Clean Coalition

Making Clean Local Energy Accessible Now

Peninsula Advanced Energy Community (PAEC)

Accelerating the transition to a clean local energy future

Justine Burt

Dr. Kristin Kuntz-Duriseti

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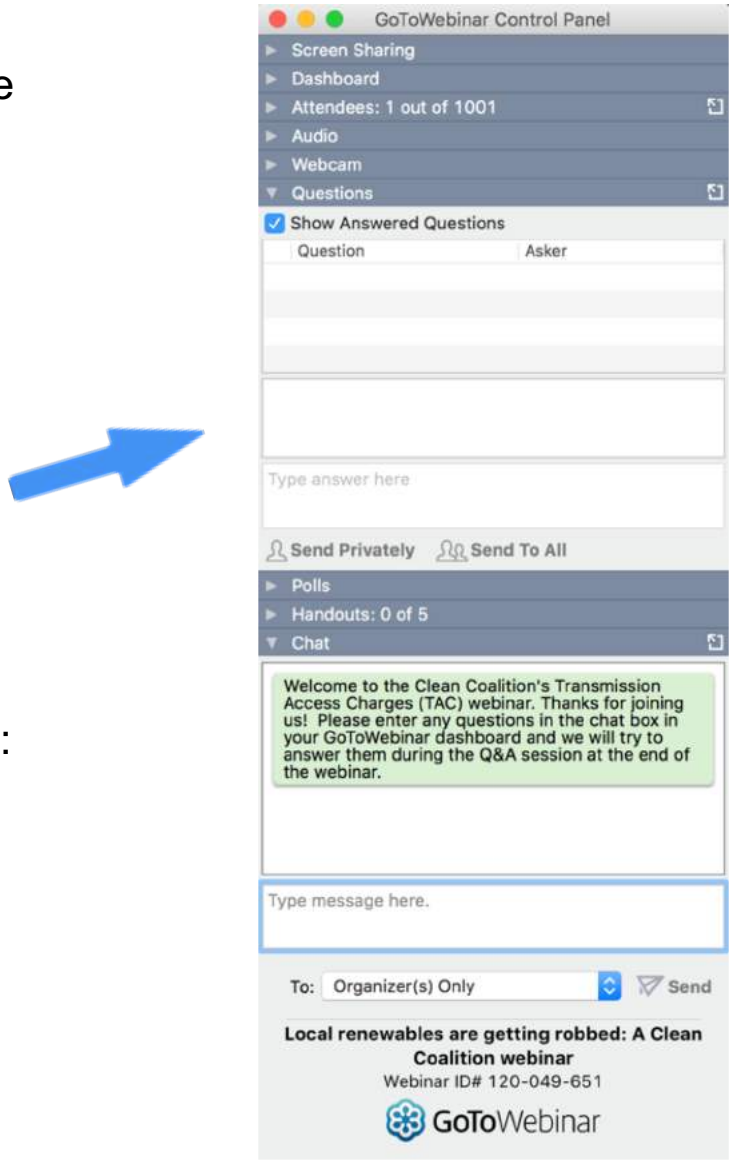


Today's presenters

Justine Burt is the Founder and CEO of Appraccel. She has 18 years experience as a sustainability project manager for advanced energy communities, waste prevention, and alternative transportation projects. She applies proven economic, policy, and behavior change tools to successfully implement lasting change for government, university, non-profit, and private sector clients. Justine has degrees in Economics and Environmental Policy.

Dr. Kristin Kuntz-Duriseti is Managing Editor of Climatic Change, an international journal publishing interdisciplinary research on the description, causes, and implications of climate change. To support responsible and progressive sustainability policies, promote renewable energy projects, and shift our community to a low carbon future, Kristin has served as an Environmental Quality Commission for Menlo Park, California and is a current Board Member for Menlo Spark, a non-profit initiative working toward climate neutrality in the city.

Agenda

- PAEC
- Advanced Energy Communities
- Policy goals and existing regulatory structure
- Key challenges
- Best practices
- Key findings
- Case studies
- Tools to accelerate to AECs
- Project benefits
- Areas for future study
- Questions

Peninsula Advanced Energy Community

- 21-month project
- 12 Clean Coalition staff and subcontractors
- Funding from California Energy Commission
- Southern San Mateo County

PAEC Reports

Task 2.2 - Best Practices report (Menlo Spark)

Task 2.4 - Gap Analysis (Menlo Spark)

Task 2.6 – Benefit-Cost Analysis Report of Potential Ordinances (DNV GL)

Task 2.8 - Interview with Public Agencies, Installers, and Vendors (Sovereign Energy)

Task 2.10 - Policy Recommendations & Guidelines for Permitting Energy Storage (Sovereign Energy)

Task 2.12 - Model Ordinances for San Mateo County (DNV GL)

Task 2.14 - AEC Regulatory and Permitting Recommendations (DNV GL)

Task 3.II - Backup Power Valuation Methodology (Sovereign Energy)

Task 3.2 – Lending, Customer Compensation, and Government Incentive Report: Strategies and Incentives Available to Advanced Energy Communities In and Around San Mateo County, California (High Noon Advisors)

Task 3.4 + 3.10 - Summary of Financial Pro-Forma Delineating the Cost of Capital, Tenor, Risk/Return Profile, and Value Streams for Behind the Meter Energy Storage (Sovereign Energy)

Task 3.6 - Dispatch Model for Energy Storage System (Sovereign Energy)

Task 3.12 - Successful Energy Storage Financing Program (Sovereign Energy)

Task 3.14 – Economic Benefit-Cost Analysis of Energy Efficiency and Fuel Switching Measures: Prototypical Residential Multifamily Building (DNV GL)

Task 3.14 – Economic Benefit-Cost Analysis of Energy Efficiency and Fuel Switching Measures: Prototypical Municipal Building (Fire Station) (DNV GL)

Task 3.14 – Economic Benefit-Cost Analysis of Energy Efficiency and Fuel Switching Measures: Prototypical Office Building (DNV GL)

Task 3.14 – Economic Benefit-Cost Analysis of Energy Efficiency and Fuel Switching Measures: Prototypical Retail Building (DNV GL)

Task 3.14 – Economic Benefit-Cost Analysis of Energy Efficiency and Fuel Switching Measures: Prototypical School Building (DNV GL)

Task 3.16 - Economic Benefit-Cost Analysis of Electric Vehicle Charging Infrastructure (Sven Thesen & Associates)

Task 3.18 - Energy Tracking/Benchmarking Tool Report – Building Energy Management Systems: An Advanced Energy Solution for Commercial Buildings (Office of Sustainability, County of San Mateo)

Task 3.i - Report Summarizing Literature Review & ISO/RTO Tariff Analysis (Sovereign Energy)

Task 4.2 – Best Practices: Interconnection for Local, Commercial-Scale, Renewable Energy Projects – Streamlining the Interconnection of Advanced Energy Communities to the Grid (Clean Coalition)

Task 4.4 – Design of Pilot for Testing Streamlined Interconnection Procedures (Clean Coalition)

Task 5.2 – Solar Emergency Microgrid Site Design and Deployment Plan (Clean Coalition)

Task 6.1 – Potential Locations for the Electric Vehicle Charging Infrastructure Master Plan (Sven Thesen & Associates)

Task 7.1 – Technical and Economic Feasibility of Sustainability Features for the Atherton Civic Center Report (WRNS Studio)

Task 7.2 – Scorecard of Sustainability Features (Clean Coalition)

Task 8 – Solar Siting Survey (Clean Coalition)

Task 10 – PAEC Community Master Plan (Clean Coalition)

Task 11 – Evaluation of Project Benefits (Clean Coalition)

Task 12.2 – Initial Fact Sheet (Clean Coalition)

Advanced Energy Community

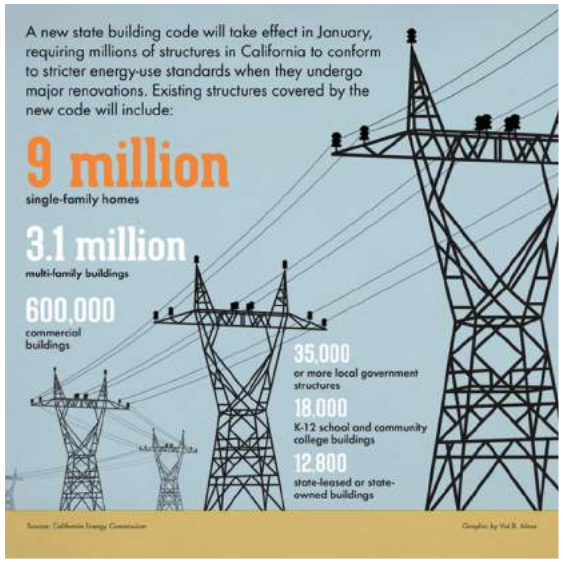
Clean Coalition

Advanced Energy Communities (AEC)

- Strive to meet zero net energy (ZNE) standards for built environment
- Take full advantage of local renewable energy, demand response, Solar Emergency Microgrids, and electric vehicle charging infrastructure (EVCI)
- Help state realize clean energy and climate change policy goals

