Clean Coalition
Making Clean Local Energy Accessible Now

Long Island Community Microgrid Project

New approach for grid design and operations

Craig Lewis
Executive Director
Clean Coalition
650-796-2353 mobile
craig@clean-coalition.org

Clean Coalition Mission

Clean Coalition

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

Clean Coalition Vision: Clean Local Energy

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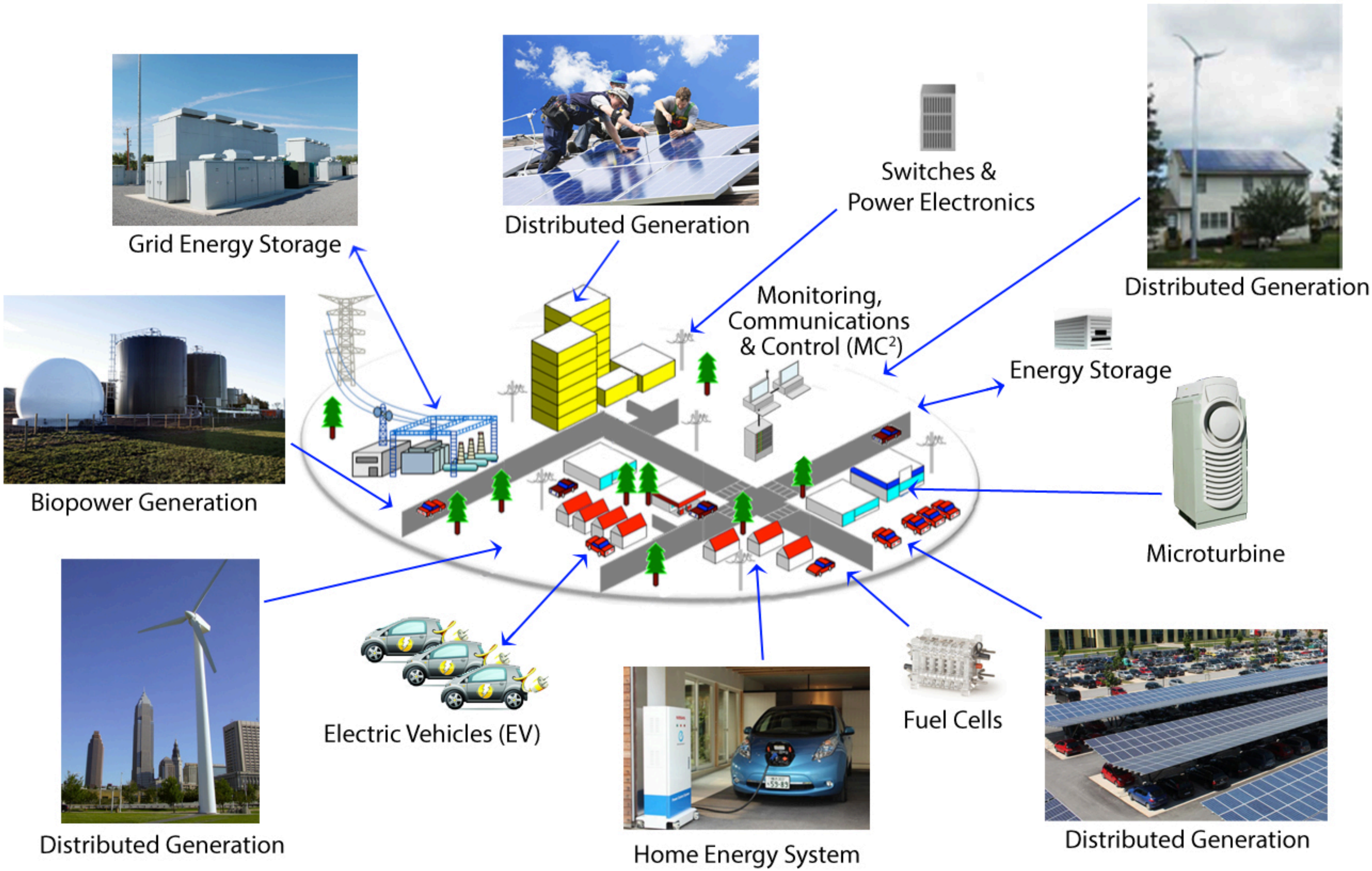

Clean Coalition technical & project expertise

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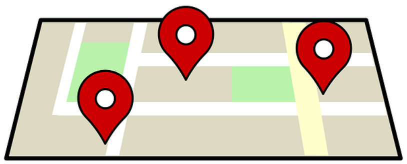
Analysis & Planning

- Renewable energy siting surveys
- Full cost and value assessment

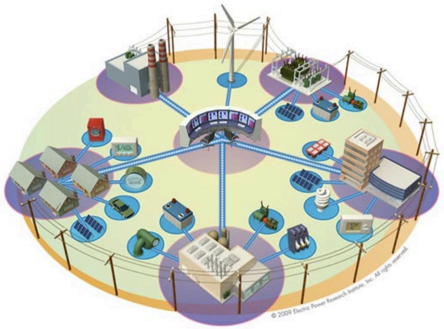


Grid Modeling & Optimization

- Powerflow modeling
- Distributed energy resources optimization

Program Design

- Procurement and interconnection policies and procedures



Community Microgrid Projects

- Community-scale distributed energy resources planning and design

What is a Community Microgrid?

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

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
- 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 across utilities

Community Microgrid benefits

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Community Microgrids offer a more scalable, cost-effective, and modern solution for our electricity grid. Key benefits include:

1. **Scale, Sustainability:** local renewables reaching 25% - 50% of total annual energy – 10 times more than today
2. **Cost-effectiveness:** lower long-term costs via technology vs commodity advantage, plus peak & transmission reductions
3. **Local investment:** substantial energy dollars spent on local / regional jobs instead of remote / offshore
4. **Resilience & Security:** improved grid reliability, resilience, and security via a replicable model that extends across any area

RESUILT: A smarter more cost-effective distribution grid featuring cleaner energy, improved grid performance, and unparalleled local economic stimulation

Community Microgrids in Six Steps

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1. Goals

Desired goals & performance metrics of the target grid area based on local resources and known or anticipated grid issues.

Includes renewables penetration goals, grid reliability & power quality performance targets, and power backup requirements.

2. Baseline Analysis

Inventory of the existing grid assets including load profiles, voltage regulation, feeder and transformer capacities, and existing generation.

Includes identifying prioritized services that require backup power during outages.

3. Siting Survey

Comprehensive survey of the renewable energy potential in the target grid area specific to local resources & site characteristics

Informs other requirements such as energy storage capacity needs and control system functionality.

4. DER Optimization

Design of optimal DER portfolios combining renewables, energy storage, and demand response.

Incorporates Baseline Grid Analysis and Renewables Survey to achieve optimal outcomes based on local resources and grid assets.

5. Benefits Analysis

Full analysis of cost- benefits and net value including reductions in T&D investments, ratepayer impacts, and local job creation.

