



Energy Storage Experiences & Installations



What will we cover?

1. Planning and Permitting Considerations
2. Fire Safety Concerns
3. Municipal Energy Storage Example

Energy Storage Permitting

Common System Types and Installation
Considerations

Permitting

Electronic Solar Photovoltaic or Power Storage Unit Permits

Small Residential Roof Mounted Solar Systems and Power Storage Units

Roof mounted photovoltaic systems 10 kilowatts or less and power storage units will be reviewed electronically.

- Applicant reviews our [checklist](#).
- Applicant emails application and drawings in PDF format to solarpermits@fremont.gov.
- Staff perform plan check and if plans are approved, a credit card authorization form is provided. If plans are not approved, comments are sent back to the applicant. Typically, the turnaround time is **three (3) business days**.
- Fees are paid when the permit is approved and ready to be issued.

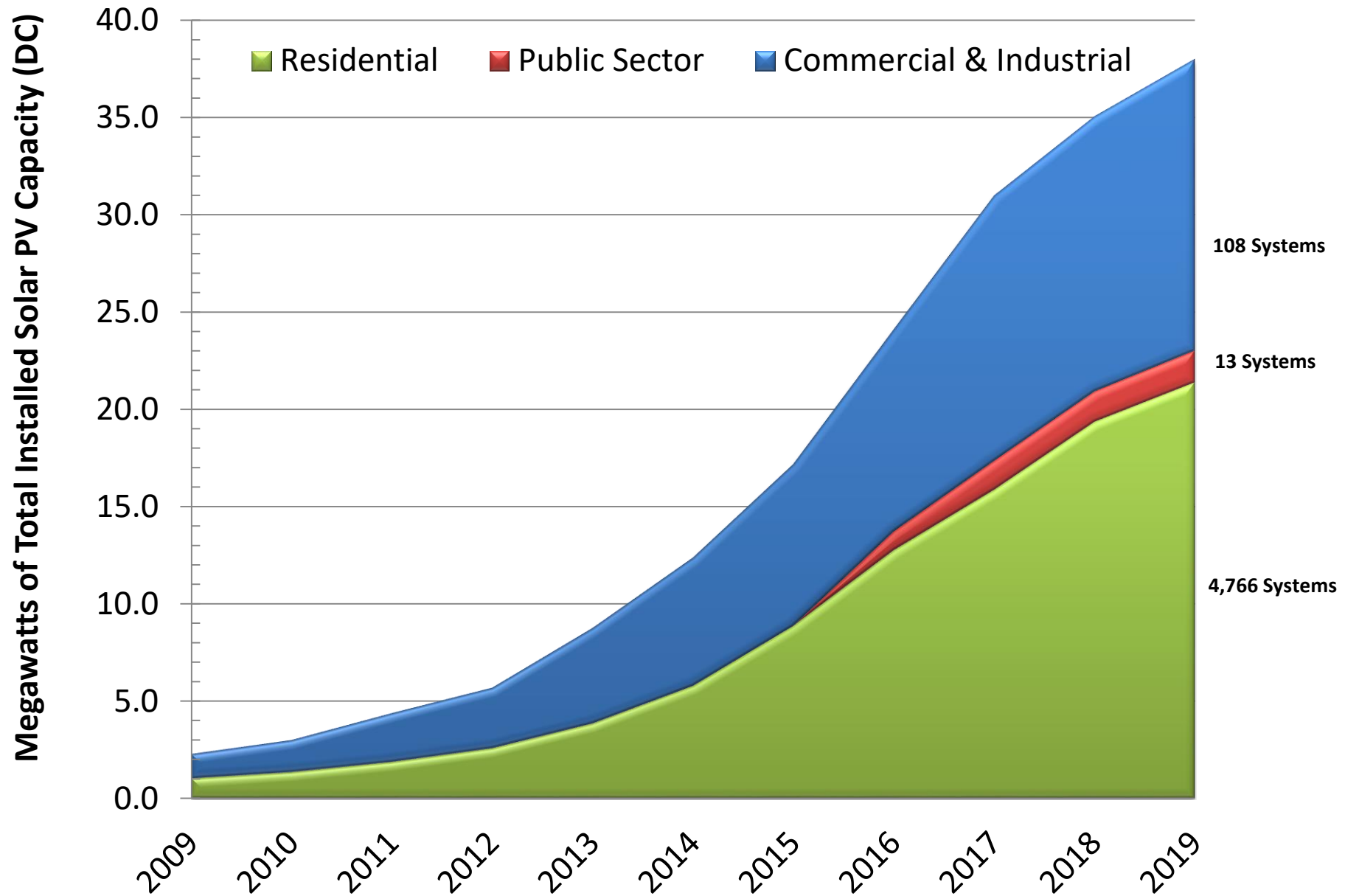
Large Residential Solar Permits and Commercial Solar Permits