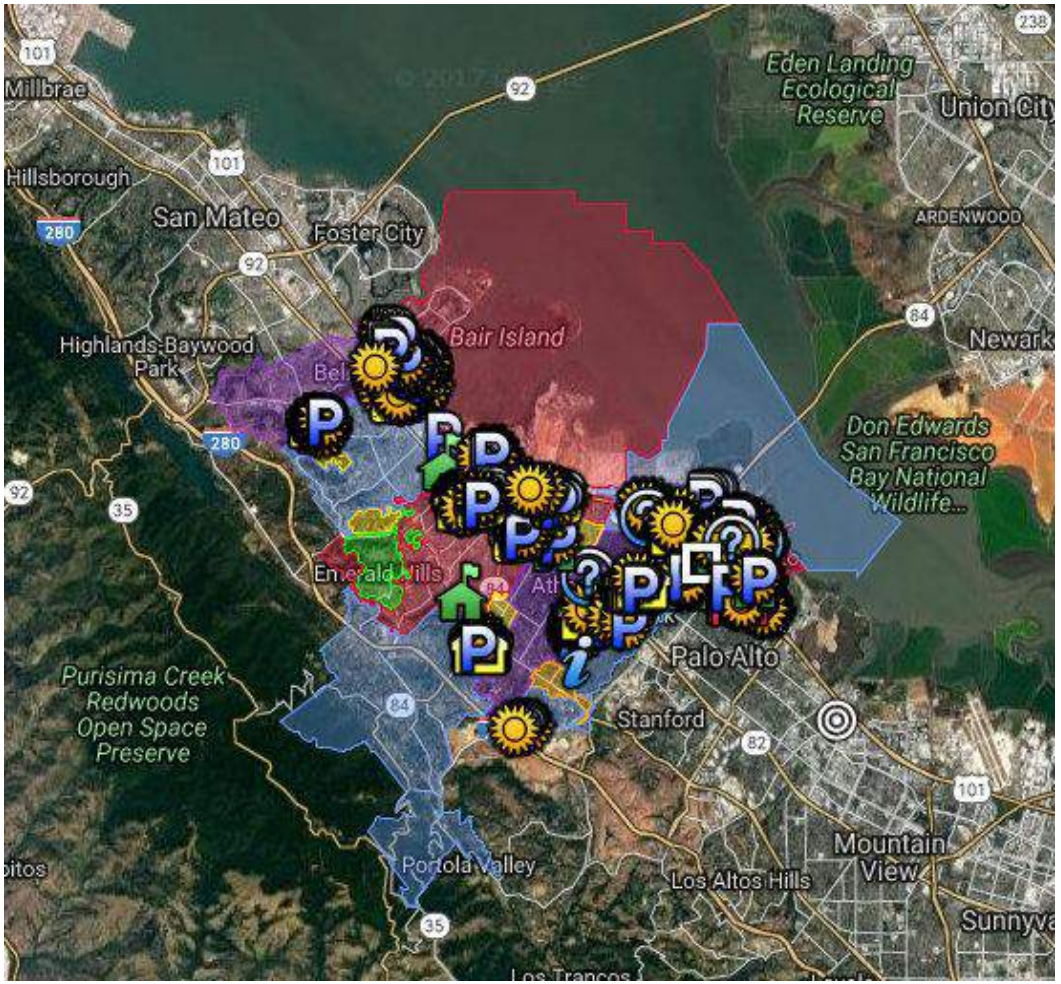
Co-benefits

- Provide energy savings
- Minimize need for new energy infrastructure
- Provide grid reliability and resilience
- Offer easier grid integration

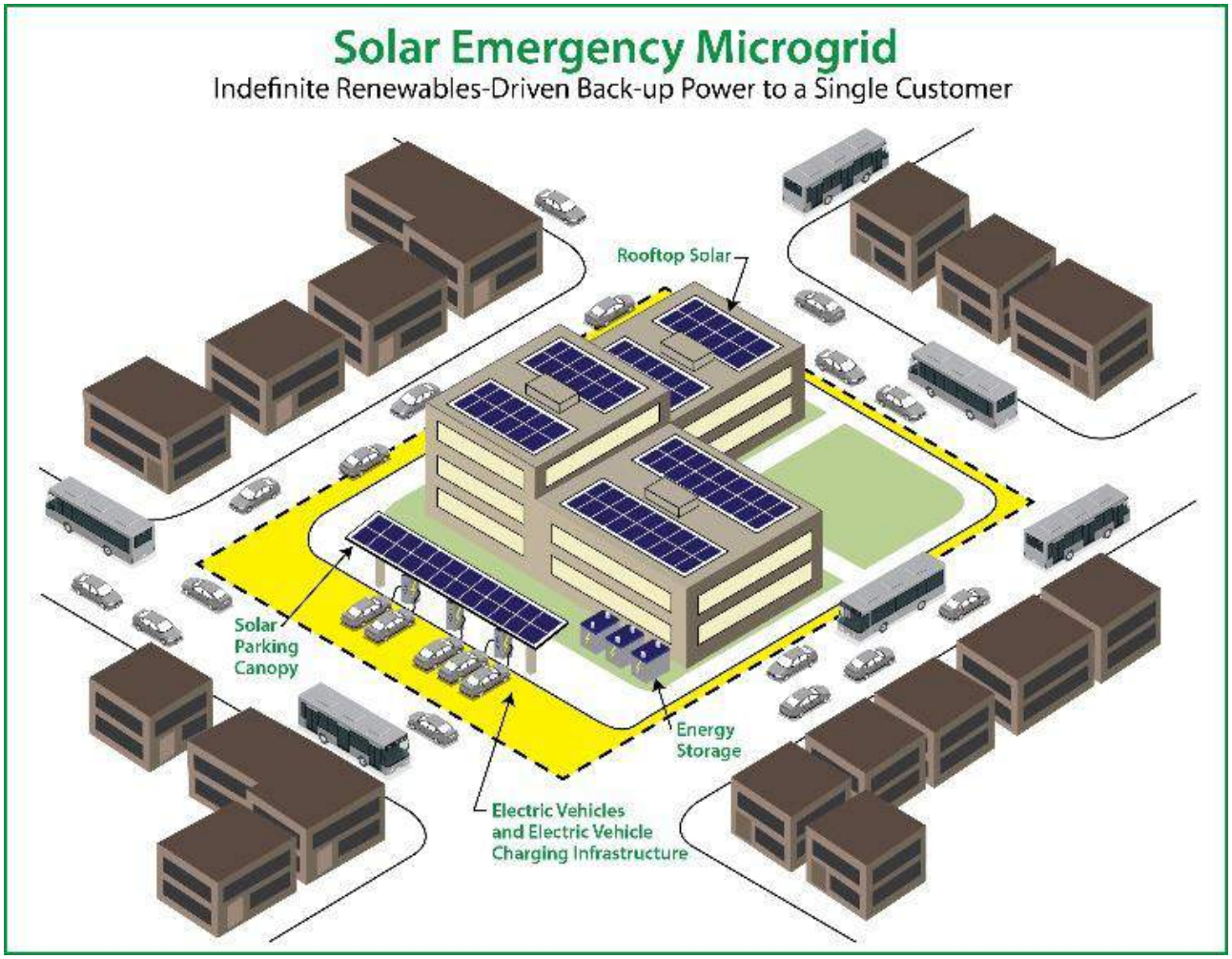


Solar Potential

- Southern San Mateo County has 65 MW solar potential
- Highly developed area
- Dense tree canopy



Vital Community Resources



Nearly 1,000 potential sites in California

Policy Goals and Existing Regulatory Structure

State goals

- AB 32 (greenhouse gas emissions)
- Title 24 and CalGreen (energy efficiency)
- CPUC Long-Term Energy Efficiency Strategic Plan (ZNE)
- CPUC Integrated Resource Plan and Long-Term Procurement Plan

- AB 117: Community Choice Aggregation
- AB 2565: EVCI in rental properties
- AB 2514: Energy Storage

Local jurisdictions

- San Mateo County
- Redwood City
- Atherton
- Menlo Park
- East Palo Alto

Key Challenges

Economic

- Life cycle cost assessments
- Capital vs. operating costs
- Split incentives
- Falling prices not fallen far enough
- Economies of scale
- Limited financing programs
- Who should fund AECs?

