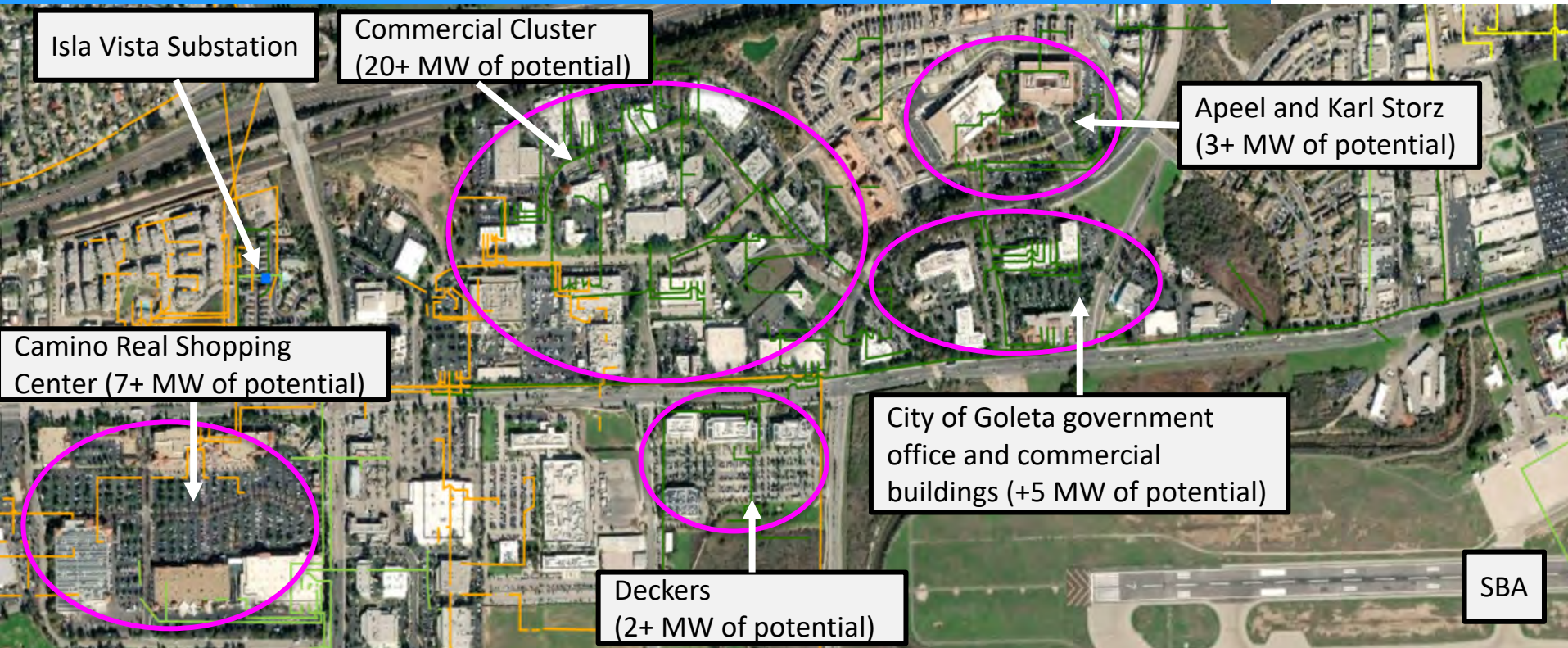


Professor Feeder powers many critical sites



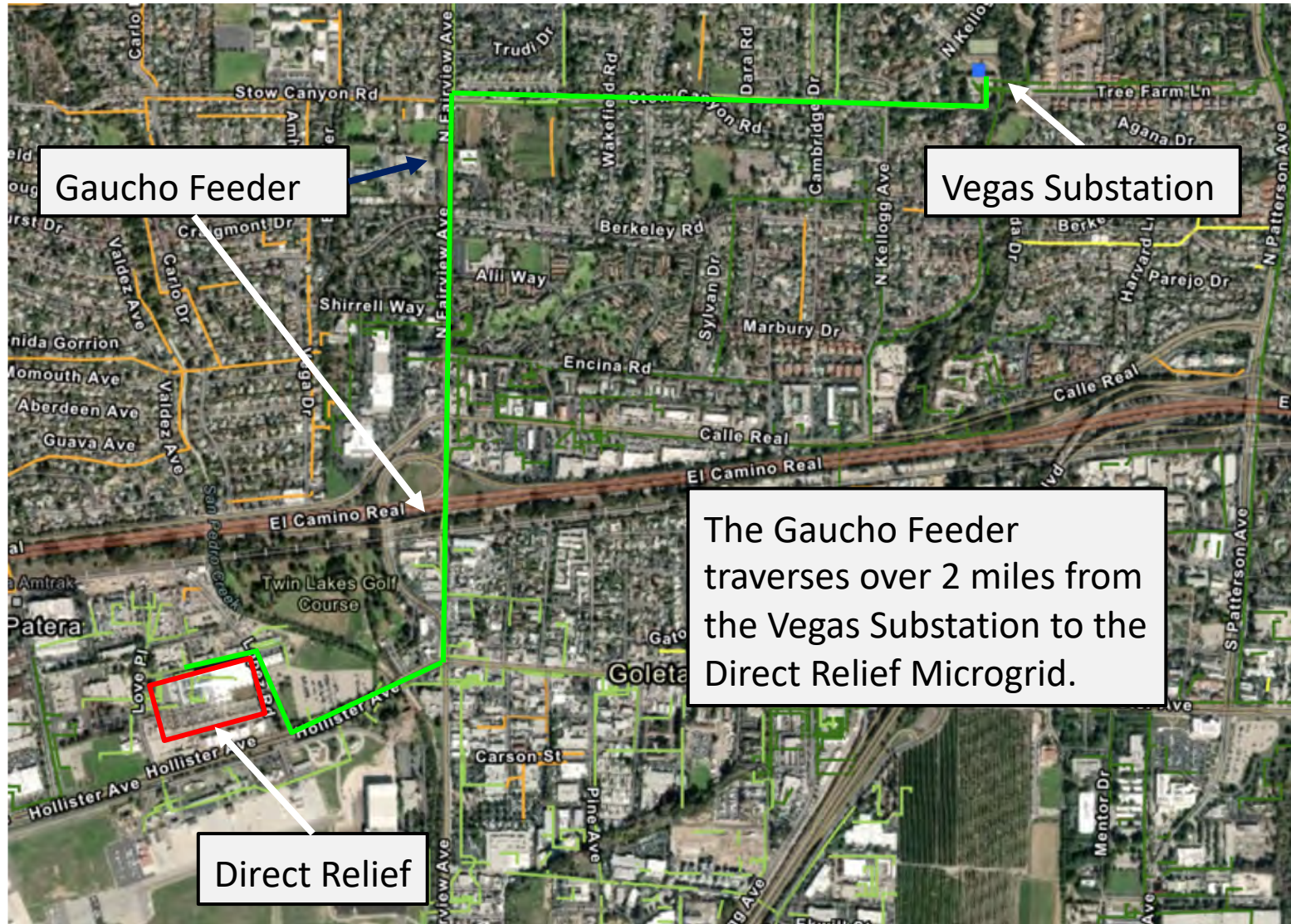
30 MW of solar siting potential on rooftops and parking lots throughout the Professor Feeder

