Clean Coalition

Making Clean Local Energy Accessible Now

Community Microgrids

How & why CCAs should drive them

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Community Microgrids are 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 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.
- 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.

Why CCAs should drive Community Microgrids

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1. Community is the arguably most important word in the CCA name: <u>Community</u> Choice Aggregation.

2. Local renewables are an expectation of most CCA subscribers and CCAs are in position to deliver.

3. Economic benefits:
   - Half the installed cost of local renewables and other Distributed Energy Resources (DER) translates into local wages and other economic stimulation.
   - Optimize economics for the CCA too via efficiency, Resource Adequacy (RA), Congestion Revenue Rights (CRR), avoided scheduling penalties, and eventually avoided Transmission Access Charges (TAC).

4. Environmental benefits: Utilizing built-environments have is far more environmentally friendly than impacting pristine remote environments and disturbing ecosystems with transmission lines and other infrastructure.

5. Resilience benefits: Local renewables and other DER are capable of providing an unparalleled level of community resilience.

Goleta Load Pocket (GLP) Community Microgrid

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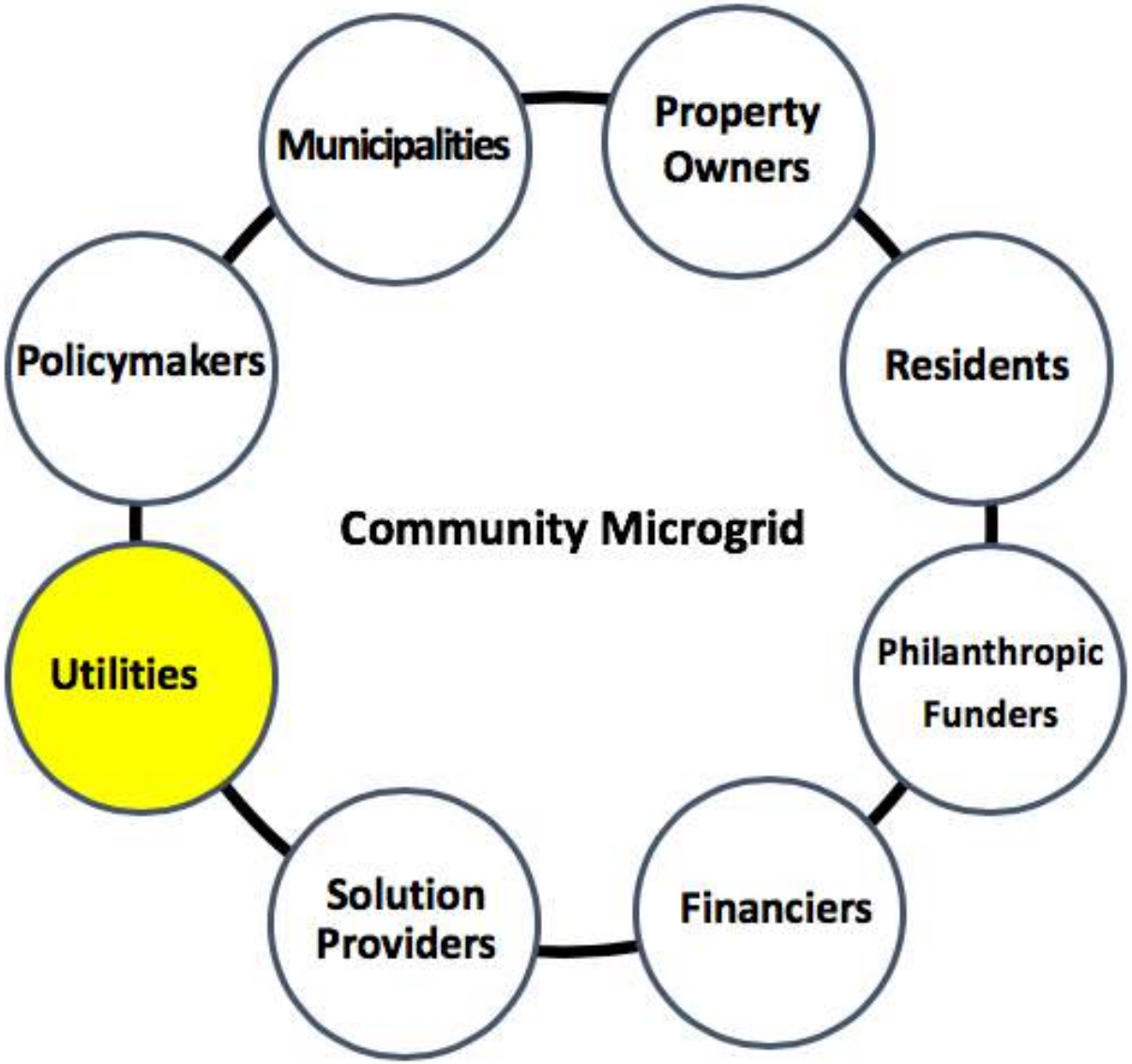
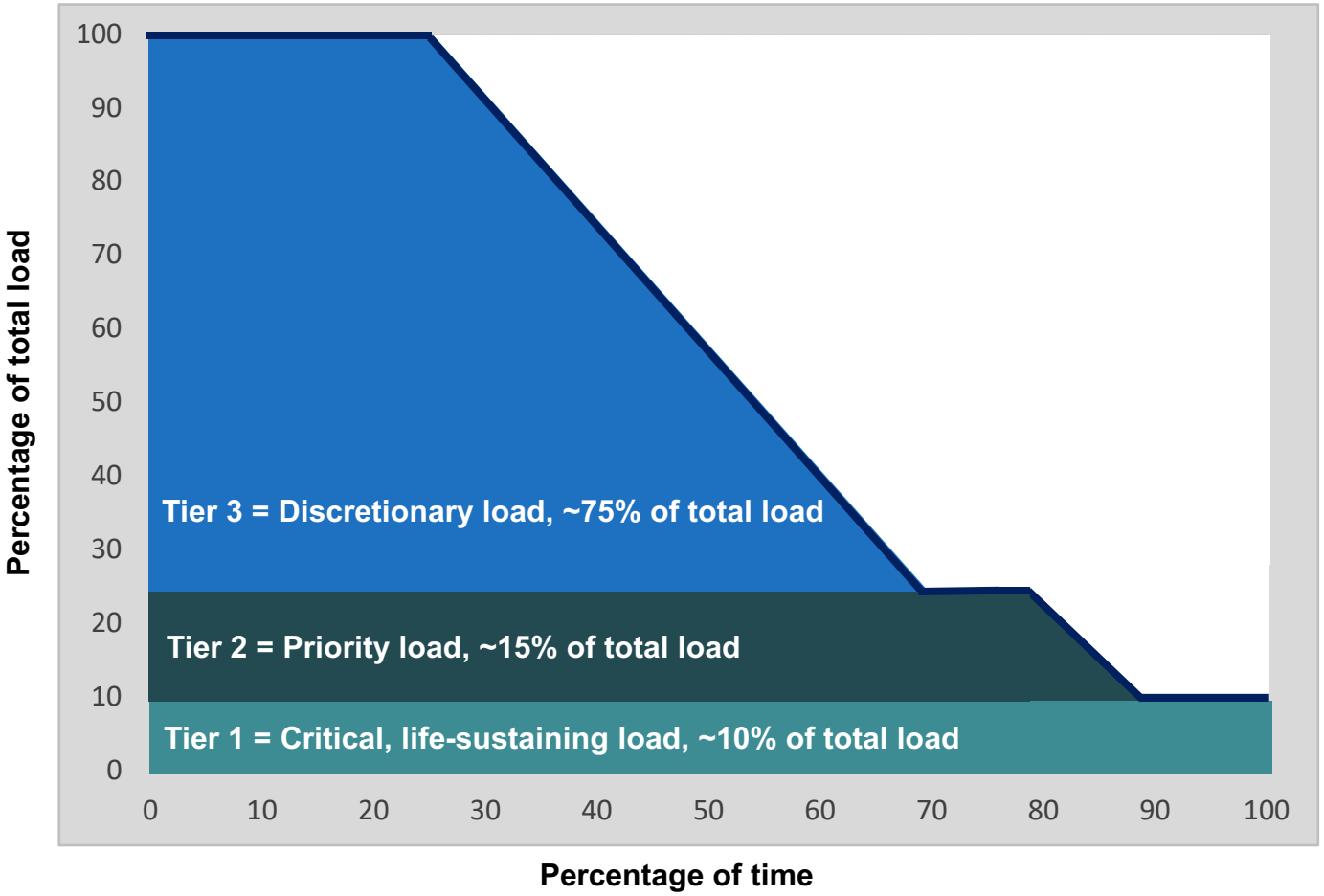
The GLP is the perfect opportunity for a comprehensive Community Microgrid

- 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.