Roof Mounted Photovoltaic System Exceeding 10 Kilowatts, Ground Mounted Systems, and Commercial Solar Permits

- Follow Electronic Plan Check Review procedures [here](#).

- 99% of PV systems ≤ 10 kW are reviewed electronically
- ≤ 10 kW PV + ESS systems receive a single permit and single inspection

Solar in Fremont (thru 7/31/19)



Backup Power Permit Applications

YEAR	Diesel Generator ²	Hydrogen Fuel Cell	Battery Storage ³
2015	12	1	-
2016	10	3	1
2017	10	1	41
2018	11	1	27
2019 ¹	9	-	63

¹ 2019 permit applications through 11/4/19

² diesel generators are almost exclusively at commercial facilities

³ battery storage is mostly at residential, though we are starting to see about 1 commercial system per month in 2019.

Common Home Battery Systems

LG



Sonnen



Tesla



Home Battery Comparisons

Manufacturer	Power Capacity	Weight	Unit Cost*	Inverter
Tesla	13.5 kWh	269 lbs	\$5,500	Included
LG	6.5 kWh	220 lbs	\$4,000	
Sonnen	4.0 kWh	377 lbs	\$5,950	Included
Sunverge	7.7 kWh	600 lbs	\$8,000	
ElectrIQ	10 kWh	375 lbs	\$13,000	Included
SimpliPhi	3.8 kWh	78 lbs	\$2,800	
Orison	2.2 kWh	40 lbs	\$1,600	

Information derived from <https://www.businessinsider.com/home-battery-rival-tesla-powerwall-2-2016-10> and from manufacturer websites.

*Unit cost does not include installation cost.

Building Dept. Considerations

- Inverters
 - Batteries must have their own inverter (DC-AC)
 - SolarEdge makes DC-coupled single PV-ESS inverter
- Backup power vs. load offsetting
 - Backup power systems require an auto transfer switch; used exclusively in the event of a grid outage
 - Load offsetting systems for homes have only become available in the past 6-8 months; require separate PG&E approval process due to potential of backfeeding the grid
- Battery system weight
 - For batteries ~250 lbs, permits are issued once the mounting/anchoring details are submitted and approved
 - For heavier batteries, structural details and calculations must be provided by a structural engineer

Energy Storage Safety

Fire and Hazmat Considerations

Fire Dept. Considerations

- Hazardous Materials Inventory Statement (HMIS, HMBP)
 - Fuel cells: hydrogen
 - Batteries: electrolytes often flammable/corrosive
 - Flow batteries: large amounts of corrosive materials involved
- Location of Installation
 - Inside/outside, separations, setbacks
- Type of Equipment
 - preassembled/listed via UL, FM, Imtek, site built/evaluated, foreign built
- Management and Monitoring
 - who is responsible for installation, how is it monitored?

Regulatory Landscape

- California Fire Code
 - Chapter 6 Building Systems
 - Chapter 50 Hazardous Materials
 - Chapter 57 FL-Combustible Liq.
 - Chapter 58 Flammable Gases
 - Chapter 60 Corrosives
- NFPA 2- Hydrogen Systems
- Ca SFM- Solar Installations
- UL 1973- Storage Batteries
- UL 9540- Prepackaged Systems

Chapter 12

Energy Systems – User note

Chapter 12 Energy Systems.

Chapter 12 was added to address the current energy storage systems found in this code and is provided for the introduction of a wide range of systems that generate and store energy in, on and adjacent to buildings and facilities. The expansion of such energy systems is related to meeting today's energy, environmental, and economic challenges. Ensuring appropriate criteria to address the safety of such systems in building and fire codes is an important part of protecting the public at large, building occupants and emergency responders. More specifically, this chapter addresses standby and emergency power, photovoltaic systems, fuel cell energy systems, battery storage systems and capacitor energy storage.

