The Resilient Energy Subscription (RES) to enable the accelerated deployment of Community Microgrids

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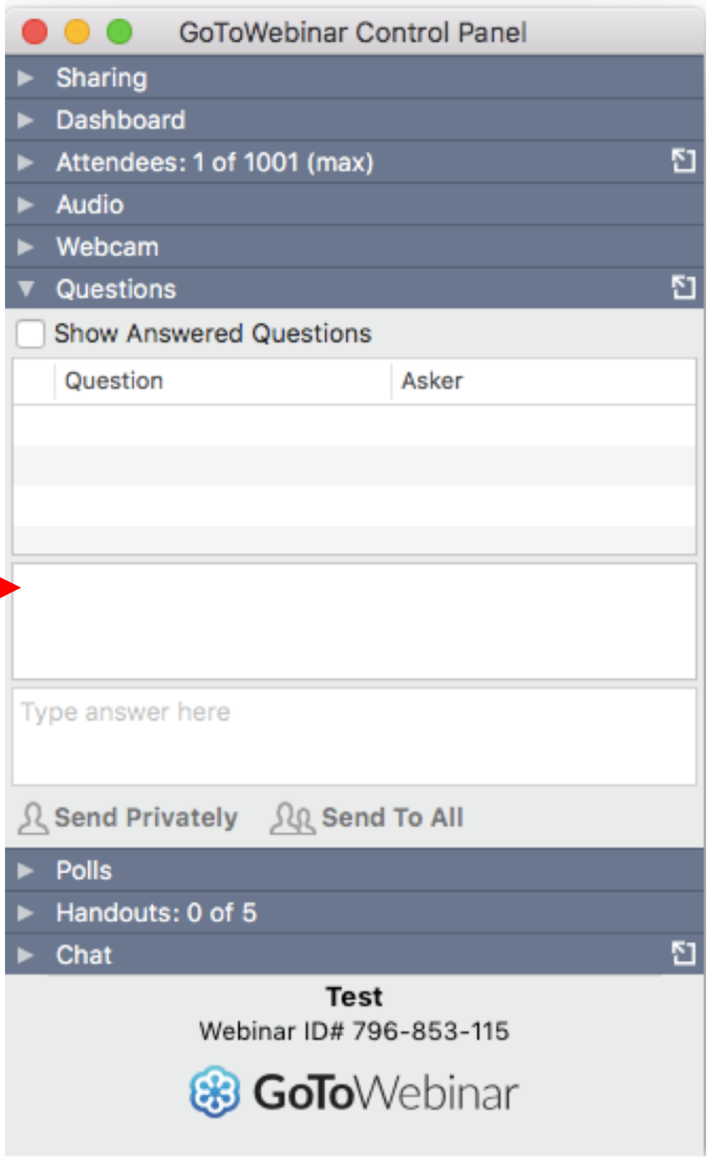

Mission

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

100% renewable energy end-game

- 25% local, interconnected within the distribution grid and facilitating resilience without dependence on the transmission grid.
- 75% remote, dependent on the transmission grid for serving loads.

Microgrids defined

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- A microgrid is a combination of energy resources, definitely including generation & storage, that are coordinated to serve specified loads, including in an islanded fashion.

- A Solar Microgrid is a behind-the-meter (BTM) microgrid that solely relies on solar for energy generation when islanded.
- A Hybrid Solar Microgrid is a Solar Microgrid that includes additional sources of energy generation, beyond just solar.

- A Community Microgrid is a microgrid that covers a target grid area and relies on existing distribution feeders (ie, power lines) to operate when islanded. Community Microgrids typically include both front-of-meter (FOM) and BTM resources, including Solar Microgrids, and require effective participation from utilities, which have mostly erected barriers to date.

Presenter

Clean Coalition

Ben represents the Clean Coalition in regulatory proceedings at the California Public Utilities Commission on microgrids, interconnection, net energy metering, and more. He uses his background in environmental studies and public policy to inform the diverse local, state, and national policy work he does at the Clean Coalition. Ben is passionate about helping humanity solve the three greatest crises that exist today: climate change, water scarcity, and the lack of clean energy. Ben also worked as a researcher and producer with the World Business Academy, where he served as producer for the New Business Paradigms podcast and as assistant producer for the Academy's Solutions News Radio Show. Ben holds a BA in History of Public Policy and Environmental Studies from UC Santa Barbara.

The Resilient Energy Subscription (RES) addresses three Community Microgrid financing challenges

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The RES helps finance Community Microgrids while properly valuing their significant resilience benefits, addressing these three challenges:

1. **Establishing** initial Community Microgrids to provide resilience to Critical Community Facilities (CCFs).
2. **Enhancing** Community Microgrids to offer resilience opportunities within the initial Community Microgrid footprint.
3. **Expanding** Community Microgrids to larger footprints that can guarantee resilience to a wider list of facilities and include additional communities.

Some Critical Community Facilities (CCFs) in a Southern California community.

Resilient Energy Subscription (RES) defined

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- A straightforward fee-based market mechanism that finances the enhancement and expansion of Community Microgrids
  - Community Microgrids provide guaranteed daily delivery of locally generated renewable energy during grid outages, ensuring unparalleled energy resilience.
- Allows any facility within a Community Microgrid to procure this unparalleled energy resilience
  - A facility pays a simple monthly $/kWh fee — separate from any existing rate tariffs — on top of their normal electricity rates for guaranteed daily delivery of locally generated renewable energy during grid outages.
  - Usually reserved for a facility's most critical loads.
- Facilitates the deployment and expansion of Community Microgrids
  - Allows the Community Microgrid owner-operators to recover the cost-of-service (COS) required to meet contracted RES obligations.
  - COS is determined by the capital expenditures (capex) associated with Community Microgrid assets, operational expenditures (opex) associated with operations and maintenance (O&M), and an appropriate rate of return.

Value-of-resilience methodology (VOR123)
as the basis for RES

Valuing resilience

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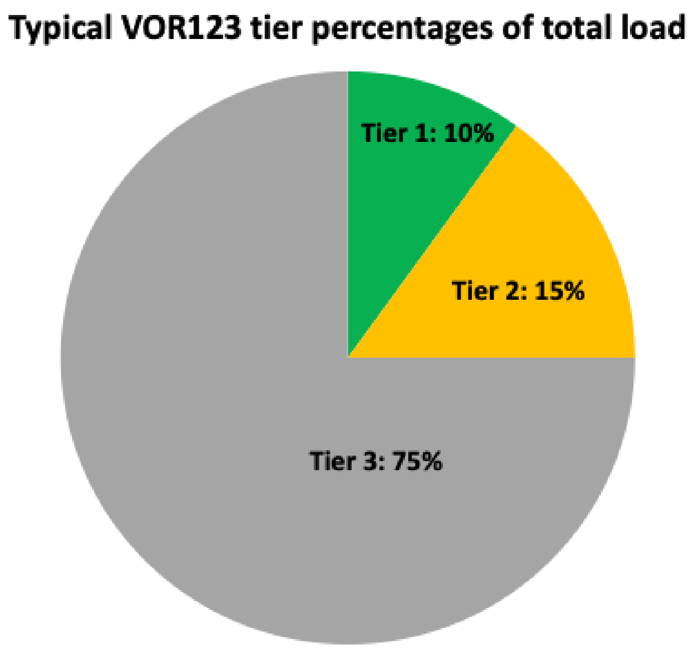
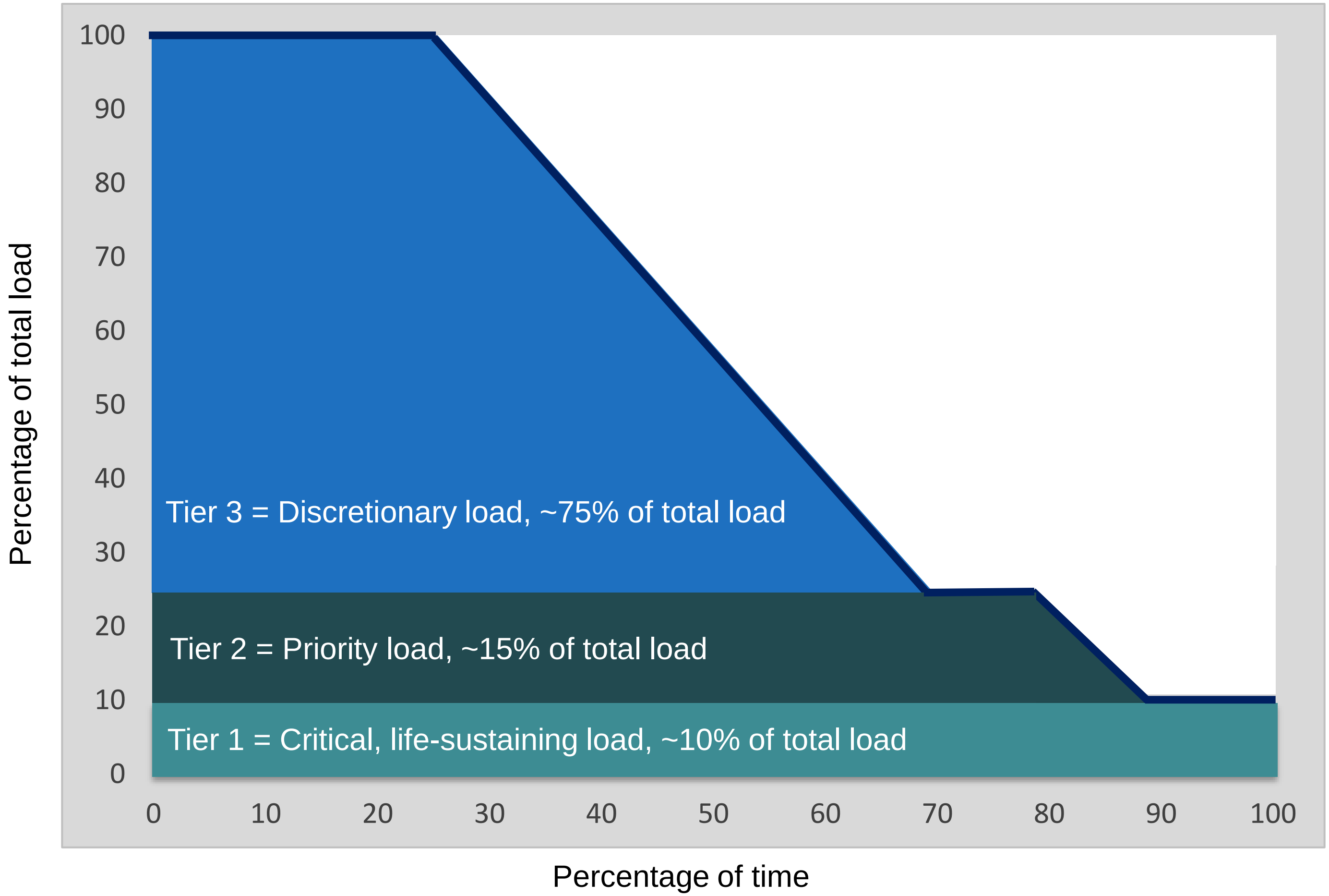
- While COS is appropriate for pricing the RES fee, prospective RES customers might want an easy way to assess the value-of-resilience (VOR).
- Everyone understands there is significant value to resilience provided by indefinite renewables-driven backup power, especially for the most critical electricity loads. But most have not quantified this value.
- The Clean Coalition developed a straightforward value-of-resilience methodology, VOR123, which makes it possible to quantify the value of renewables-driven resilience **at any facility type, in any location**.
- VOR123 helps RES customers understand the premiums that are appropriate for indefinite renewables-driven backup power to critical loads, almost constant backup power to priority loads, and backup power to all loads a lot of the time.
- **The key to VOR123 is tiering loads** — because different loads have different values.