Includes bulk procurement & interconnection that achieve a “plug-and-play” model, further reducing costs.

6.Deployment Plan

Final system design, financial model and operational plan for the Community Microgrid.

Includes vendor analysis (e.g. RFIs, RFPs) appropriate to the final design criteria, financial model, and operational requirements.

Deployment Planning - Long Island example

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- NY Prize Community Microgrids Competition grant award. Collaboration with PSEG Long Island, Long Island Power Authority (LIPA), and NYSERDA covering a substation in the East End of Long Island that serves over 3,300 customers (10% C&I).
- Combines 15 MW of local solar (via Feed-In Tariff) with a 5 MW / 25 MWh battery system, multiple smaller batteries, and targeted load management
- Achieves almost 50% of total annual energy consumption from local solar. Minimizes the use of existing fossil generators including local diesel peakers and diesel backup generators.
- Provides ongoing power backup to multiple critical facilities as well as other priority loads across the area
- Sets the stage to preempt hundreds of millions of dollars in transmission and fossil generation investments – pays for itself from day 1

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PSEG LONG ISLAND
We make things work for you.

Wholesale DG is the Critical & Missing Segment

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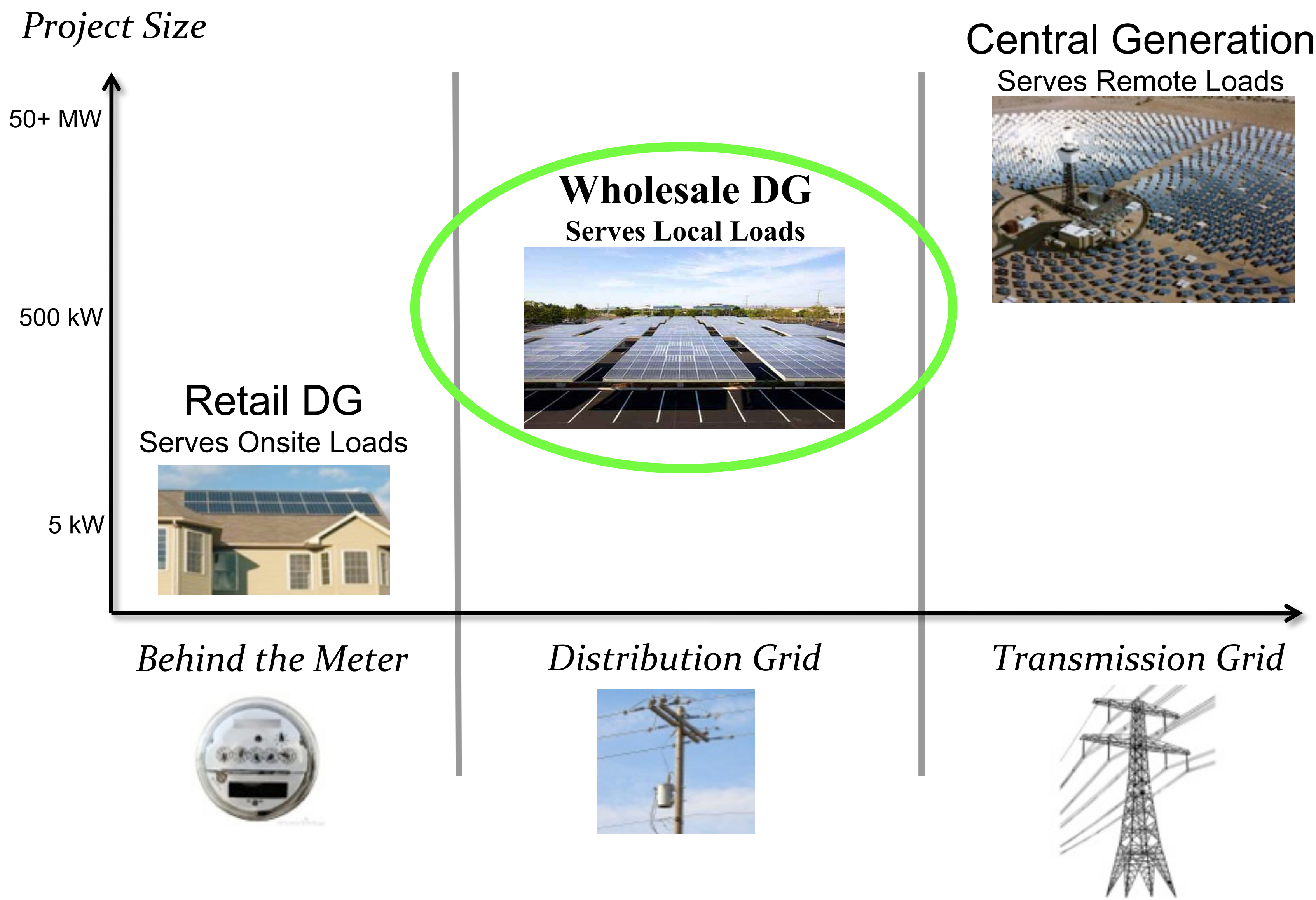