January 1, 2020

CFC Chapter 12 – Energy Systems

- 1201- General
- 1202- Definitions
- 1203- Emergency & Standby Systems
- 1204- Solar Photovoltaic Power Systems
- 1205- Stationary Fuel Cell Systems
- 1206- Electrical Energy Storage
 - Plans & Permits Required
 - **Hazard Mitigation Analysis***
 - Table 1206.2 Battery Storage System Thresholds
 - Table 1206.2.9 Maximum Allowable Battery Quantities

Select Resources

- California Building Standards Commission Website
<https://www.dgs.ca.gov/BSC/Codes>
- NFPA Standards 2 and 835
- UL Listing Protocols 1973 and 9540

Energy Storage Case Study

Fremont Fire Station Microgrid Demonstration
Project

Introduction

- Demonstration of “Microgrid Systems” on Fire Stations
- Solar PV System + Battery + Smart Controller
- Systems operate with or independently from the grid
- Provides clean energy generation *plus* operational resiliency



Project Overview

- Project Costs

\$1,817,925 Grant from the CA Energy Commission (PON-14-301: Group 1)

+ \$657,260 in matched funds

= \$2,475,185 total project value

- Proposed Sites

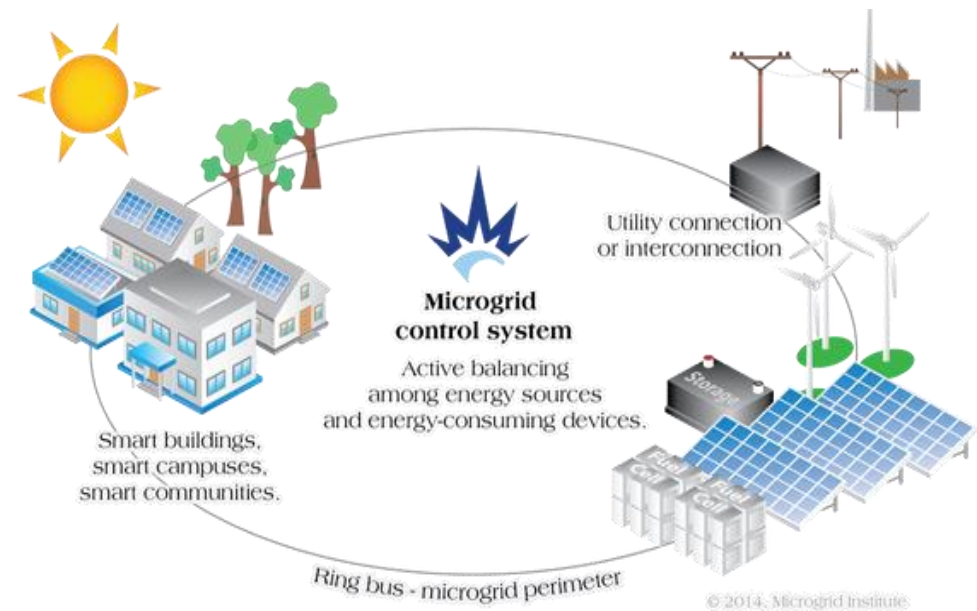
- (3) Fremont Fire Stations

- Benefits to Sites

- Resilience
- Energy Cost Savings
- Clean Energy Source

- Project Details (per site)

- 37-43 kW Solar Canopy + 95 kWhr Energy Storage
- Gridscape Microgrid Controller System
- Gridscape Cloud-based Predictive Energy Management Software