Policy

- Inconsistent permitting requirements
- Cumbersome and lengthy interconnection approval
- Insufficient staffing
  - to review an increasing number of applications
  - to develop policies and ordinances that support AE solutions

Best Practices

- Renewables
- Energy efficiency
- Zero net energy
- EV charging infrastructure
- Energy storage

- Economics (CCA, on-bill financing, fees)
- Policy (ZNE, retrofits)
- Technical

Renewable Energy (RE)	Energy Efficiency (EE)	Zero Net Energy (ZNE)	Electric Vehicle Charging Infrastructure (EVCI)	Additional Clean Energy Measures
Model Municipal Ordinance Options				
Solar Rooftops [RE1] (mandatory ordinances) could also include solar water heaters, cool roofs, or other alternatives, e.g., San Mateo **Solar Carports [RE2]** over parking, could be coupled with energy storage and/or EV charging, e.g., Palo Alto or Green Charge **Zoning or Building Codes [RE3]** requiring 100% Renewable Energy, e.g., Menlo Park, covering electricity & gas **Solar or Zero Carbon Water Heaters [RE4]** requiring new or replacement water heaters to be solar (e.g., Hawaii) or a non-fossil fuel alternative such as heat pumps	**Reach Codes for New Construction [EE1]** Palo Alto & Santa Monica (e.g., 15% efficiency improvement over title 24) **Point of Sale [EE2]** energy audits and disclosure, e.g., Berkeley and Austin **ECBO: Existing Commercial Building Benchmarking Ordinance [EE3]**, e.g., San Francisco Buildings report energy use + audit each year *or* retro-commissioning every 5 years **Other Mandatory Requirements** Higher efficiency equipment, etc.	**Reach Codes [ZNE1]** for CA ZNE, e.g., Santa Monica **Financial Incentives [Fees2]:** New Climate Impact Fee, fully refunded for ZNE, e.g., Watsonville	**City Ordinance & Zoning [EVCI1]:** Minimum parking spaces required with pre-wiring or EV Chargers for **new** homes, multi-family, commercial or parking, e.g., City of San Francisco	**Fees [Fees1]** for Fossil Fuel Use or Carbon, e.g., Palo Alto Natural Gas offset fees
Additional Measures				
Financing: Rebates, PACE, on-bill financing, etc. **New technology** – in-pipe hydro, Pressure Relieving Valve (PRV)/Turbine technology, e.g., Portland – Lucid project **Permitting** improvements	**Audit programs** – NYC Retrofit Accelerator, Green @ Home, Green House Calls, PG&E audits **Incentives**, e.g., Energy Upgrade CA **Permitting**, e.g., fees waived and/or expedited, e.g. Encinitas **Building Electrification** / Natural Gas Replacement, Boulder	**District Approaches** (e.g., 2030 Districts, Fort ZED, Cambridge) **RFP & Lease Language** **Existing Building Retrofits** Energiesprong, ZNE overhauls with modular components	**City Charging Stations** (for city fleets and public use) **Incentives** (preferred parking, free charging or low/no cost charging) **Streamlined Permitting** **City EV "First" purchasing policy**, Palo Alto	**Innovations through CCEs** (aggregated solar, EV deployment) **Solar Emergency Microgrids** **Energy Storage**

Key PAEC Findings

Economics

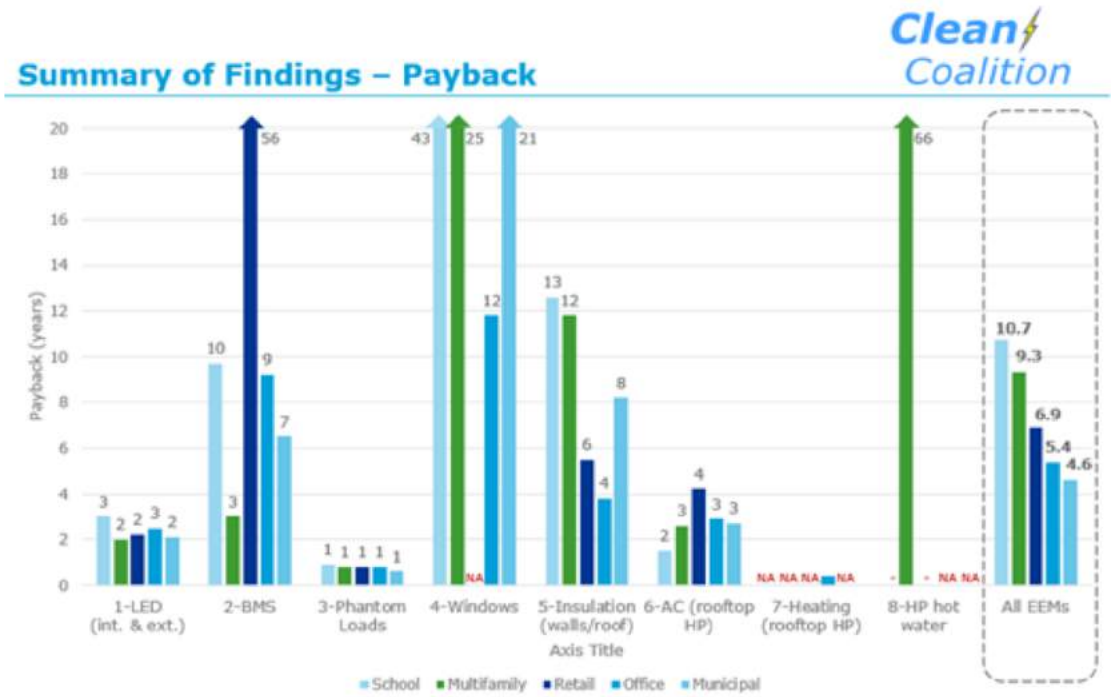
- Future financial viability of energy storage
- Bundling energy efficiency
- Model ordinances
- Inconsistent financial tools (on-bill financing)

Policy

- Context specific
- Deep energy retrofits
- Streamline interconnection
- Streamline permitting

Technical

- Solar Siting Survey - 65 MW WDG, minimum project size 100 kW A/C
- EVCI master plan



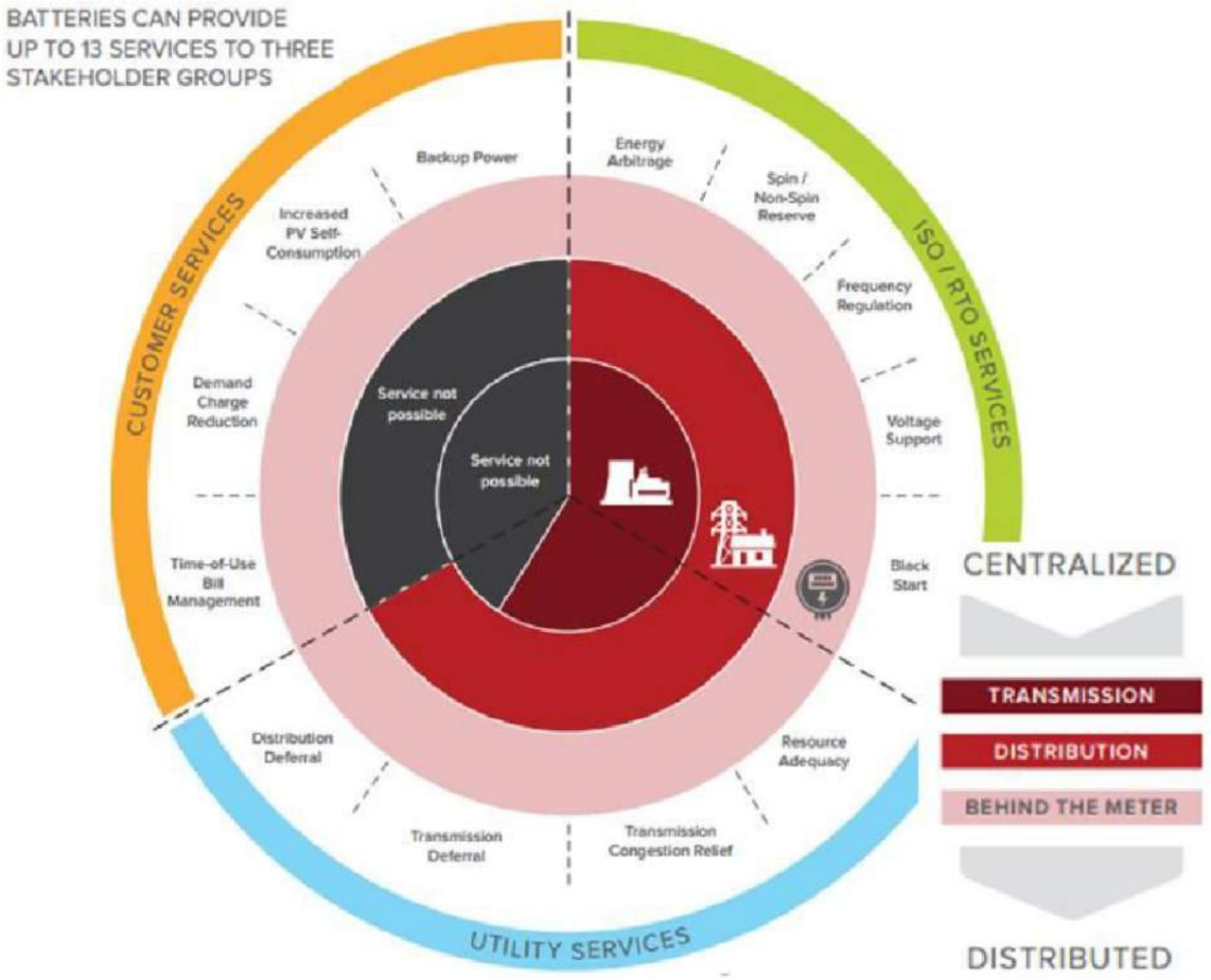
Electric Vehicle Charging Infrastructure

Clean Coalition

EVCI Master Plan – low cost measures for jurisdictions

1. Create stronger code requirements for EV Level 2 charging outlets at Multi-Unit Dwellings (MUD) and workplaces -- new construction or major renovations.
2. Encourage Direct Current Fast Charging stations at transit corridors -- ownership, installation and operation by third parties.
3. Encourage building owners to secure grants from public agencies and utilities for costs of installing at MUDs and workplaces.
4. Encourage public signage visible from roadways to educate and reassure non-EV owners there are plenty of places to plug in.
5. Host or encourage “EV Ride & Drives” to educate people about the benefits of EVs.