Scaling local renewables achieves cost-effectiveness

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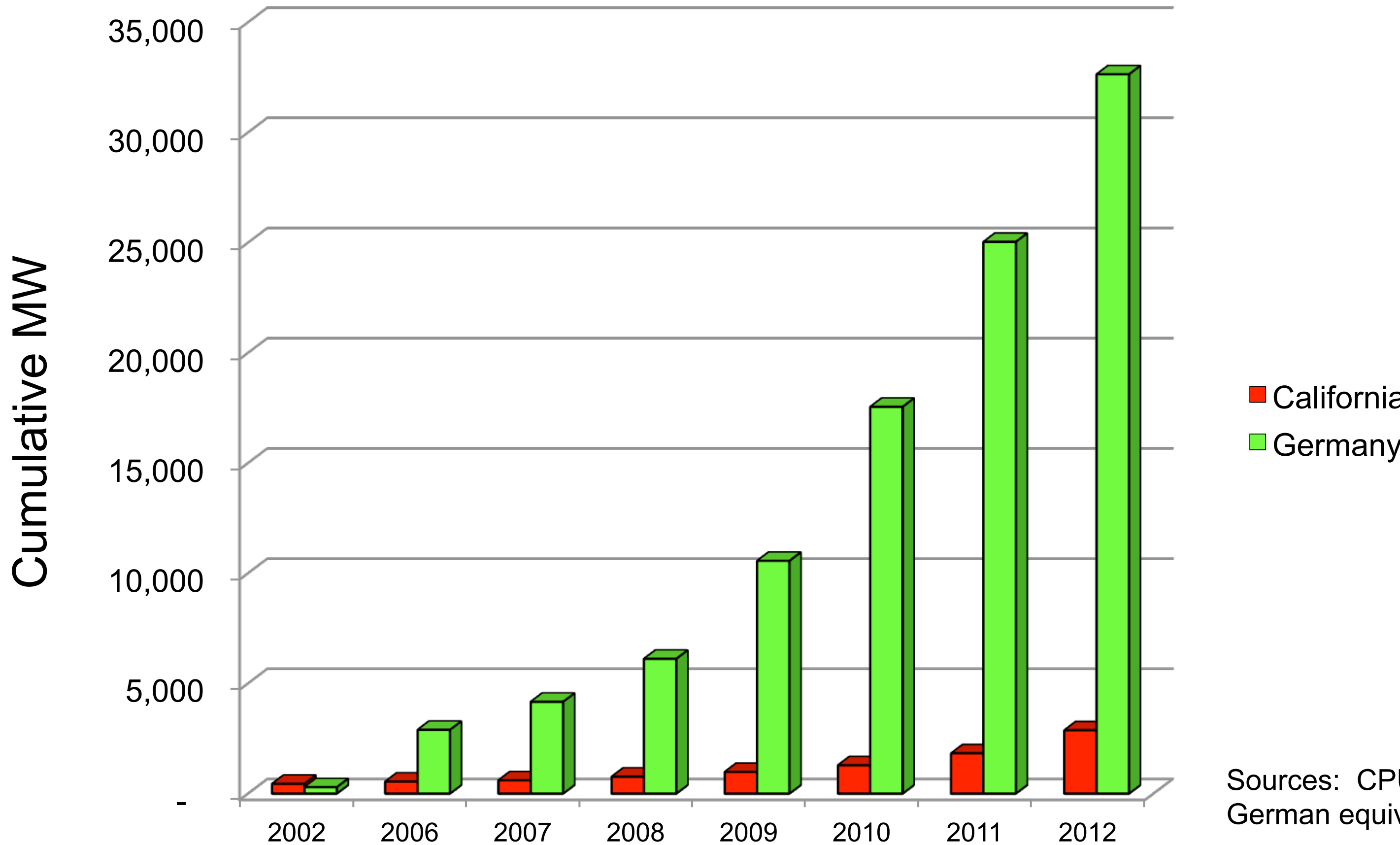
Solar Markets: Germany vs California (RPS + CSI + other)



Sources: CPUC, CEC, SEIA and German equivalents.

Germany has deployed over 10 times more solar than California in the last decade despite California's 70% better solar resource!!!

German solar is mostly local (on rooftops)

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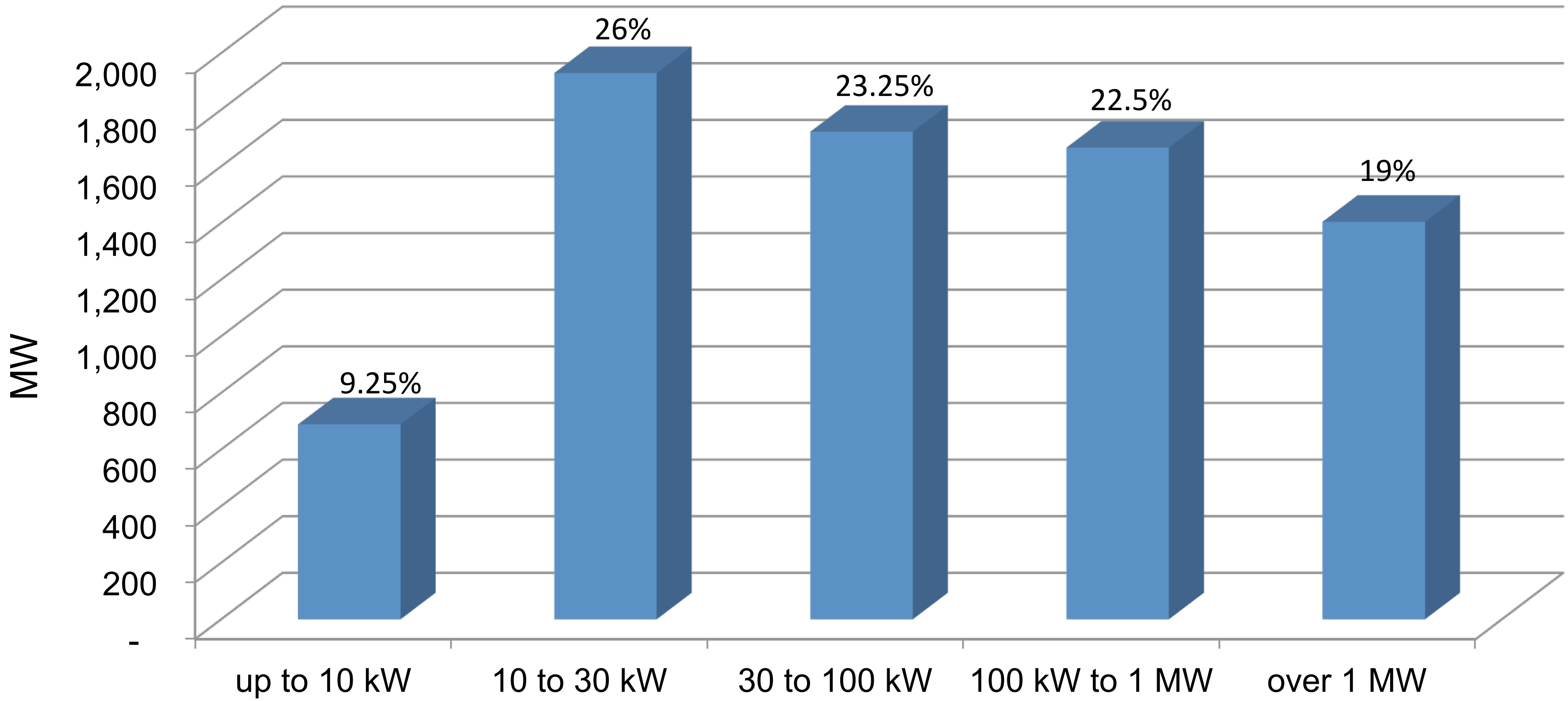
German Solar PV Capacity Installed in 2010