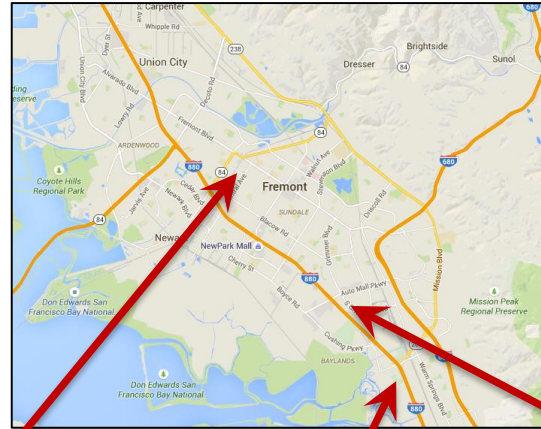


Site Locations

Fire Station #6

4355 Central Ave., Fremont, CA 94536

- 13,224 sq. ft.
- 97,500 kWh/yr
- \$17,900/yr electric bill (~18.3¢/kWh)



Fire Station #7

43600 S. Grimmer Blvd., Fremont, CA 94538

- 10,161 sq. ft.
- 108,000 kWh/yr
- \$19,000/yr elec. bill (~17.6¢/kWh)

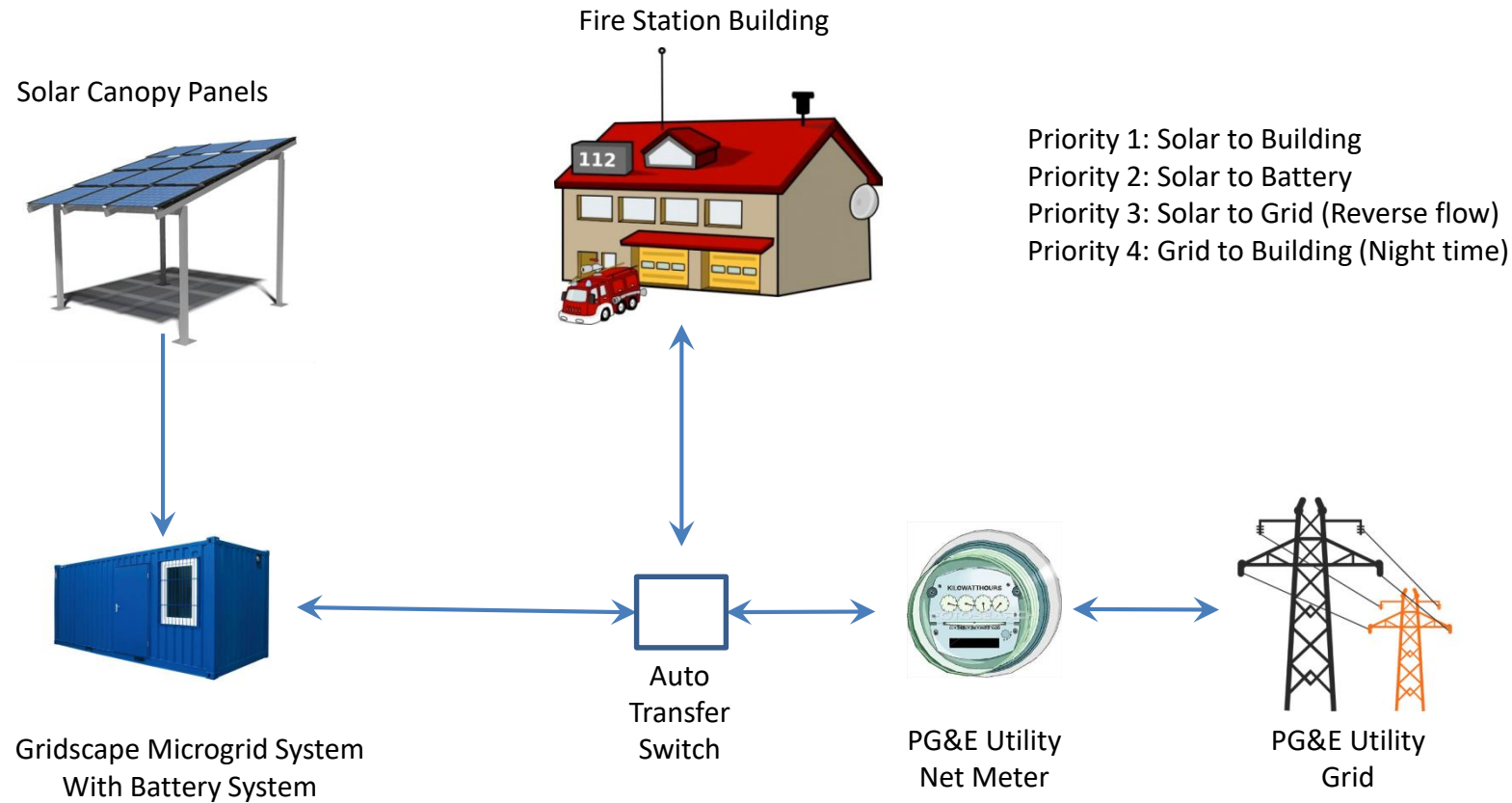


Fire Station #11 (LEED Gold)