Significant operational flexibility in the Deckers area



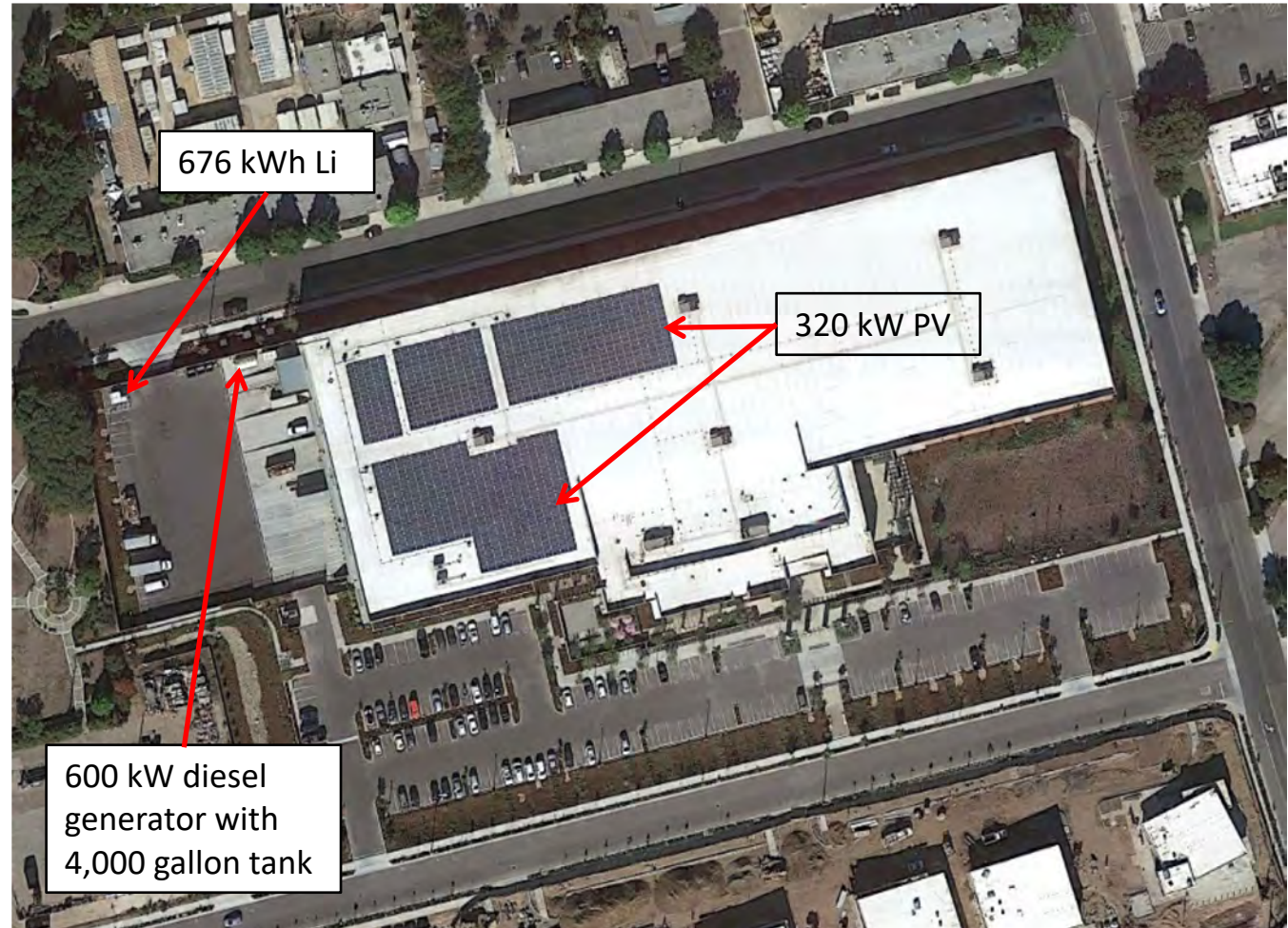
Operational flexibility is identified as a certain number of Megawatts (MW) of generation that could be interconnected at a specific feeder section without requiring a study to determine integration capacity.

Direct Relief is served by the Gaucho Feeder



Direct Relief offers a microgrid showcase

- Resilience is #1 concern:
 - **320 kW PV**
 - **676 kWh Storage**
 - 600 kW diesel generator
 - 4000 gallons of diesel fuel
- PV annual generation designed to cover annual consumption.
- Storage designed to time-shift the generation to more valuable times, and provide Resilience.
- Genset provides “back-up to the back-up”.
- Direct Relief Microgrid requirement is that the critical loads are operational indefinitely, even through local disasters that causes long-term interruptions to normal electricity service.



Microgrid only serves Direct Relief needs:

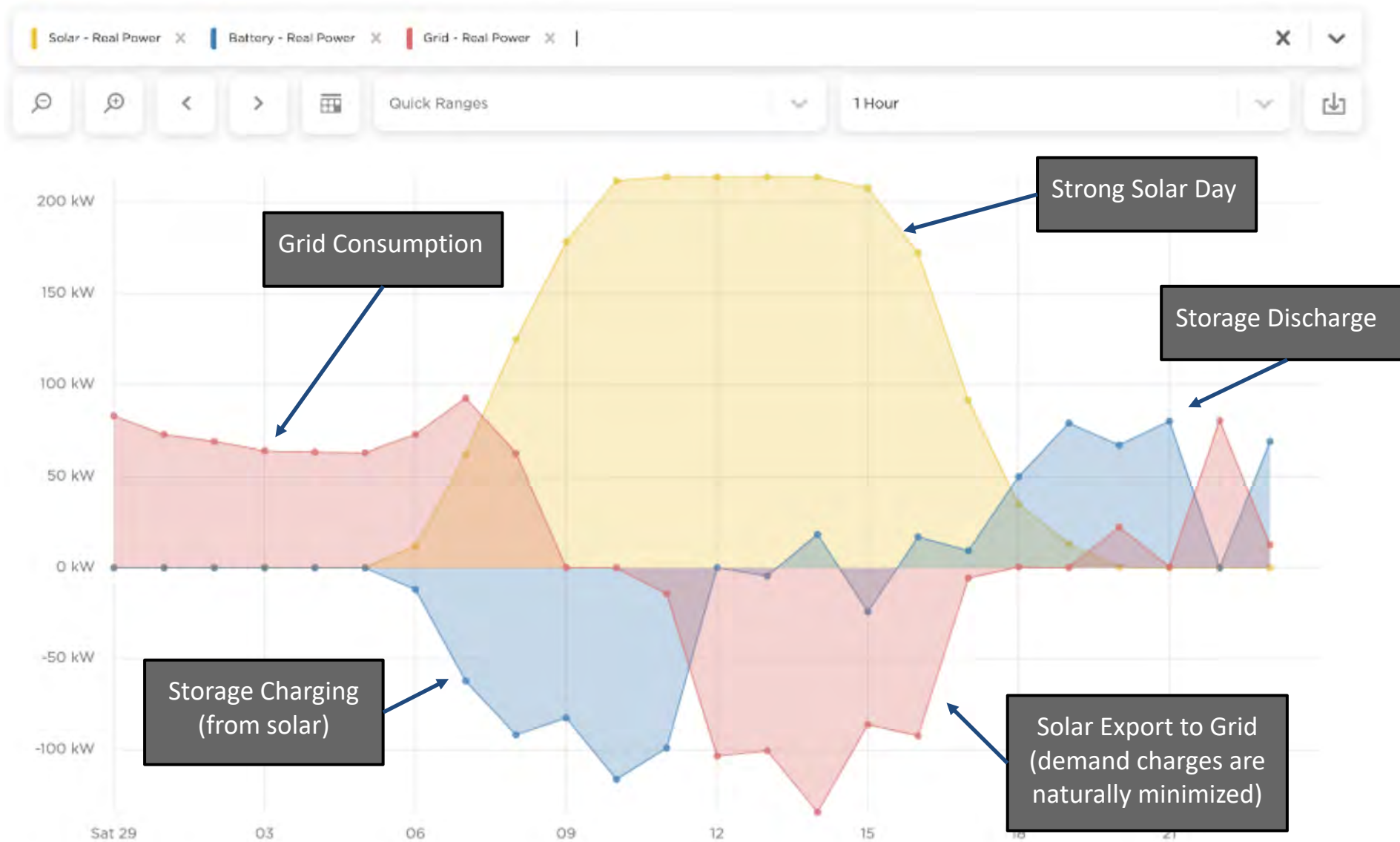
- 70% of roof and 100% of massive parking area solar potential is unused.
- Additional storage not able to be considered due to policy prohibitions around exporting energy from a battery to the grid – even though the energy is 100% stored solar.