Source: Paul Gipe, March 2011

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 is 5 to 7 cents/kWh today

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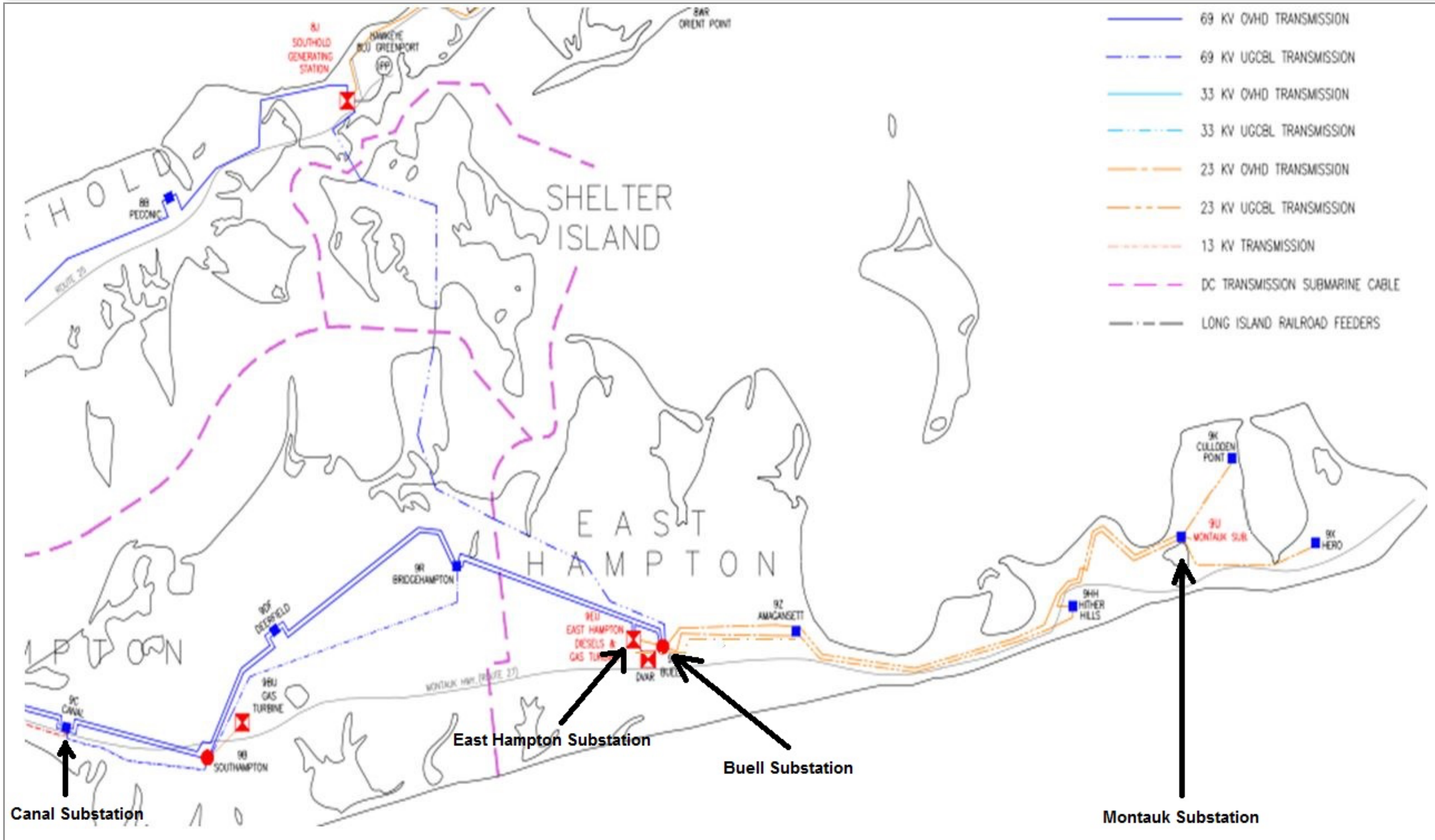
Project Size	Euros/kWh	USD/kWh	California Effective Rate $/kWh
Under 10 kW	0.145	0.1903	0.0762
10 kW to 40 kW	0.138	0.1805	0.0722
40.1 kW to 1 MW	0.123	0.161	0.0644
1.1 MW to 10 MW	0.101	0.1317	0.0527

Source: http://www.wind-works.org/cms/index.php?id=92, 10 September 2013

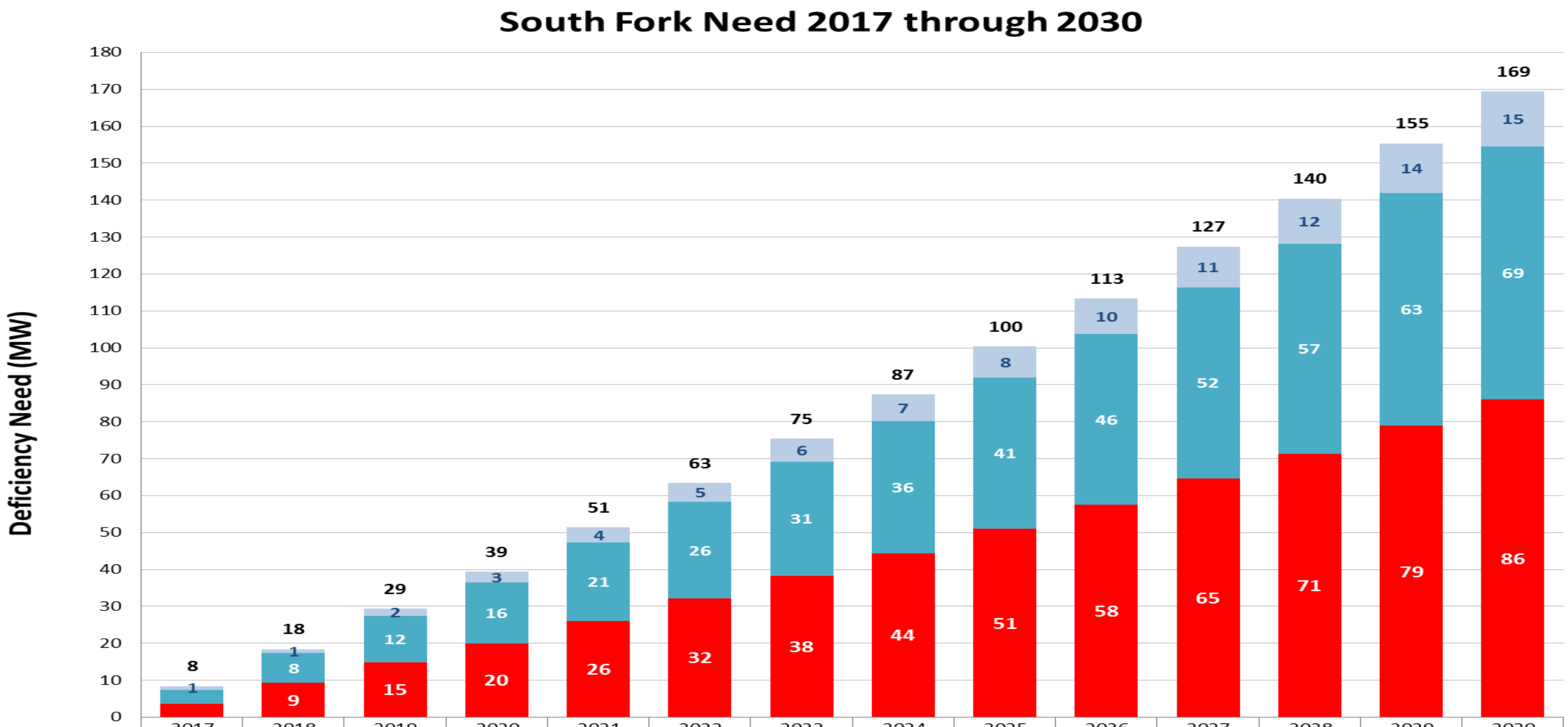
- Conversion rate for Euros to Dollars is €1:$1.309
- California's effective rate is reduced 40% due to tax incentives and then an additional 33% due to the superior solar resource