47200 Lakeview Blvd., Fremont, CA 94538

- 10,375 sq. ft.
- 64,500 kWh/yr
- \$12,500/yr elec. bill (~19.4¢/kWh)

System Design & Power Flow



City Contracting & Approval

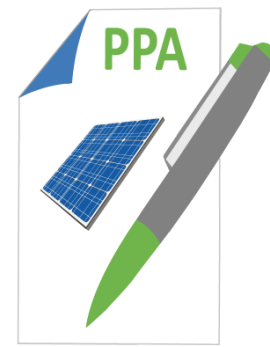
- CA Government Code 4217.10-4217.18:
 - Public facilities can sole source for energy services contracts



- “Demonstration Period”
 - System design, Construction, and Testing per CEC grant requirements
 - City provides Gridscape access to sites; receives energy produced at no cost



- “Regular Term”
 - 10 yr PPA w/ system monitoring & maintenance
 - Electricity pricing at ½ cost of PG&E

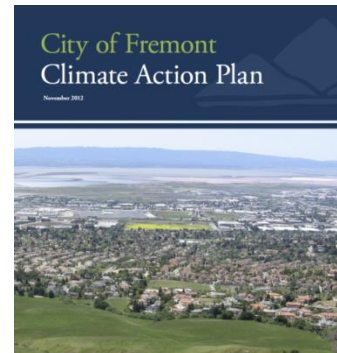


Project Savings

	Station #6	Station #7	Station #11	TOTAL
Current PG&E Rate	18.30 ¢/kWh	17.61 ¢/kWh	19.42 ¢/kWh	-
Microgrid PPA Rate	9.16 ¢/kWh	8.81 ¢/kW	9.71 ¢/kWh	-
Annual Rate Escalator	2.5%	2.5%	2.5%	-
PG&E Bill Savings during Demonstration Period	\$9,574	\$11,604	\$10,849	\$32,027
Electric Bill Savings Over 10 Year PPA Term	\$60,886	\$74,399	\$79,559	\$214,844
Total Electric Bill Savings (Demonstration + PPA)	\$70,460	\$86,003	\$90,408	\$246,870