Community Microgrid key stakeholders



Percentage of time online for Tier 1, 2, and 3 loads for net zero solar+storage microgrids in California



How CCAs should drive Community Microgrids

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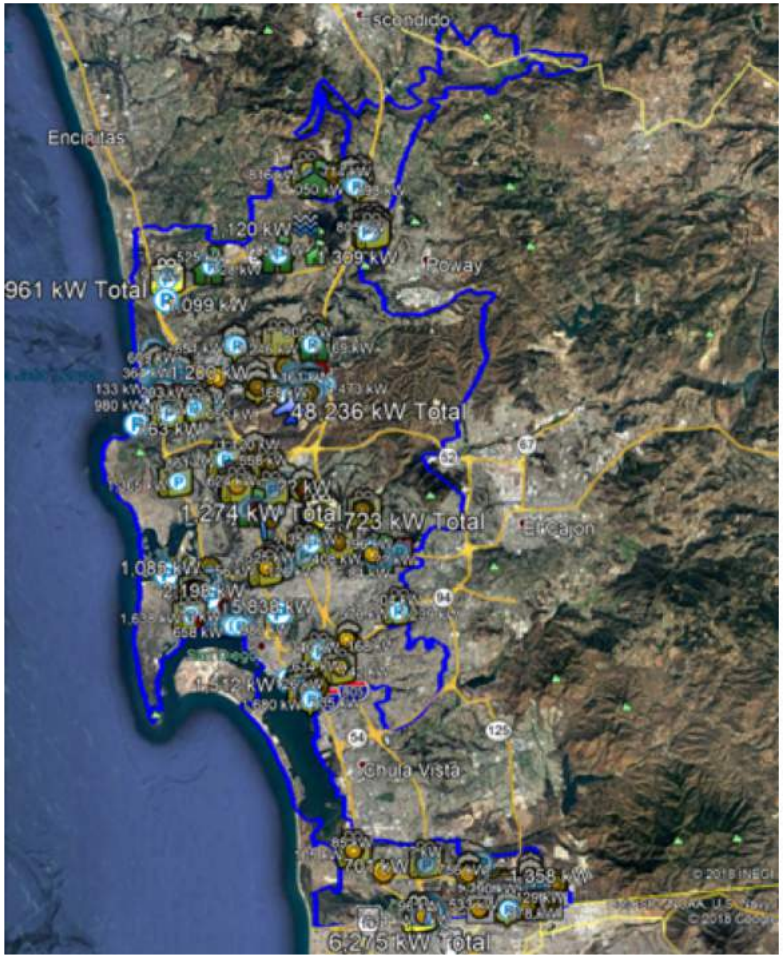
1. Conduct a Solar Siting Survey (SSS) to assess the solar potential on built-environments
   - There is massive solar siting potential on rooftops, parking lots, and parking structures, and that potential needs to be far better understood.

2. Implement a behind-the-meter (BTM) market responsive Feed-In Tariff (FIT) with Dispatchability Adder to unleash commercial-scale renewables
   - BTM – streamlines interconnection and avoids PCIA and TAC while generation meters can effect a wholesale relationship with the FIT facility owner.
   - Market Responsive Pricing (MRP) mechanism – ensures efficiency of a FIT while ensuring that ratepayers are always benefiting from renewables that are contracted at current market pricing.
   - Dispatchability Adder – encourages energy storage to be combined with the local renewables to maximize CCA economics and provision indefinite renewables-driven site resilience.

3. Support the Transmission Access Charges (TAC) Campaign
   - This is a huge market distortion that currently steels a average of 3 cents/kWh of value from local renewables in California IOU service territories.
   - NEM 2.0 almost lost the ability to avoid TAC and all other delivery charge components, and NEM 3.0 must be prepared for any outcome.

San Diego Solar Siting Survey

Clean Coalition



Total:	% of survey:	24.0%		72.9%		2.8%		0.2%		0.2%	
		Summary by Structure Types									
		Roof_Flat	kW_Total	Pkg_Lot	kW_Total	Pkg_Garage	kW_Total	Roof_Angled	kW_Total	Water	kW_Total
Totals:		237	119,630 kW	478	363,748 kW	25	14,189 kW	5	1,086 kW	1	1,120 kW
ZIP	Rank										
92037	19	3	1,746	9	6,125	-	-	-	-	-	-
92093	11	-	-	25	16,674	3	1,141	-	-	-	-
92101	4	4	5,040	18	32,242	2	3,136	-	-	-	-
92102	25	3	1,512	4	2,227	-	-	-	-	-	-
92105	31	-	-	3	1,547	-	-	-	-	-	-
92106	23	-	-	3	5,306	-	-	-	-	-	-
92108	2	6	1,292	38	48,419	4	1,575	-	-	-	-
92109	6	-	-	22	24,542	-	-	-	-	-	-
92110	8	14	9,200	13	13,951	-	-	-	-	-	-
92111	9	13	7,004	22	14,854	-	-	-	-	-	-
92113	12	6	3,092	23	10,192	-	-	-	-	-	-
92115	20	3	1,432	5	4,704	-	-	-	-	-	-
92117	27	1	26	3	2,940	-	-	2	571	-	-
92120	18	11	5,071	9	2,926	-	-	-	-	-	-
92121	10	8	3,762	23	15,659	-	-	-	-	-	-
92122	21	4	707	6	3,724	3	1,358	-	-	-	-
92123	7	13	7,715	14	15,533	2	819	-	-	-	-
92126	14	7	2,758	15	8,827	1	497	-	-	-	-
92127	5	11	8,365	30	19,369	-	-	-	-	-	-
92128	13	9	4,149	15	8,505	-	-	-	-	-	-
92129	24	1	210	6	5,068	-	-	-	-	1	1,120
92130	15	2	301	16	9,051	1	1,099	-	-	-	-
92131	29	1	273	1	1,505	-	-	-	-	-	-
92134	30	-	-	-	-	3	1,673	-	-	-	-
92136	26	-	-	5	3,667	-	-	-	-	-	-
92145	3	29	8,054	82	39,668	-	-	3	515	-	-
92154	1	56	38,565	34	33,193	-	-	-	-	-	-
92161	28	-	-	5	2,198	1	245	-	-	-	-
92173	16	21	4,922	12	3,944	-	-	-	-	-	-
92182	17	6	1,383	14	4,494	5	2,646	-	-	-	-
92199	22	5	3,053	3	2,695	-	-	-	-	-	-

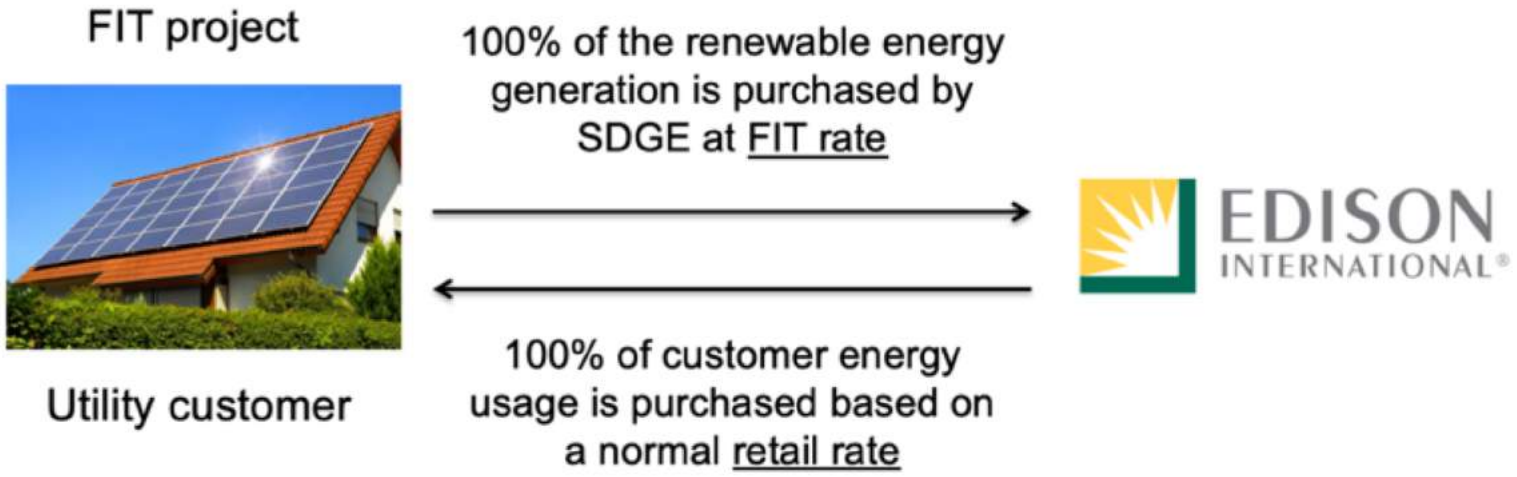
Massive solar siting potential on rooftops, parking lots, and parking structures

Why FITs are the world-class solution

FITs are unparalleled in unleashing cost-effective, commercial-scale renewables

Feed-In Tariffs (FITs) and Dispatchability Adders

- The Clean Coalition designs market-based, cost-effective FITs with streamlined interconnection
  - A FIT is a standardized, long-term, guaranteed contract that allows smaller local renewable energy projects to sell power to the local utility or other load-serving entity
- FITs work far better than NEM or auctions to unleash commercial-scale renewables.
- Our FITs use Market Responsive Pricing, which allows subsequent contract prices to adjust based on market response to pricing of current contracts— ensuring that energy contracts are always set at the best market price to ensure deployments while protecting ratepayers.
- A Dispatchability Adder, a fixed ¢/kilowatt-hour (kWh) capacity bonus on top of the FIT rate, to attract energy storage that make renewable energy fully dispatchable.



