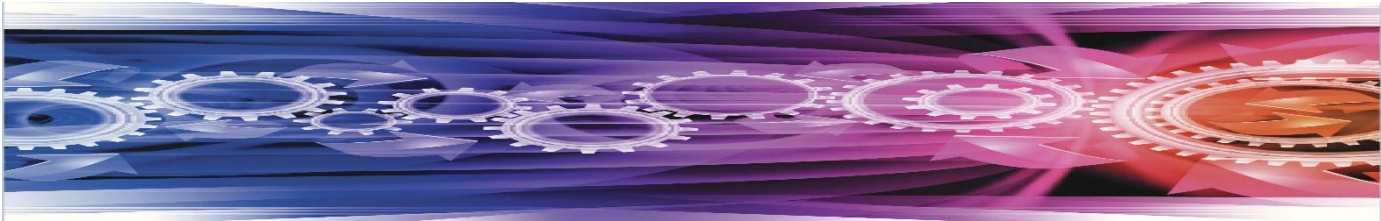




# NARUC

*128th Annual Meeting*



# **Committee on Energy Resources & the Environment**



We Partner to Build the New  
**CLEAN ENERGY ECONOMY**



**STOP**  
ENERGY WASTE



**CREATE**  
CLEAN ENERGY



**BUILD**  
A SMART ENERGY FUTURE



@UtahCleanEnergy



Utah Clean Energy

**WWW.UTAHCLEANENERGY.ORG**

# Solar Market Pathways

Salt Lake City is one of 15 SunShot projects advancing solar deployment across the U.S.



# Solar and Storage will play an integral role in a more resilient energy future



- ❖ Emergency Shelters
- ❖ Public Buildings/  
Emergency Response  
Station
- ❖ Hospitals
- ❖ Fire Stations
- ❖ Critical Business Operations

# SPACE: Solar Powered Adaptive Containers for Everyone - Houston



*Case Study: SPACE, OutBack Power Technologies*

- ❖ Adaptive containers provide mobile power during emergencies
- ❖ Provide office space for local government facilities and events
- ❖ Size ranges from 7kW of solar power in an 8-by-20-foot model to 13kW in an 8-by-40-foot model



# Florida SunSmart Emergency Shelter Program



*Source: Case Study, Energy.Gov*

- ❖ 115 solar + storage systems
- ❖ Reduce school electricity costs, and provide interactive learning tool for students
- ❖ 10-kW PV array, 25-kWh lead acid battery pack, and a 10-kW battery based inverter
- ❖ Shelter 10,000 – 50,000 people during an emergency

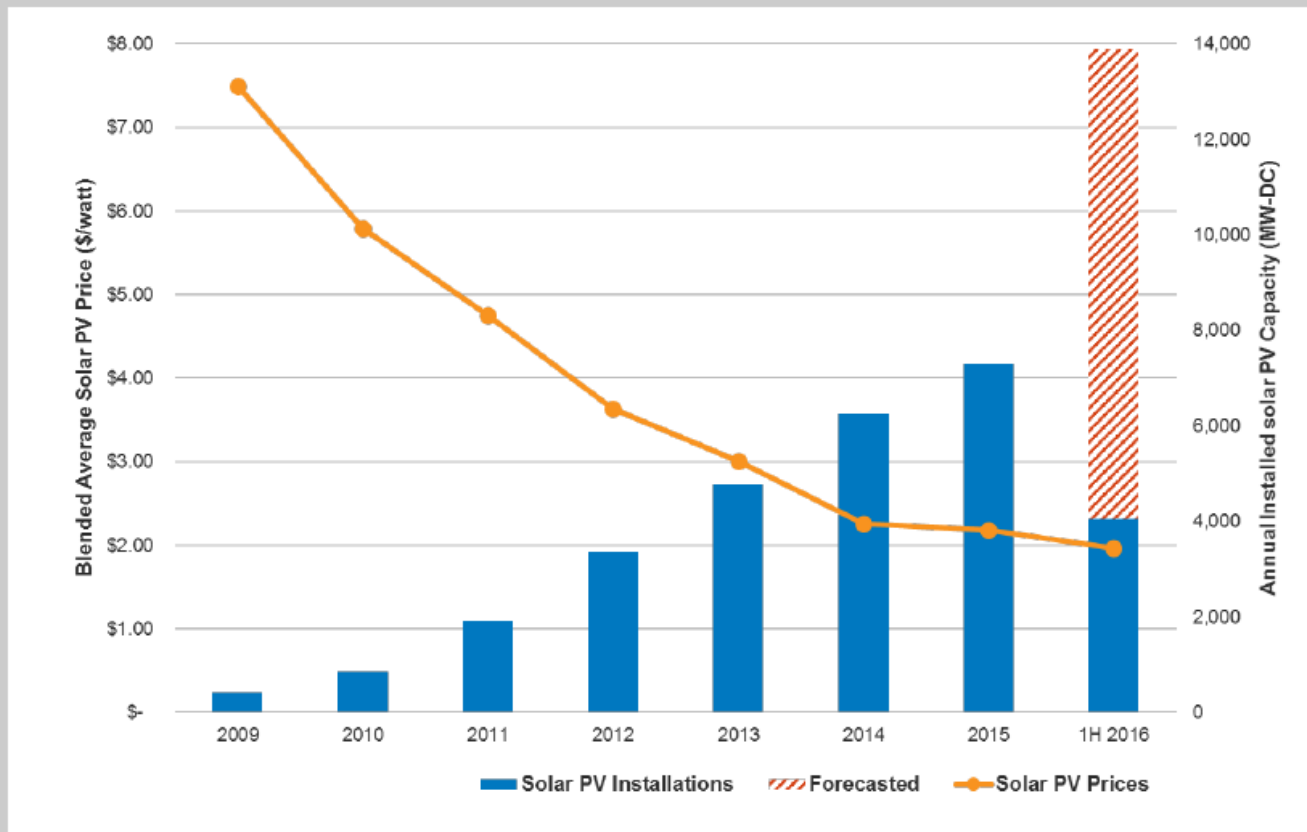
# Stafford Hill Solar Farm



*Photo Source: Green Mountain Power*

- ❖ Can generate 2 MW of solar during full sun, enough to power 2,000 homes
- ❖ 4 MW of battery storage
- ❖ Can be disconnected from the grid to provide backup power to an emergency shelter at a high school
- ❖ Located on a closed city landfill