Ready to do way more::

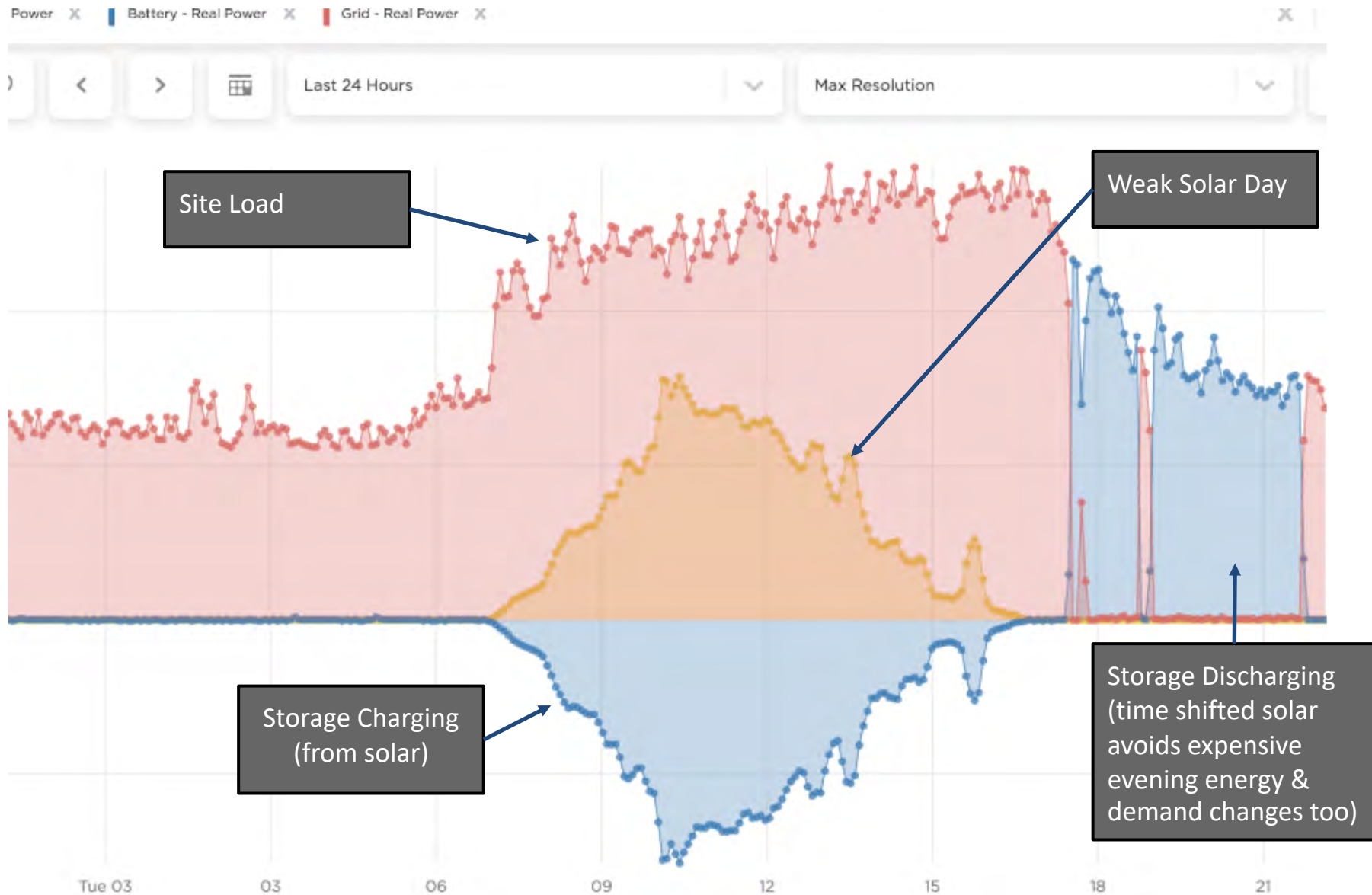
- 1,133 kW in total solar siting potential, 427 kW more rooftop and 386 kW in parking lots.
- Existing switch gear is already sized for the expansion and is just awaiting the policy innovation!



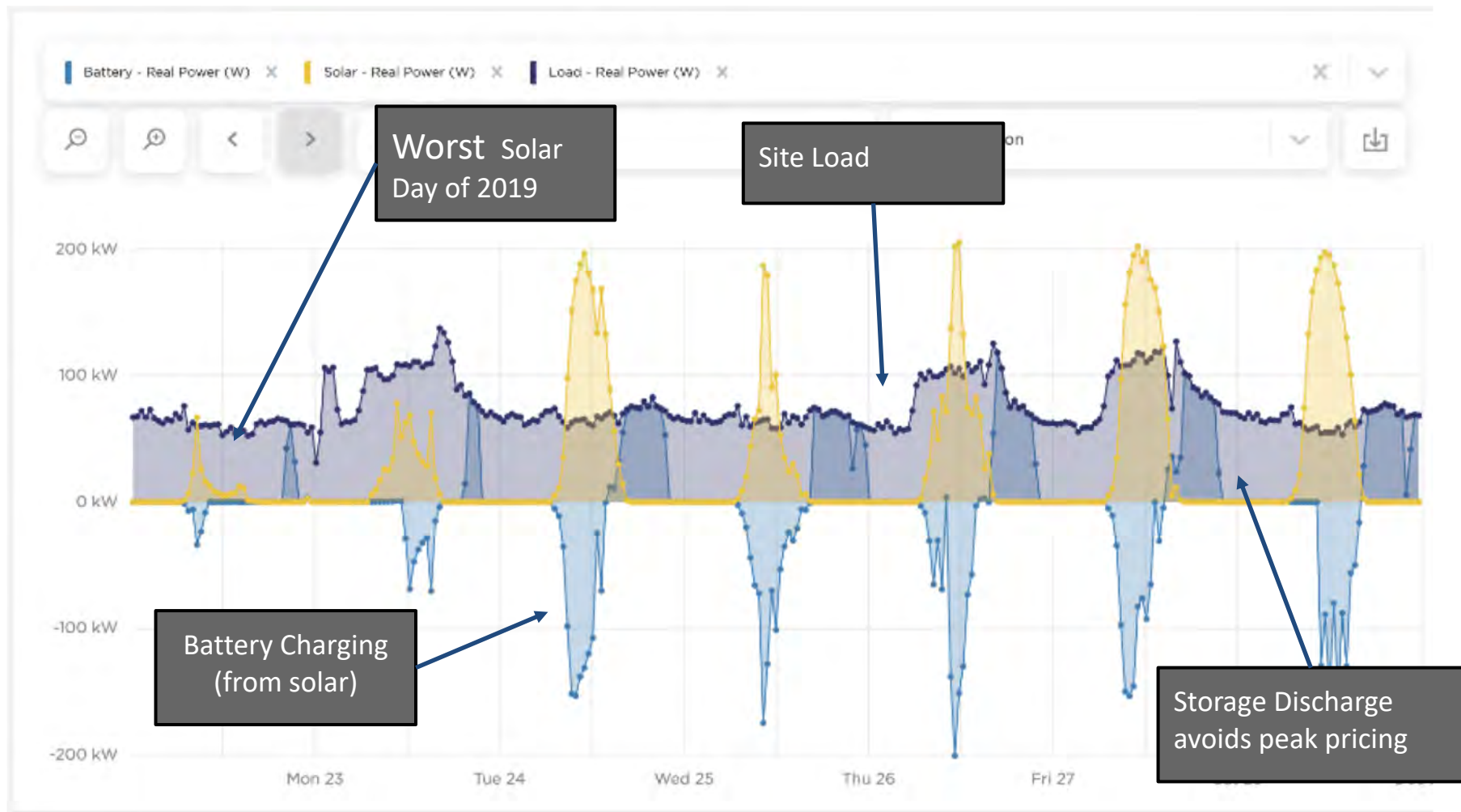
Strong solar day results in net zero energy