San Diego FIT Market Responsive Pricing (MRP)

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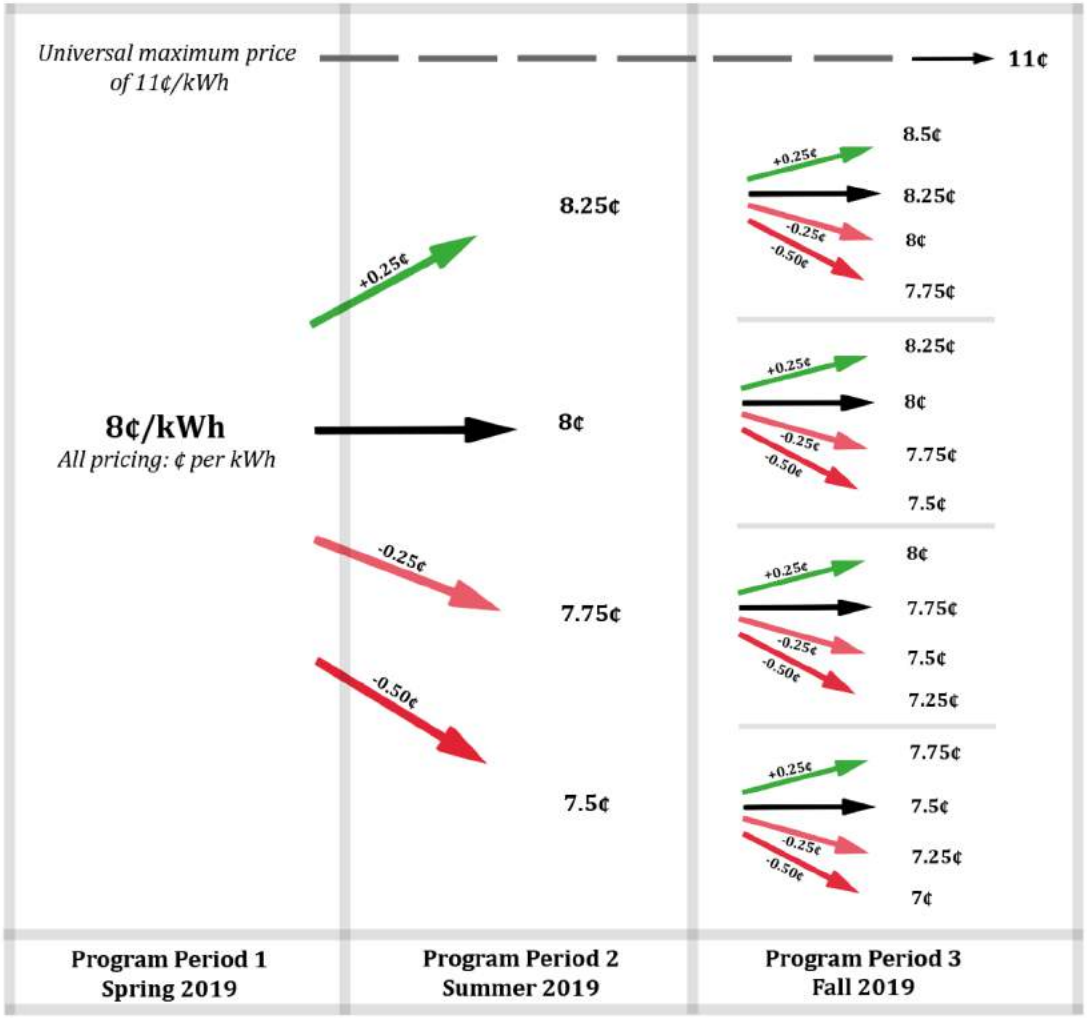
Once baseline pricing is set for the initial FIT tranche, MRP governs baseline pricing, which can never exceed a universal maximum of 11¢/kWh.

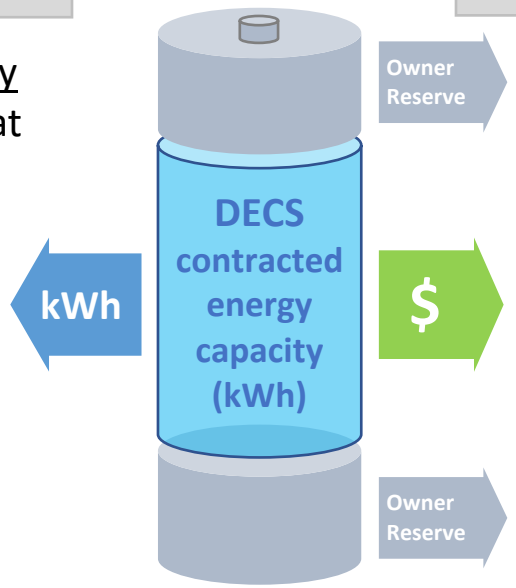


Dispatchable Energy Capacity Services (DECS)

Clean Coalition

Load Serving Entity (LSE)

- LSE contracts for dispatchable daily cycling of energy capacity (kWh), at a fixed $/kWh fee, used or not.
- LSE optimizes fully flexible energy capacity, dispatching for any purpose, which could be based on time of day, day of week, season, event, and/or other optimizations over the DECS contract period.
- Initial DECS contracts are priced at Cost of Service (COS) while subsequent DECS contract pricing is adjusted for market response.



Storage Asset Owner

- Owner retains discretion over any capacity not under DECS contract.
- Owner earns guaranteed $/kWh payments for the DECS-contracted energy capacity.
- Owner retains discretion over any capacity not under DECS contract.

Three COS components:

1. Net Cost of Energy (NCOE).
2. Capital expenditure ("capex").
3. Operating expenditure ("opex").

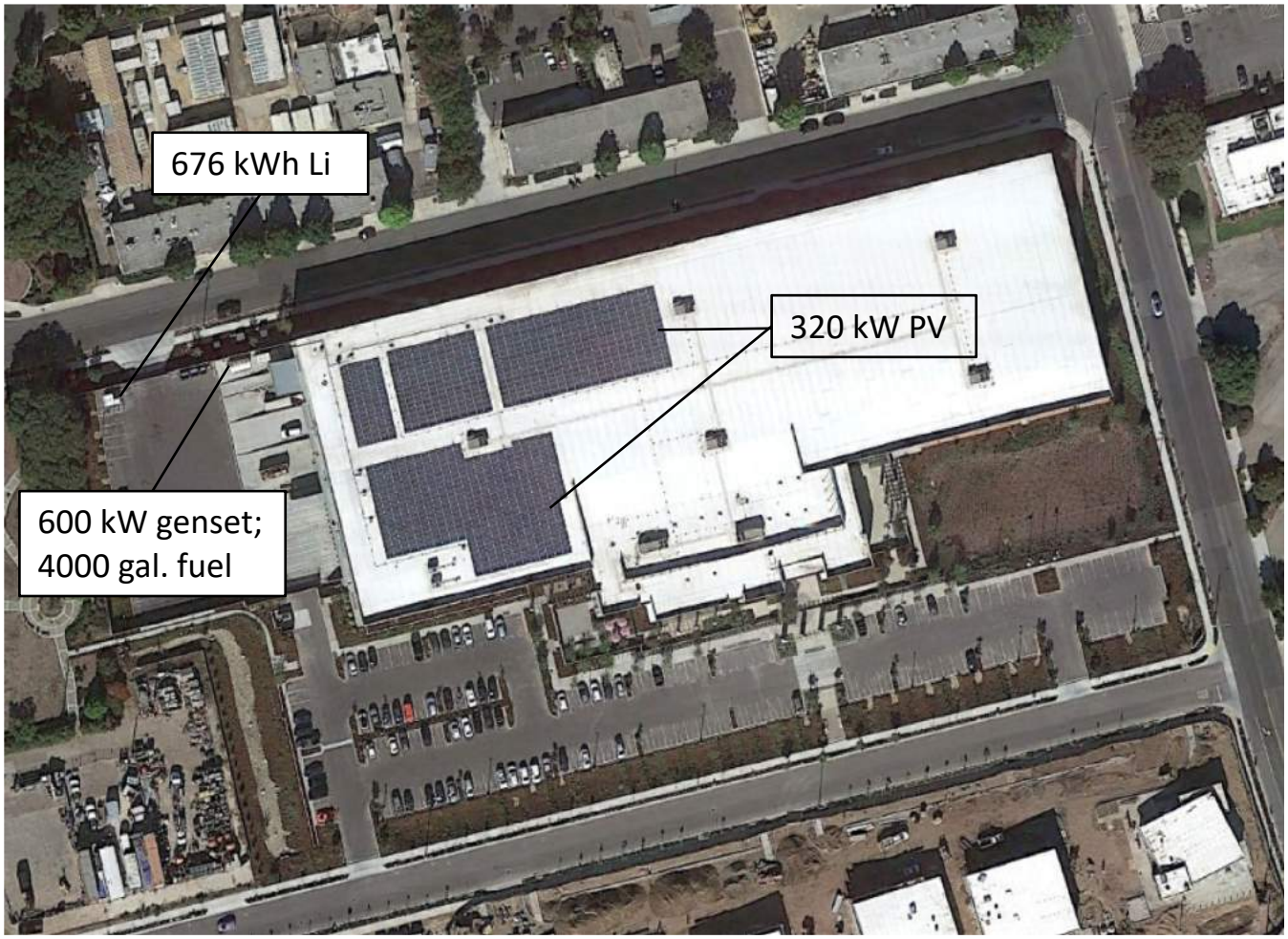
DECS offers a single bankable revenue stream for energy storage owners and a fully flexible & dispatchable energy source for LSEs available daily.

Direct Relief Microgrid should expand greatly

- Location: Santa Barbara, CA.
- Owner: Direct Relief (one of the largest disaster recover/supply non-profits in the world).
- Brand new 155,000-square-foot pharmaceutical warehouse.
- Ships direct to disasters zones, internationally. Cold storage cannot be without power.
- Needed a microgrid for indefinite renewables-driven backup power.

Direct Relief Microgrid – onsite Resilience only

- Resiliency is #1 concern:
  - 320 kW PV
  - 676 kWh Storage
  - 600 kW generator
  - 4000 gal. of fuel
- PV annual generation designed to cover annual consumption.
- Storage designed to time-shift the generation to more valuable times, and provide Resiliency.
- Genset provides “back-up to the back-up”.
- Direct Relief’s mission is to stay operational in the event of a local disaster that causes interruption of electricity.



Direct Relief Microgrid ready to do way more!