Replicating German scale and efficiencies would yield rooftop solar today at only between 5 and 7 cents/kWh to California ratepayers

South Fork Transmission System



South Fork – Forecasted Deficiency

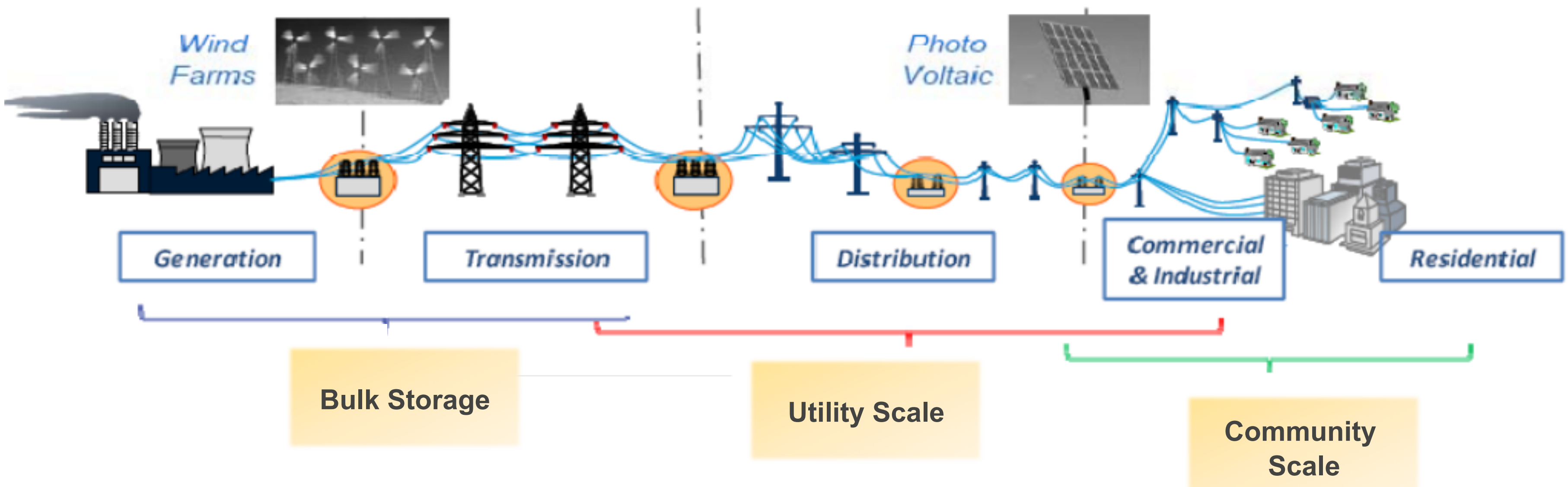


	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Need E/O Amagansett Only	1	1	2	3	4	5	6	7	8	10	11	12	14	15
Need at Buell/E. Hampton or East	4	8	12	16	21	26	31	36	41	46	52	57	63	69
Need E/O Canal	4	9	15	20	26	32	38	44	51	58	65	71	79	86
Total SF Need	8	18	29	39	51	63	75	87	100	113	127	140	155	169

Request for Proposals (RFP) for South Fork are seeking 63 MW of capacity

Why is energy storage important to PSEG Long Island?

- Benefits across the electricity value chain: *Generation to T&D to End Users*
- Primary drivers:
  - Develop a robust and resilient electricity delivery system
  - Enable & Enhance renewable energy integration
  - Mitigate Infrastructure investment



Community Microgrids start with Goals

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Typical Community Microgrid Goals

- Achieve high penetrations of local renewables (generally at least 25% of total electric energy consumed within the grid area served by the Community Microgrid)
- Defer substantial investments in traditional Transmission & Distribtution (T&D) infrastructure through load shifting and peak shaving etc
- Save ratepayers money
- Provide an efficient pathway to Distribution Services Operator (DSO) grid operations and the Distributed Energy Resources (DER) future
- Enhance grid performance (grid power quality, reliability, and resilience), including by combining local renewables and Energy Storage for indefinitely ongoing power backup to prioritized loads (critical loads and premium services)

Long Island Deployment Plan overview

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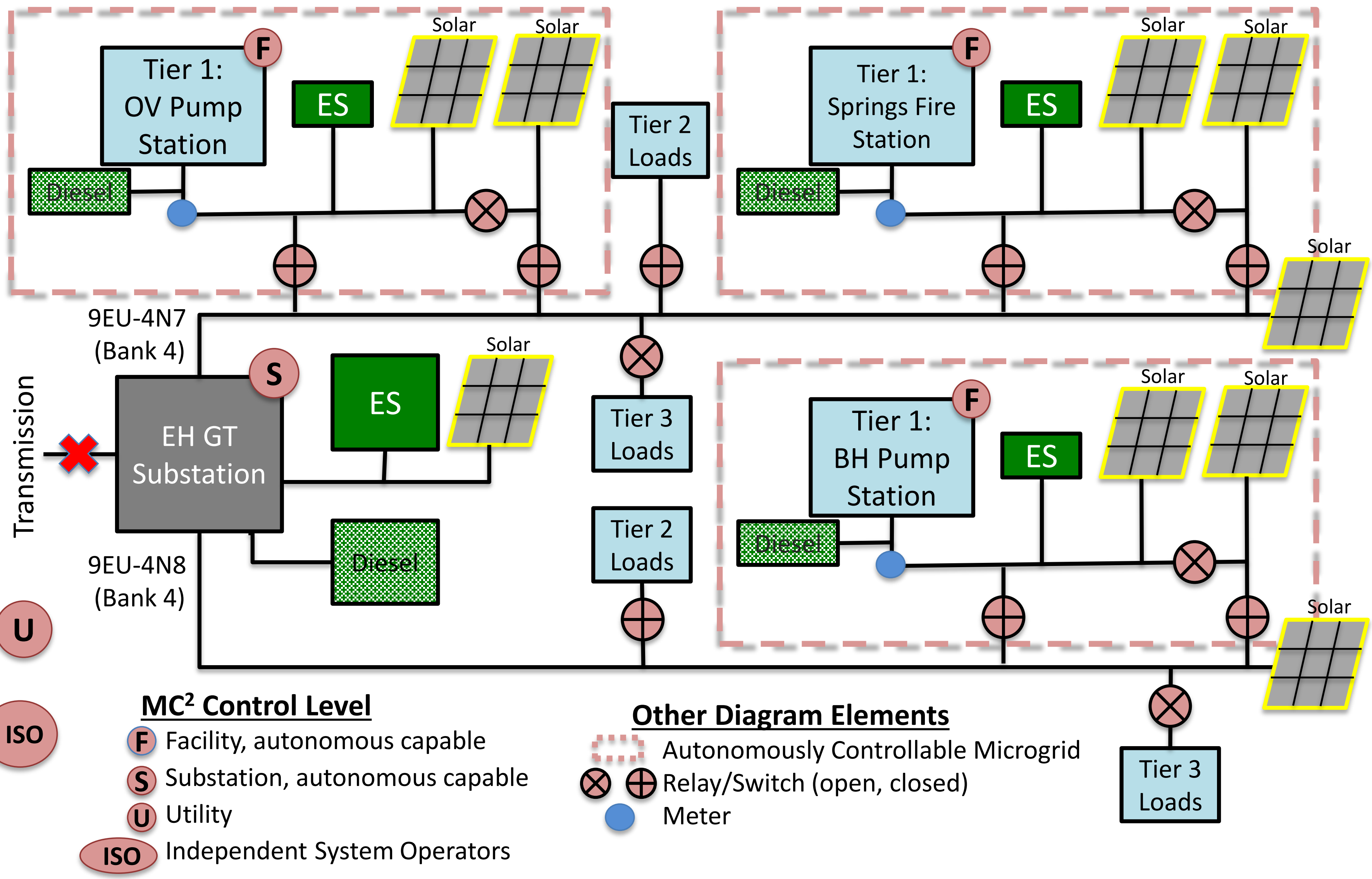