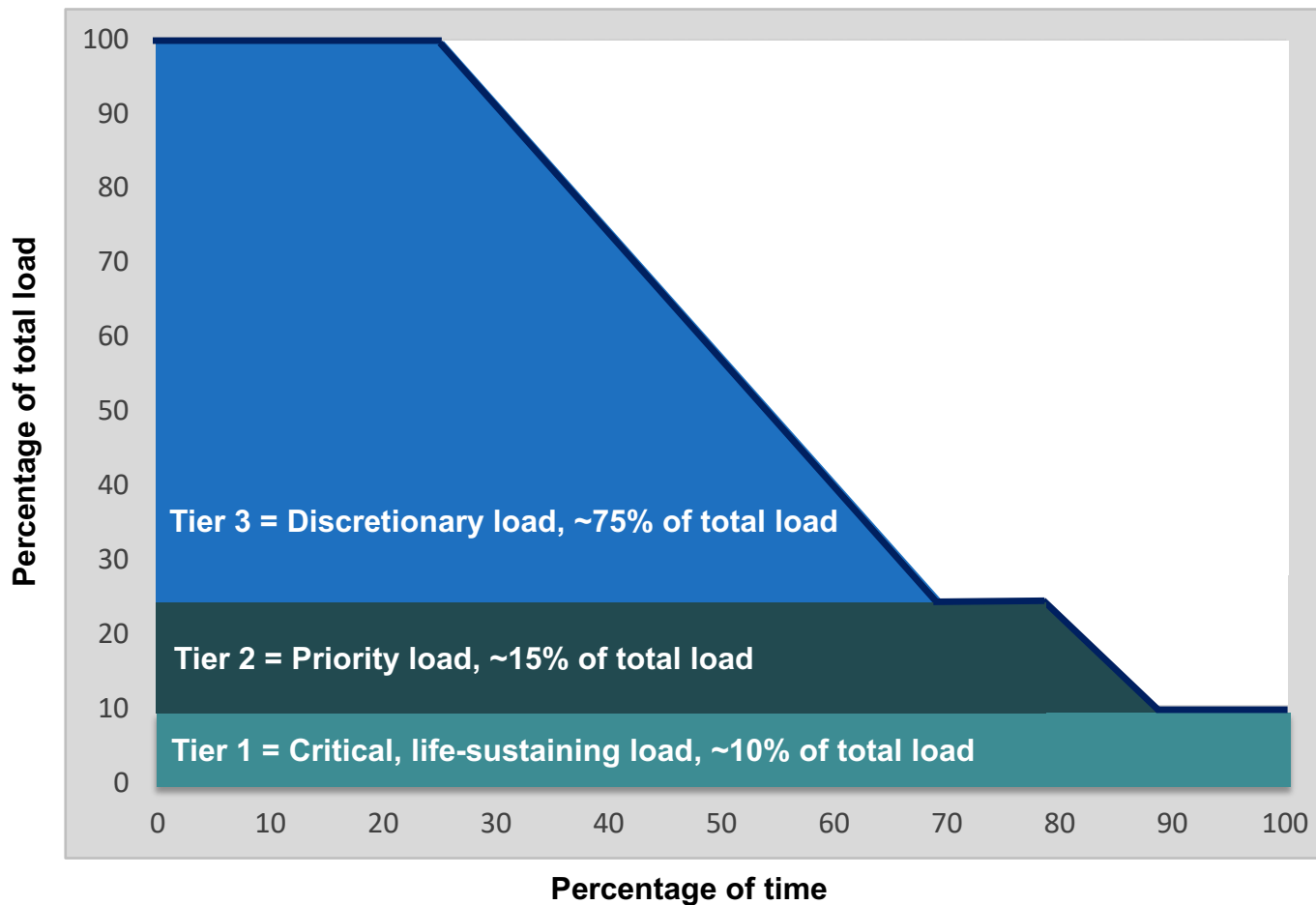
Weak solar day results in net imports



Worst solar day still covers most critical loads



Percentage of time online for Tier 1, 2, and 3 loads for net zero solar + 2 hours storage microgrids at UCSB



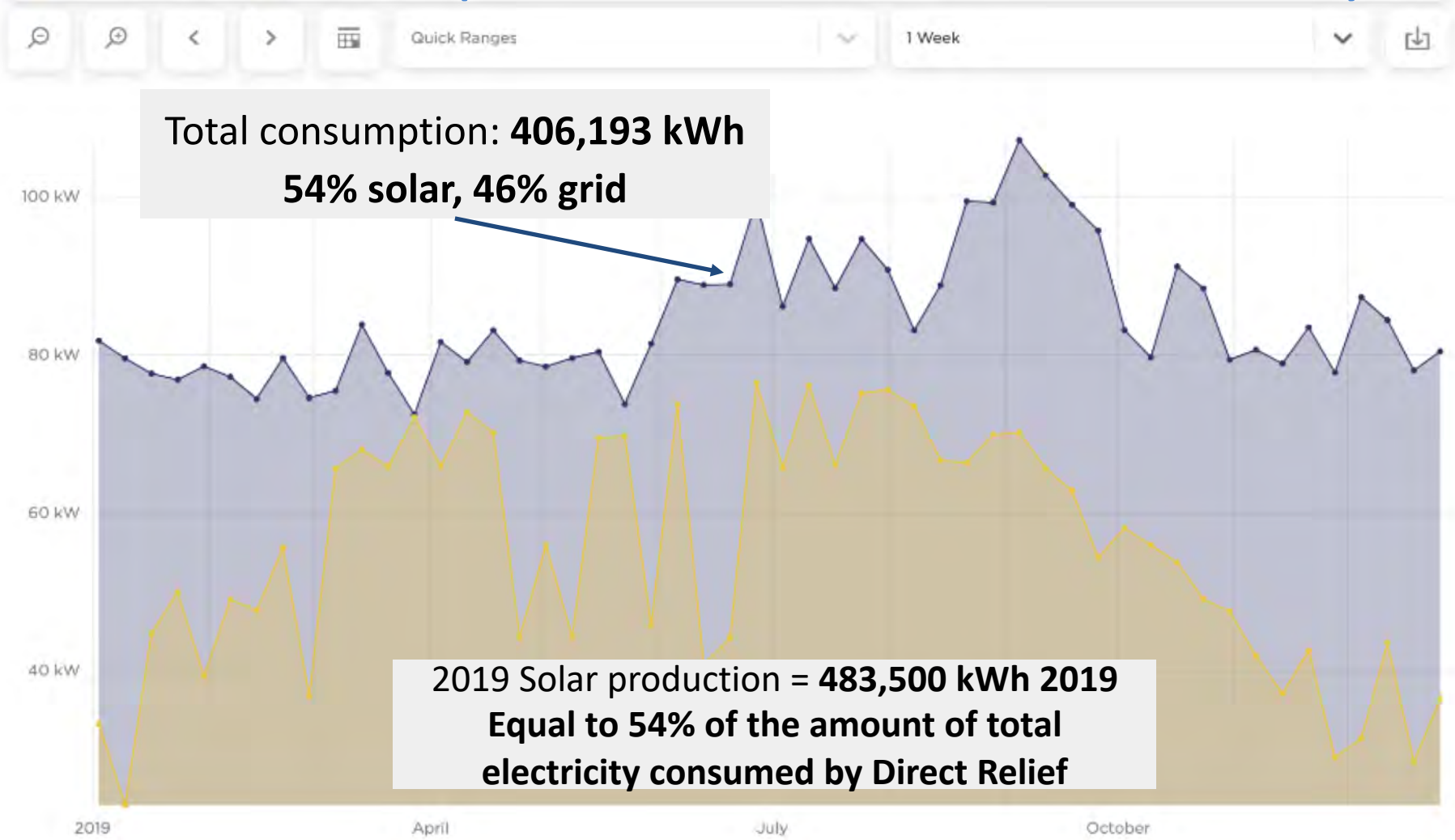
	Edison kWh	Edison Annual Spend	Solar kWh	Microgrid Annual Spend	Year Total Spend	Blended Rate/kWh
No Microgrid	889,693	\$132,564	0	0	\$132,564	\$0.149
Microgrid	406,193	\$67,209	483,500	\$83,850	\$153,059	\$0.172