Clean Coalition

Microgrid only serves Direct Relief needs:

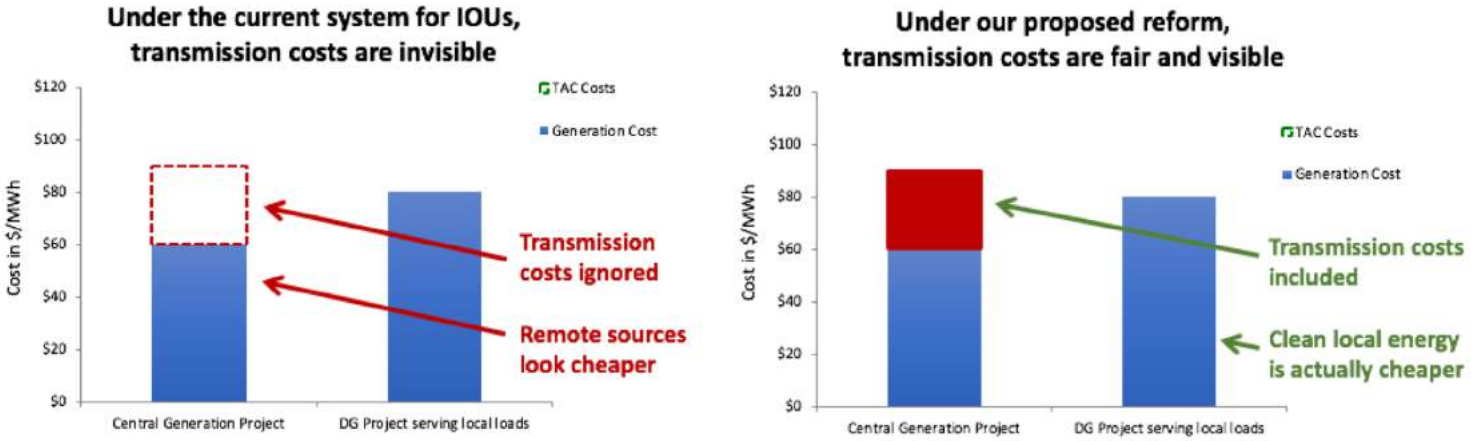
- 70% of roof and 100% of massive parking area solar potential is unused.
- Additional storage not able to be considered due to policy prohibitions around exporting energy from a battery to the grid – even though the energy is 100% stored solar.

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!

TAC Campaign

- Transmission Access Charges (TAC) in California are assessed inconsistently and unfairly, creating a massive market distortion
  - In PTO utility service territories, California ratepayers pay the same charge for "using" the transmission system whether or not the energy they use travels across the transmission system
- The TAC market distortion has hidden costs:
  - Californians could pay up to $60 billion extra over the next 20 years
  - 3 cents per kWh is being stolen from clean local energy projects — 50% of their total cost — making them look more expensive than they really are
  - Fewer $$ are available for the resilience that Community Microgrids bring our communities
- The Clean Coalition is proposing this reform: Charge for electricity transmission based on actual use of the transmission grid
  - This method is already being used successfully by California's municipal utilities



Backup slides

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.

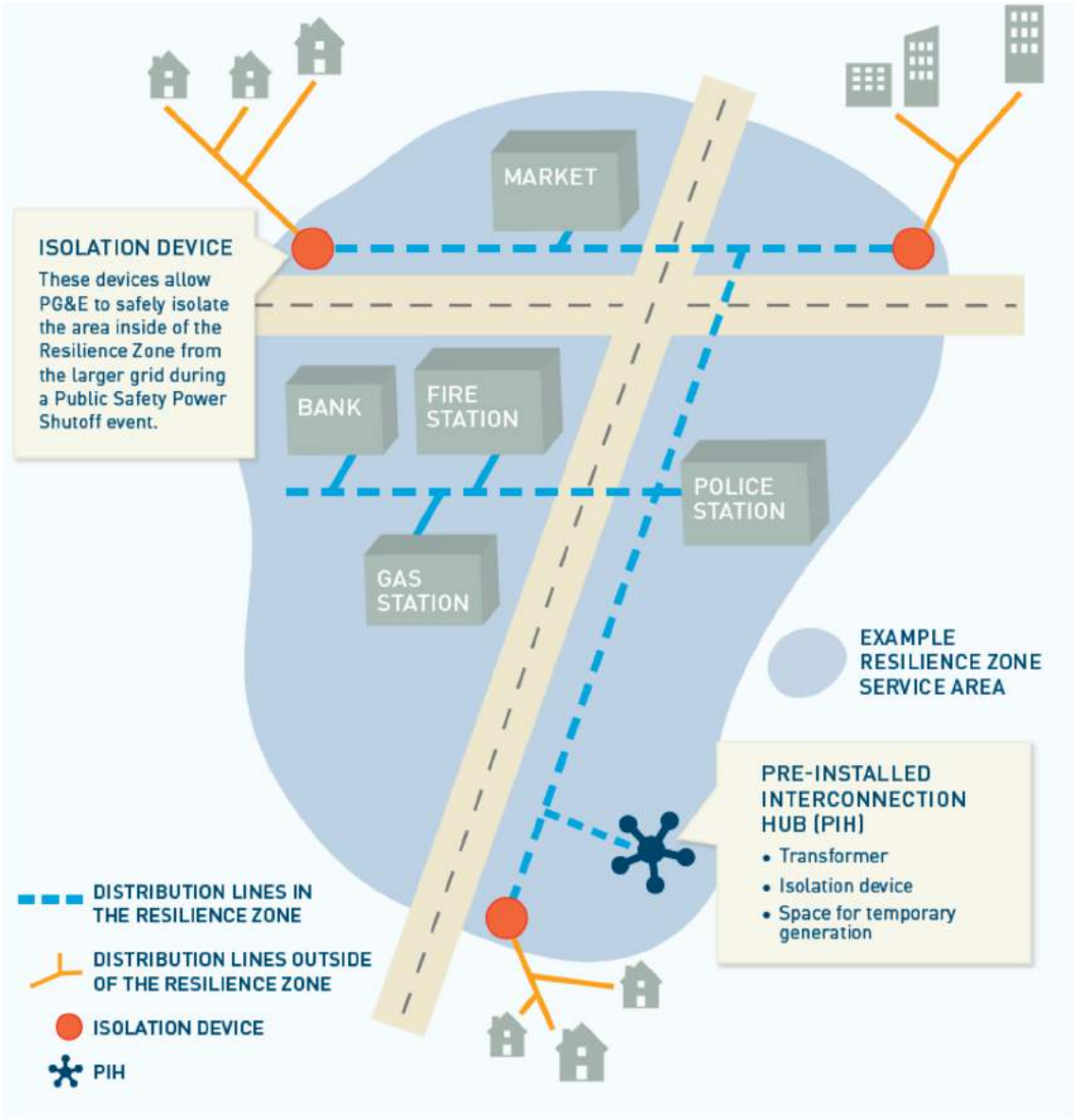
Valencia Gardens Energy Storage (VGES) project

Clean Coalition

Ecoplexus WDG solar project at the Valencia Gardens Apartments in San Francisco, ~800 kW equivalent to ~80% of annual load.

PG&E Resilience Zones = Community Microgrids

Clean Coalition



Source: PG&E, Jul2019

Get involved in the GLP Community Microgrid

- Contribute to the funding requirements of the GLP Community Microgrid Initiative, which should be staffed with several full-time equivalent experts to fulfill the vision.
- Bring properties into play for near-term NEM installations and to stage for WDG projects as policies and market mechanisms are innovated.
- Engage in the policymaking, including in upcoming County & City meetings.
- Bring solutions to the GLP, including Demand Response (DR), Electric Vehicle Charging Infrastructure (EVCI), and Energy Efficiency (EE).
- Share the GLP Community Microgrid as a game-changing showcase for delivering renewables-driven resilience to communities.
- Subscribe to the Clean Coalition newsletter to stay informed.