# Cost of Solar

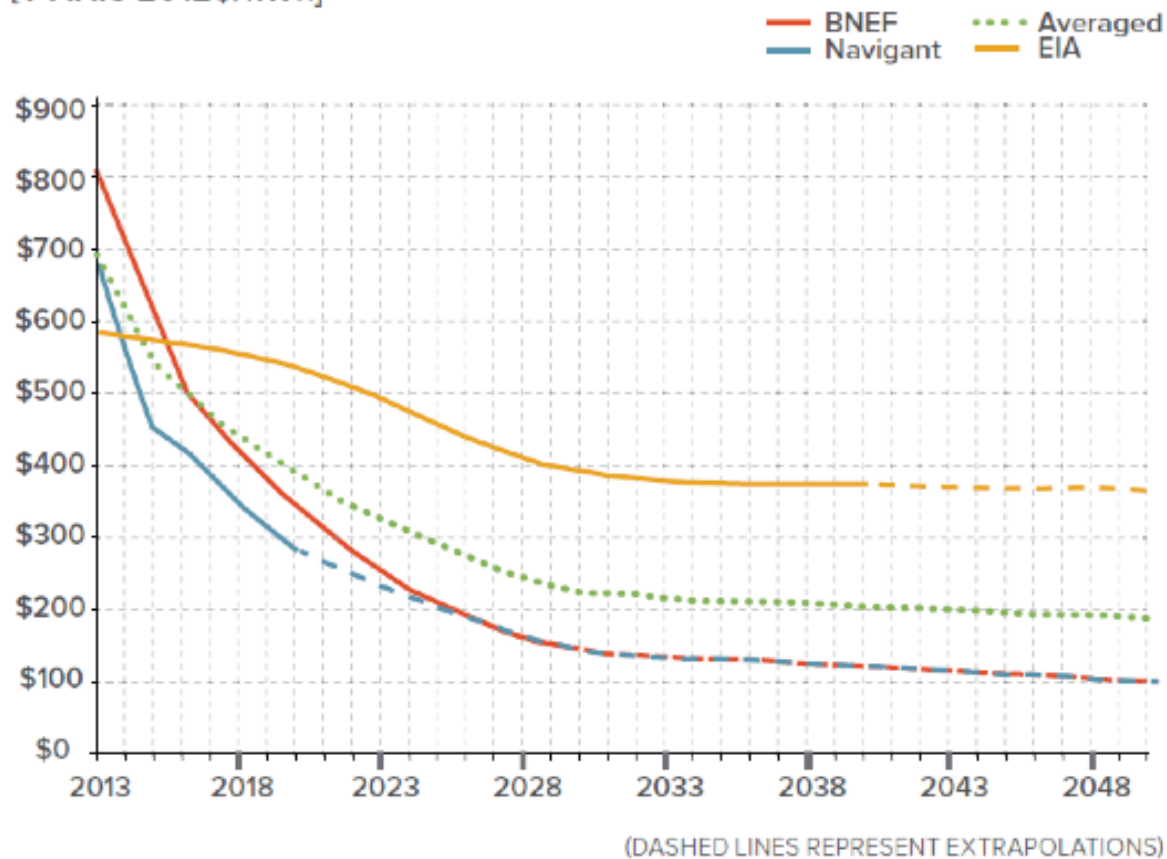




# Cost of Storage

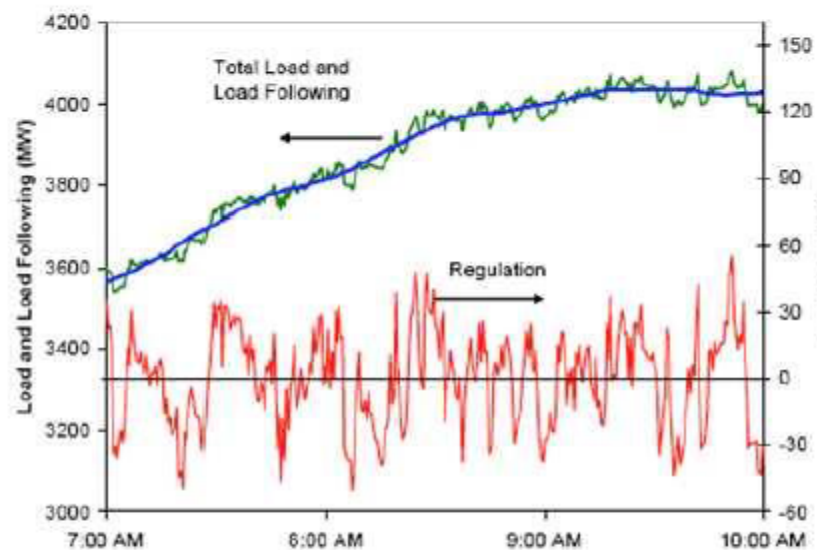
## BATTERY PRICE PROJECTIONS

[Y-AXIS 2012\$/kWh]