Microgrid cost includes \$0.10/kWh solar + \$37,500 annual battery lease

Current annual cost of indefinite resilience: \$20,495

Direct Relief initially pays \$0.023/kWh for indefinite resilience for critical loads but this premium will disappear with SCE increases

Total Consumption and PV Production Overlay



- An additional 1+MW of PV and >2MWh of storage at Direct Relief is both physically possible and fully practical.
- The solar-siting opportunity that Direct Relief represents a significant foundation for the generation and resiliency resources needed for the Goleta Community Microgrid. These resources can be interconnected into the existing distribution infrastructure without stressing the grid or requiring system upgrade.
- Only an outdated and restrictive sustainable energy interconnection and operations paradigm prevents the project from moving forward.

- Direct Relief could use another equivalently sized microgrid to offset the 406 MWh/year it currently imports from the grid.
 - This is allowed under net metering and would achieve net zero at Direct Relief.
 - Expanded EV charging would support even more additional solar capacity while maintaining net zero.



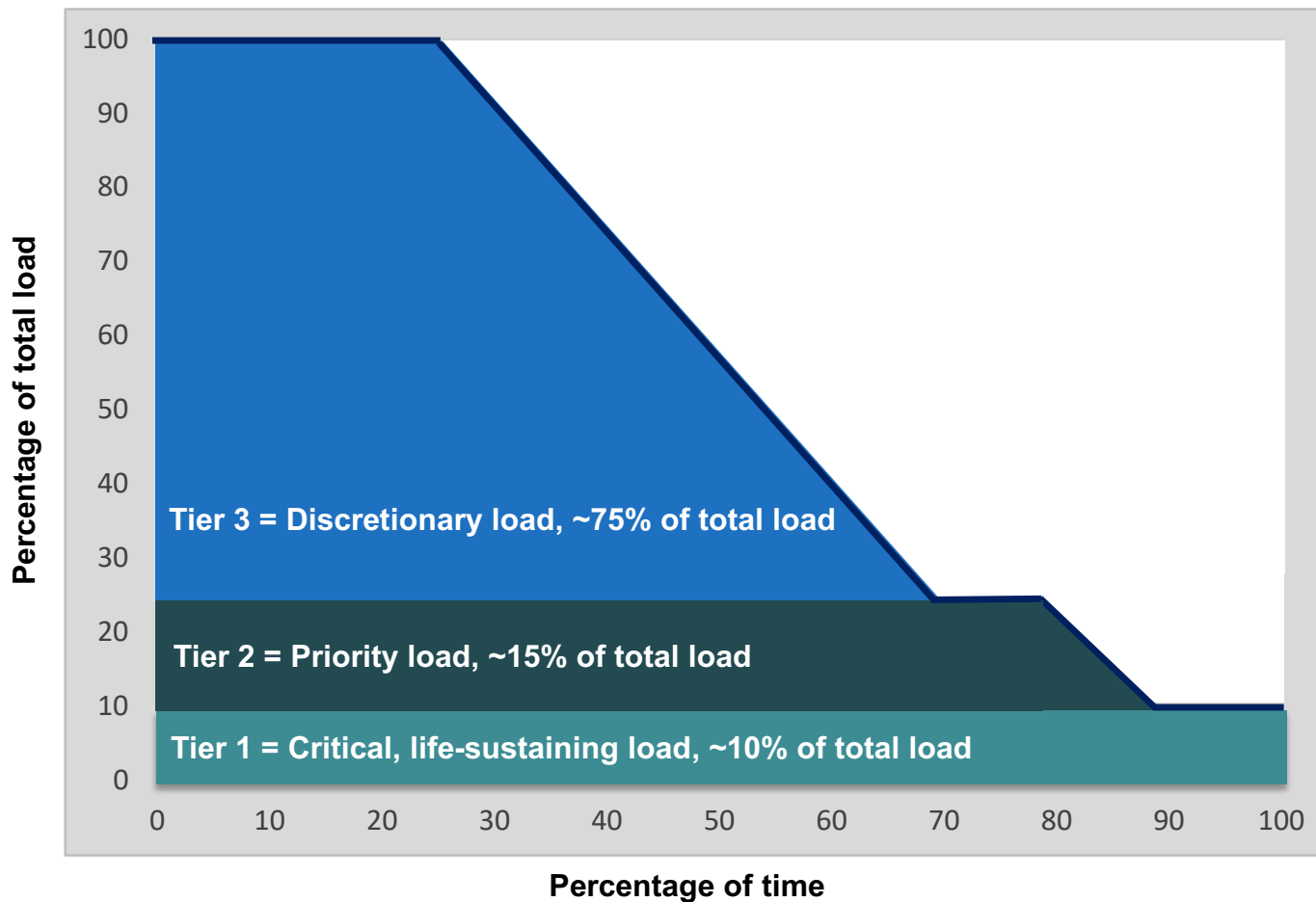
Economic Projection with 2x Microgrid (all new)

	Edison kWh	Edison Annual \$	Solar kWh	Microgrid Annual \$	Total Annual \$	Blended Rate/kWh
No Microgrid	889,693	\$132,564	0	0	\$132,564	\$0.149
2x Microgrid (old + new)	-77,307	-\$3,392	967,000	\$149,695	\$146,603	\$0.152
2x Microgrid (all new)	-77,307	-\$3,392	967,000	\$127,690	\$124,298	\$0.129

1. Expanded microgrid costs are estimated at about 30% reductions to the existing solar and storage, which were contracted in 2017. New costs assumed to be \$0.07/kWh for solar (vs \$0.10) and \$2,500/month for the storage capacity currently deployed (vs \$37,500).
2. The Net Energy Metering (NEM) credit scheme is applied to net exports.
3. Anticipated growth in EV charging will significantly increase load.

Microgrid expansion saves \$0.02/kWh vs SCE rates at the start, while saving more as SCE rates rise and providing indefinite solar-driven resilience for free.

Percentage of time online for Tier 1, 2, and 3 loads for net zero solar + 2 hours storage microgrids at UCSB



Backup Slides

Without Microgrid: (only buying power from SCE)

- Direct Relief's annual electricity cost: **\$132,564**
 - \$67,209 spent on "Generation" (kWh)
 - \$65,355 spent on "Power" (demand charges)

With Microgrid: \$0.10/kWh solar, and storage cost of \$3,125/month + remaining electricity purchased from SCE

- The Microgrid cost them **\$85,850**
 - \$48,253 for 483,500 kWh @ \$.1/kWh
 - \$37,800/year in Energy Storage cost.
- Direct Relief ALSO spent \$67,209 in charges from Edison.
- **Direct Relief TOTAL electricity spend in 2019 was \$153,262**

EV Charging at Direct Relief:

- 12 EV charging units installed: 6 dedicated for employees, 6 available to “guests”.
- Metering of EV charging is not currently monetized
- Almost 10% the 140 parking spots are configured for EV charging.