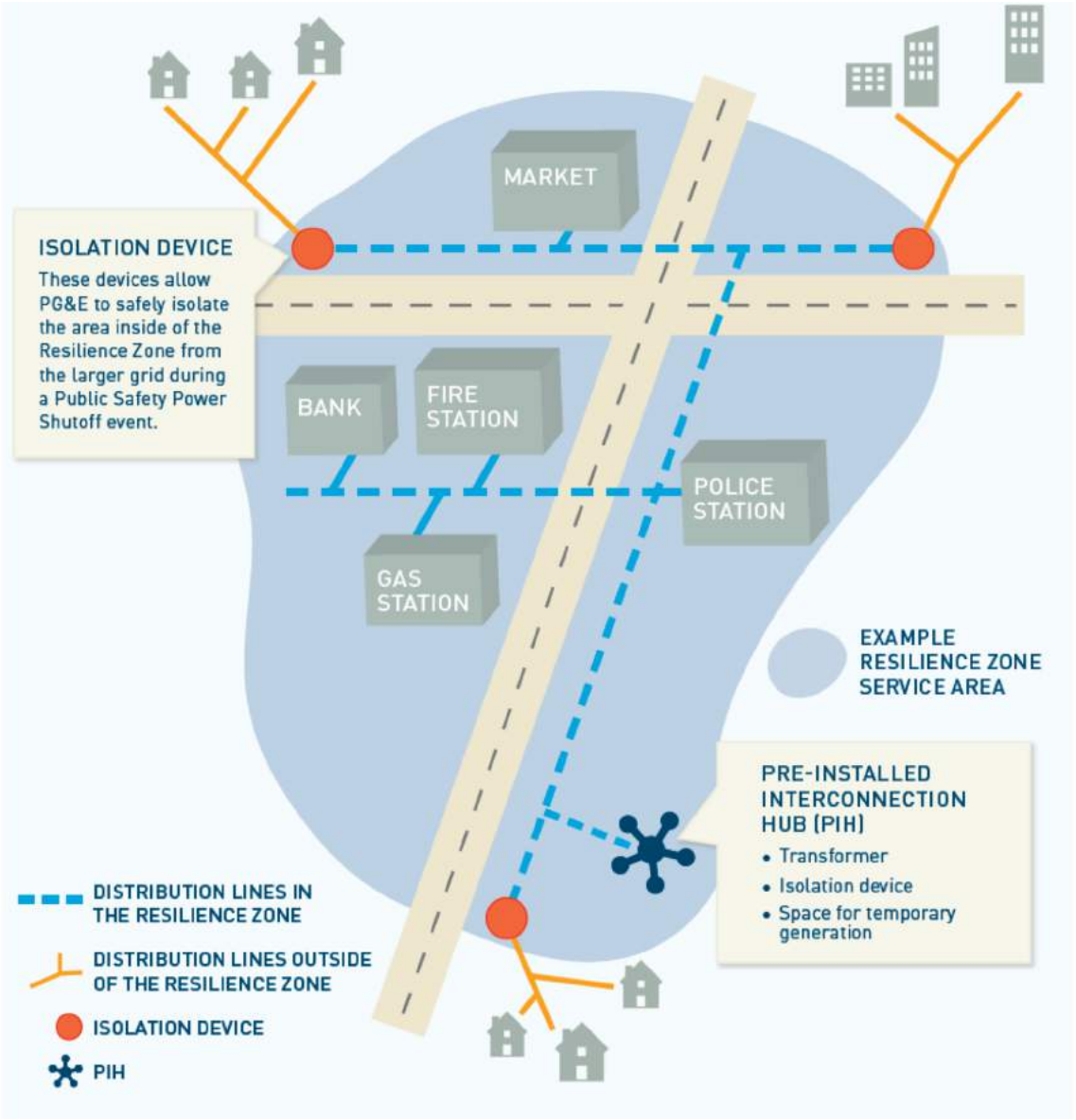
Ellwood peaker and the need for grid isolation switches

Puente Peaker Plant in Oxnard

- During extensive power outages caused by the Thomas Fire and Montecito Debris Flows damaging the transmission lines serving the county, the Ellwood peaker plant did not turn on for reasons not entirely clear. Likely had to do with worker safety in repairing damages power lines that did not have proper grid isolation switches.
- 50 MW Ellwood peaker should be replaced by 50MW multi-hour battery.
- Investor owned utilities need to install proper grid isolation switches to island from future damaged power lines.

PG&E Resilience Zones = Community Microgrids

Clean Coalition



Source: PG&E, Jul2019

Wholesale Distributed Generation (WDG) defined

Clean Coalition

Project Size

50+ MW

500 kW

5 kW

Wholesale DG

Serves Local Loads

Central Generation

Serves Remote Loads

Retail DG

Serves Onsite Loads

Behind the Meter

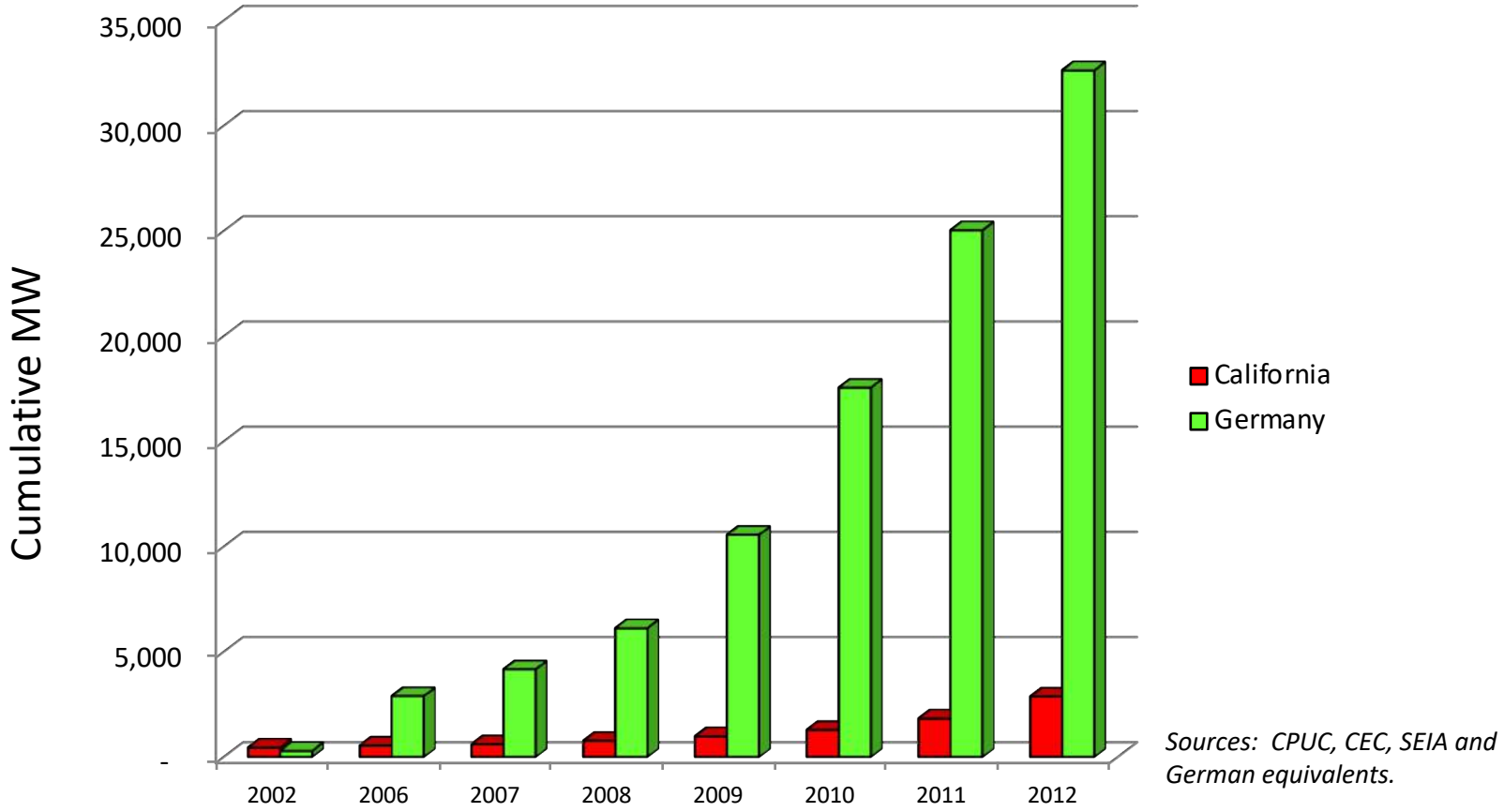
Distribution Grid

Transmission Grid

WDG and FIT drove huge solar use in Germany

Clean Coalition

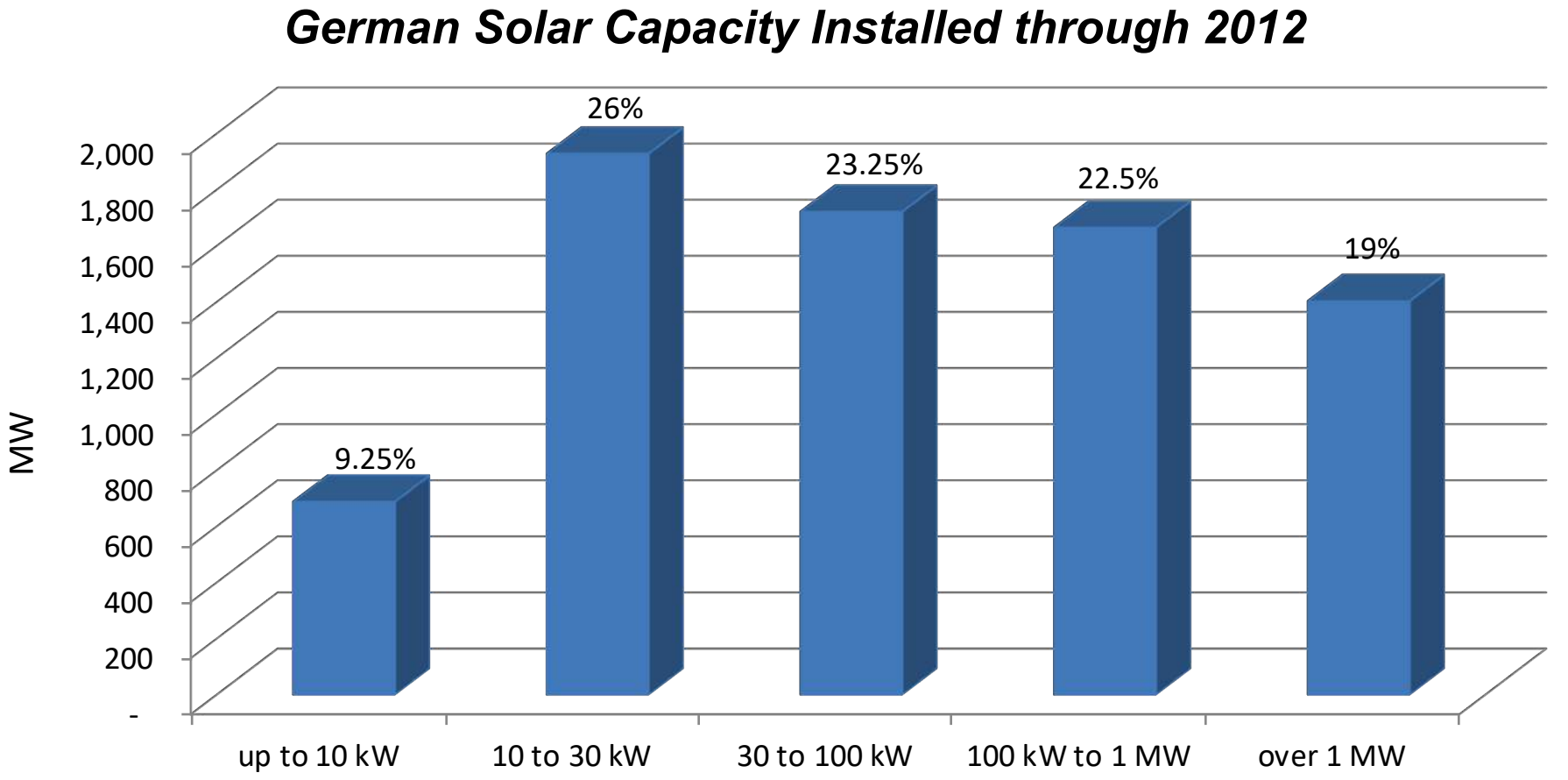
Solar Markets: Germany vs. California (2002-2012)



Sources: CPUC, CEC, SEIA and German equivalents.