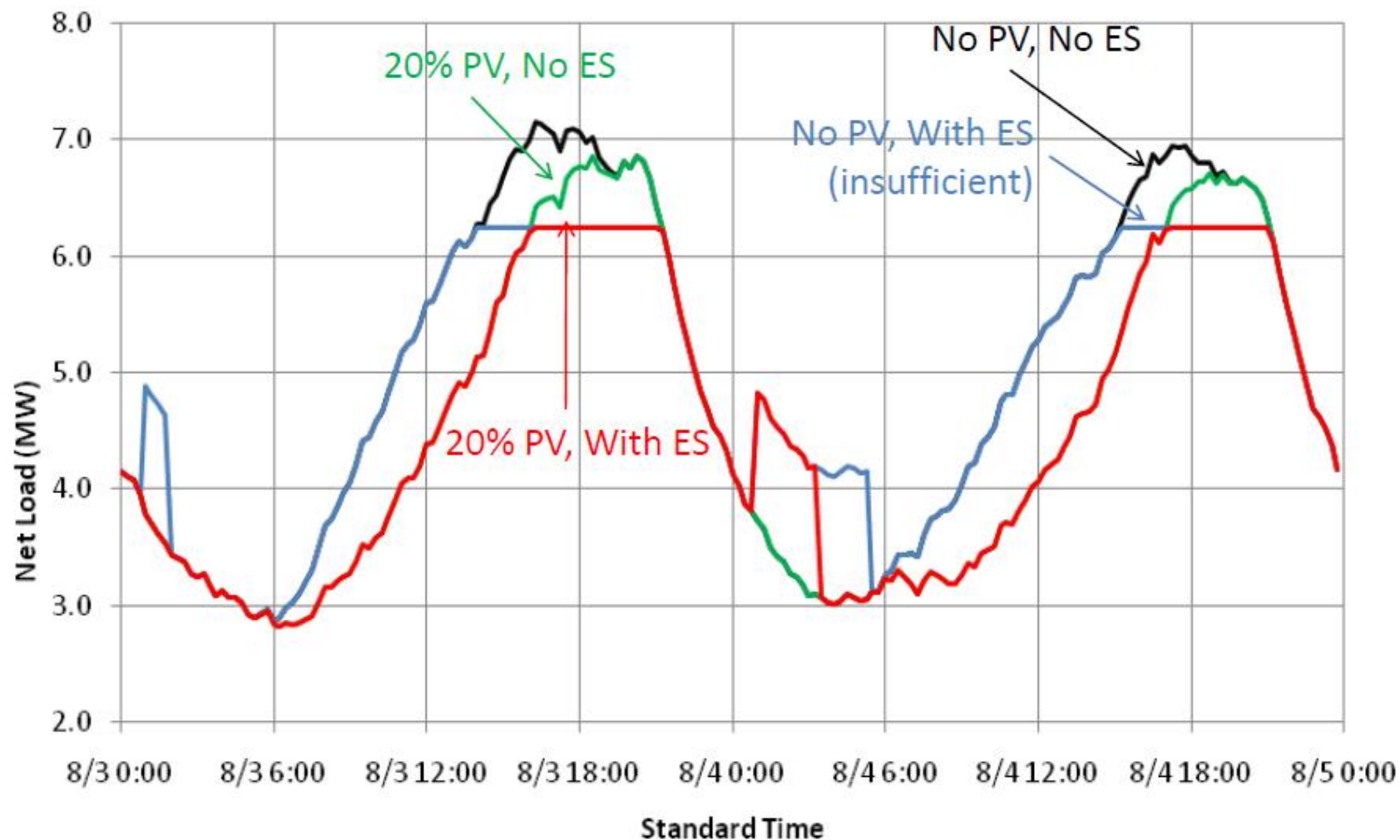


# Additional Energy Storage Benefits

- Utility/System operator
  - T&D deferral (distribution)
  - Voltage support
  - Power quality
  - Transmission congestion
  - Regulation, load following
- Customers
  - DSM (TOU, etc)
  - Power quality
  - Service Reliability (UPS)



# Example With Residential Load



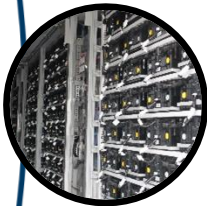
# RMP Solar & Energy Storage Technology Program

- ❖ Rocky Mountain Power is evaluating solar and storage to reduce transmission costs
- ❖ Solar combined with storage is a lower cost alternative to traditional capital investments
- ❖ Additional benefits:
  - Energy arbitrage
  - Reduce transmission congestion

# Key Takeaways



Innovation is driving a transition to a more diverse, resilient energy future



Solar and storage can provide backup power and grid benefits



Now is the time to explore policies that can facilitate this transition



# Questions?

**Kate Bowman**

Solar Project Coordinator

Utah Clean Energy

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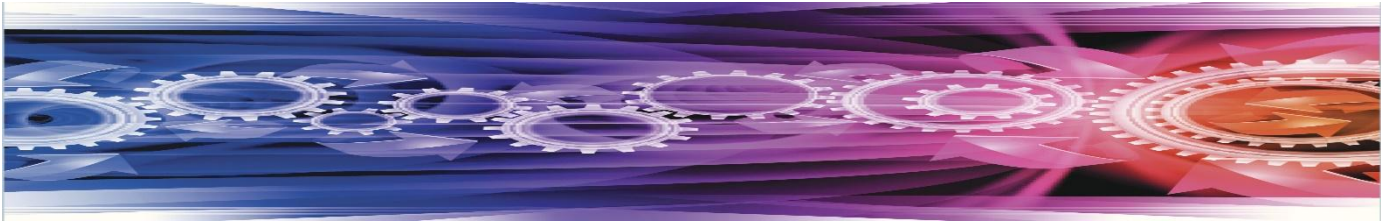


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A Department of the City and County of San Francisco