Charger Make and Model:

- SemaConnect model 620 Commercial “Fast Chargers”.
- 7kW (30amp, 240v)
- Can be monitored / monetized
- If all 12 EV chargers are used simultaneously, the EV peak load would be about 84kW



Direct Relief EVCI in prime parking spots



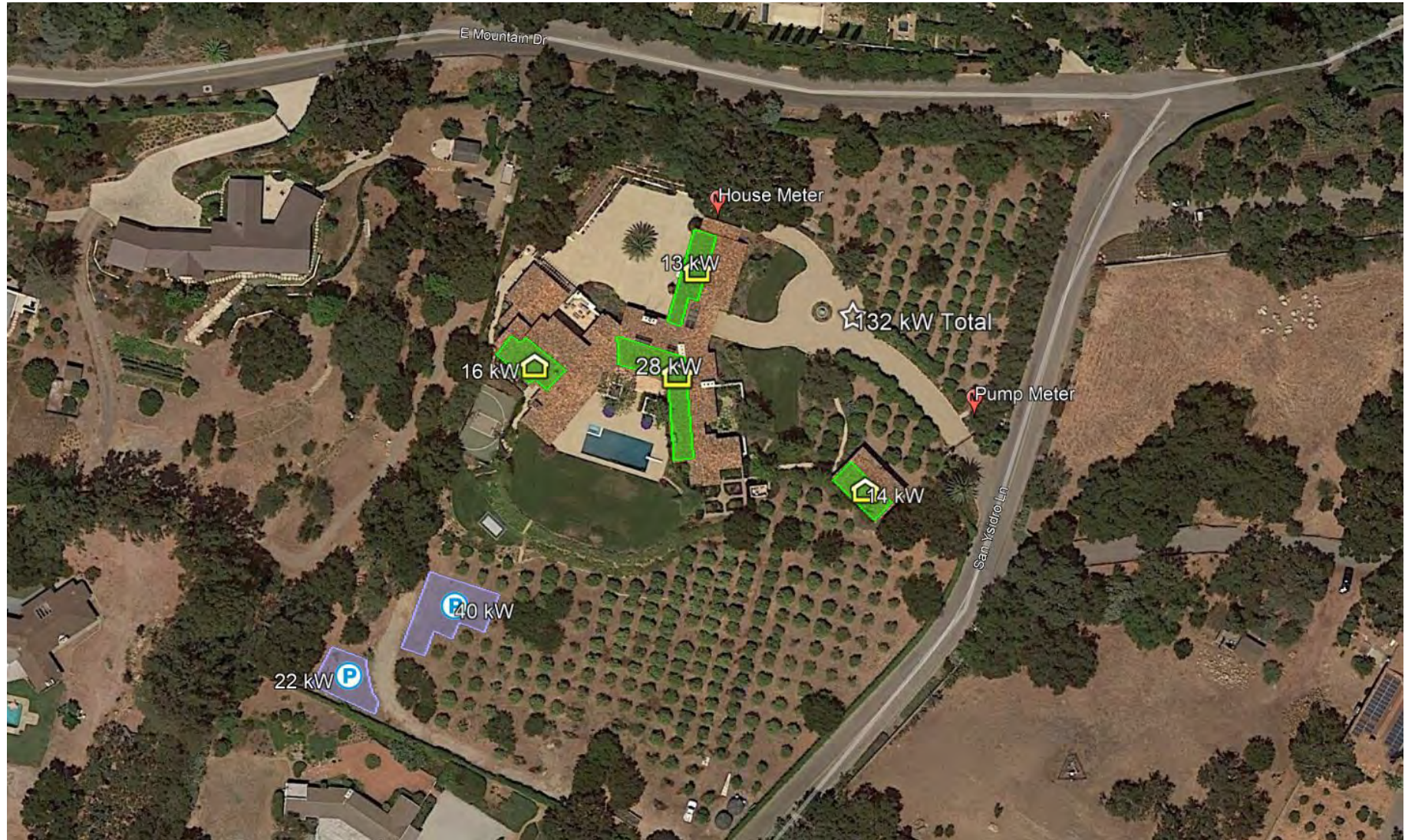
Direct Relief is already doing what it can to support its local community.

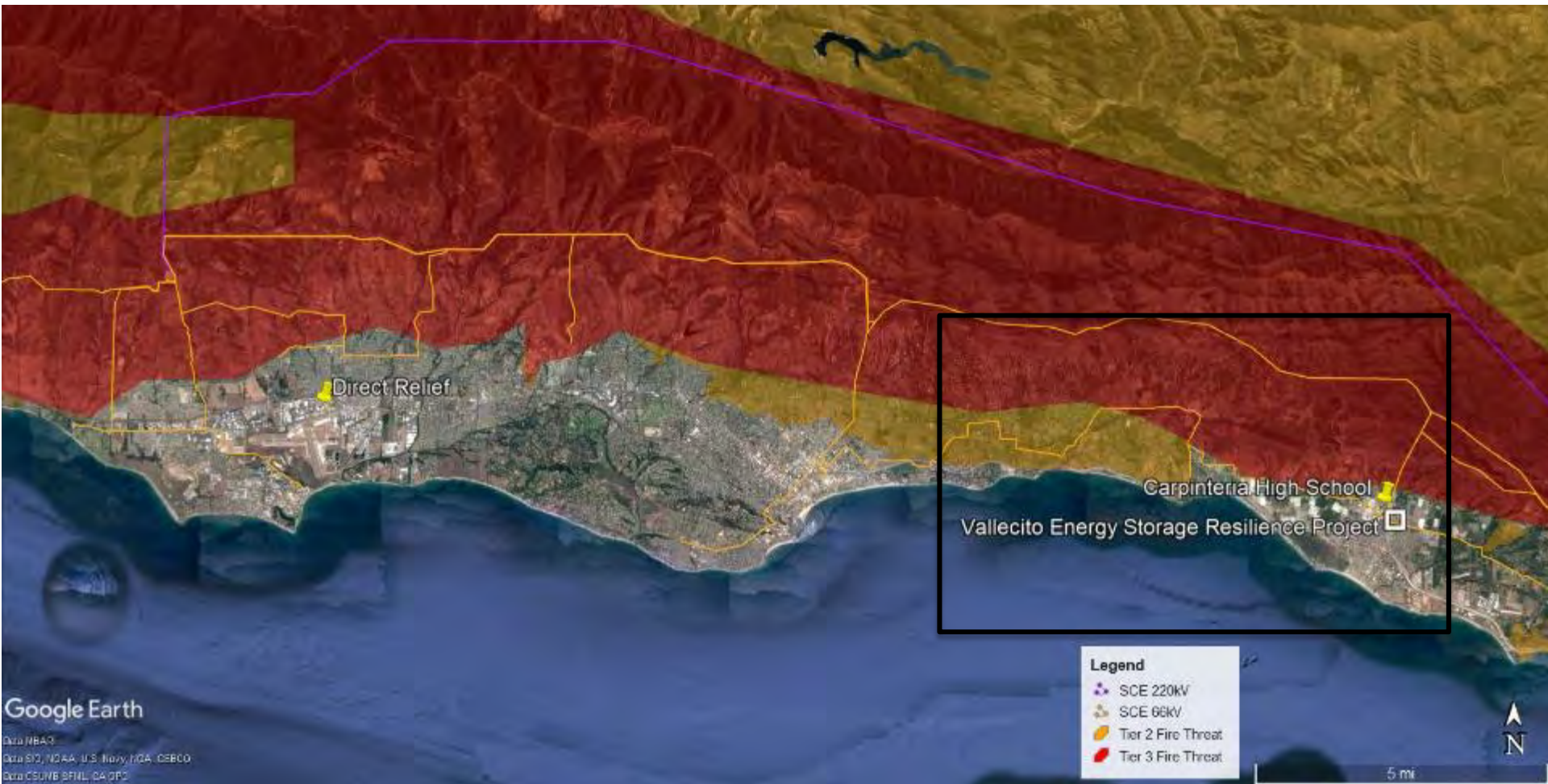
Existing Plans are a Good Start:

- “Power Center” for community use during PSPS
- Charge cell phones, portable batteries, EVs...