VOR123 depends on tiering electricity loads

- The Clean Coalition's VOR123 approach standardizes resilience values for three tiers of loads, regardless of facility type or location:
  - **Tier 1, usually about 10% of the total load, are mission-critical, life-sustaining loads** that warrant 100% resilience.
  - **Tier 2, or priority loads, usually about 15% of the total load**, should be maintained as long as doing so does not threaten the ability to maintain Tier 1 loads.
  - **Tier 3 are discretionary loads** that make up the remaining loads, usually about 75% of the total load. Maintained when doing so does not threaten Tier 1 & 2 resilience.



Typical load tier resilience from a Solar Microgrid



Percentage of time online for Tier 1, 2, and 3 loads for a Solar Microgrid designed for the University of California Santa Barbara (UCSB) with enough solar to achieve net zero and 200 kWh of energy storage per 100 of kW solar.

Diesel generators are designed for limited resilience

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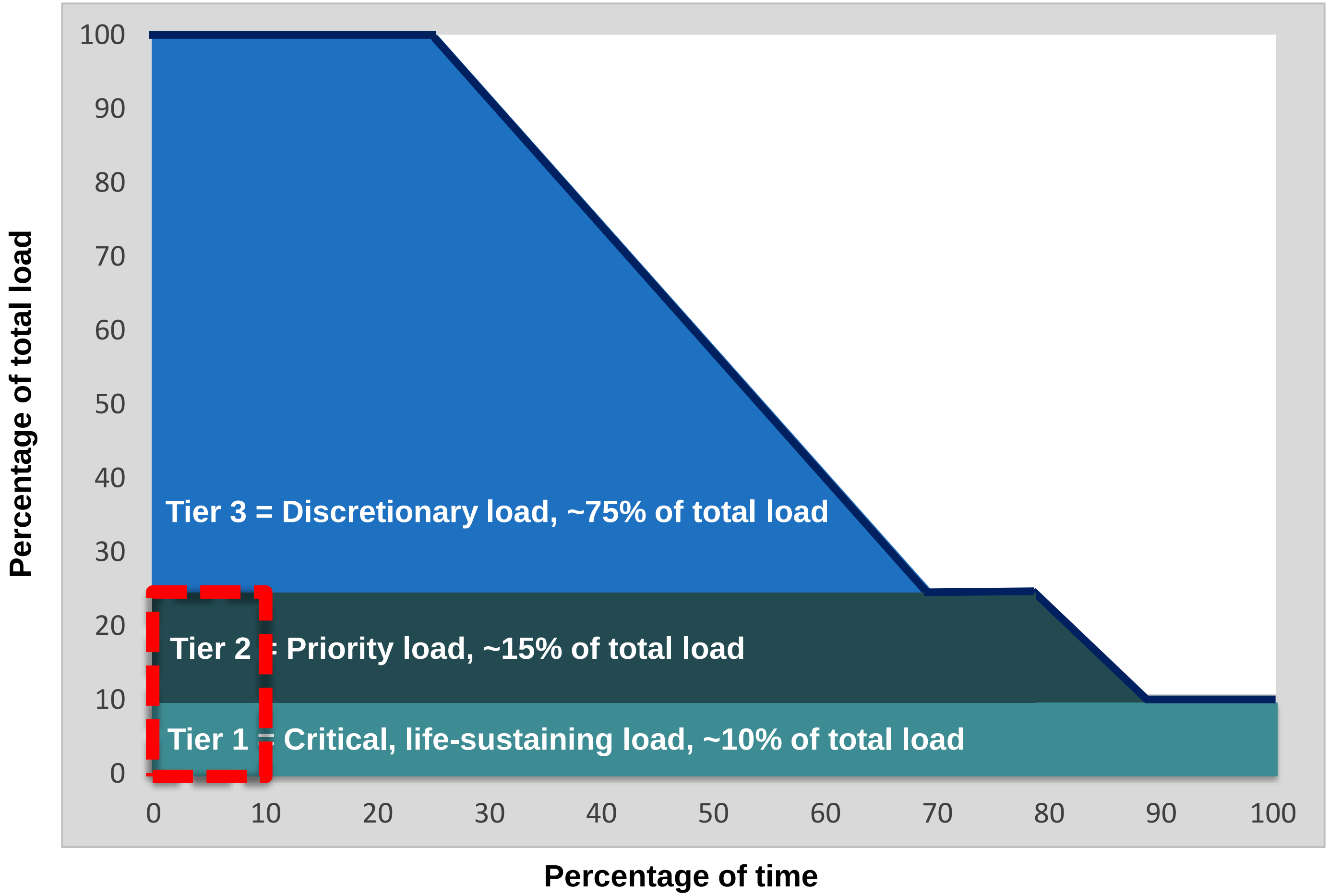
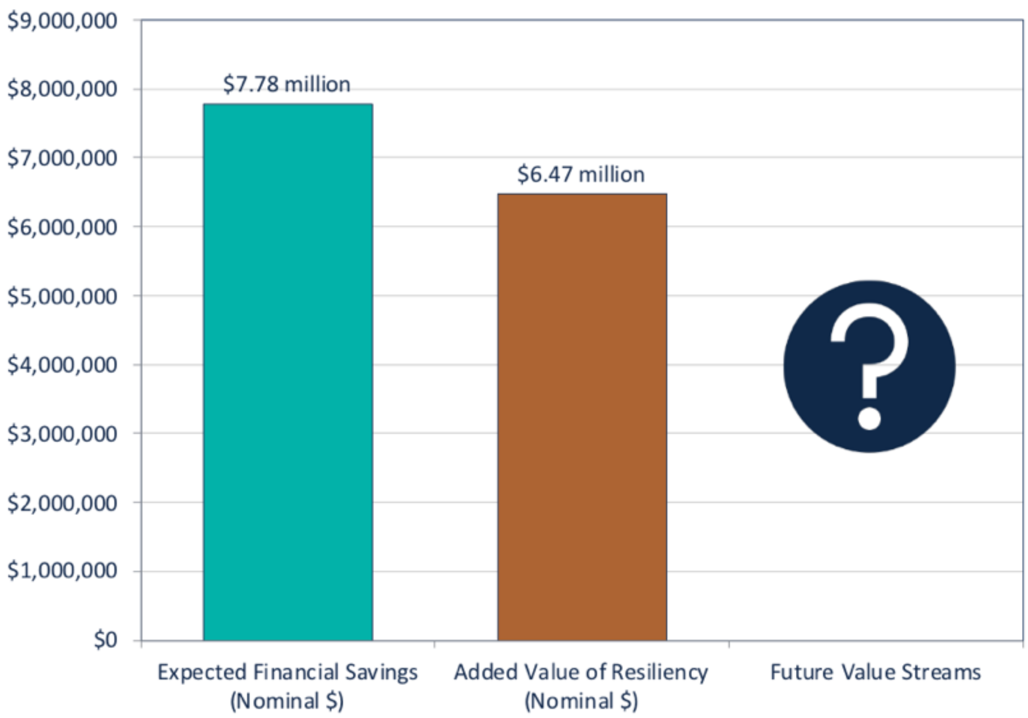


A typical diesel generator is configured to maintain 25% of the normal load for two days. If diesel fuel cannot be resupplied within two days, goodbye. This is hardly a solution for increasingly necessary long-term resilience. In California, Solar Microgrids provide a vastly superior trifecta of economic, environmental, and resilience benefits.