# San Francisco Solar + Storage for Resilience

NARUC 2016

Cal Broomhead, Climate and Energy Strategist





# Growth Chart



14.6%  
Population

49.1%  
GDP

23.3%  
GHG Emissions

# Communicating the Issue of Climate Change



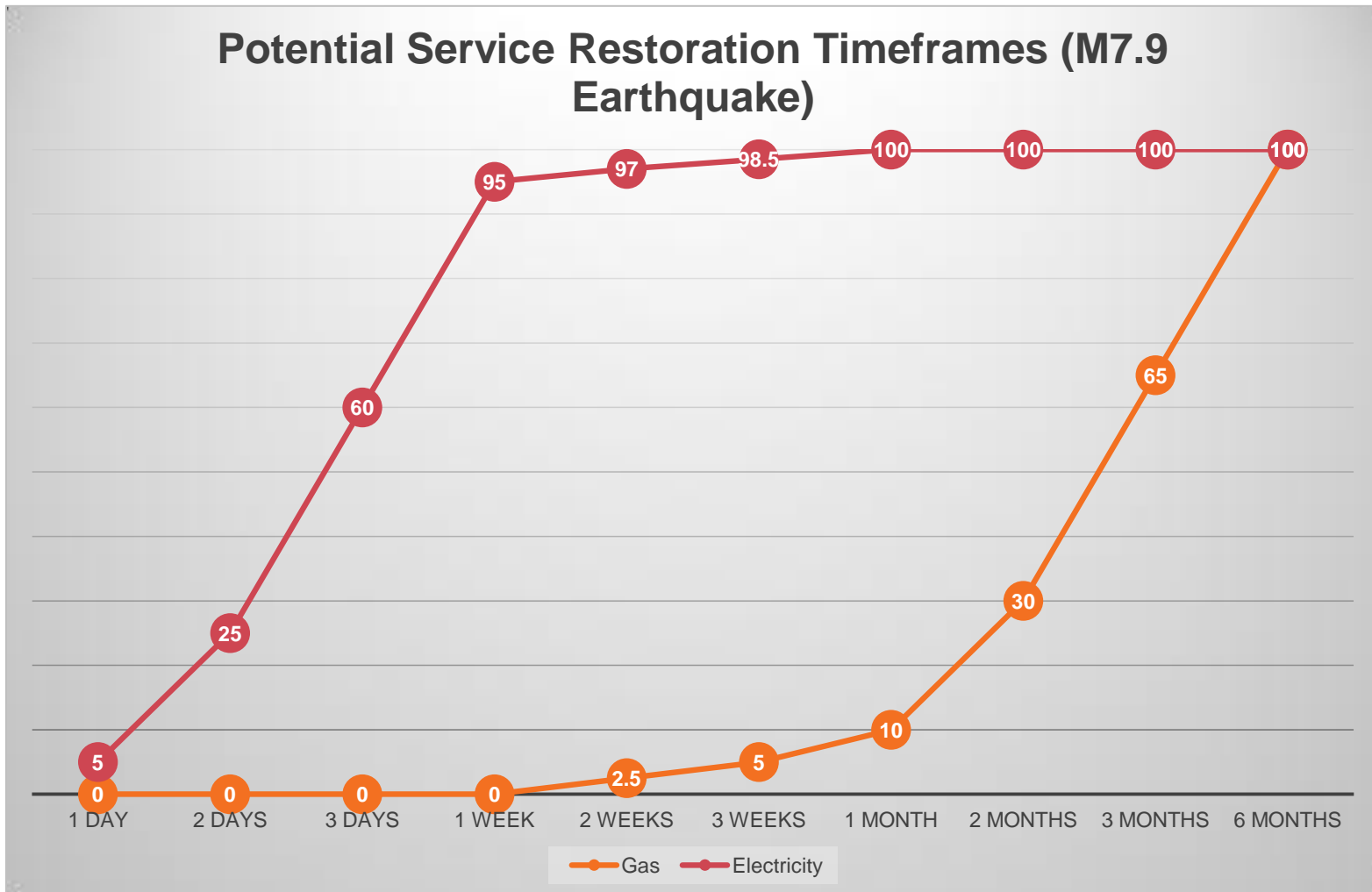
SAN FRANCISCO CLIMATE ACTION

0 50 100





# Plan for 3-7 day electricity outage

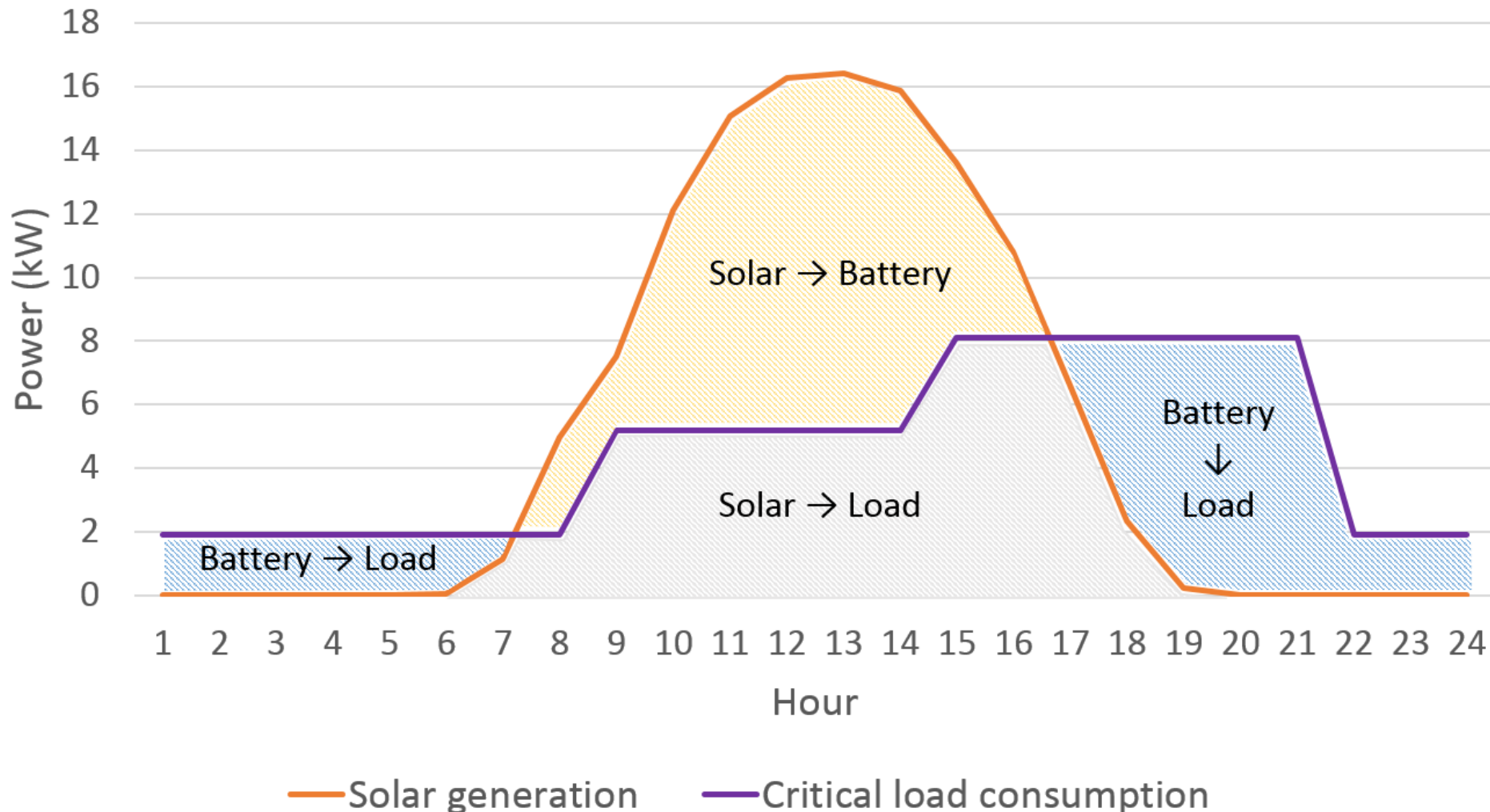


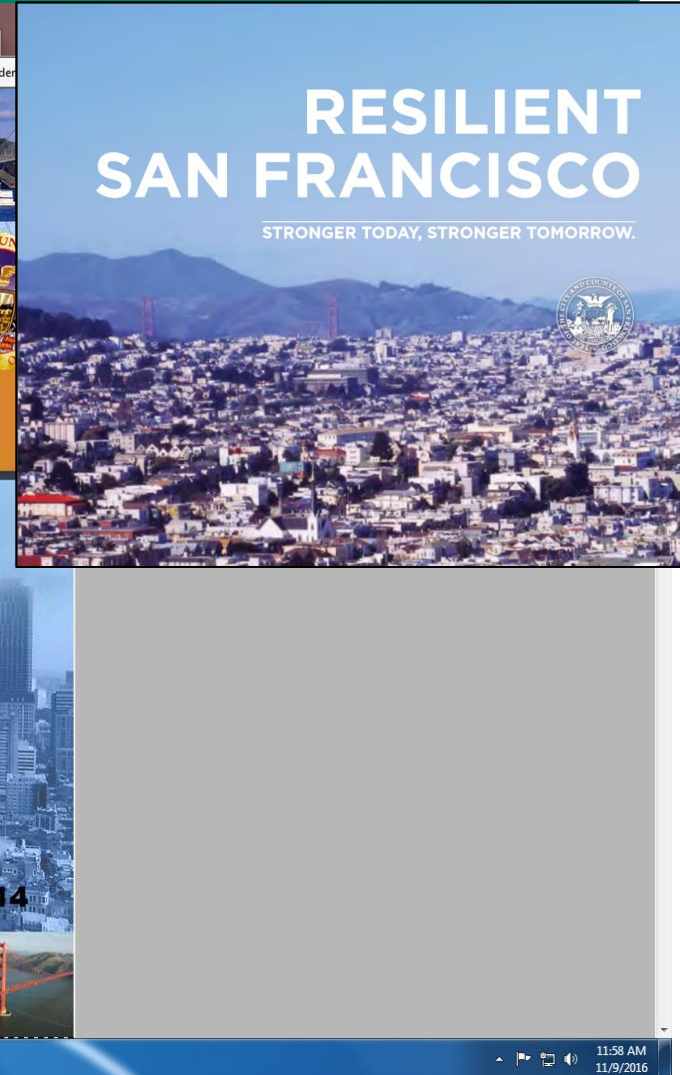