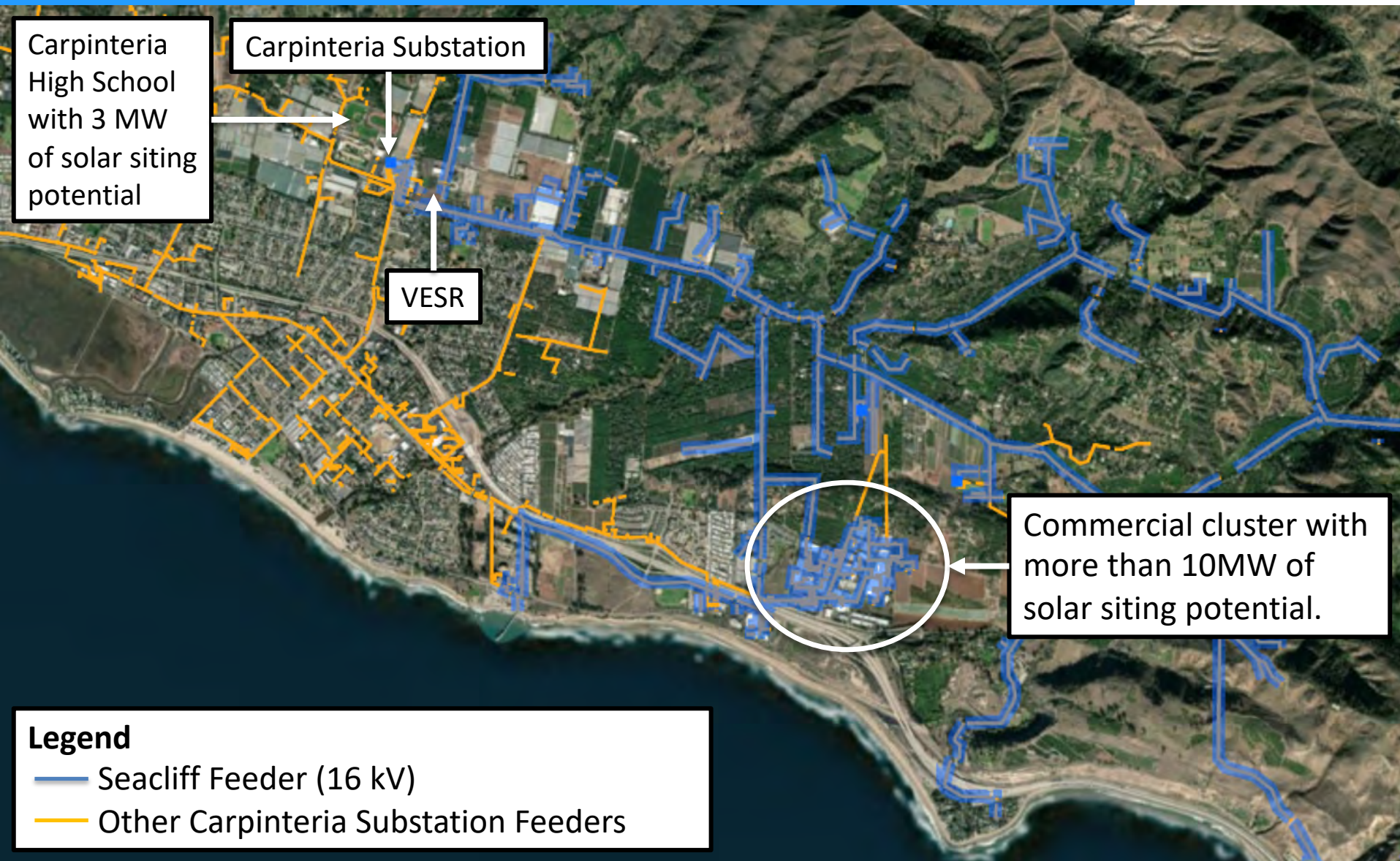
Future Plans are Ground Breaking:

- Community Microgrid Building Block.
- GLP needs 200MW/400MWh - Direct Relief alone can provide a meaningful contribution to these totals.
- The recently upgraded infrastructure in the area facilitates the potential for a local Community Microgrid with only minimum grid upgrades.
- Vegas Substation alone supplies power to a large area that would benefit from significant further solar-driven resilience.