Peek at the Future of Community Microgrid areas

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

Backup

Community Microgrids start with Goals

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Typical Community Microgrid Goals

- Achieve high penetrations of local renewables.
- Enhance grid reliability and power quality.
- Provide energy resilience to the community.
- Defer investments in traditional Transmission & Distribtution (T&D).
- Save ratepayers money.
- Stage an efficient pathway to Distribution Services Operator (DSO) grid operations and the Distributed Energy Resources (DER) future.
- Meet community expectations etc.

Baseline vs DER Optimization with Advanced Inverters

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1. 6AM:
   - No PV impact
2. Noon:
   - 20MW PV causes overvoltage
3. Noon:
   - 20MW PV with advanced inverters set at 0.9 power factor stabilizes voltage

Siting Considerations are Critical

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C&I Match with Solar:

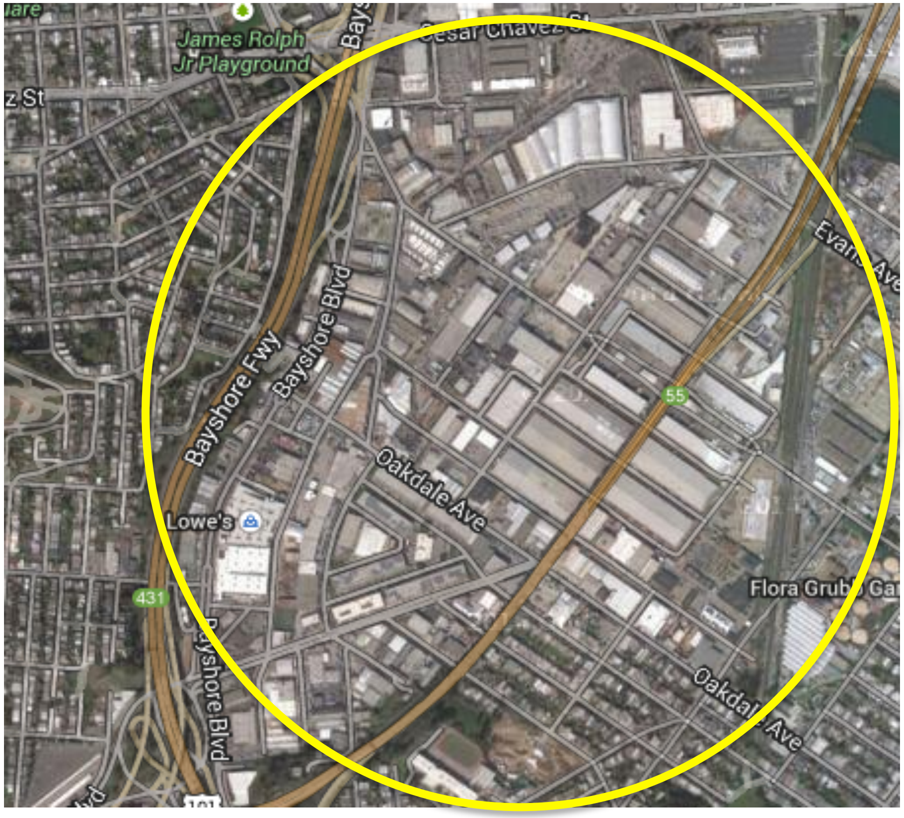
1. **Most Generation**
Larger rooftop spaces generate more energy

2. **Lowest System Costs**
Larger systems reduce overall costs

3. **Best Grid Locations**
Large loads served by robust feeder segments

4. **Matching Load Profiles**
Larger daytime loads match solar generation

5. **Financially Motivating**
Rooftop lease income is large enough to be compelling to property owners



Solar Siting Survey for SCE Preferred Resources Pilot

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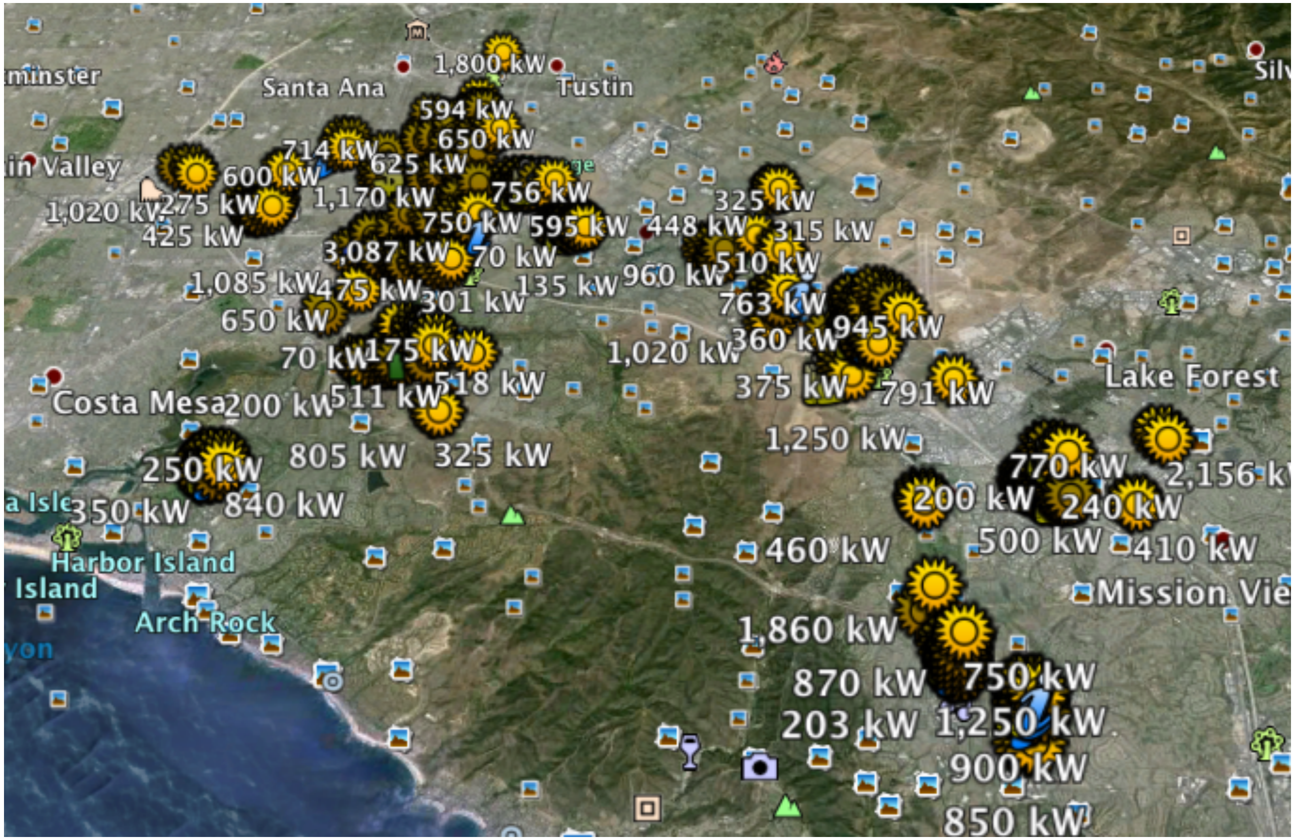
Objective: Conduct a Solar Siting Survey across Southern California Edison's Preferred Resources Pilot (PRP) area for sites 500 kW or greater