VOR123 yields a 25% typical adder

- Based on this tiering system, the Clean Coalition arrived at **25% as the typical VOR123 adder** that a site should be willing to pay for resilience.
- The Clean Coalition has validated the 25% adder using four approaches: Cost-of-service, Department of Energy multiplier, market-based, and avoided diesel generator cost (see https://clean-coalition.org/disaster-resilience/#adder).
- We also applied VOR123 to the Solar Microgrids for the Santa Barbara Unified School District (SBUSD), which is getting significant resilience benefits for free:



Bill savings and resilience value accruing to the SBUSD from six Solar Microgrid sites plus eight additional solar-only sites.

VOR123 for a Community Microgrid

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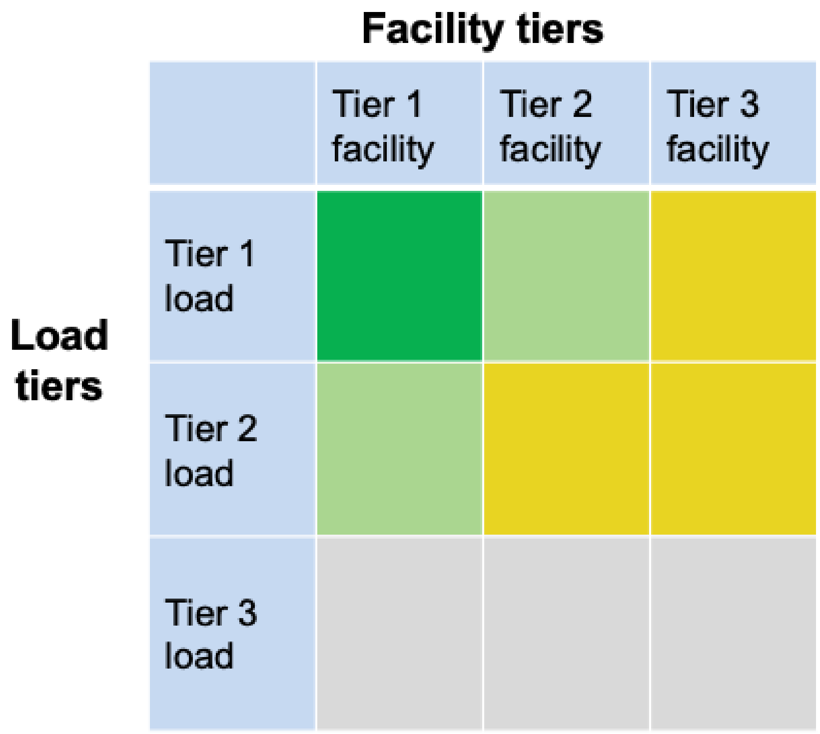
- The VOR123 principles for an individual facility can also be applied to a larger grid area by tiering facilities, in addition to tiering loads:



= Critical for the entire community, such as Tier 1 loads at Tier 1 facilities like fire stations

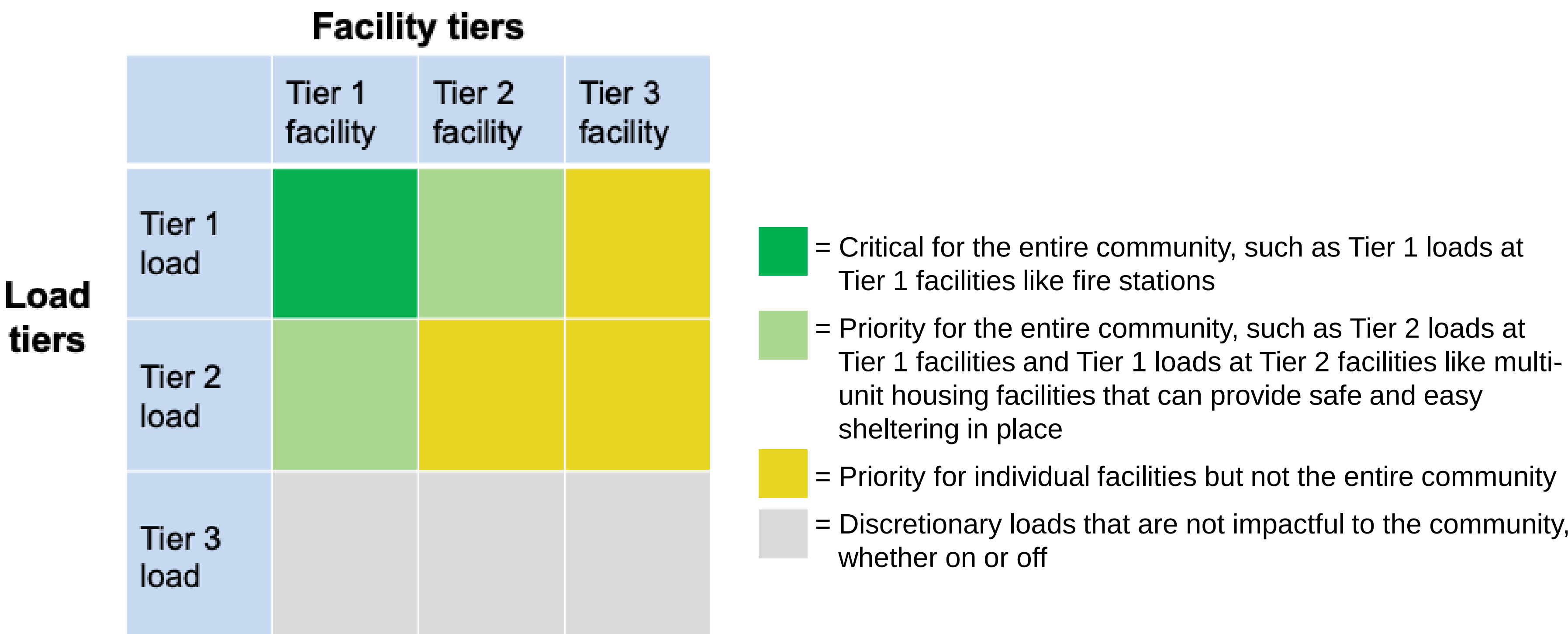
= Priority for the entire community, such as Tier 2 loads at Tier 1 facilities and Tier 1 loads at Tier 2 facilities like multi-unit housing facilities that can provide safe and easy sheltering in place

= Priority for individual facilities but not the entire community

= Discretionary loads that are not impactful to the community, whether on or off

VOR123 for a Community Microgrid

- The top emphasis is to provision 100% resilience for Tier 1 loads at Tier 1 facilities (the darker green square in the chart).
    - Tier 1 facilities include CCFs such as fire stations and emergency shelters — and can also include grocery stores, data centers, pharmacies, gas stations, EV charging stations, & apartment complexes that can provide sheltering-in-place during grid outages.
- The second emphasis is for Tier 1 loads at Tier 2 facilities and Tier 2 loads at Tier 1 facilities (the lighter green squares).



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Financing Community Microgrids and their expansion with RES

Financing Community Microgrids: Ratebasing COS

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- Due to the critical role and societal value of Tier 1 facilities for a community, the **COS for serving all Tier 1 loads at Tier 1 facilities should be socialized**.
  - COS associated with the transmission and distribution (T&D) grids are already socialized via ratebasing.
  - In addition to unparalleled resilience value, Community Microgrids provide substantial economic benefits daily by generating energy and obviating massive transmission investments.
  - Community Microgrid COS should be ratebased to a level that they can deliver RES allocations covering Tier 1 loads at Tier 1 facilities.
  - The COS could arguably also be ratebased for Tier 2 loads at Tier 1 facilities, and for Tier 1 loads at Tier 2 facilities.