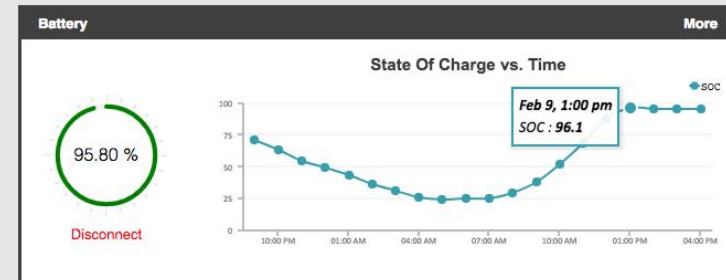
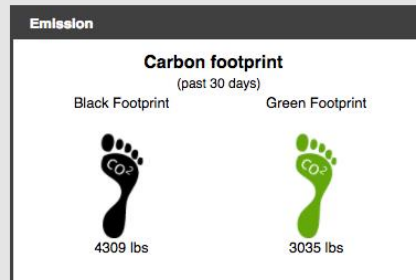
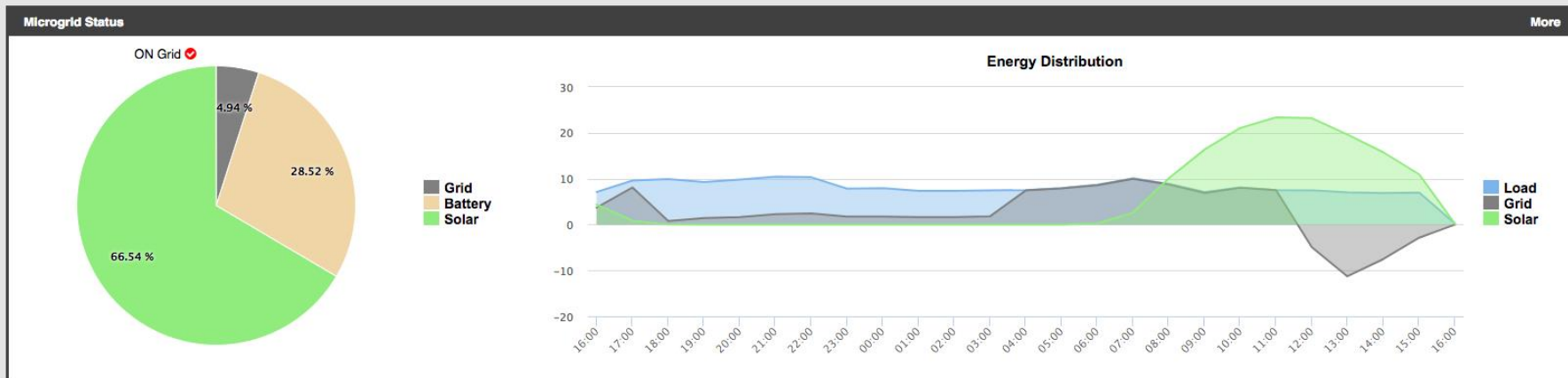
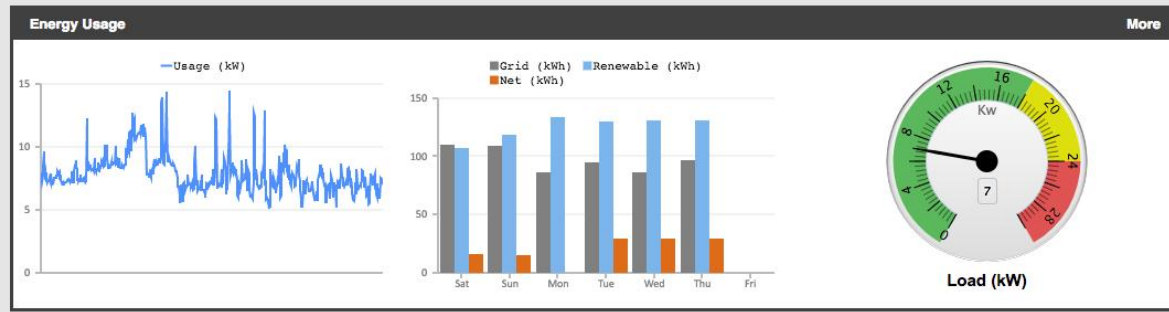
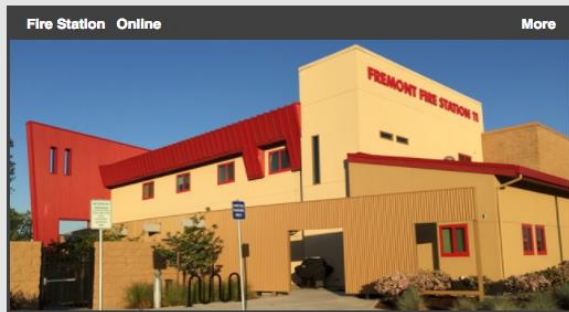
Benefits to City

- ✓ Protects critical facilities against power outages
- ✓ Reduces demand on the grid through use of stored battery energy
- ✓ Increases community resiliency
- ✓ Reduces utility bills by \$32,000 during Demonstration Period + \$215,000 over 10 year PPA Term
- ✓ Reduces municipal greenhouse gas emission reductions by ~80,000 lbs/yr (~36 MTCO₂e)
- ✓ Supports local cleantech company advancement & innovation



Gridscape eScope Dashboard

February 9, 2018









PG&E LOCKABLE
VISABLE
GENERATOR
DISCONNECT
SWITCH

EATON
LOCKABLE
GENERATOR
DISCONNECT
SWITCH

EATON
LOCKABLE
GENERATOR
DISCONNECT
SWITCH

PIPES
TRANSFORMER

GRIDSAFE

Delta

Thank You!

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