The PRP area is approximately 120 square miles in Orange County, CA, bordered roughly by Santa Ana in the north and Laguna Niguel in the south.



SCE PRP Solar Siting Survey summary

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Summary: over 160 MW of new solar PV technical potential exists in the PRP on very large rooftops, parking lots, and parking garages (500kW+ project sizes)

PRP Solar Potential by PV size: totals per sites greater than 1 MW, sites greater then 500 kW but less than 1 MW, and sites less than 500 kW. The sites that are less than 500 kW are included as part of logical groupings such as office parks or shopping centers.

		Summary by PV Size							
		Num_Sites	kW_Total	PV W_AC >	1,000 kW	> PV W_AC >	500 kW	Less than	500 kW
PRP Area:	24	110	69,964 kW	26	36,599 kW	34	22,118 kW	50	11,246 kW
PRP Area:	59	221	105,437 kW	16	26,371 kW	68	48,031 kW	137	31,035 kW
PRP Area Overlap:		22	11,023 kW	4	6,673 kW	4	2,564 kW	14	1,786 kW
Totals:		309	164,378 kW	38	56,297 kW	98	67,585 kW	173	40,495 kW

PRP Solar Potential by site type: totals for rooftops, parking garages (multi-story parking structures that would enable rooftop-style mounting), parking lots (e.g. ground mount), and brown fields

		Summary by Site Type							
		Roof_Flat	kW_Total	Pkg_Garage	kW_Total	Pkg_Lot	kW_Total	Brown_Fld	kW_Total
PRP Area:	24	48	40,728 kW	18	12,831 kW	43	14,605 kW	1	1,800 kW
PRP Area:	59	113	58,125 kW	15	11,081 kW	93	36,232 kW	-	- kW
PRP Area Overlap:		15	9,599 kW	1	504 kW	6	920 kW	-	- kW
Totals:		146	89,253 kW	32	23,408 kW	130	49,917 kW	1	1,800 kW

Benefits Matter - Hunters Point example

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Overview

- Innovative project in the Bayview-Hunters Point area of San Francisco, in collaboration with Pacific Gas & Electric

- Model for achieving 25% of the total energy consumed in the area from local renewables, while maintaining or improving grid reliability and power quality using dynamic grid solutions

- The Hunters Point substation serves ~20,000 customers (about 90% residential, 10% commercial/industrial)

Hunters Point CMP Benefits from 50 MW New PV

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50 MW Total = Existing Structures @ 30 MW + Redev Zone @ 20 MW

Example: 180 Napolean St.
- PV Sq. Ft = 47,600
- System size = 714 kW

Commercial: 18 MW

Example: 1485 Bay Shore
- PV Sq. Ft = 37,800
- System size = 567 kW

Parking Lots: 2 MW

Example: 50 avg. rooftops
- Avg. PV Sq. Ft = 343
- Avg. system size = 5 kW

Residential & MDU: 10 MW

Benefits from 50 MW New PV Over 20 Years

Energy

Cost Parity: Solar vs. NG, LCOE
$260M: Spent locally vs. remote
$80M: Avoided transmission costs
$30M: Avoided power interruptions

Economic

$200M: New regional impact
$100M: Added local wages
1,700 Job-Years: New near-term and ongoing employment
$10M: Site leasing income

Environmental

78M lbs.: Annual reductions in GHG emissions
15M Gallons: Annual water savings
375: Acres of land preserved

Cubberley Solar Emergency Microgrid

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- Leverage the existing 125 kW solar facility and allow it to continue operating under the existing Net Energy Metering (NEM) agreement and interconnection with the Palo Alto Utilities.
- Implement an electrical configuration that allows the Cubberly Solar Emergency Microgrid (SEM) to autonomously isolate (aka “island”) from the Palo Alto Utilities grid without power interruption to the identified critical facilities, including the Offices of Emergency Services (OES) communication facilities and administrative offices; and all facilities associated with Palo Alto’s only emergency shelter.
- Implement energy storage to complement the solar and provide indefinite backup power to the critical facilities, which are estimated to require average power of 10kW and peak power of 50kW.

Solar Emergency Microgrid (SEM) - Cubberley

Palo Alto Office of Emergency Services 3/1/16

Peninsula Advance Energy Community (PAEC)

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- Funding: 20-month, $1.3 million California Energy Commission (CEC) planning & design grant to stage policy and project implementations that facilitate and showcase Advanced Energy Communities (AECs).
- Policy: Identify best-practice AEC policies associated and stage to proliferate them policies throughout the PAEC region and beyond.
- Projects: Identify showcase AEC projects and cross-fertilize them to projects throughout the PAEC region and beyond.