Germany deployed over 10 times more solar than California in the decade from 2002 — despite California having 70% better solar resource.

Majority of German solar is small WDG



Source: Paul Gipe, March 2012

Germany's solar deployments are almost entirely sub-2 MW projects on built-environments and interconnected to the distribution grid (not behind-the-meter).

German rooftop solar converts to 3 cents/kWh

Clean Coalition

Project Size	Euros/kWh	US$/kWh	California Effective Rate US$/kWh
Under 10 kW	0.1270	0.1359	0.0628
10 kW to 40 kW	0.1236	0.1323	0.0611
40.1 kW to 750 kW	0.1109	0.1187	0.0548
Other projects up to 750 kW*	0.0891	0.0953	0.0440

* For projects not sited on residential structures or sound barriers.

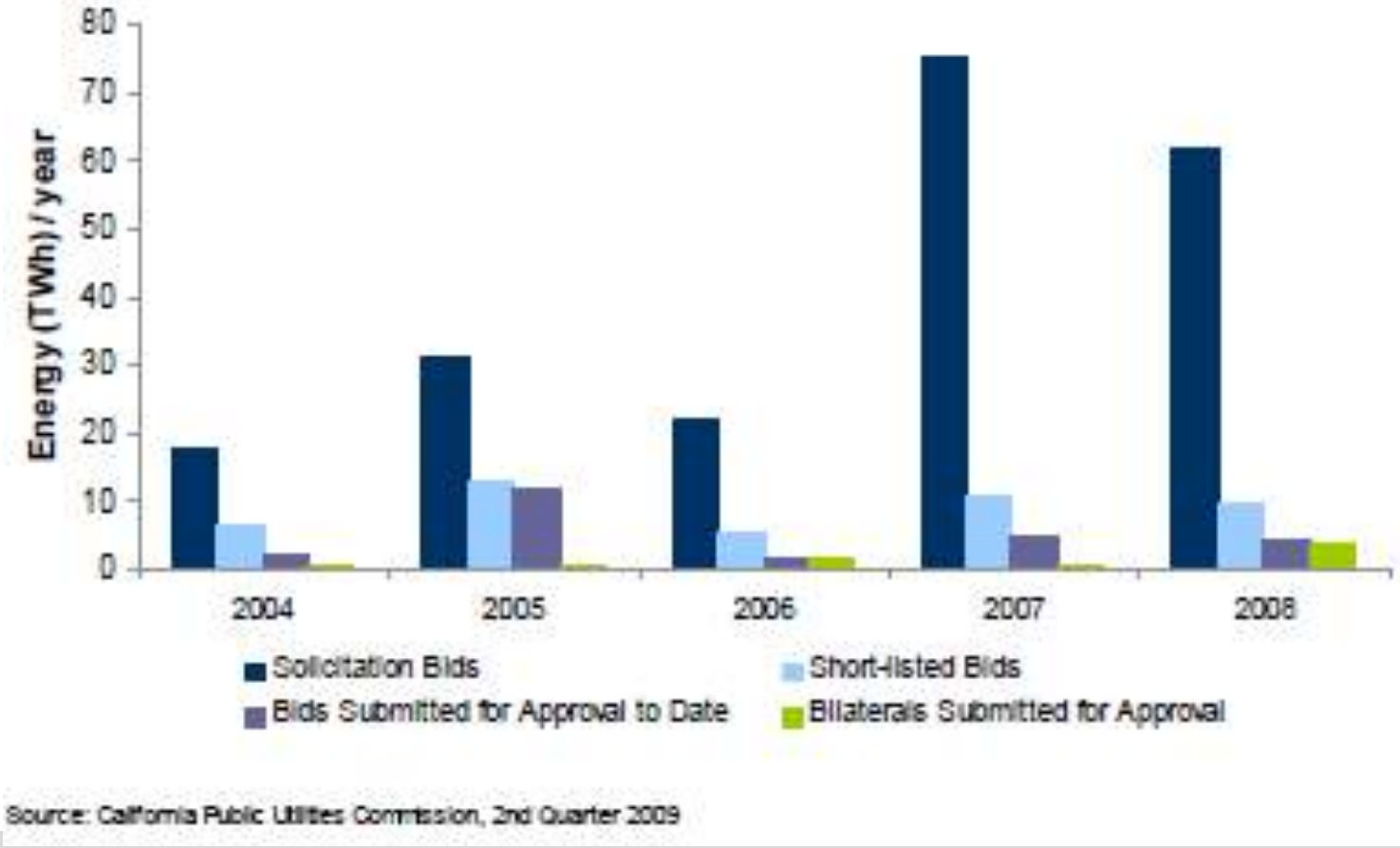
- All data in table is from 2016. Foreign exchange conversion applied is 1 Euro to 1.07 US$.
- California's effective rate is reduced 40% due to tax incentives and then an additional 33% due to the superior solar resource.

Replicating German scale and efficiencies yields commercial-scale rooftop solar in California at the lowest energy price possible: 3 cents/kWh for delivered energy.

Auctions/solicitations have massive failure rates and are NOT appropriate for commercial-scale

Clean Coalition

- Across California RPS solicitations, fewer than 1 in 10 project bids were actually developed, which resulted in high administrative costs for the program and exorbitant risk/cost for renewable energy project development.
- It is insane to think that auctions could possibly attract commercial-scale renewables and other DER, and yet, California utilities and policymakers chronically prove Einstein's definition of insanity by continuing to pursue local renewables and other DER via auctions!



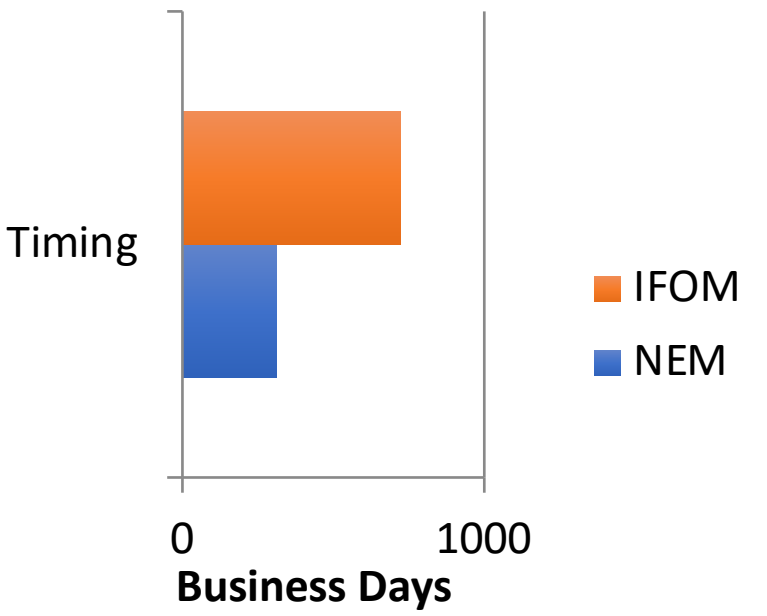
Source: California Public Utilities Commission, 2nd Quarter 2009

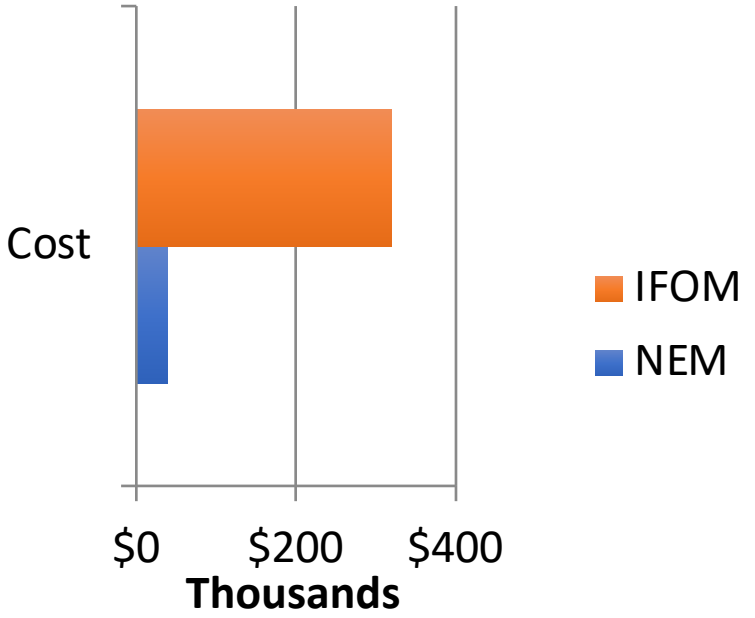
WDG & NEM interconnection need to be aligned

Clean Coalition

Our goal is to address the circumstances that lead to differences in timeframe and costs between what are otherwise identical PV systems, based on whether they are installed “behind the meter” (NEM) or “in front of meter” (IFOM or WDG).