Energy Storage



Energy Storage

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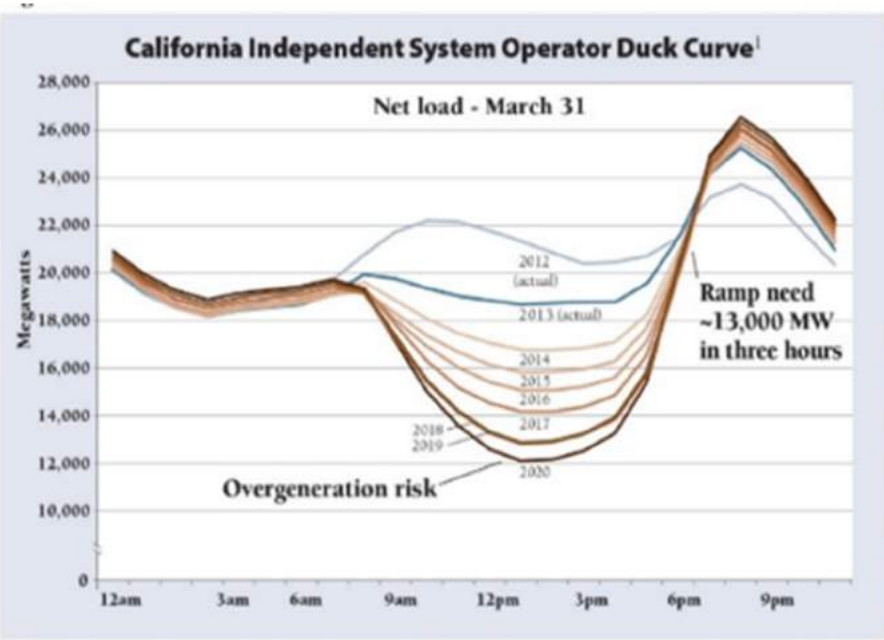
Double duty

- Back-up power
- Renewable energy storage
- Peak shaving
- Load shifting
- Power conditioning (energy supply smoothing)
- Spinning reserves



Atherton Civic Center

Anticipated first Zero Net Energy civic center in the US

Atherton Civic Center

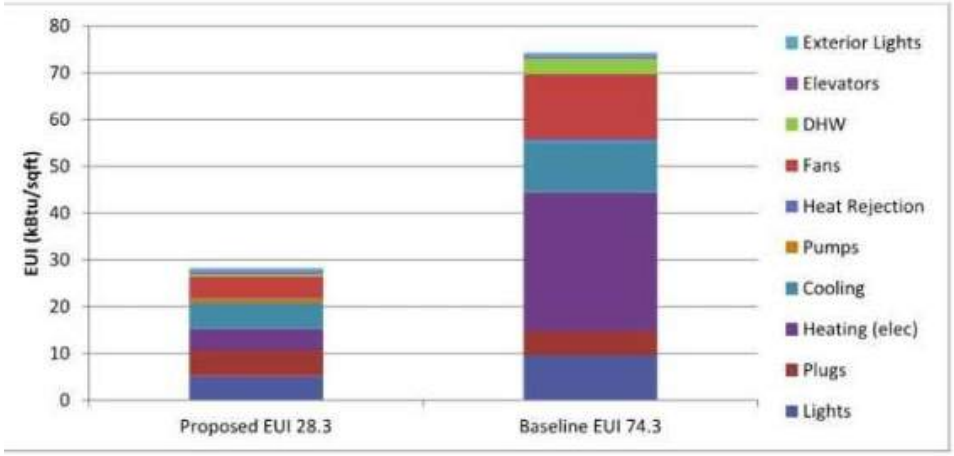
Challenge: matching limited solar potential to energy demand

Atherton Civic Center

Clean Coalition

Solution:

- energy saving features reduce EUI

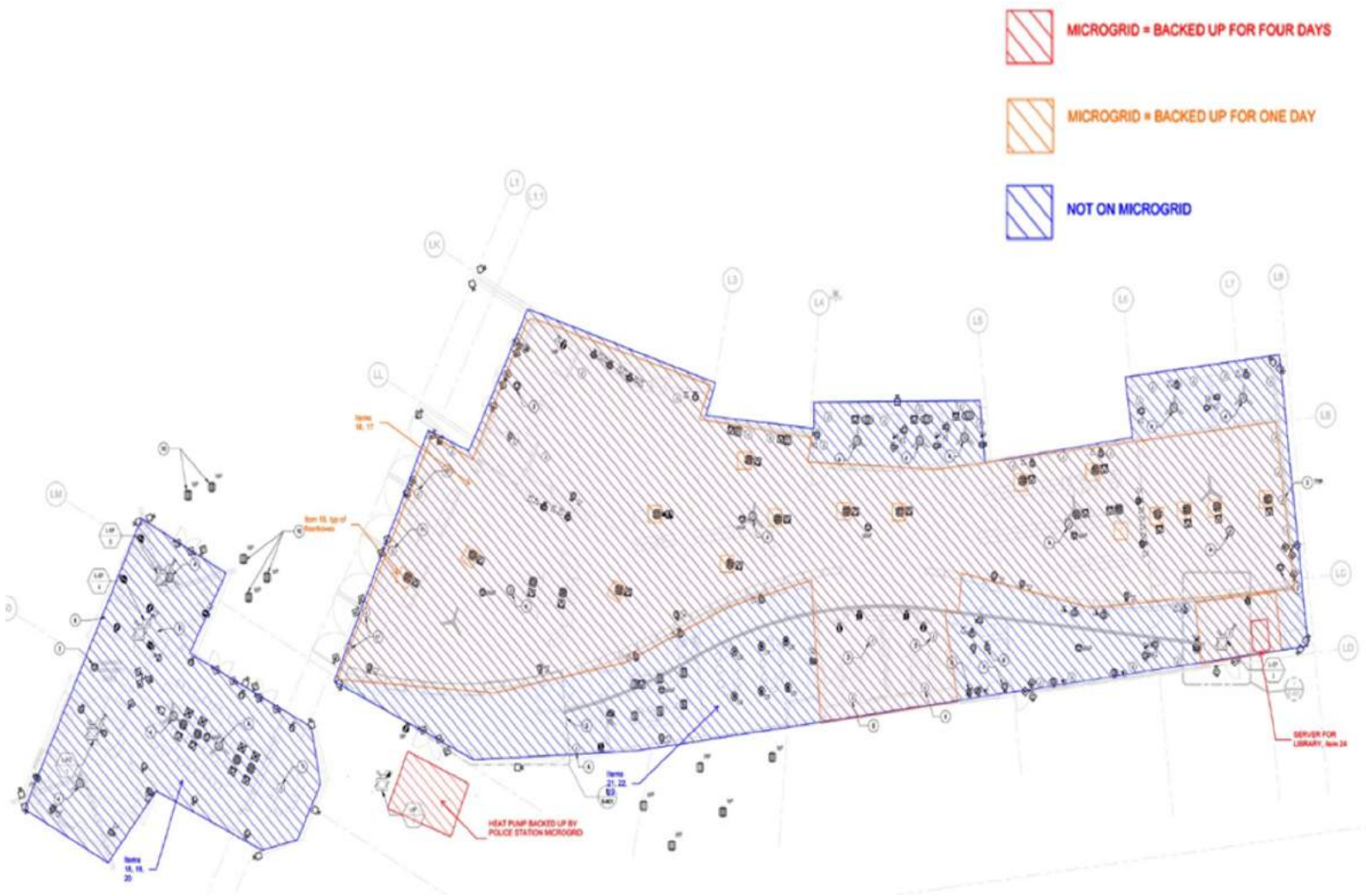


- heat pump with heat recovery (water thermal storage)