Facility tiers

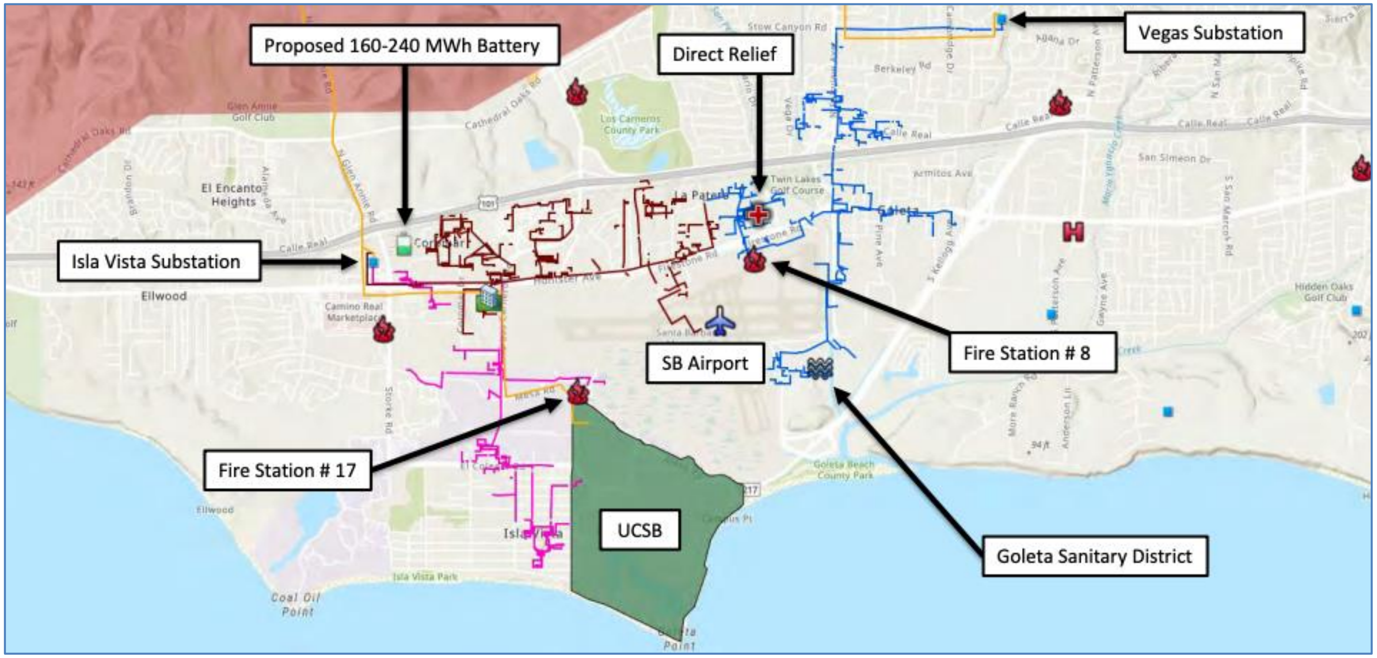
Load tiers

	Tier 1 facility	Tier 2 facility	Tier 3 facility
Tier 1 load			
Tier 2 load			
Tier 3 load			

Financing Community Microgrid expansion: RES

Clean Coalition

- RES allows a utility to plan strategically for resilience by aggregating RES allocations as they are contracted by facilities across the Community Microgrid footprint.
  - Simple market forces determine the expansions of Community Microgrids and the additional facilities covered.
  - As Community Microgrids expand, costs and fees will trend lower, and RES fees will be recalculated periodically to account for reductions.
  - This is similar to how costs associated with the traditional transmission and distribution grids are regularly recalculated.

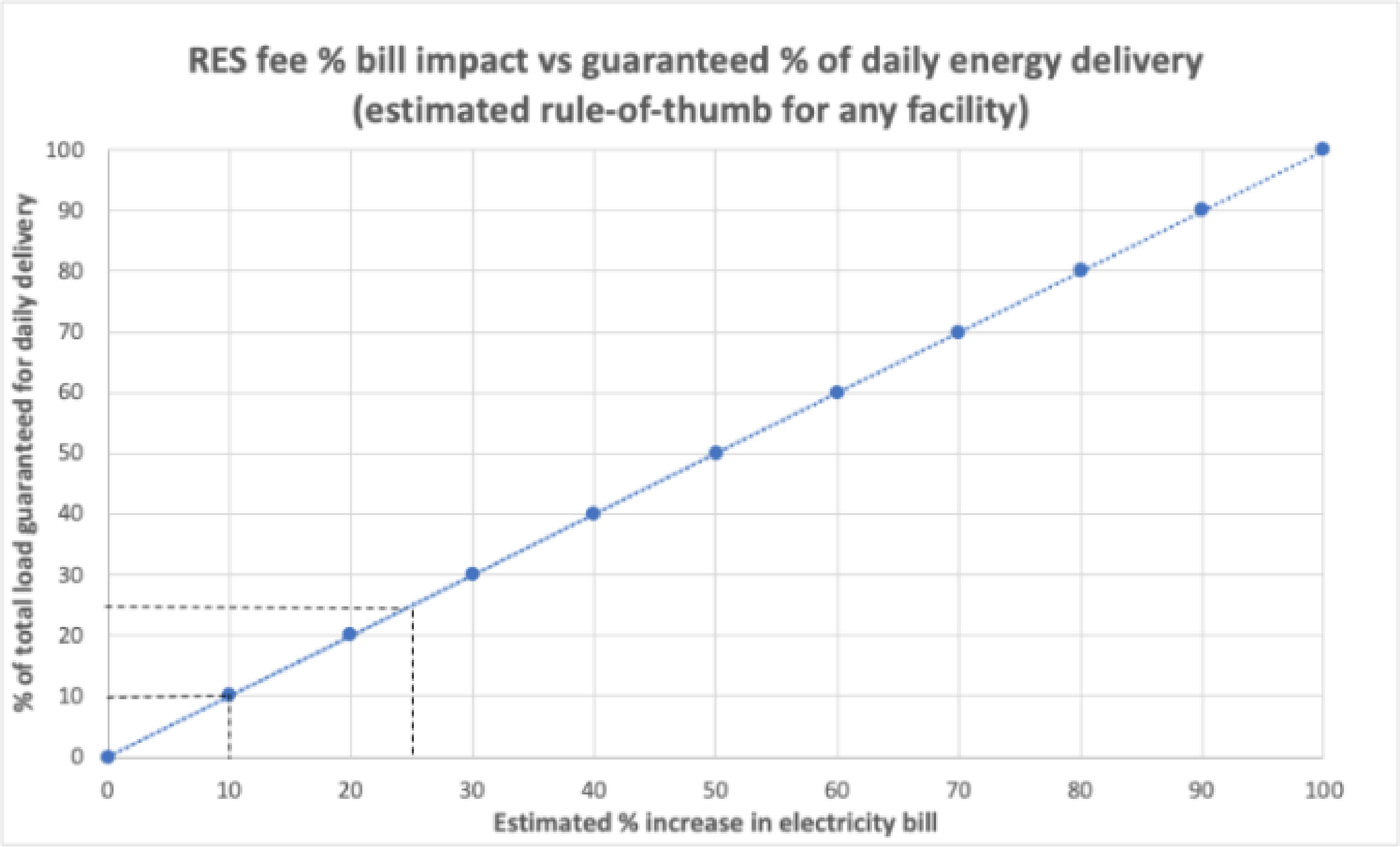


Potential for a Community Microgrid in the Santa Barbara, California region.

COS for expanding a Community Microgrid via RES

Clean Coalition

- Once an initial Community Microgrid is established for serving the CCFs, incremental COS will be low for expanding the Community Microgrid via the market-based RES.
- Each 1% of load that a facility secures via a RES will result in an approximately 1% electricity bill increase:

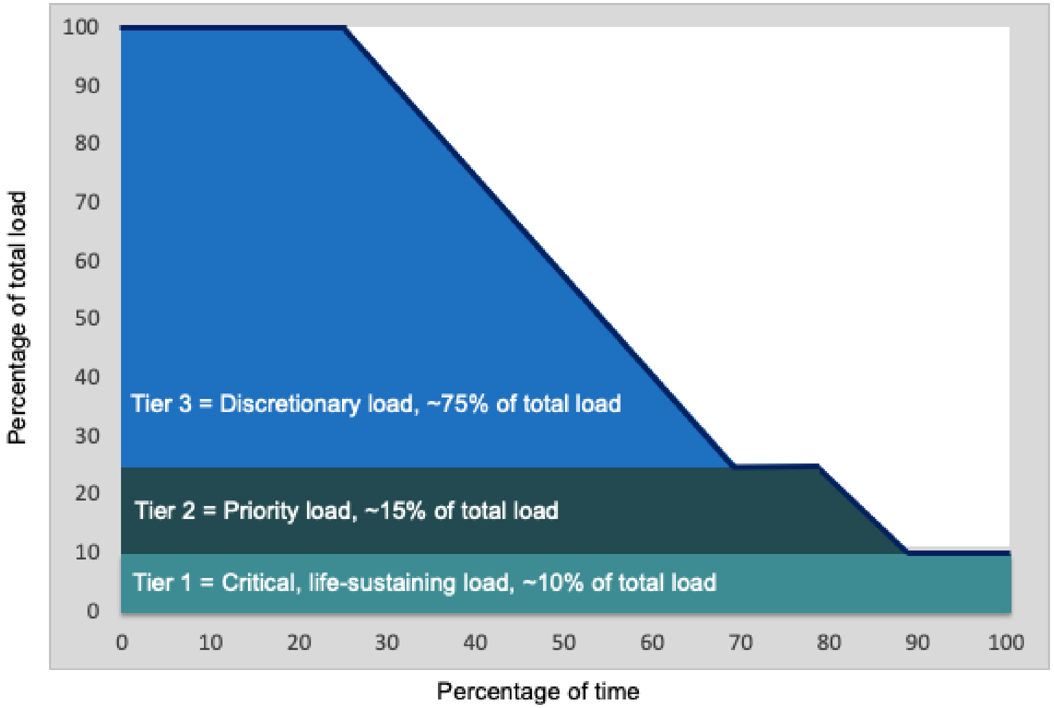


How RES works for subscribed facilities

How RES works for subscribed facilities

Benefits of RES for facilities

- **Under normal grid conditions**, subscribed facilities will operate with all loads served.
- **During grid outages**, facilities will get at minimum their contracted RES allocations, and will **often receive more than these minimums**:
  - Community Microgrids are sized to deliver resilience during grid outages of any duration, including over numerous days of low solar production.
  - Therefore, Community Microgrids will generally deliver far more energy than the contracted RES allocations during grid outages — given that solar production is better than the worst-case day, on any other day.