Data: SF Lifelines Council, April 2014

# Design for emergency operation

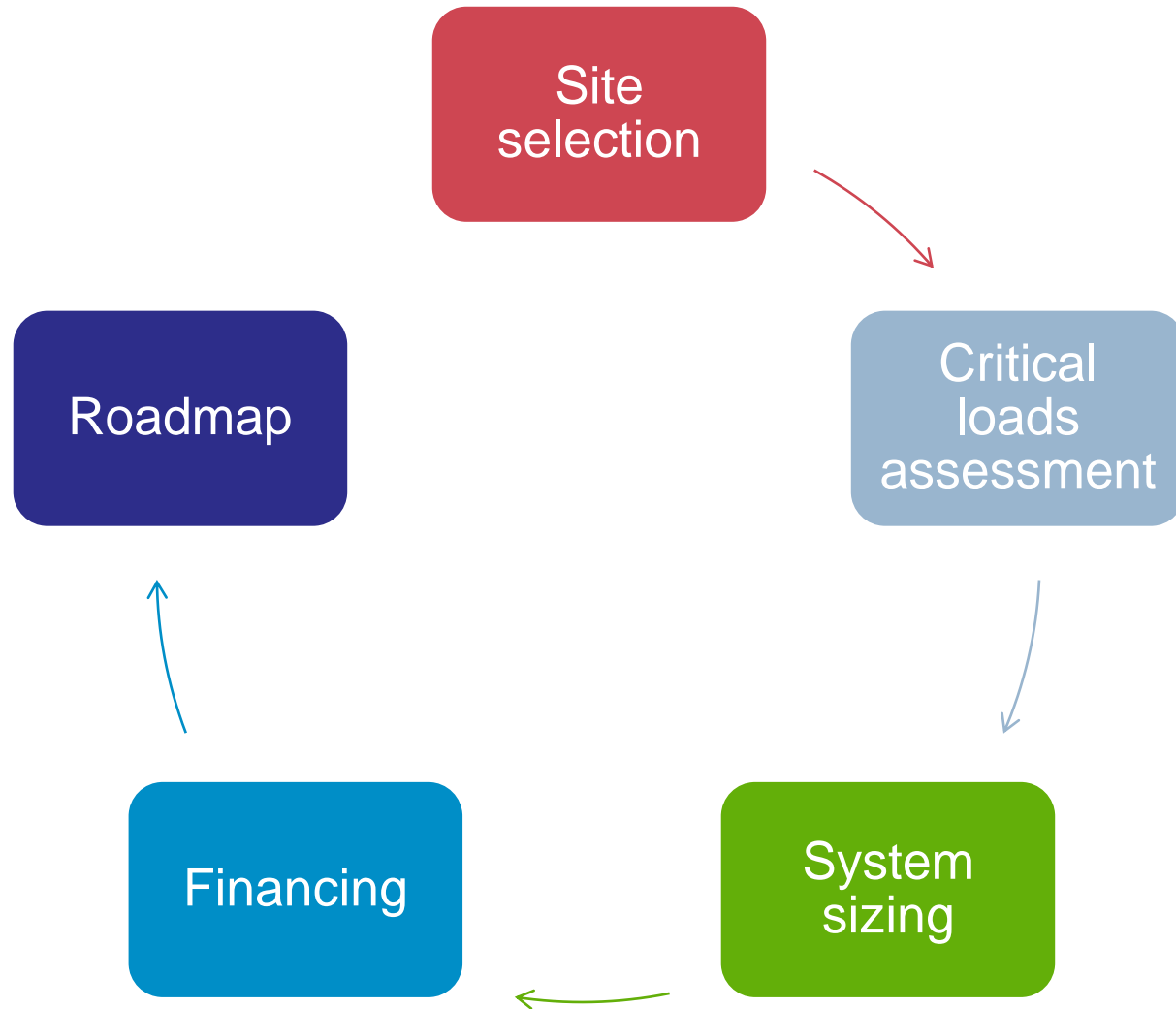


Emergency operation during loss of grid power





# Project flow





# Site selection



ARUP

Solar+Energy Storage for Resiliency  
spatial data viewer

Help

Legend

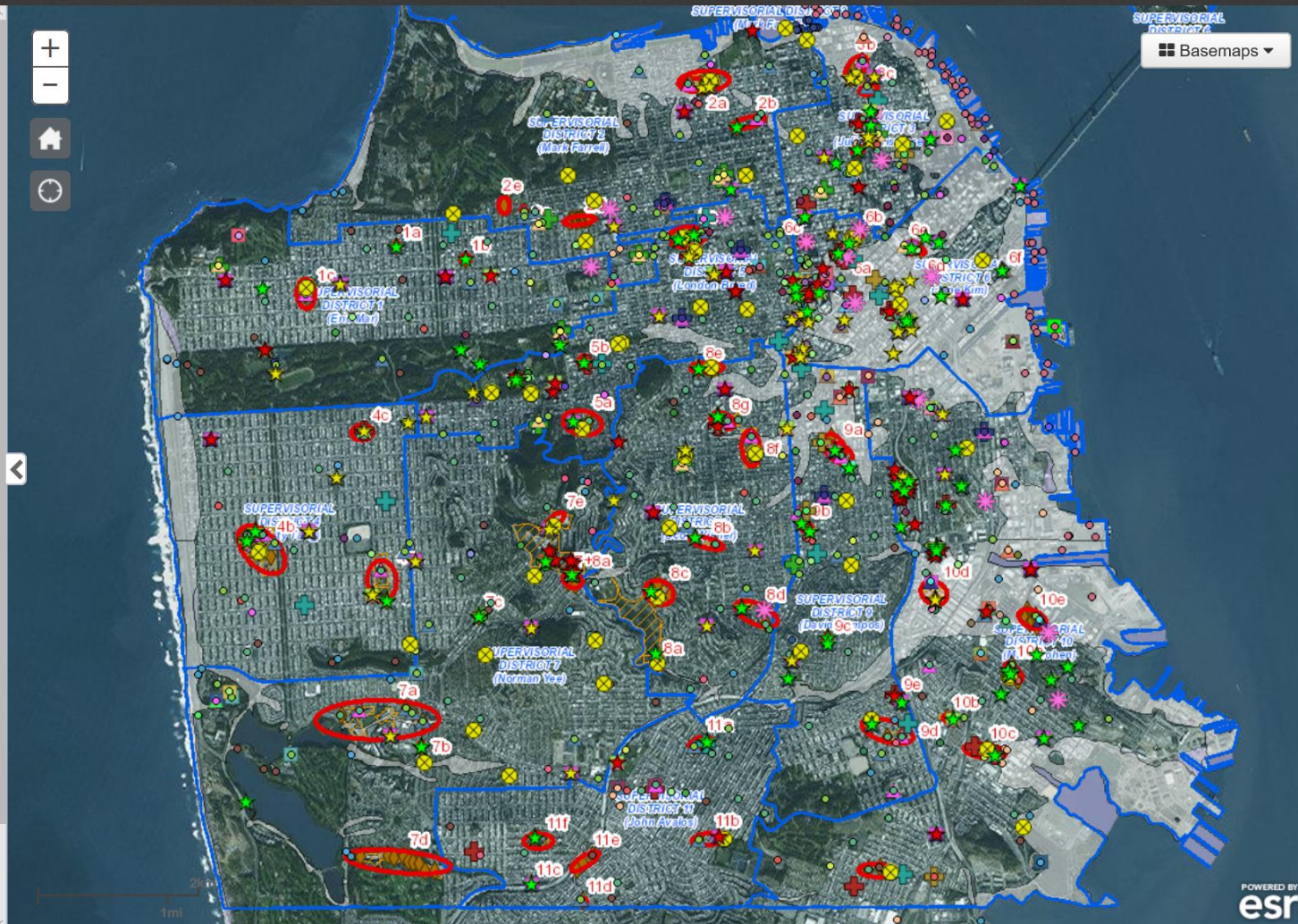
Layers

- ☒ Hazus Results
- ☒ Critical Infrastructure
  - ☒ Primary NGO Kitchens - 2015
  - ☒ NERT Staging Location
  - ☒ All Facilities
  - ☒ Facilities with Critical Power Need
  - ☒ Facilities with Generators
  - ☒ Medical Assets
- ☒ Microgrids
  - ☒ Selected Sites
  - ☒ Original Sites Under Consideration
- ☒ City Data
- ☒ Hazards
  - ☐ C05 - San Andreas
  - ☐ C06 - Hayward
  - ☒ C07 - Soil Liquefaction
  - ☐ C08 - Landslide
  - ☒ C09 - Tsunami
  - ☐ C13 - Wildfire
  - ☐ C14 - Reservoir Inundation
  - ☐ C18 - Heat Vulnerability