Atherton Civic Center

Police department and administrative services

Atherton Civic Center

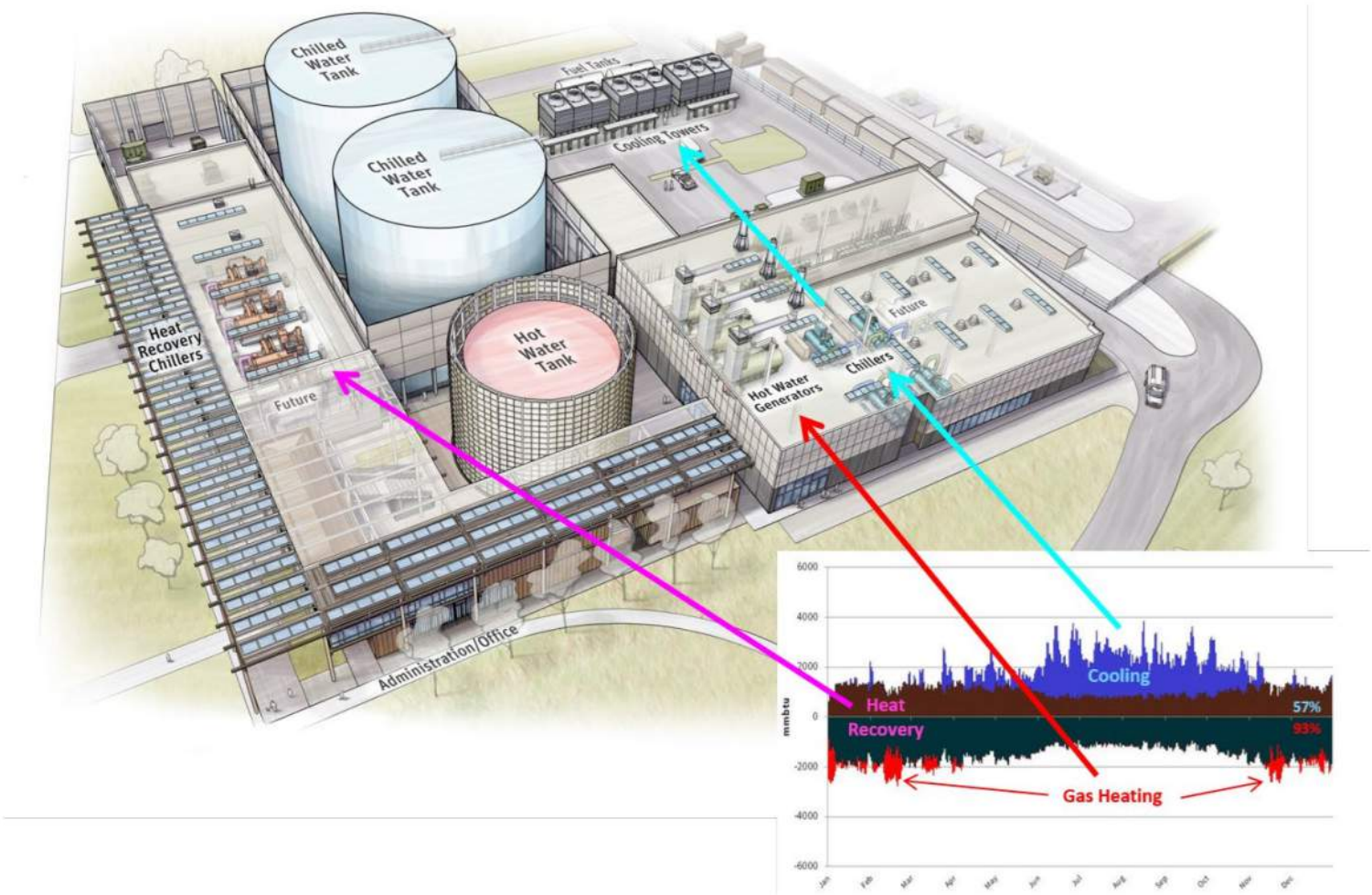


Library and historic City Hall

Stanford University

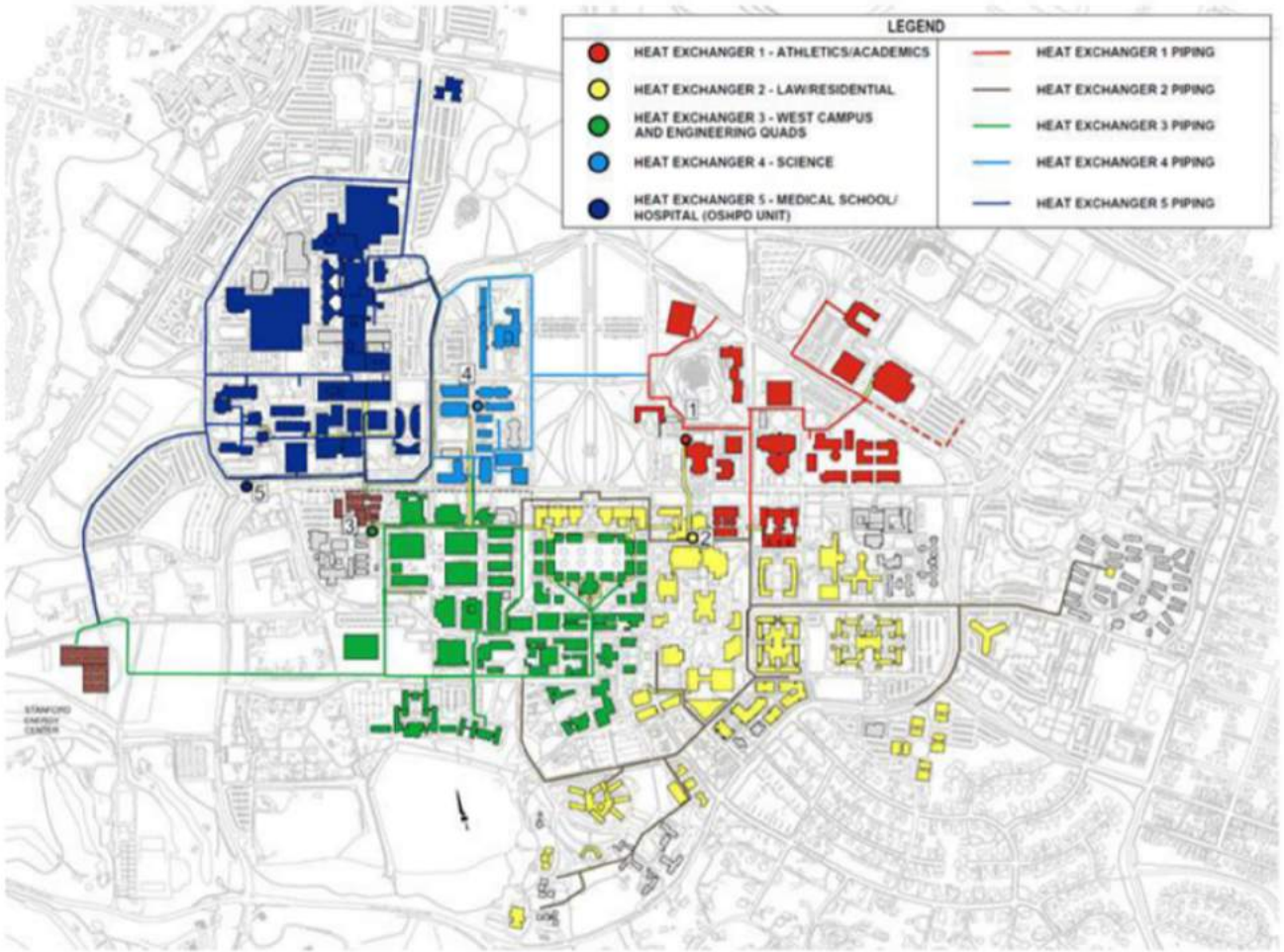
Clean Coalition

Stanford Energy System Innovation (SESI) and Central Energy Facility



Stanford University

Overall Conversion Plan



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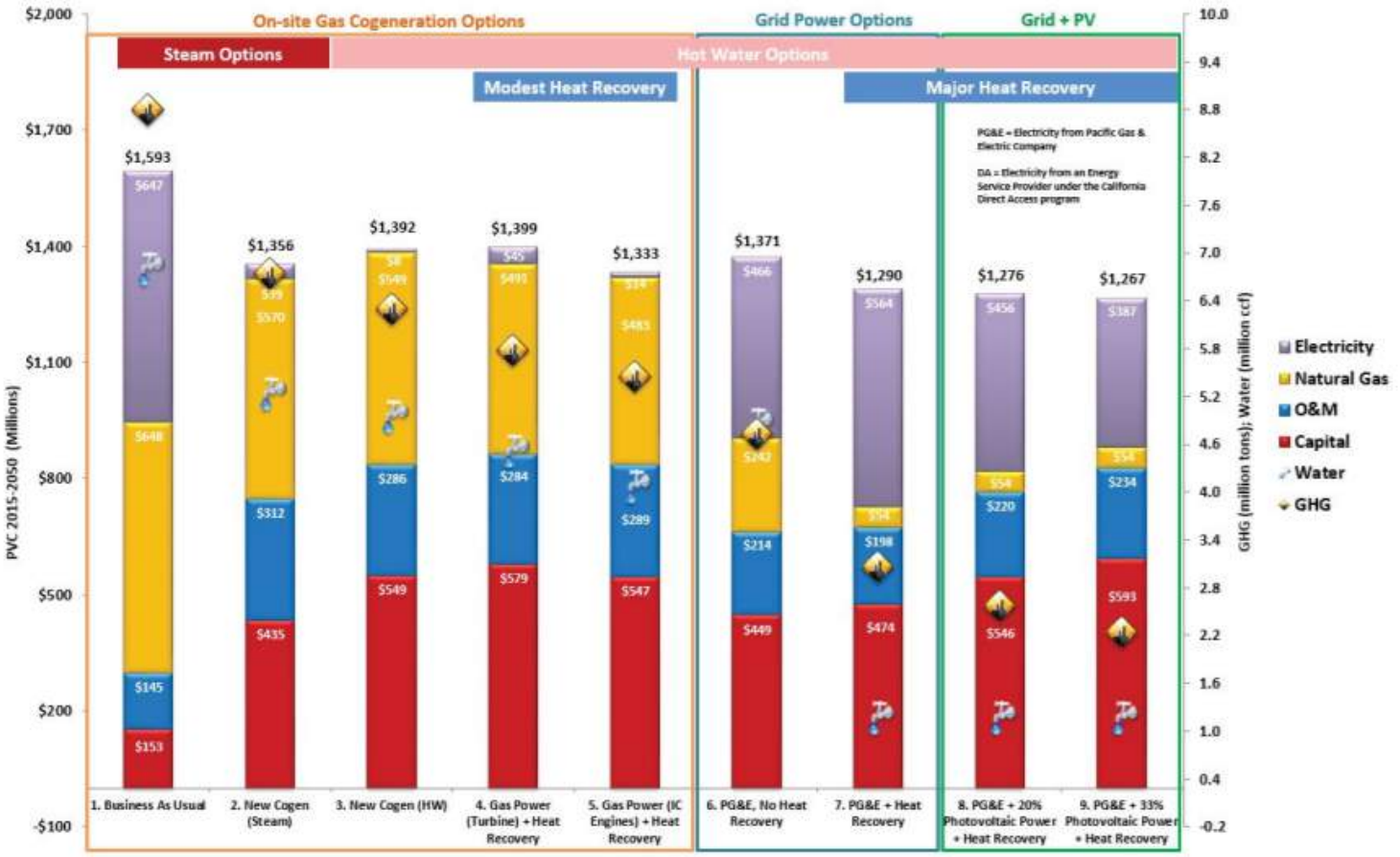
Comparison of Energy Supply Options