PAEC Geography

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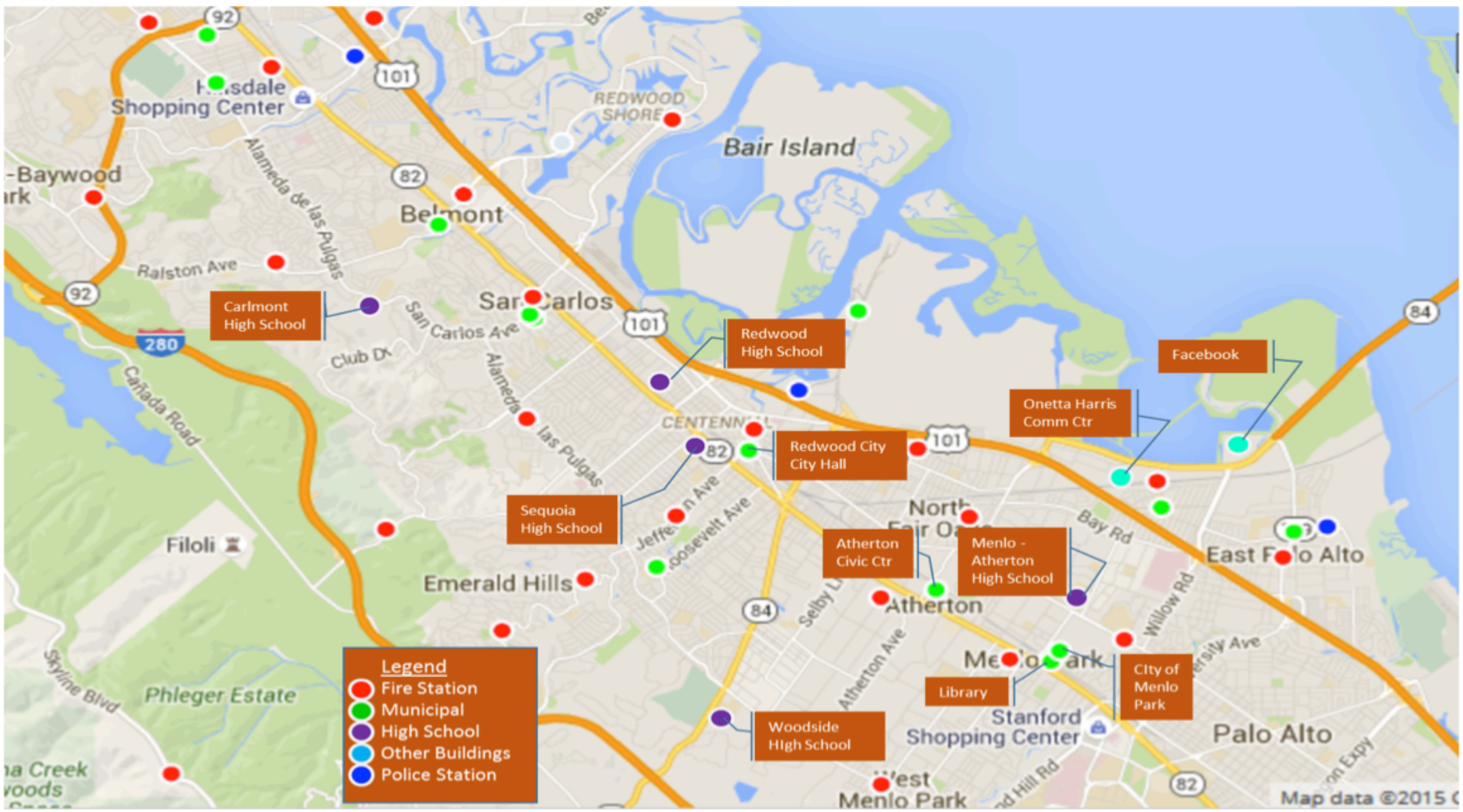
- Core region: Southern San Mateo County within the boundaries of Redwood City, Atherton, Menlo Park, and East Palo; including embedded unincorporated areas.
- Broader region: San Mateo County in its entirety plus City of Palo Alto.
- California & beyond: PAEC region is representative of suburban California, largely built-out a facing development pressure; ensuring wide PAEC replication with relative ease.



PAEC Core Tasks

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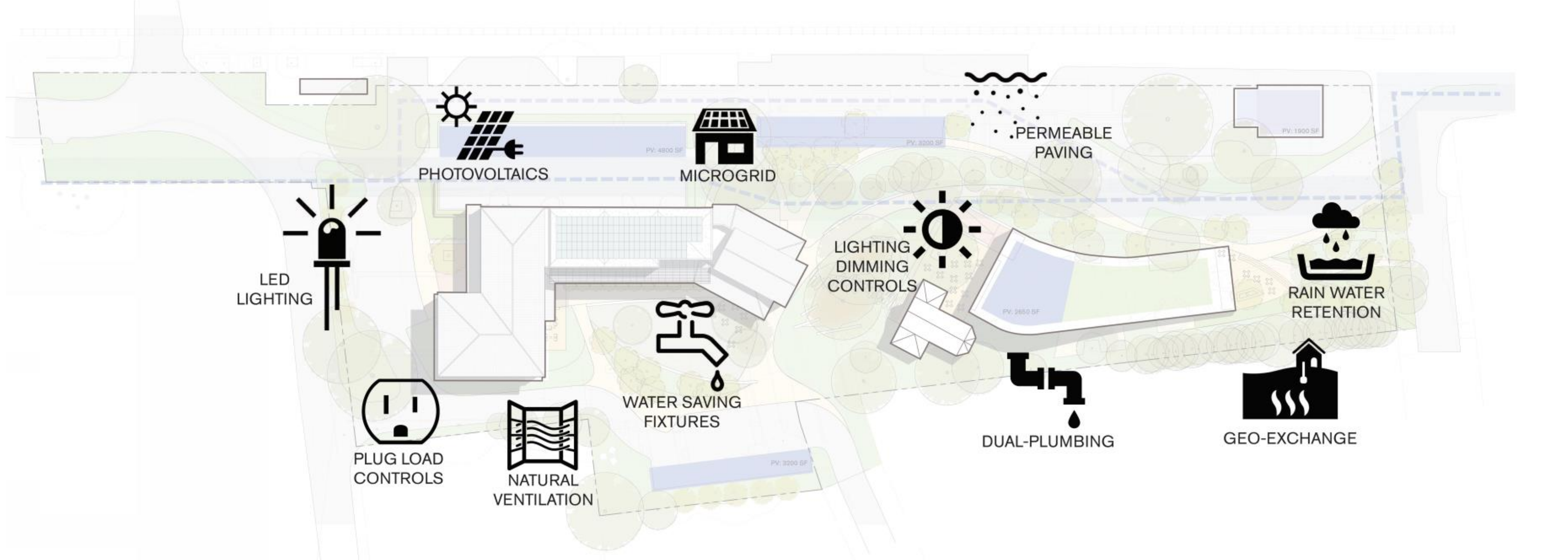
- Streamlining of Permits, Codes, and Ordinances that facilitate AECs
- Streamlining interconnection of AEC projects to the grid
- Financial and Business Models that facilitate AECs
- Solar Emergency Microgrids (SEM)
- Electric Vehicle Charging Infrastructure (EVCI) Master Plan
- Atherton Civic Center Net Zero Energy (NZE) & Fuel Switching (FS) Showcase
- Solar Siting Survey (SSS)
- PAEC Case Study & Master Community Design

Atherton Civic Center Showcase

- Design Development of Civic Center's Sustainability Features
  - ZNE, EE, RE, Fuel Switching, water saving and storage
  - No natural gas service (no natural gas plumbing whatsoever)
  - Scorecard of potential green building initiatives
  - Benefit-Cost Analysis
- Project timed to begin build-out in 2018, perfect for PAEC Phase II



PAEC Collaborators – So Far

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