With enough solar to net-zero a site and typical load tier percentages, the following levels of resilience are provisioned to each load tier:

- Tier 1 loads: Online 100% of the time.
- Tier 2 loads: Online at least 80% of the time.
- Tier 3 loads: Online at least 25% of the time.

Sizing RES for a specific facility

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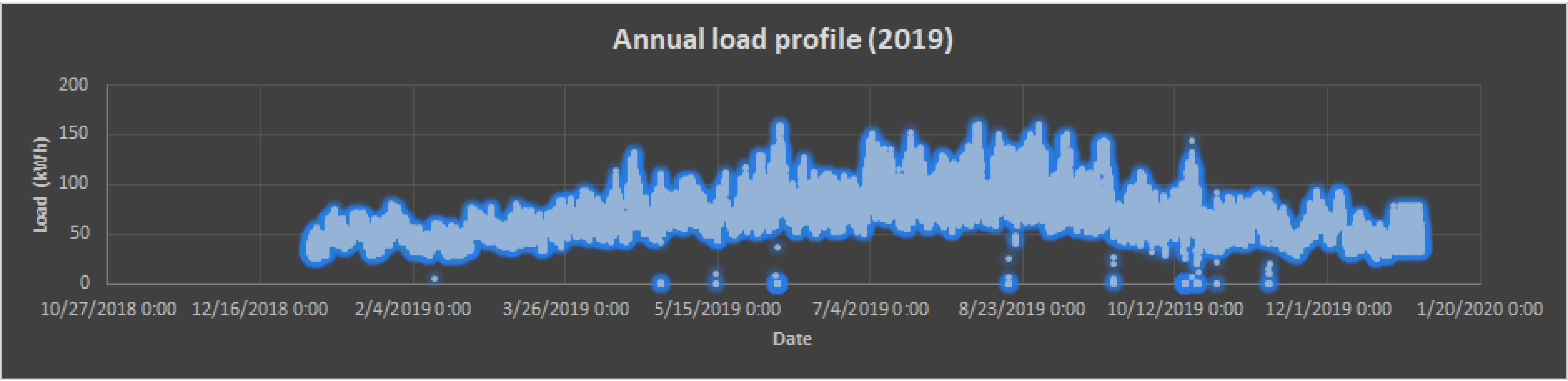
- To determine its RES allocation, a facility should first conduct a simple review of its historical energy usage, accounting for variations across seasons and times of day.
- Then, the facility can either:
  - Use the VOR123 methodology to assess general load tier percentages and determine how much RES it wants to procure. The facility can use the VOR123 methodology to determine whether the cost of the RES contract will be less than the VOR123-derived value.
  - Use empirical experience from past grid outages or some other method to determine its load tiering, VOR, and appetite for RES fees.

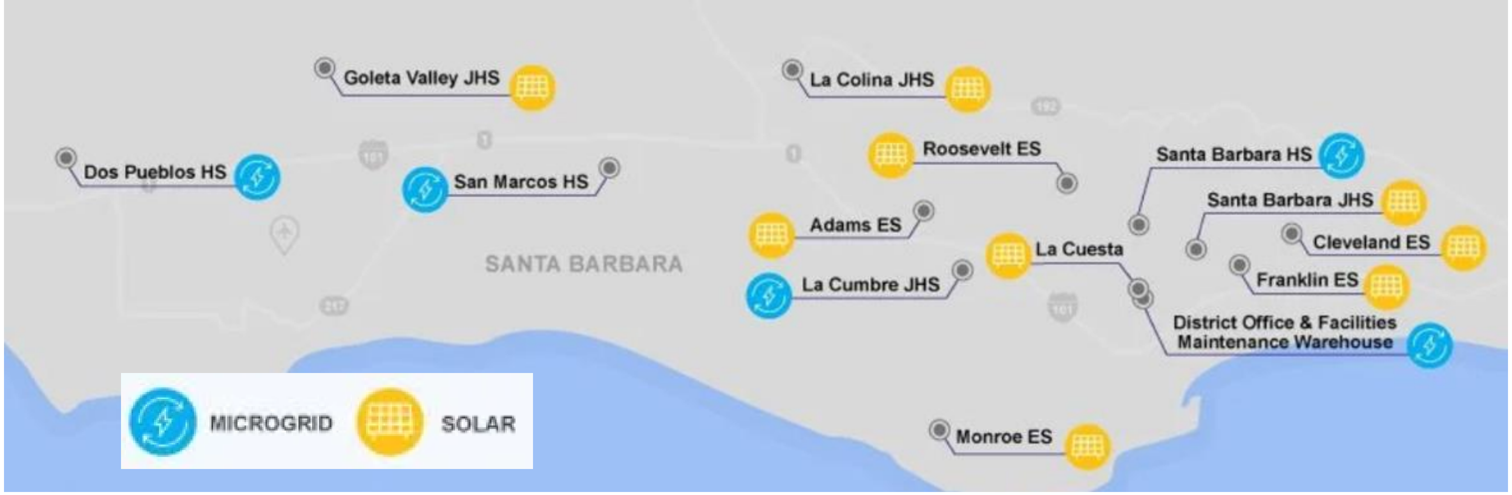


Energy usage profile for a hypothetical facility.

Facilities with existing solar subscribing to RES

Clean Coalition

- Facilities within a Community Microgrid that have their own solar can also subscribe to RES:
  - A RES contract will ensure that the facility maintains electrical service during grid outages, from the Community Microgrid.
  - The facility's solar will stay active during a grid outage, and the self-generation will cover at least a portion of the facility's resilience requirements.
  - The facility will enjoy uninterrupted self-generated solar while also receiving RES-contracted energy as needed from the Community Microgrid (unless energy availability is low from the Community Microgrid **and** the facility's RES allocation has been exceeded on a given day).
- Examples of facilities with existing solar that can subscribe to RES are the solar-only installations planned for the Santa Barbara Unified School District (SBUSD).



While some of the SBUSD sites will enjoy unparalleled resilience from Solar Microgrids, the sites with solar only can also benefit from this resilience via the RES. Image source: Engie Systems.

Analyzing RES feasibility

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RES feasibility for Community Microgrids owner-operators and subscribed facilities

Analyzing RES feasibility

Key Question

- Is RES feasible for both Community Microgrid owner-operators and subscribed facilities?

RES feasibility analysis framework

- RES feasibility can be understood as a mutual benefit:
  1. **For Community Microgrid owner-operators**: Income from RES subscription fees that ensures a positive return on the Community Microgrid COS.
  2. **For RES subscribers**: Value-appropriate, guaranteed locally generated resilient energy.
- *If both these conditions are met, RES is feasible.*

RES feasibility: Subscriber perspective

Clean Coalition

- RES affordability is defined in terms of % increase in the subscriber's electricity bill, per the % of subscriber load guaranteed by the RES.
- This ratio can be defined as follows:

$$\frac{\text{\% increase in bill}}{\text{\% load guaranteed}} = \frac{\text{RES fee (\$/kWh)*}}{\text{Electricity bill blended rate (\$/kWh)}}$$

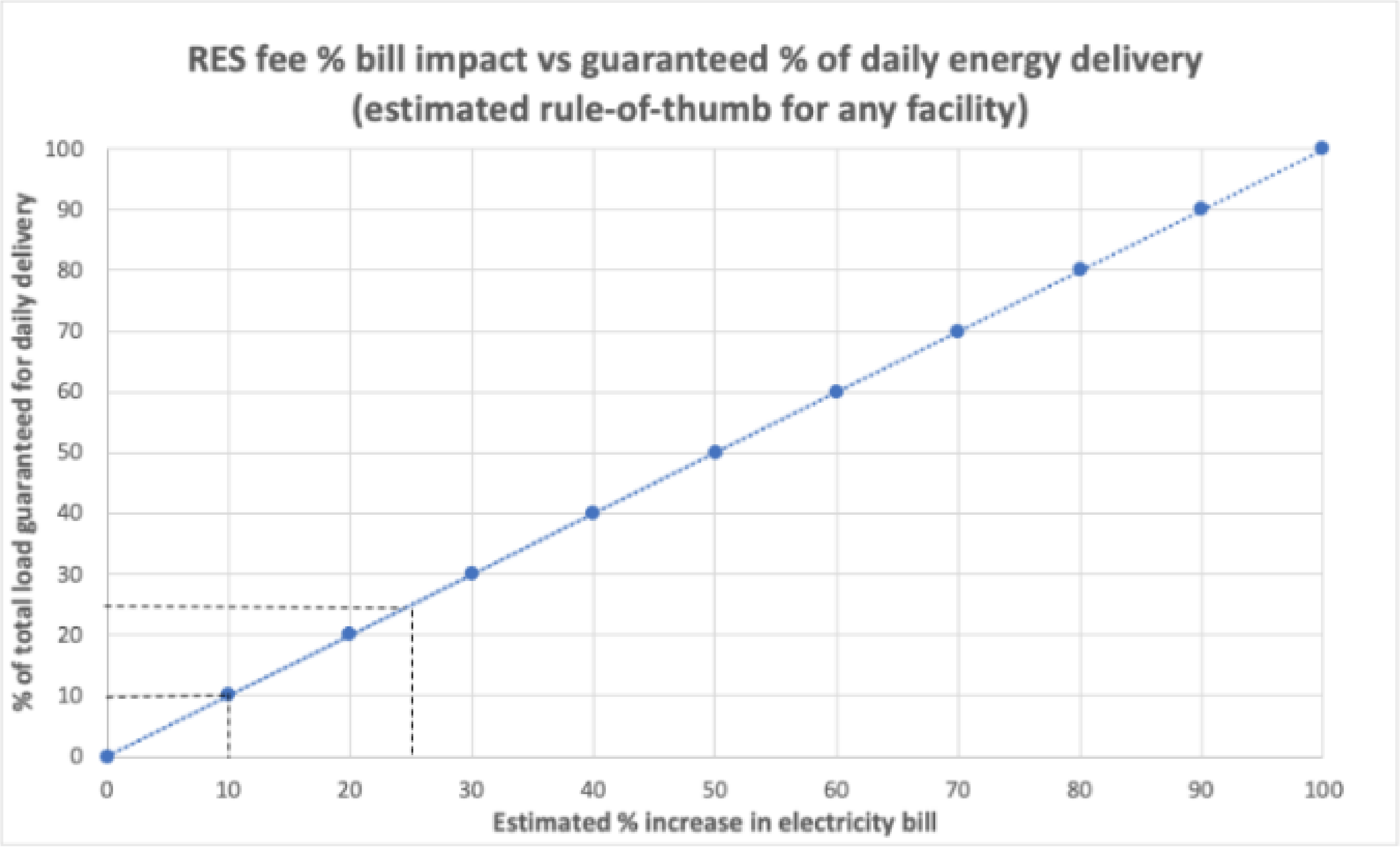
- Clean Coalition analysis shows that a RES fee of $0.20/kWh is feasible.
- A typical electricity bill blended rate is $0.20/kWh.
- **This yields a ratio of 1.0**