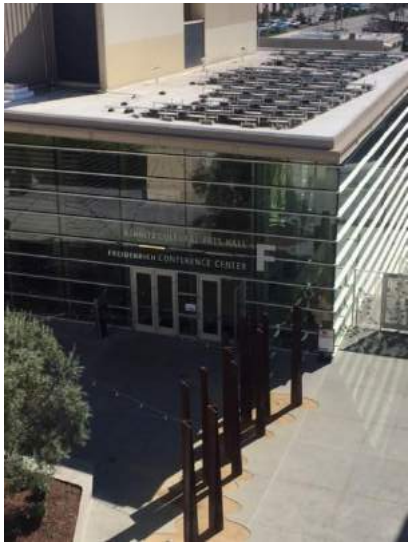
Source: Stanford University Energy and Climate Plan (2015)
For more information, see: http://sustainable.Stanford.edu

Stanford University

Other SESI components:

- Hourly dispatch plan to optimize CEF operations increases efficiency by 6%
- Consolidating computer servers and using energy efficient cooling technology saves the university approximately $1 million per year
- Behavior incentives reduce electricity demand by 4% since 2004 and save $320,000 yearly
- New construction designed to LEED gold standards
- Real time monitoring of building performance
- Retrofit investments save Stanford more than $4.5 million each year
- Electrification of the university vehicle fleet and installation of EVCI, including both Level II and DC fast-charging stations.

Oshman Family Jewish Community Center



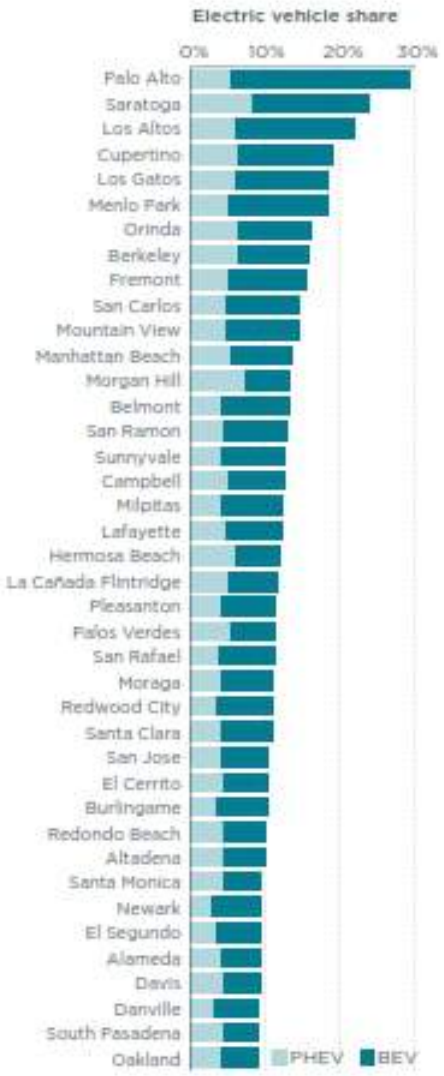
Key features

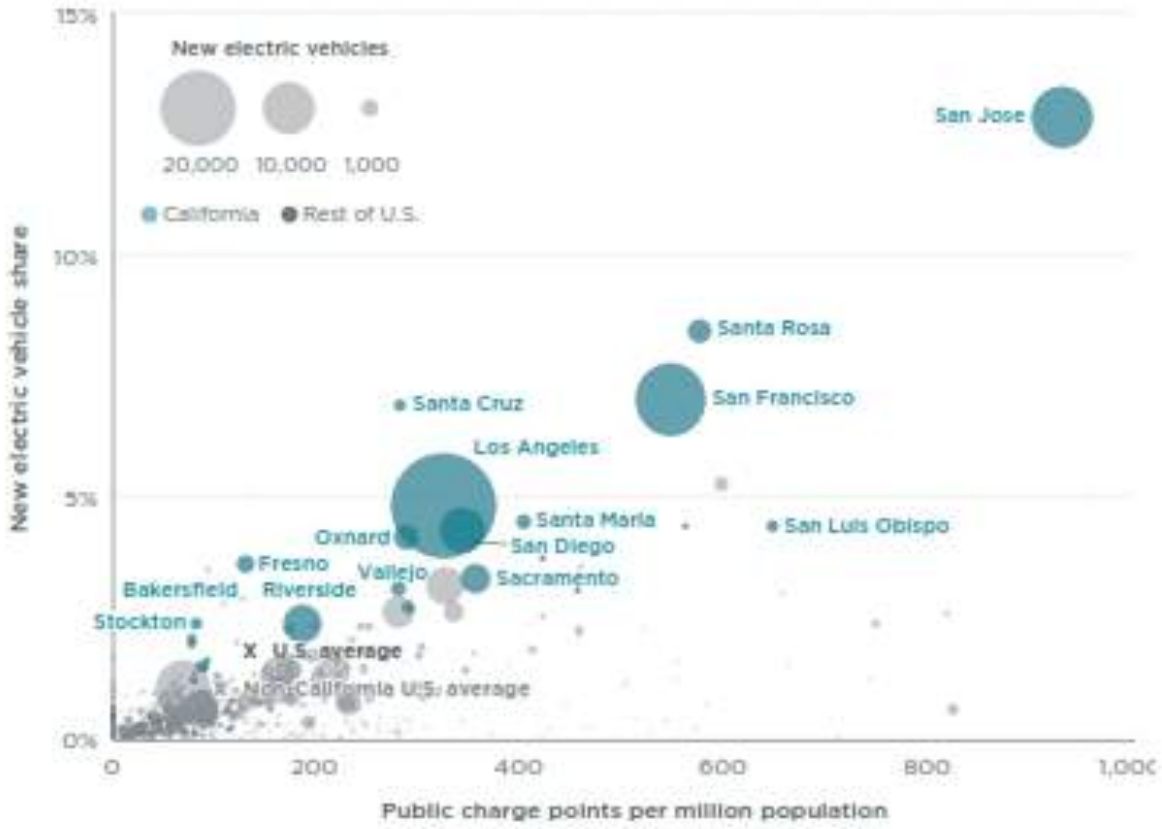
- Rooftop PV
- Occupancy sensors
- Building management system (BMS)
- 4 EV chargers
- Water source heat pump
- Individual heat pumps in residential units

Kaiser Permanente

- Healthcare industry 2nd most energy-intensive building sector in US, spends $5.3 billion on energy/year, emits 8% of GHG emissions
- Mission: protect and enhance both community and environmental health, e.g., potential health impacts of climate change
- Minimum LEED Gold certification for all new construction
- Nearly 300 EV charging stations
- 20-year power purchase agreements meet 50% of energy demand
- Goal: carbon net positive by 2025