Currently, there are <u>significant</u> differences in both project development timing and costs between NEM and IFOM/WDG systems:





Comparing Investor-Owned Utilities (IOUs) and SMUD project development timelines

Clean Coalition

CA IOUs	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12
Cluster process	Potential cluster process waiting period											2nd cluster window	IR review	Scoping Meetings	Phase I study					Results meeting	
Fast Track	IR validation and initial review	Options mtg and supp. Review agreement	Supp. Review	IA	EPC (construction)																
Ind. Study Procedure	IR validation and initial review	System Impact Study Agreement (SISA)	SIS			Security Posting	Facilities Study (FS)			IA	EPC										
SMUD FIT Program	IR review and scoping meetings				IA		Contract execution	EPC (estimated)													

Jan-13	Feb-13	Mar-13	Apr-13	May-13	Jun-13	Jul-13	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14
Security posting	Phase II study							Interconnection agreement negotiation (IA)			EPC (construction)											

- SMUD: about 1 year total (6 months for interconnection)
- IOU default cluster process: up to 3.5 years (average of 2 years for interconnection)

Interconnection with California IOUs takes 4 times longer than with SMUD

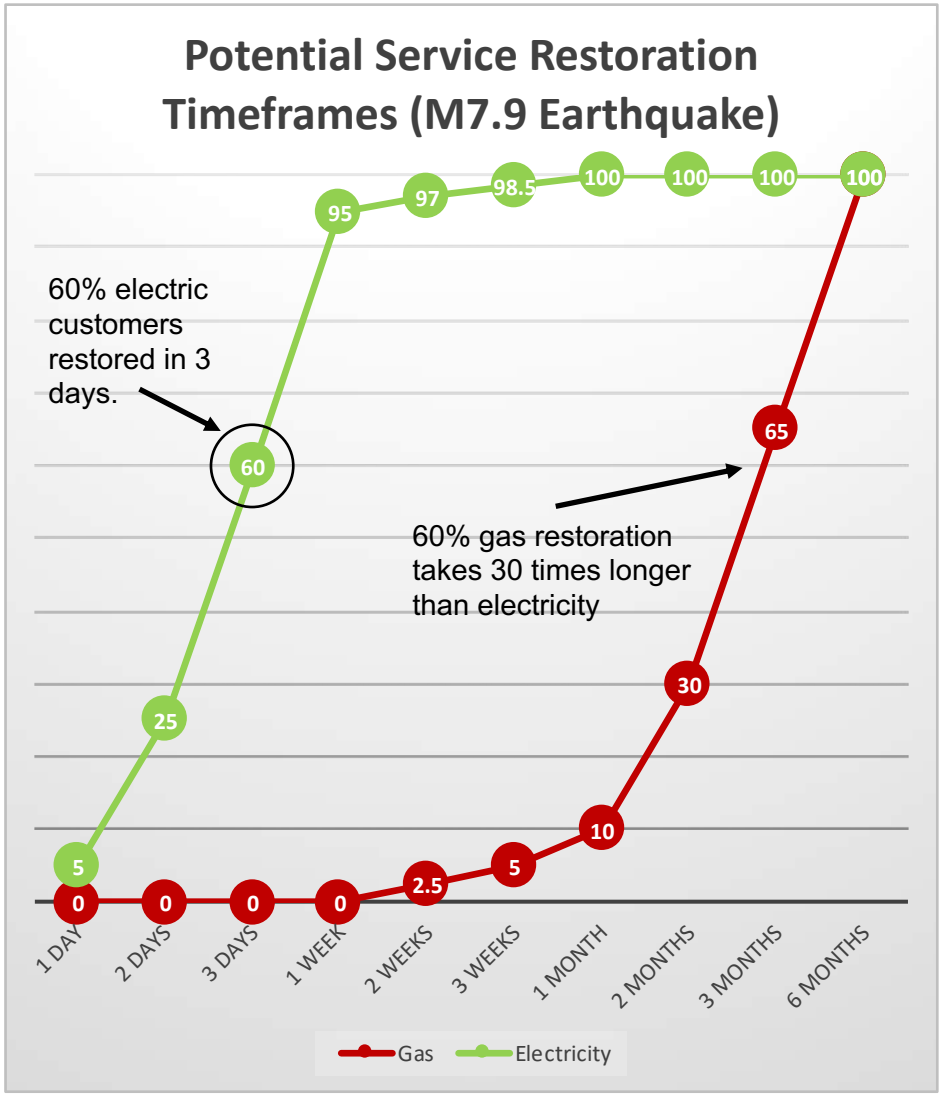
WDG interconnection

- Wholesale distributed generation (WDG): projects on the utility side of the meter rather than behind the customer's meter — often commercial-scale solar
- The interconnection process for WDG is broken in California
  - It can take years to interconnect these projects to the grid
  - The process can be arduous and expensive
- The Clean Coalition has designed a WDG Interconnection Pilot with these aims:
  - Make the WDG interconnection processes efficient and cost-effective while maintaining a safe and reliable electric grid
  - **Give WDG the same advantageous streamlined treatment as net energy metered (NEM) projects, making it equally fast and predictable**. Currently, WDG interconnections are significantly more risky, costly, time-consuming, and expensive.

Natural gas infrastructure is not resilient

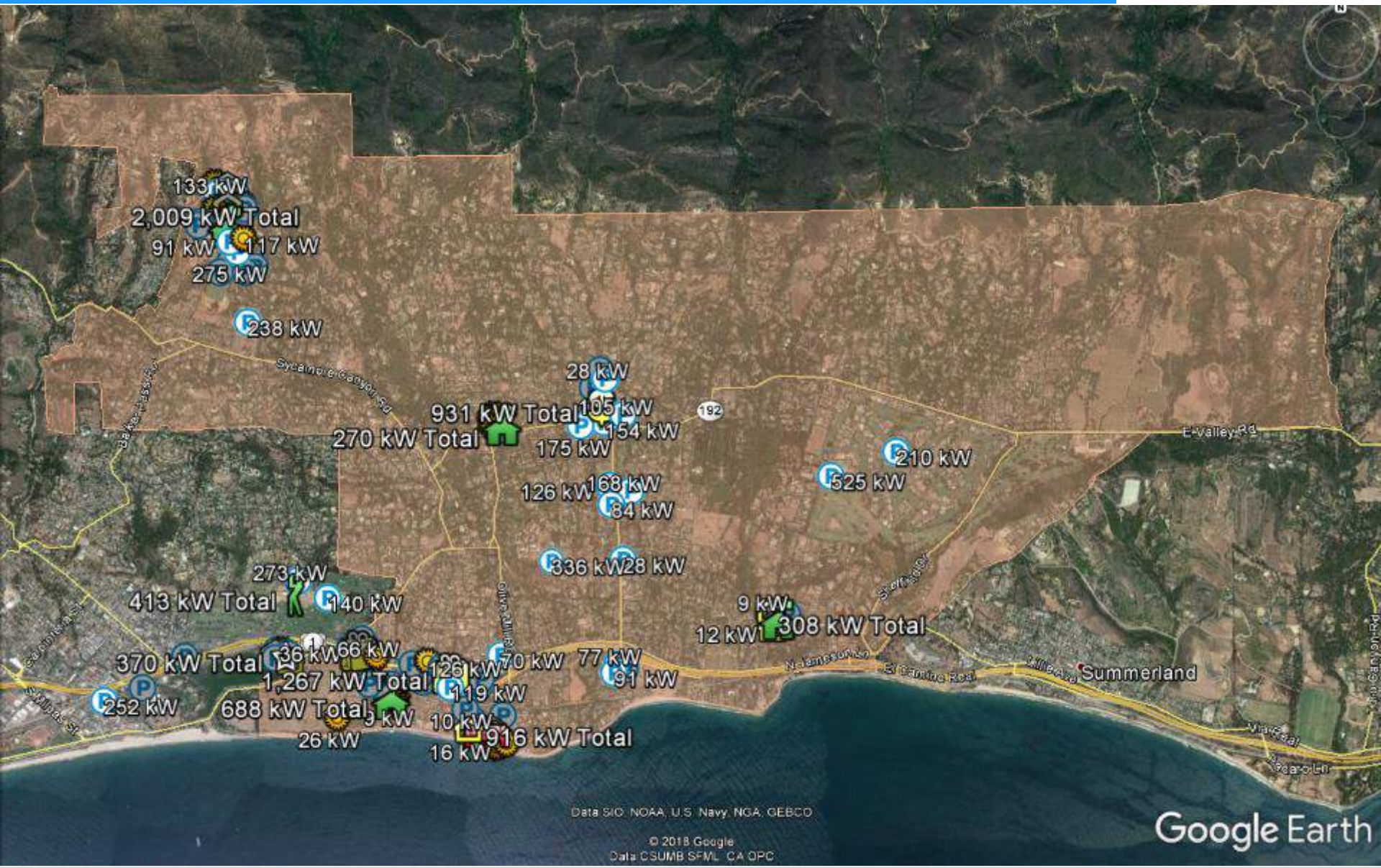
- **Assertion:** Gas-driven generation is often claimed to be resilient.
- **Reality:** Gas infrastructure is not resilient and takes much longer to restore than electricity infrastructure.
- **Threats:** Gas infrastructure can be flat-out dangerous and highly vulnerable to earthquakes, fires, landslides,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

2010 San Bruno Pipeline Explosion



Source: The City and County of San Francisco Lifelines Study

Solar Siting Survey (SSS) for Montecito



Montecito Upper Village has a concentration of critical community facilities (Fire, Water, Shelter)