  - The RES allocation is the guaranteed delivered energy within any 24-hour period, based on the worst-case solar+storage capacity of the Community Microgrid. The amount of delivered energy is measured and renews each 24-hour period during multi-day grid outages.
  - The RES fee is calculated as the total guaranteed deliverable energy per month and is billed monthly.

Example: RES subscriber backing up 10% of load

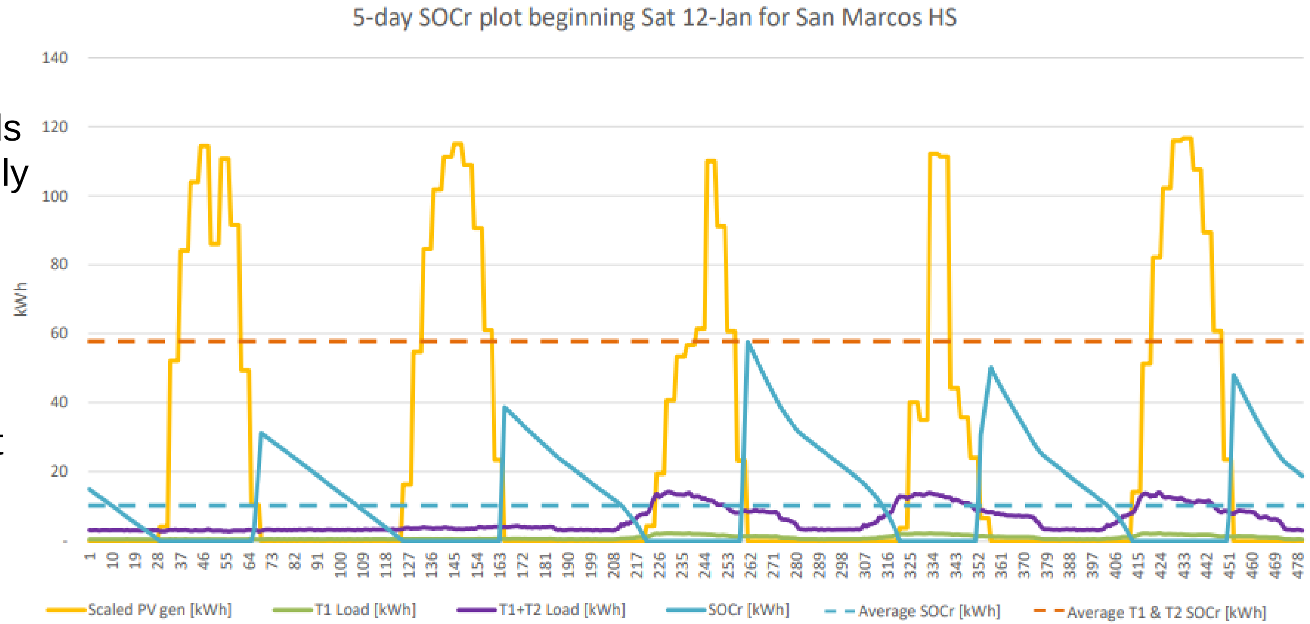
Clean Coalition

- Revisiting the previous chart, we see the 1.0 ratio rule-of-thumb.
- Guaranteeing resilience from the Community Microgrid for 10% of a site's load during utility outages adds 10% to the site's electricity bill:



RES feasibility: Community Microgrid owner-operator perspective

- ROE for the Community Microgrid owner depends on the following factors:
  - Microgrid financial inflows:
    - RES fees*
    - Energy sold to the utility on an everyday basis
    - Solar and battery energy storage system (BESS) financial incentives
  - Microgrid financial outflows:
    - Microgrid capital expenditures (capex)
    - Microgrid operational expenditures (opex)



* Income from RES fees depends on the maximum guaranteed daily energy from the Community Microgrid. The Clean Coalition calculates this quantity using its state-of-charge for resilience (SOCr) methodology, which analyzes BESS capacity against actual solar generation and site load profiles.

RES feasibility:
Community Microgrid owner perspective

Clean Coalition

Analysis factors from a real-world design for a Community Microgrid in Southern California:

Factor	Amount	Units
RES fee	0.20	$/kWh
Tariff for energy sold to utility	0.10	$/kWh
Daily site load guaranteed by RES	2,300	kWh
PV+BESS financial incentives	1,800,000	$
PV size	1,500	kW
PV capex	3,000,000	$
BESS size	2,000	kWh
BESS capex	1,400,000	$
Microgrid hardware + MC2*	500,000	$
PV annual opex	7,000	$/year
BESS annual opex	5,000	$/year
Microgrid MC2 annual opex	15,000	$/year

* MC2 = Monitoring, Communications, and Controls for a microgrid.

RES feasibility: Community Microgrid owner-operator perspective

Microgrid financial outflows:

	Year:	Capex	Opex
PV		$3,000,000	$7,000
BESS		$1,400,000	$5,000
Microgrid hardware + MC2		$500,000	$15,000
PV+BESS incentives		-$1,800,000	
Total annual expense:	1	$3,100,000	$27,000
	2	$-	$27,000
	3	$-	$27,000
	4	$-	$27,000

30-year analysis

Microgrid financial Inflows:

	RES fees
RES fee ($/kWh)	$0.20
Guaranteed daily load (kWh)	2,300
Total annual income:	$165,000
	$165,000
	$165,000
	$165,000

	Sales to utility
Tariff to utility	$0.10
Annual PV sold (kWh)	2,400,000
	$236,000
	$236,000
	$236,000
	$236,000

With these expenses and income, the Community Microgrid owner will see an internal rate of return (IRR) of at least **9%.**

Grand Orcas Community Microgrid plan for the entire OPALCO territory

Clean Coalition

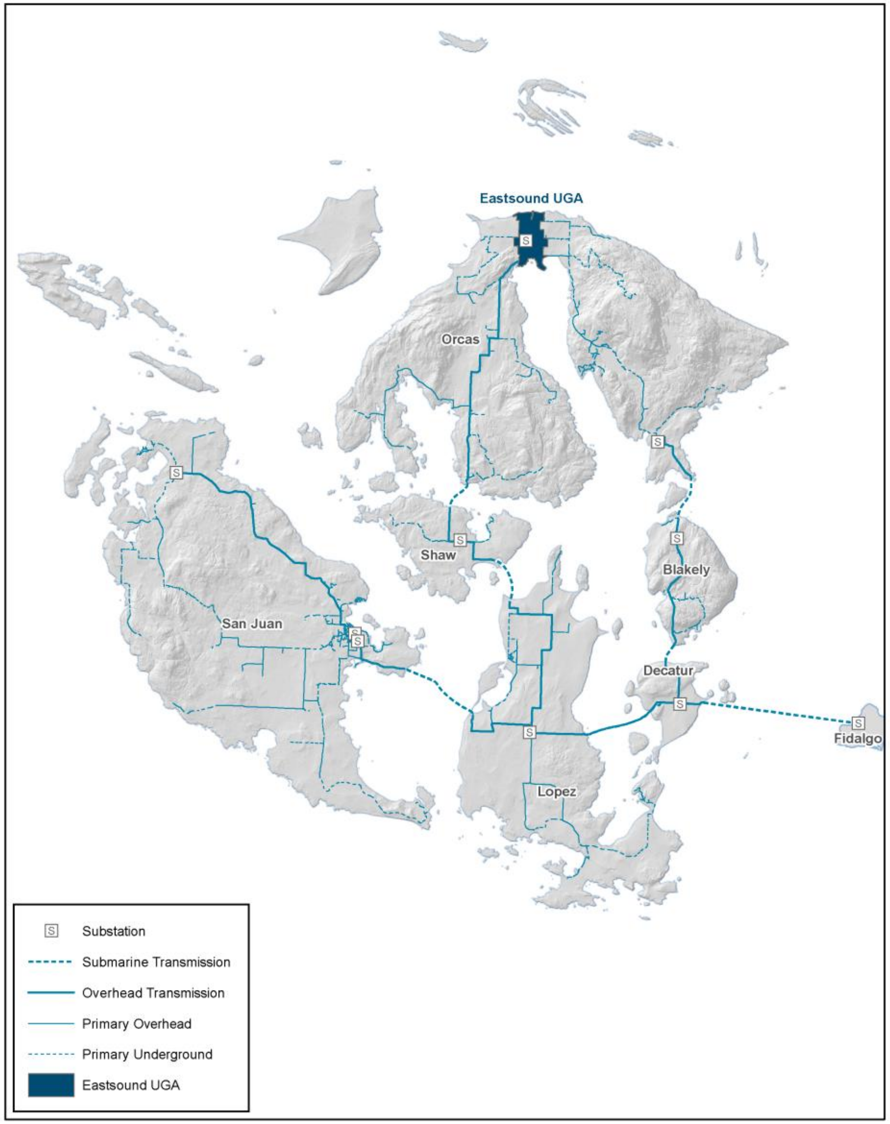


Figure 1: OPALCO's service territory covers San Juan County and includes 20 islands. Eastsound is shaded towards the top of Orcas Island and represents the initial Orcas Community Microgrid location. Over time, the Community Microgrid will expand to cover all of Orcas and then eventually the entire OPALCO service territory.