City of Palo Alto Bryant Street Garage



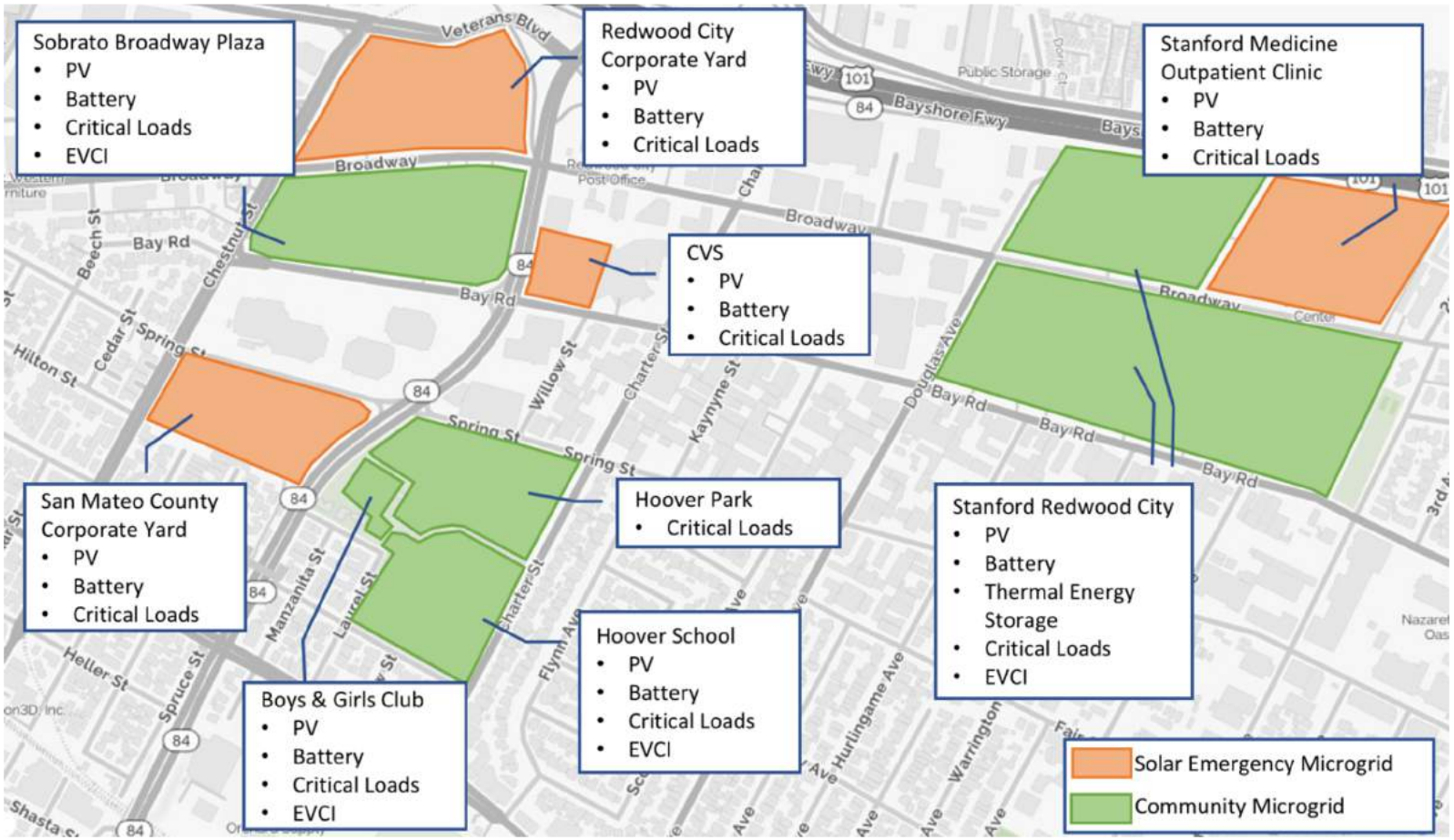


Source: www.theicct.org

Public-private partnership facilitated by Feed-in Tariff to install:

- 1.3 MW of solar PV on public garages
- 18 EV charging ports
- EVCI to support an additional 80 ports

Redwood City Community Microgrid

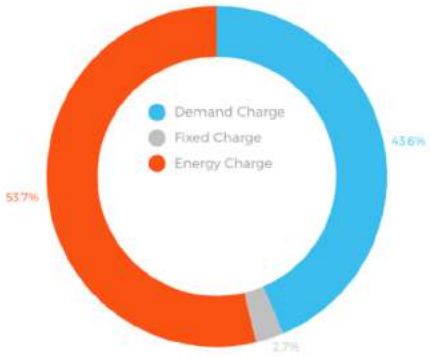


Source: Clean Coalition

Redwood City Corporate Yard

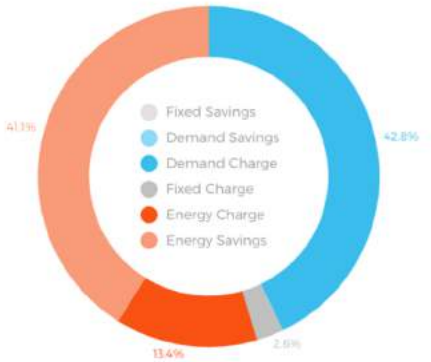
Clean Coalition

Baseline



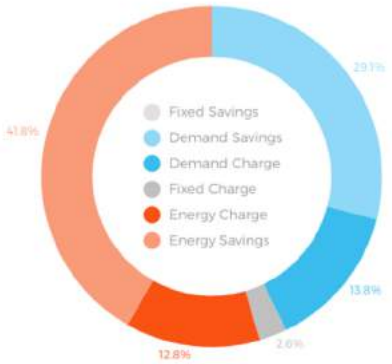
Tariff:	E-19-TOU-NOPDP
Energy Charges:	$ 33,999
Demand Charges:	$ 27,605
Fixed Charges:	$ 1,679
Total Utility Bill:	$ 63,283

Solar PV Only



Tariff:	E-19-TOU-NOPDP-NEM2
Energy Charges:	$ 8,664
Demand Charges:	$ 27,605
Fixed Charges:	$ 1,679
Total Utility Bill:	$ 37,948
Energy Savings:	$ 26,480
Demand Savings:	$ 0
Energy Assets:	$ 0
Tariff Switch:	$ 0
Fixed Savings:	$ 0
Total Savings:	$ 26,480
Payback:	11.97 years
NPV:	$ 15,314
IRR:	6.59 %

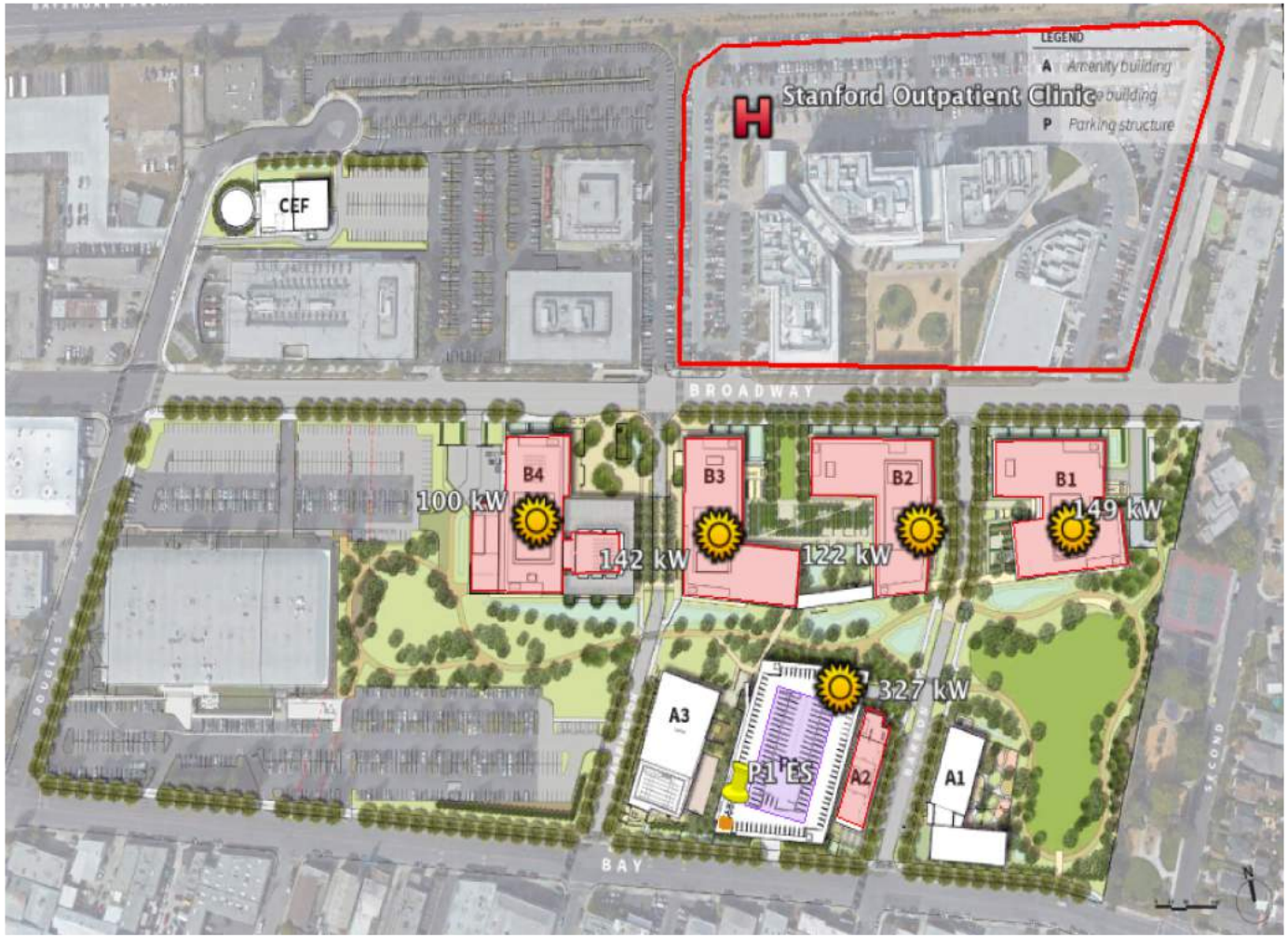
Solar PV & Storage



Tariff:	E-19-TOU-NOPDP-NEM2
Energy Charges:	$ 8,238
Demand Charges:	$ 8,880
Fixed Charges:	$ 1,679
Total Utility Bill:	$ 18,797
Energy Savings:	$ 26,923
Demand Savings:	$ 18,725
Energy Assets:	$ 18,725
Tariff Switch:	$ 0
Fixed Savings:	$ 0
Total Savings:	$ 45,648
Payback:	7.88 years
NPV:	$ 232,118
IRR:	11.41 %