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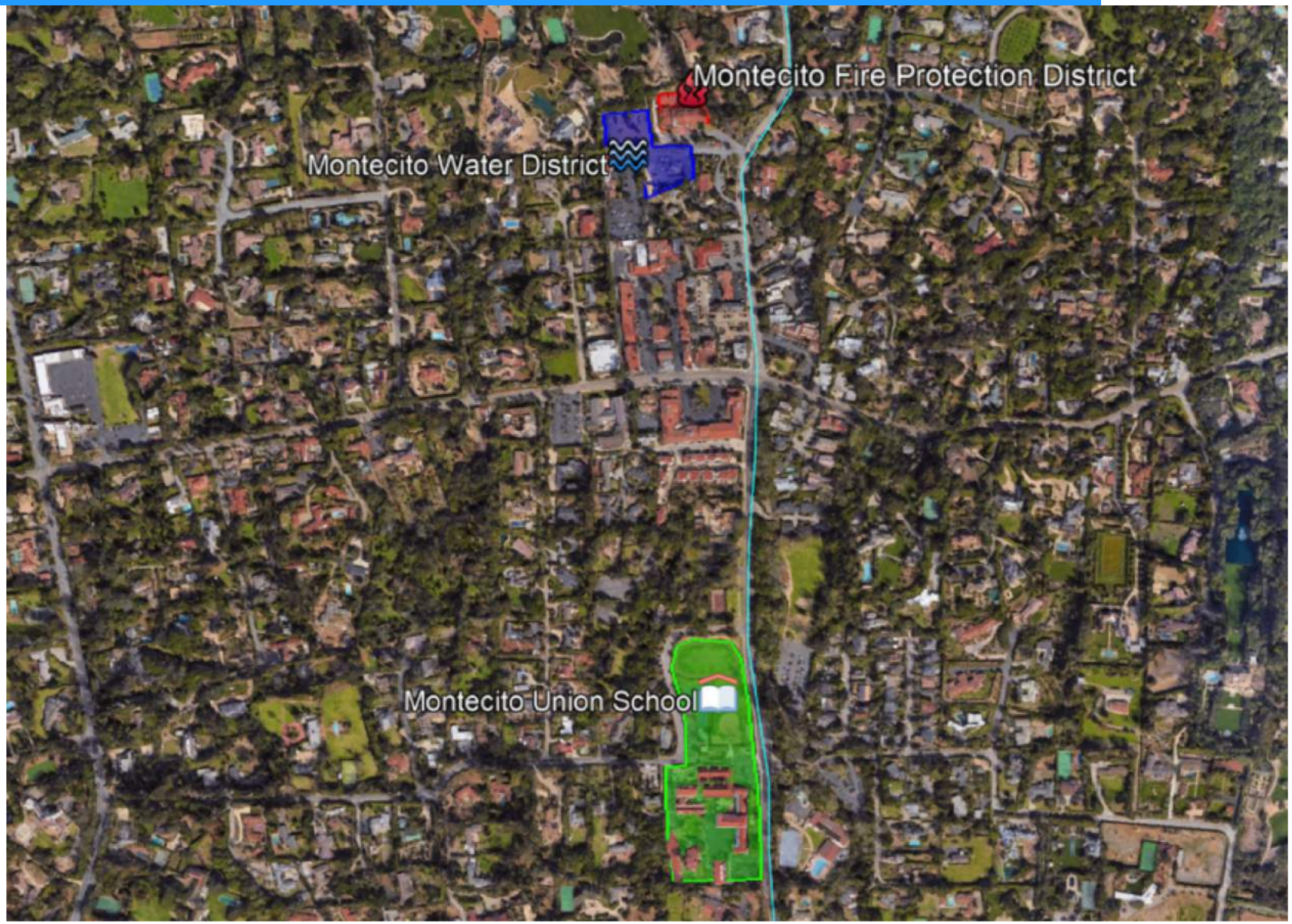

Montecito Community Microgrid block diagram

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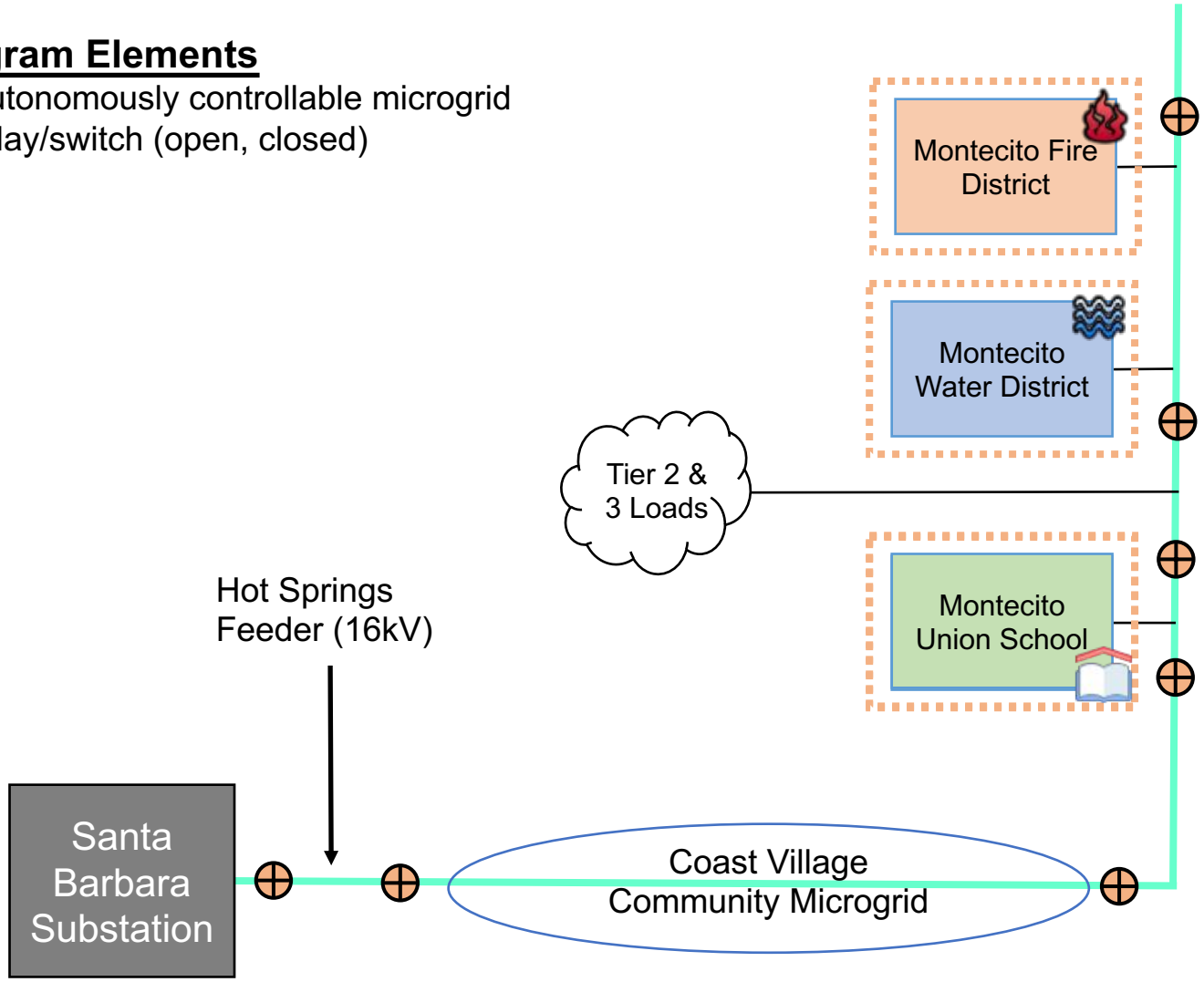
Diagram Elements

Autonomously controllable microgrid relay/switch (open, closed)



Montecito Community Microgrid – overview

Clean Coalition

Overall Goal is to provide renewables-driven energy resilience to critical community facilities in Montecito and to showcase the benefits of Community Microgrids for communities around the world.

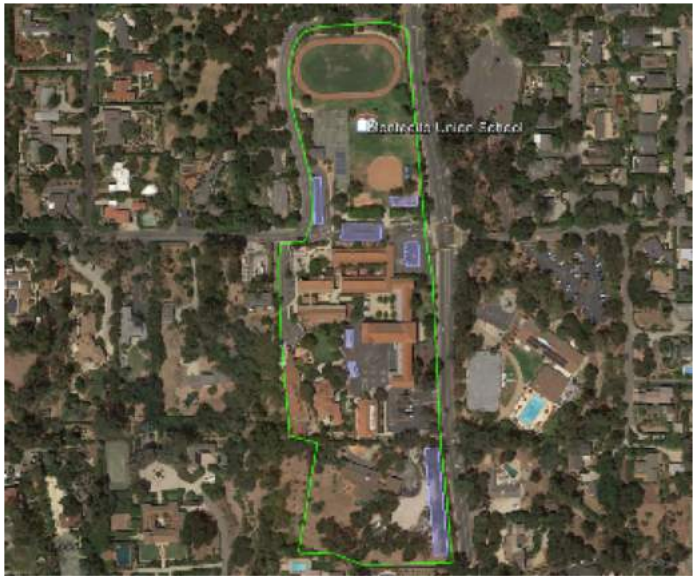
Initial Facilities:

- Montecito Fire Protection District headquarters & primary fire station
- Montecito Water District headquarters & critical pumps
- Montecito Union School

Each site is anticipated to have an independent microgrid with enough solar+storage to be net zero and deliver indefinite renewables-driven backup power to the most critical loads:

- 10% of the load 100% of the time.
- 100% of the load at least 25% of the time.

Montecito Fire and Water Districts



Montecito Union School