Eastsound Tier 1 & 2 facilities map

Clean Coalition

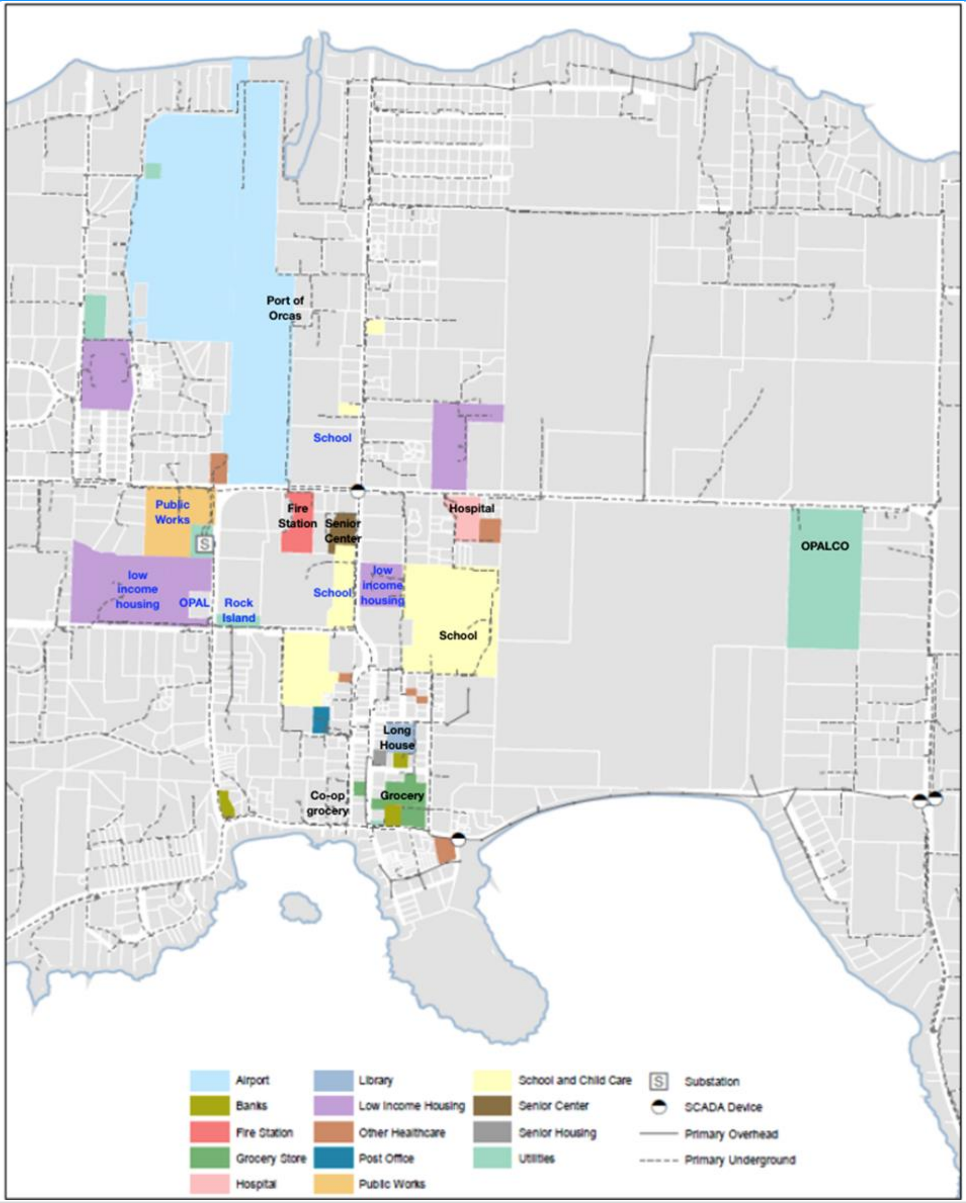
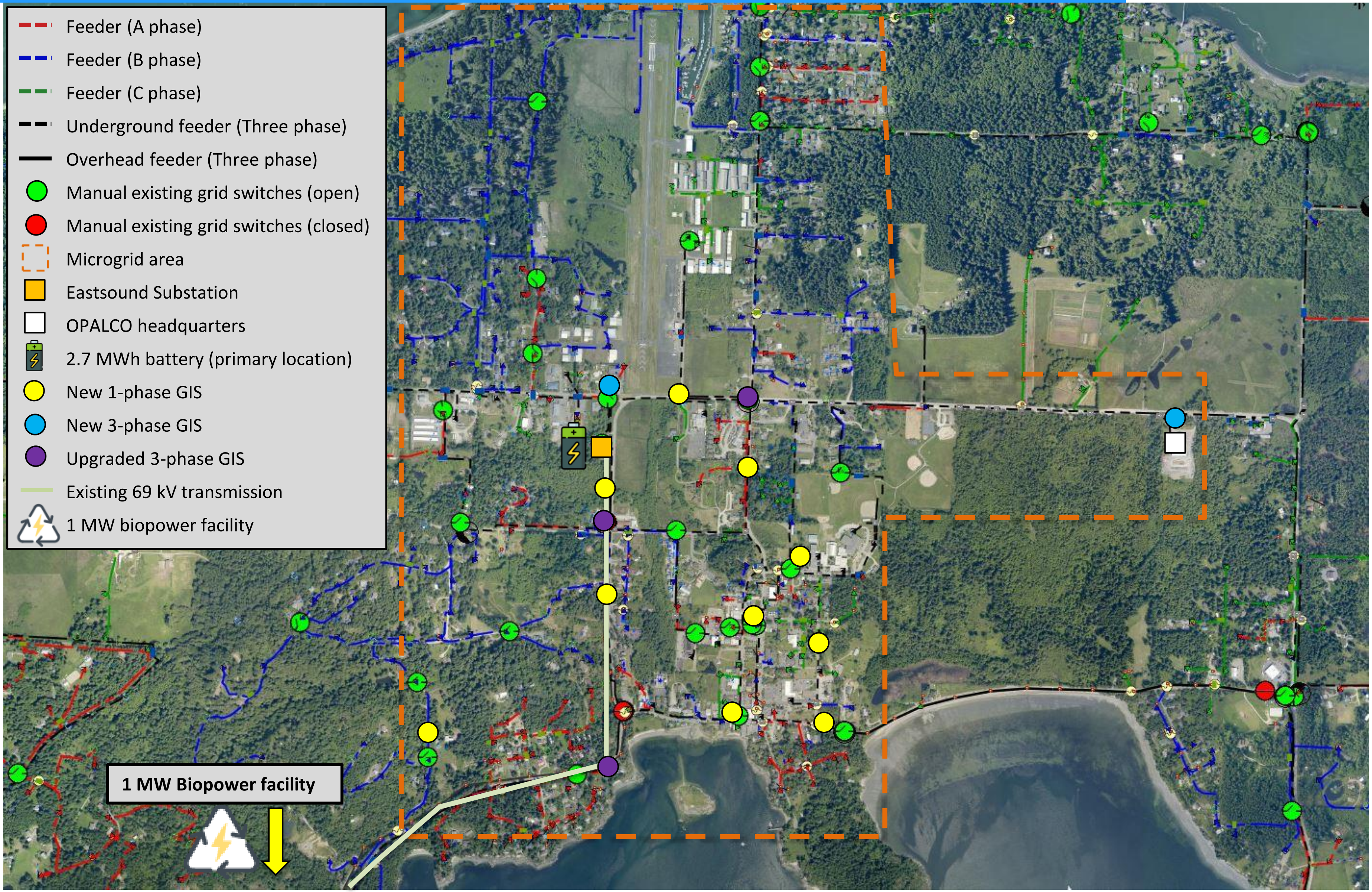


Figure 2: Eastsound facilities that are being provisioned with priority Community Microgrid resilience in the initial Orcas Community Microgrid design are shaded. Tier 1 Critical Community Facilities (CCFs) are shaded and labeled with black text, while Tier 2 CCFs are shaded in blue text. Figures 3 and 4 further depict the initial Orcas Community Microgrid in block diagram form.