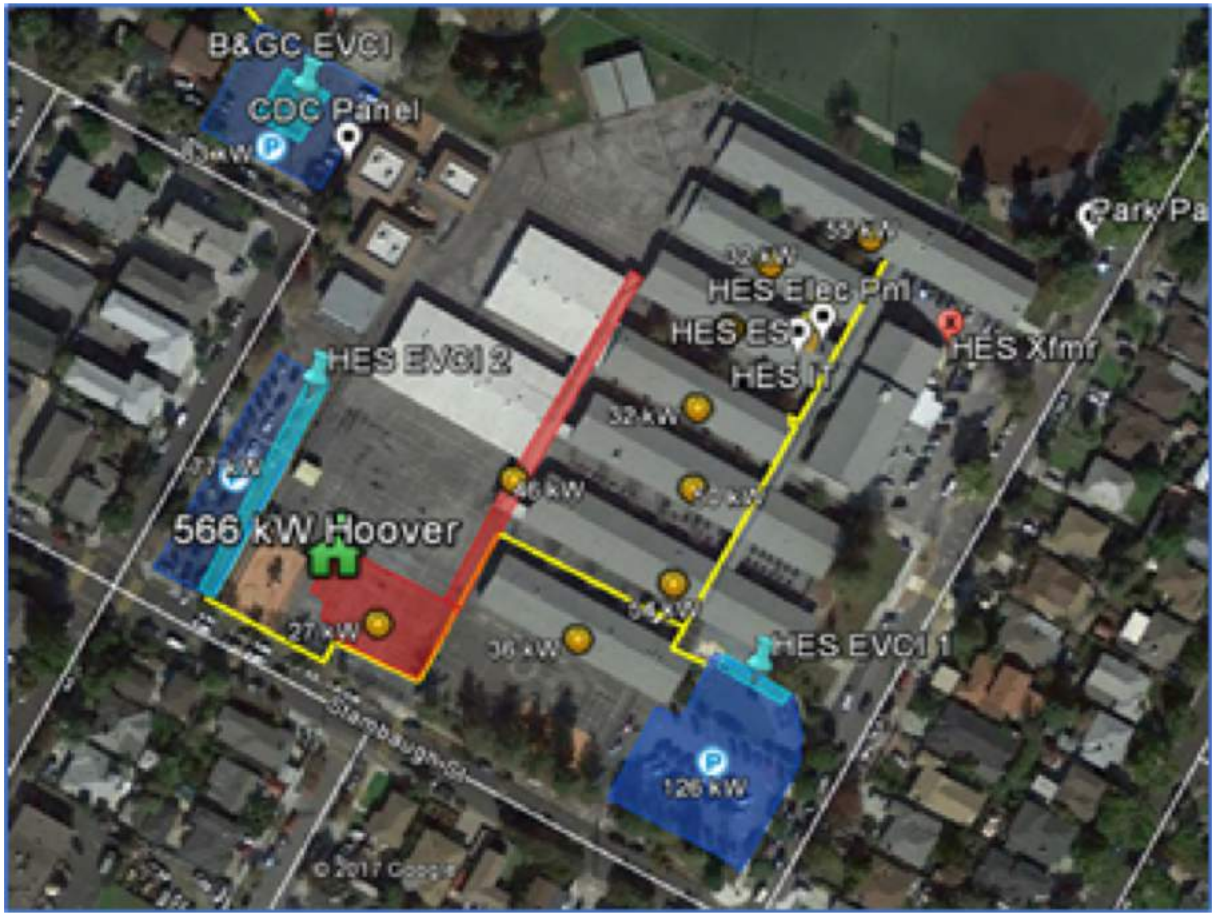
Stanford Redwood City Community Microgrid

Clean Coalition



Source: Stanford University

Hoover Elementary – Solar Emergency Microgrid



Source: Clean Coalition

Hoover Elementary – Solar Emergency Microgrid

Clean Coalition

Scenario 1
- 87.4 kW DC solar PV
- 29 kW/ 60 kWh energy storage

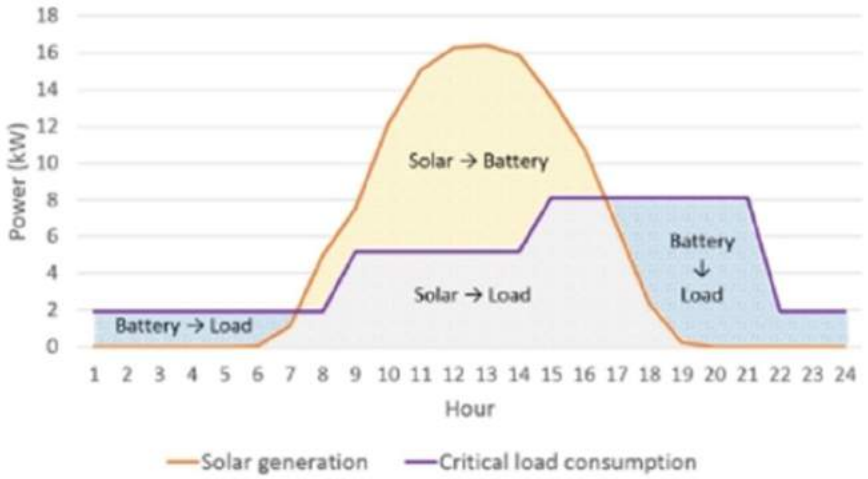
Energy Storage System Size	Payback	Net Present Value	IRR
29 kW inverter/ 60 kWh (2 hours of energy)	4.2 years	+$242,713 (because of the savings on energy bill)	20.6%

Scenario 2
- 87.4 kW DC solar PV
- 29 kW/ 120 kWh energy storage
- 10 Level 2 EV charging

Energy Storage System Size	Payback	Net Present Value	IRR
29 kW inverter/ 120 kWh (doubled size of battery)	3.3 years	+$261,207	22.5%

Scenario 3
- Off-grid operation w/o EVCI (21% of kWh baseline)
- 25 kW DC solar PV
- 4 kW/135 kWh energy storage

Feed-in tariffs would incentivize Solar Emergency Microgrid development at schools



Redwood City Community Microgrid

Clean Coalition

Site Name	Meters or Buildings	Critical Loads	NEM Solar [kW AC]	FIT Solar [kW AC]	Total Solar [kW AC]	Battery [kW]	Battery [kWh]	EVCI [Level-2 charging port count]
Stanford Redwood City Phase 1	P1, B1-B4	Campus emergency response	886	0	886	251	2,100	52
Hoover Cluster	Hoover School	Shelter & food service	73	203	276	29	150	20
	Boys & Girls Club	Shelter & food service	11	90	101	0	0	10
	Hoover Park	Equipment staging	0	0	0	0	0	0
Redwood City Corporate Yard	Redwood City Corporate Yard	Road and public facility maintenance and repair	136	352	488	58	360	*4
San Mateo County Corporate Yard	San Mateo County Corporate Yard	Road and public facility maintenance and repair	100	173	273	TBD	TBD	*4
Sobrato Broadway Plaza	Sobrato Broadway Plaza (multiple meters)	Low income housing	0	1,197	1,197	TBD	TBD	TBD
	Sobrato CVS	Pharmacy & grocery	0	83	83	TBD	TBD	TBD
New Deployments TOTAL			**1,206**	**2,098**	**3,304**	**-**	**2,610**	**82**

NEM: only 1.2 MW of solar PV (1/3 of total solar PV capacity)

FIT: an **additional 2.1 MW** of local, renewable generation could be deployed

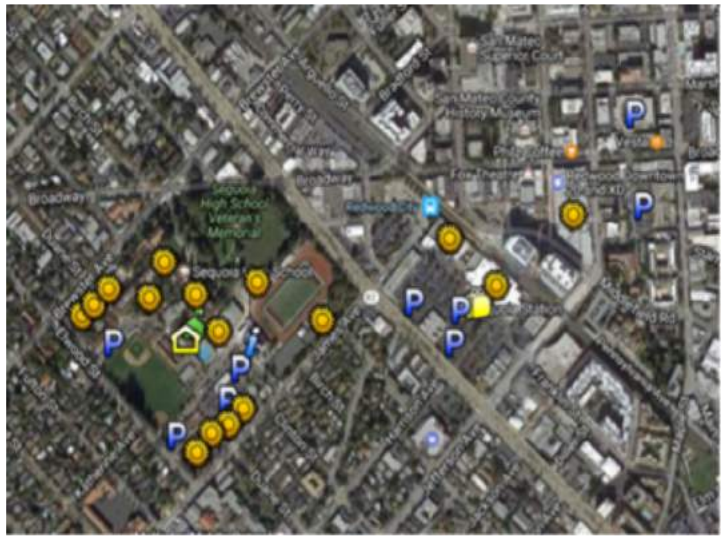
Tools to Accelerate AEC Deployment

Economic

- Standard tools - known benefits, disincentives, competing priorities
- Non-monetary benefits (qualitative metrics) - minimize fossil fuels, accelerate AECs, reduce GHGs
- Scenario analysis (especially resilience)

Policy

- Streamlined permitting guidelines
- Model ordinances
- Model interconnection process checklist
- Green lease language



Technical

- Solar Siting Survey
- Building management systems

Project Benefits

Clean Coalition

Quantitative:

- $2,000 savings per commercial application
- $116 million in total added economic output
- $35 million in local wages from construction and installation
- Energy consumers will save $27 million
- 20% lower prices for clean local energy

Qualitative:

- Help meet clean energy policy goals and reduce GHG emissions
- Enhance grid resilience and security
- Provide emergency power
- Obviate expense of new power plants
- Support grid modernization
- Increase percentage of renewables for RPS
- Improve interconnection policies
- Create green jobs

Conclusion: Areas for Future Study

- Need additional financing tools and incentives to implement AEC components
- Train more planning and building inspection staff to incorporate AEC component requirements into permitting and inspection checklists
- Accelerate reach codes and deep energy retrofits
- Additional revenue streams for energy storage
- New rates and tariffs for virtual microgrids
- Integrated technology solution providers

Questions?

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