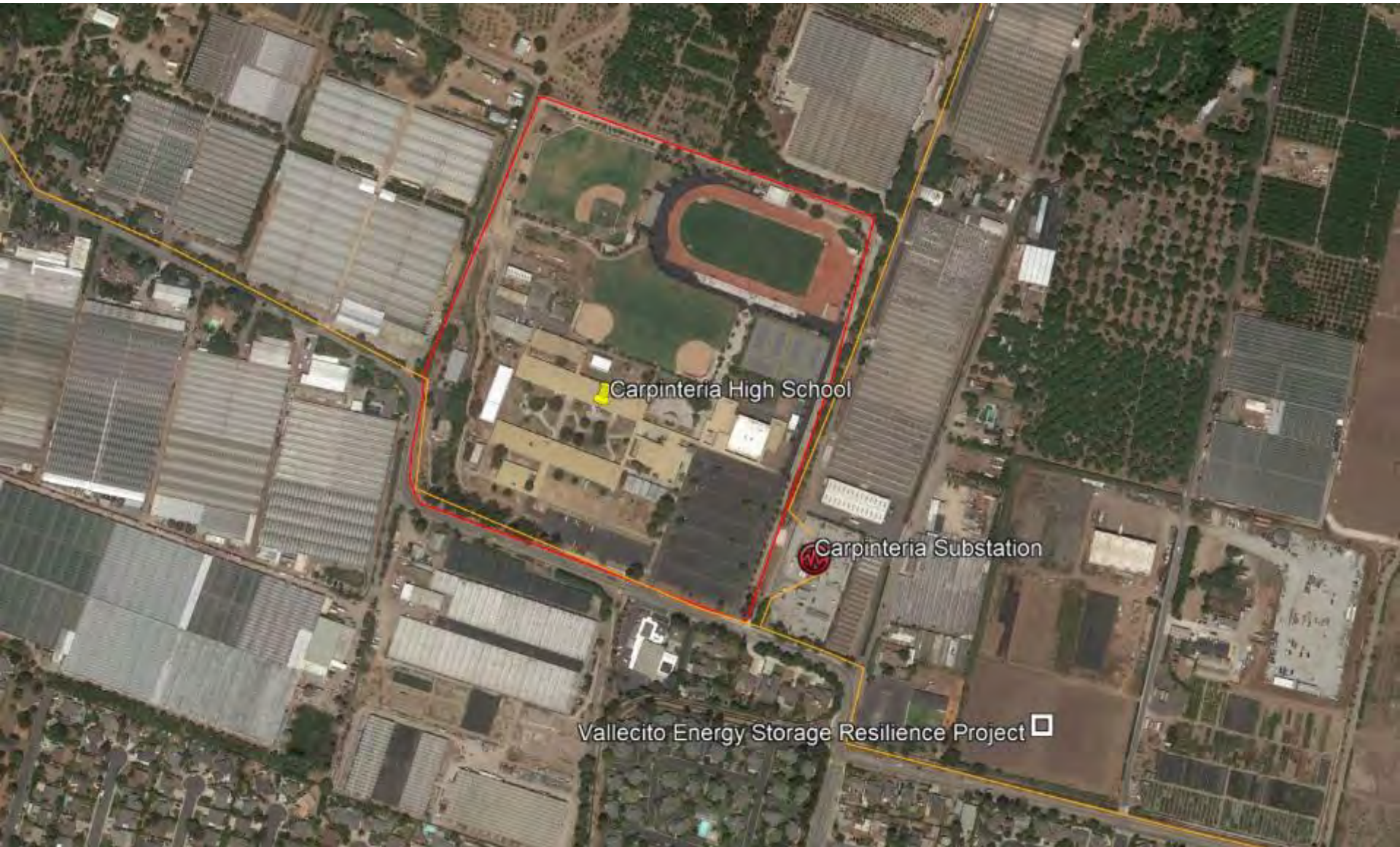


VESR is on the Seacliff circuit



Carpinteria critical sites

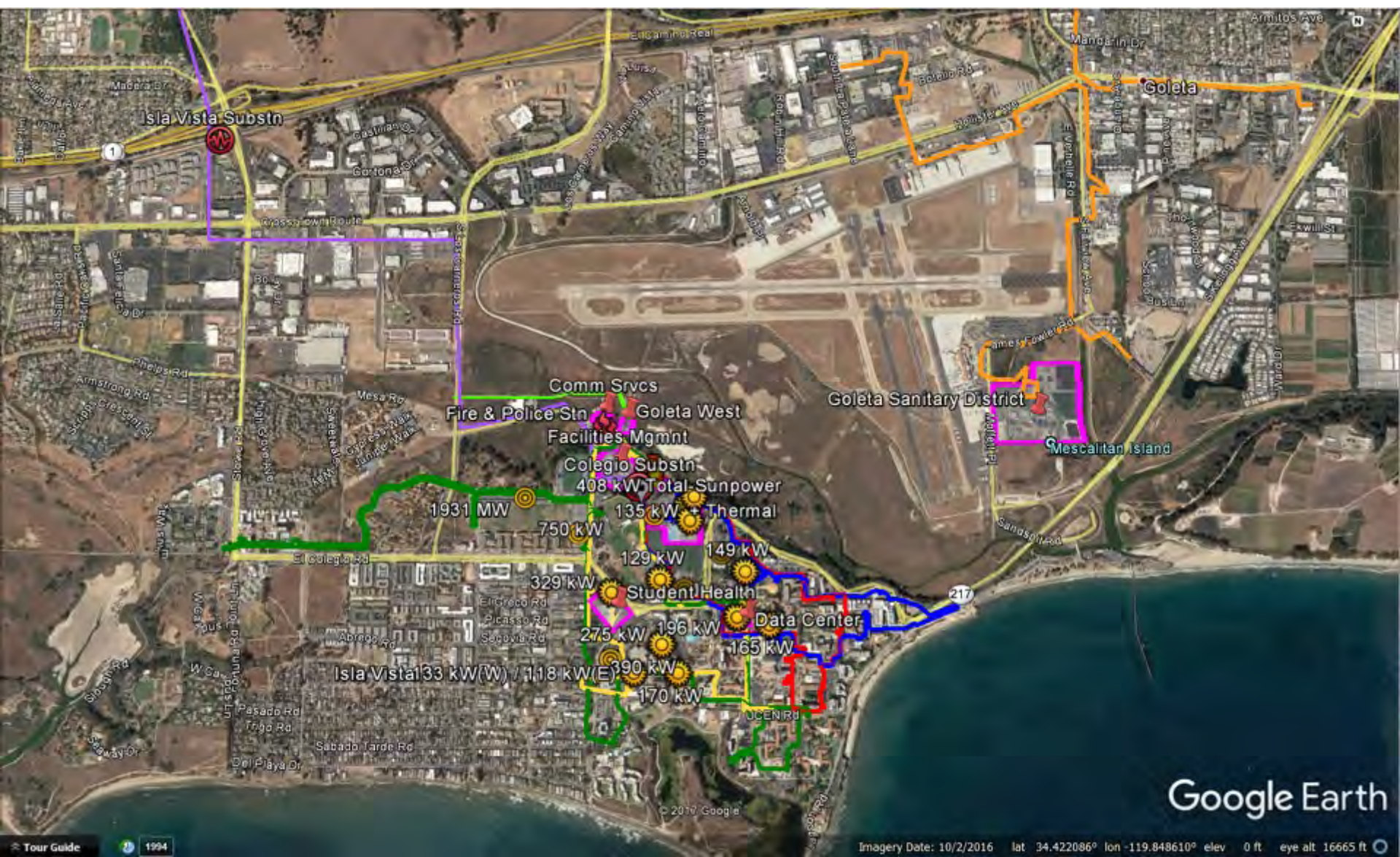




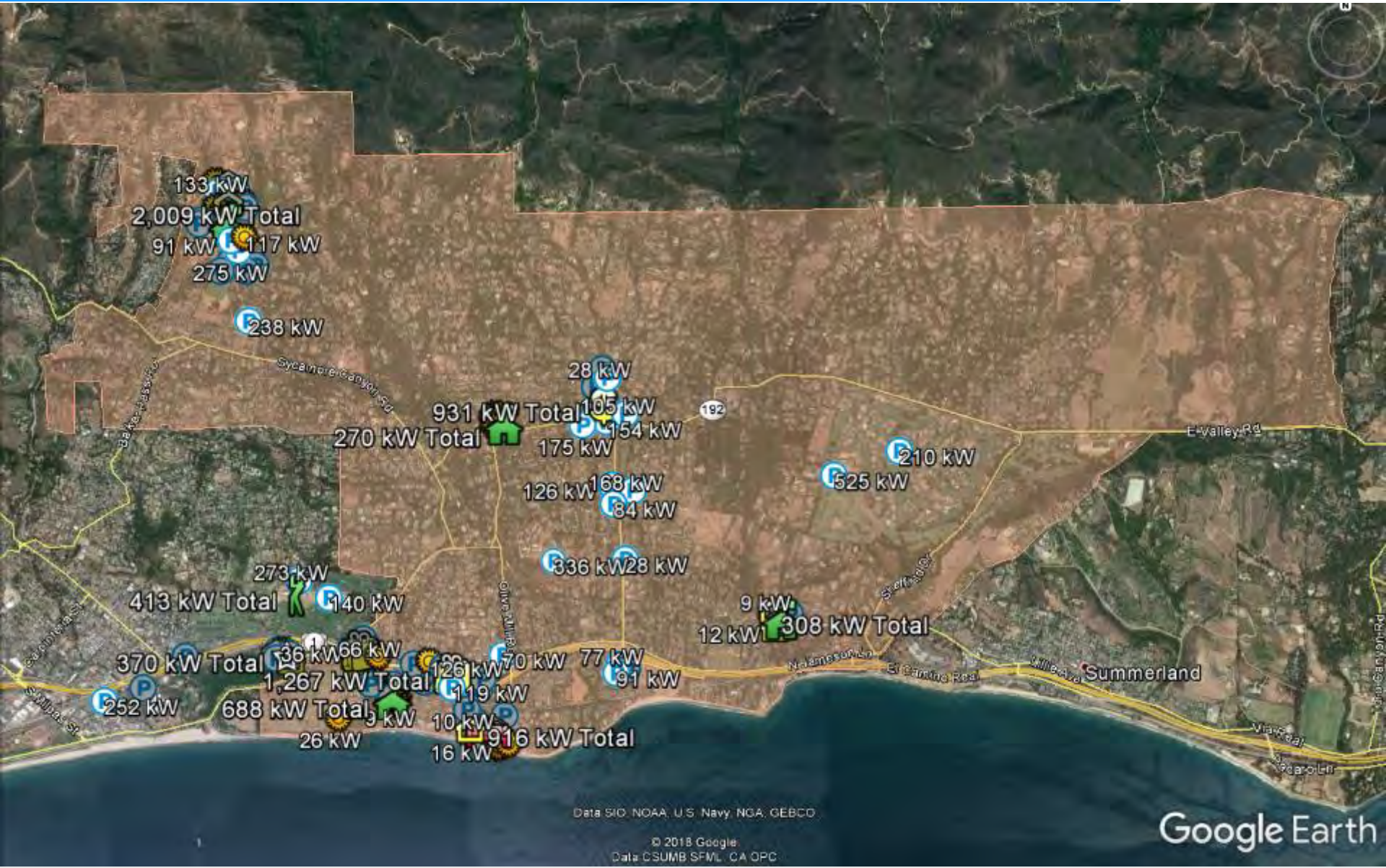
Carpinteria High School solar potential – 3MW



UCSB Community Microgrid – Area Map



Solar Siting Survey (SSS) for Montecito



Vallecito and Carpoil circuits serve downtown Carpinteria

Vallecito Circuit



Carpoil Circuit