OCM map for Orcas Island

Clean Coalition



RES feasibility analysis results

- Clean Coalition analysis shows that:
  - A **value-appropriate** RES subscription ratio of 1.0 (1% bill increase per 1% guaranteed load coverage) for the subscriber is feasible.
  - A **positive IRR** of 9% for the Community Microgrid owner is feasible.
- *Therefore, the RES is financially feasible for all stakeholders.*

- RES allows Community Microgrids to be deployed at scale and expanded, as more facilities desire resilient energy guarantees.
- RES provides a revolutionary and straightforward approach for financing Community Microgrids and delivering unparalleled resilience to communities.

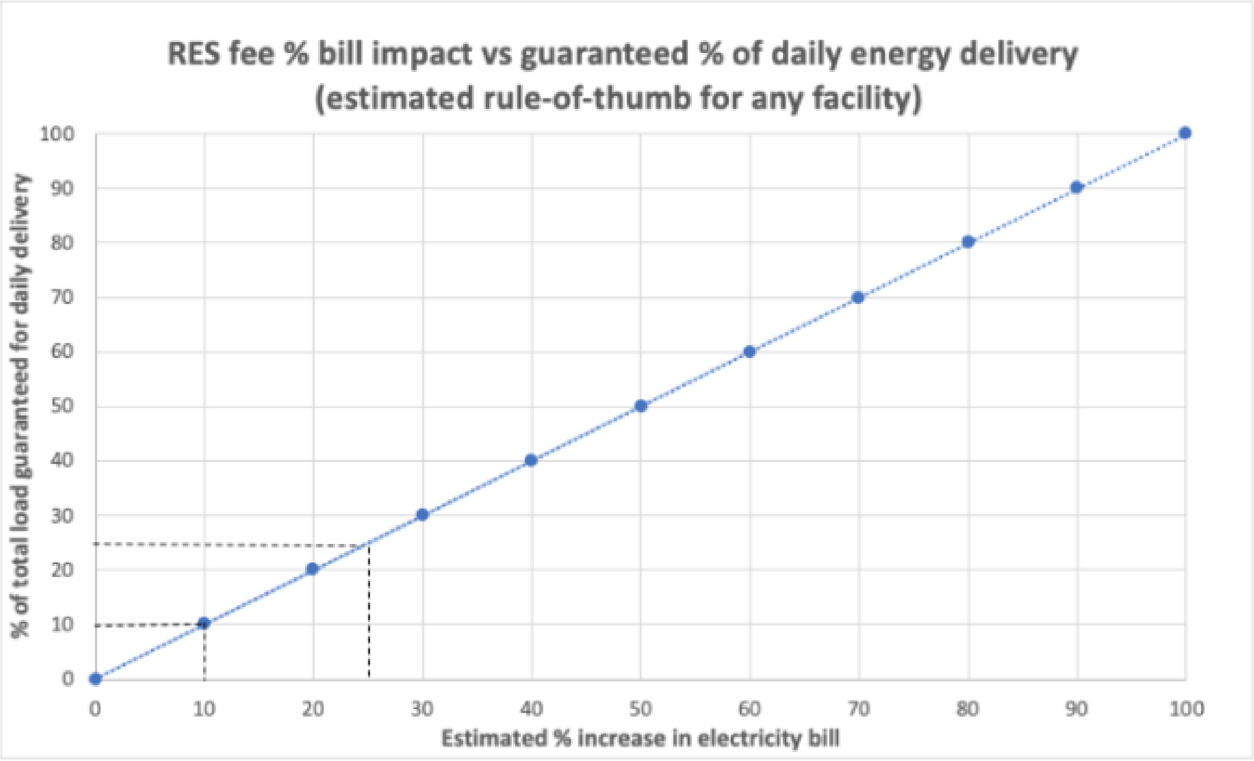
Backup Slides

Clean Coalition

Backup Slides

Sizing RES for a specific facility: Example

- Example: A financial institution wants to procure guaranteed resilience for some of its loads.
- The previous chart shows RES fees as a percentage of the total electric bill:



- Assuming the financial institution has the typical load tiering percentages of 10% for Tier 1 and 15% for Tier 2 loads (hashed black lines):
  - A RES contract for Tier 1 loads only will result in the bank's electricity cost increasing only 10%.
  - A RES contract for both Tier 1 and Tier 2 loads will result in a 25% increase.

Example: RES subscriber backing up 10% of load

- Using VOR123, the subscriber determines that its Tier 1 load = 3 kWh/day.
- The subscriber opts to pay the RES fee for 3 kWh/day of guaranteed energy delivery during a grid outage, supplied from the Community Microgrid.
- For this guaranteed energy resilience, the subscriber pays the RES fee on its monthly bill — including during normal grid operations.

RES fee formula:

- RES fee = kWh * $/kWh RES fee * 30 (days in monthly billing cycle)
- For this subscriber, RES fee = 3 kWh * $0.20 * 30 = **$18/month**

- This subscriber pays a fixed $18/month RES fee in addition to its usual electricity bill, for **guaranteed delivery of 3 kWh/day minimum of energy during grid outages**.
  - For this subscriber facility, 3 kWh/day is the minimum guaranteed amount to be delivered to the facility by the Community Microgrid, keeping its Tier 1 load online indefinitely.
  - Under normal solar conditions, RES subscribers will be provided with significantly more energy than their contracted RES allocation, being able to maintain Tier 2 and Tier 3 loads for a major portion of time.

Eastsound Tier 1 & 2 facilities block diagram

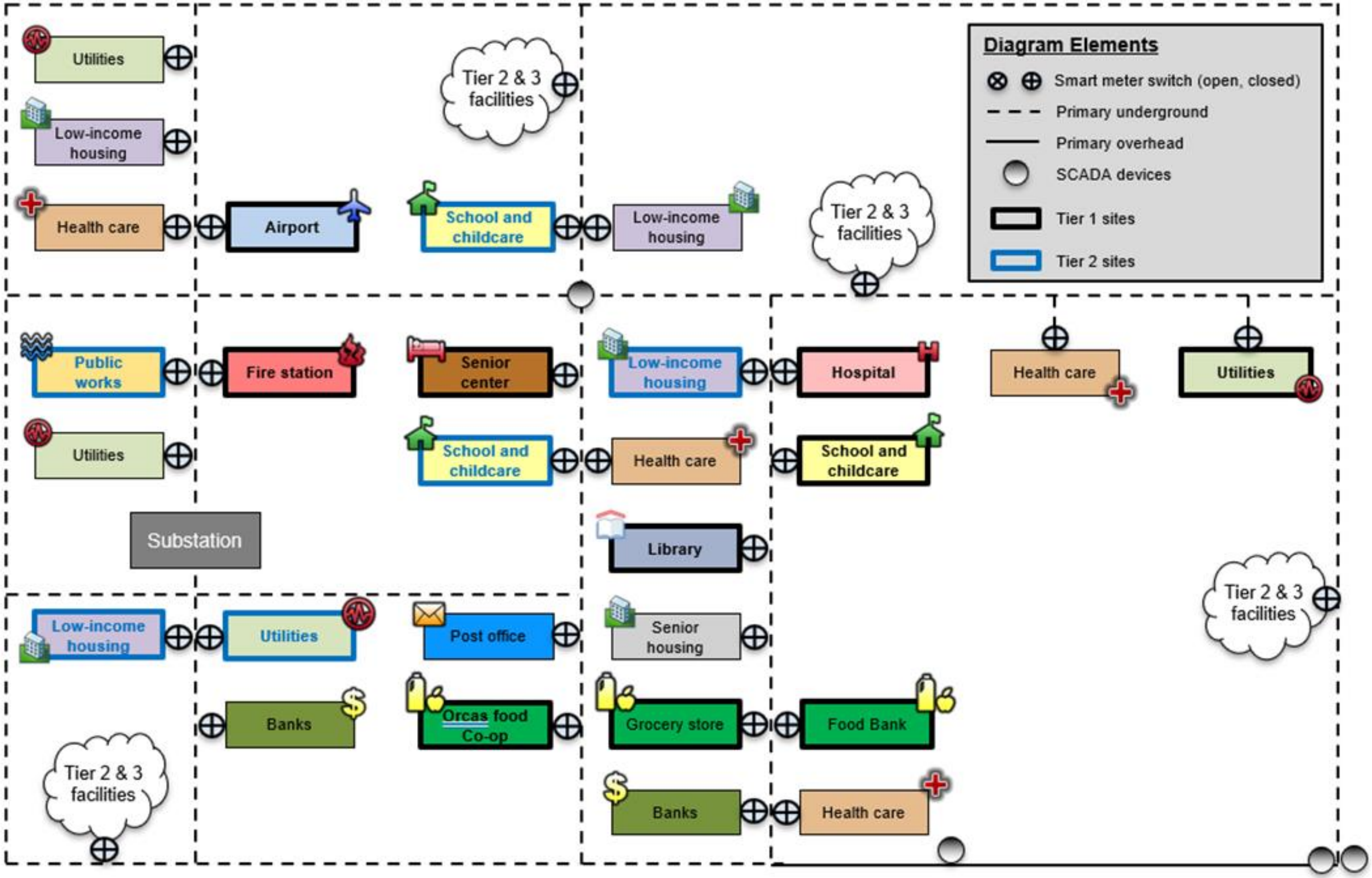


Figure 3: Noteworthy facilities in Eastsound and within the target grid area of the initial Orcas Community Microgrid. This figure reflects the block diagram version of the grid area shown in Figure 2.