Bookmarks

Identify

Find





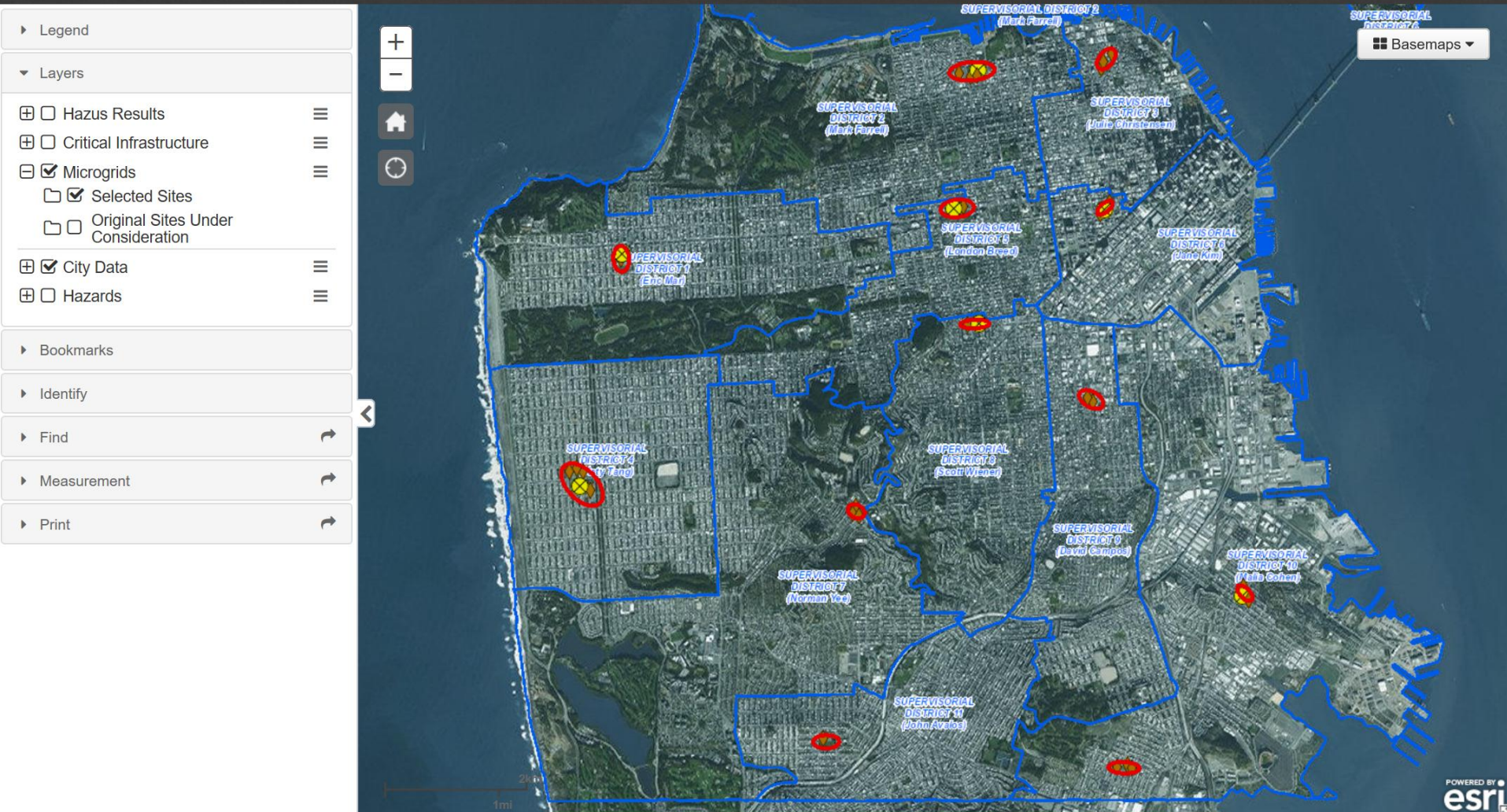
# 12 sites



## ARUP Solar+Energy Storage for Resiliency

spatial data viewer

Help

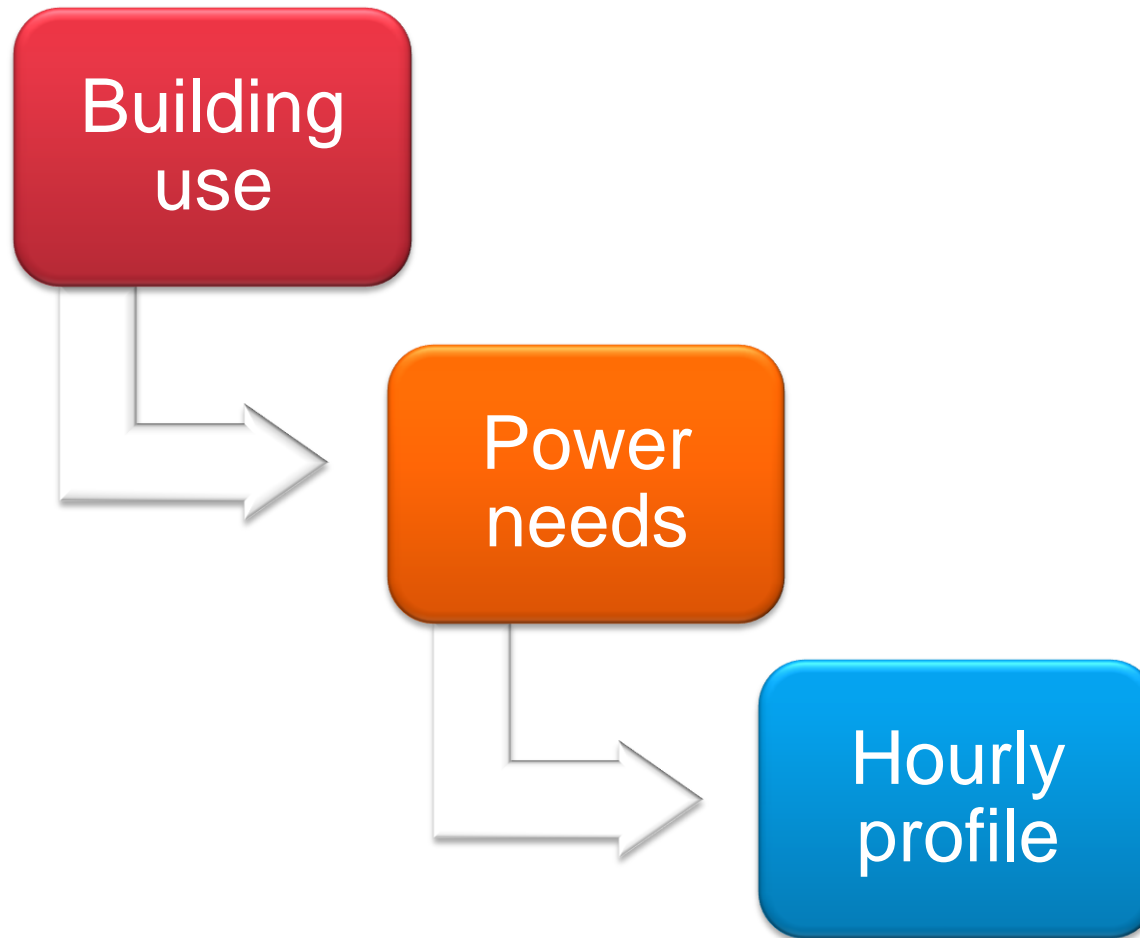




# Typical site



# Critical loads assessment



# System sizing tool



## SolarStorageTool beta version

Logged in as kacia.brockman@sfgov.org | [View all properties](#) | [Log Out](#) | [Leave Feedback](#)

Recalculate

Save

Copy

Delete

Worst

Typical

### Property Info

Project name:

School

City:

San Francisco

State:

CA

Zip:

94103

Roof area available for PV (sq.ft.):

50000

Parking lot area (sq.ft.):

0

Target outage duration (days):

0

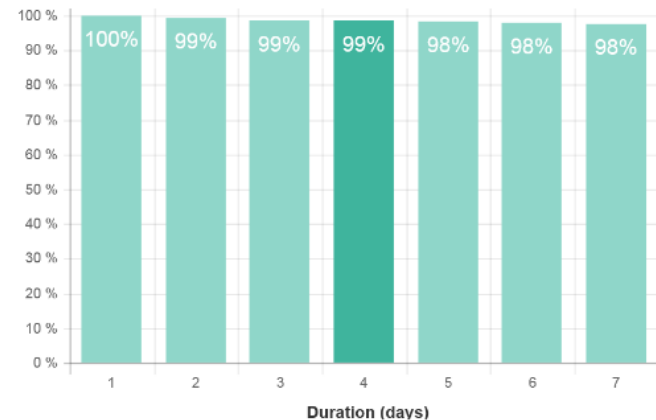
### Electrical emergency load

Quick

Standard

Detailed

### System duration - Probability



Disaster can strike at any time. Your system's performance will vary based on the time of year and time of day it begins operation. This graph shows the percent probability that the recommended system will power your building for each of the durations shown above. Your target outage duration (set in the slider at left) is shown in dark green.

### PV system

Array size:

72 kW

Area required:

10%

Roof

4,800 sq.ft.

Parking

0 sq.ft.

### Battery system

System size:

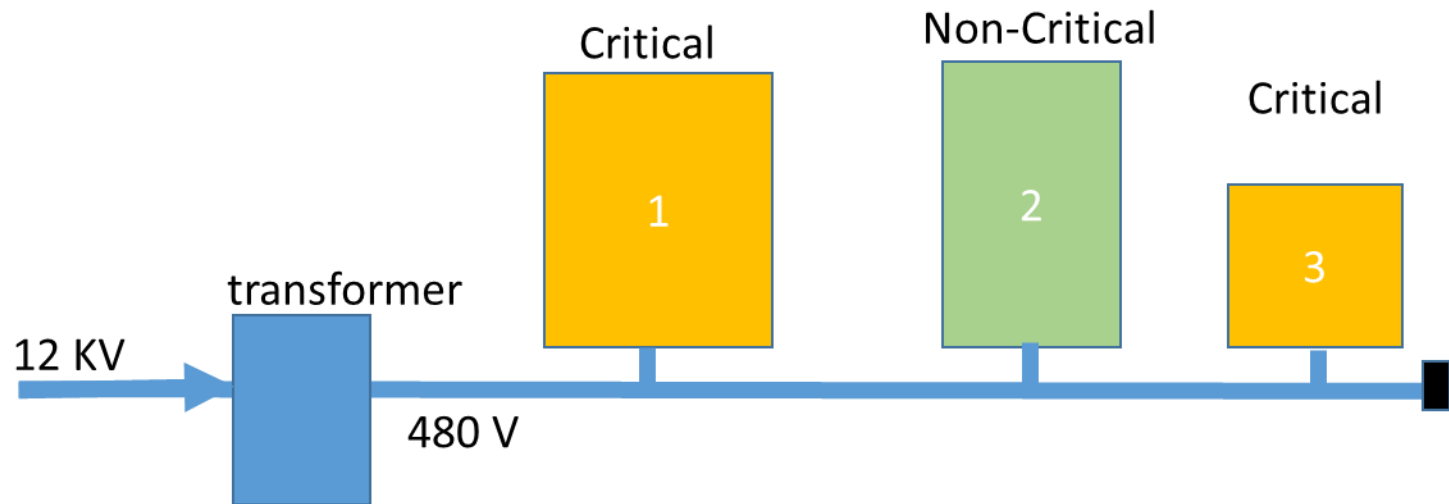
68kW / 274 kWh

SFEnvironment.org/  
solarstoragetool-beta

# Should buildings be connected?



## End of the same feed branch





# Funding & Value Streams



- KWH Savings
- KW Savings
- Grid Services
- Insurance





“municipal project design teams shall **analyze the costs and benefits of incorporating onsite battery electricity storage systems (with) onsite solar photovoltaic systems...** and submitted to the Municipal Green Building Task Force, Department of Emergency Management, and Office of Resilience and Recovery.”

# 6000 Existing PV systems







## Kacia Brockman

Renewable Energy Coordinator

San Francisco Department of the Environment

[kacia.brockman@sfgov.org](mailto:kacia.brockman@sfgov.org)

415-355-5019

Search: Sfenvironment, then Solar energy storage



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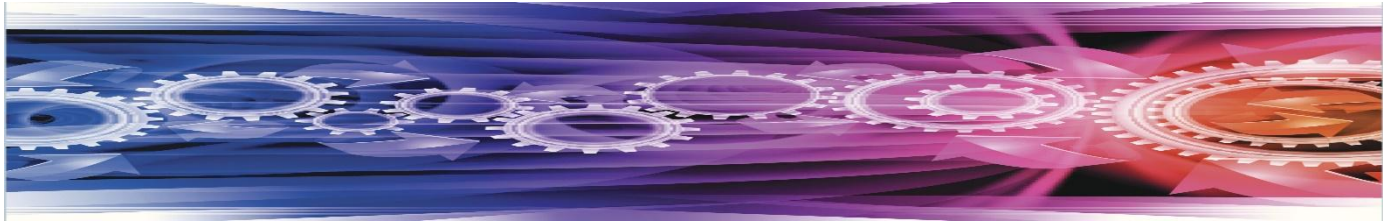
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# NARUC

## Distributed Resources and Grid Resiliency

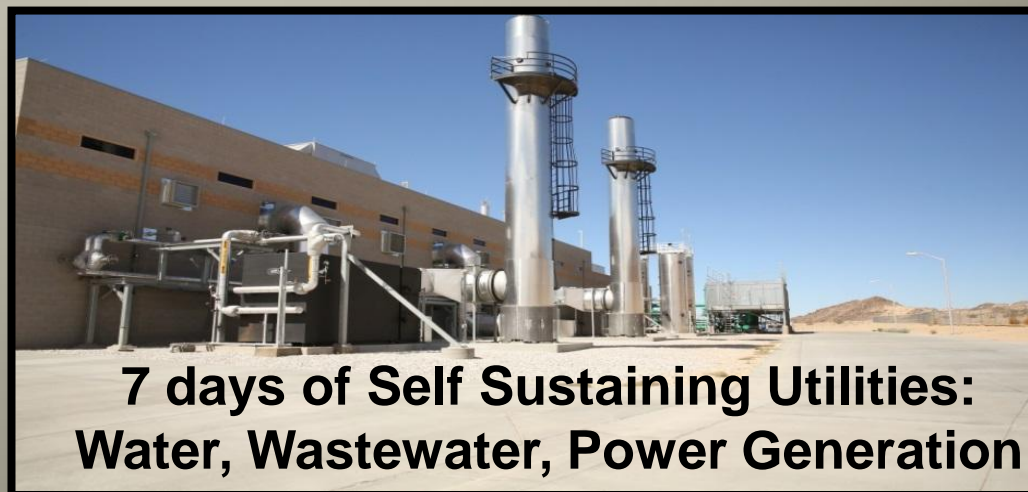
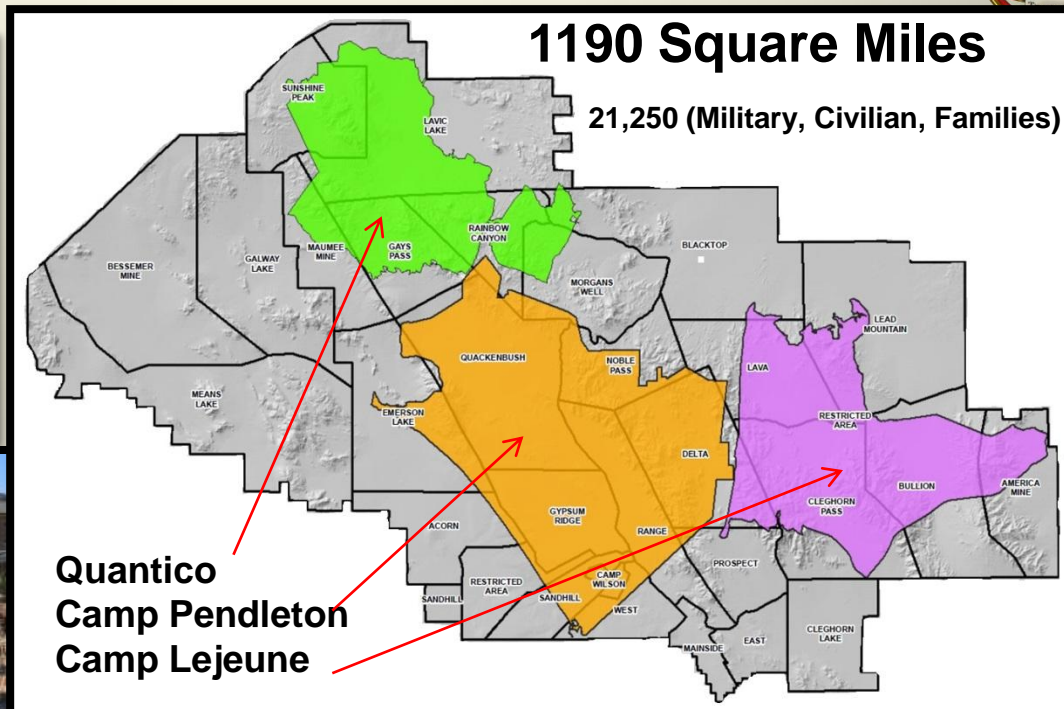
Marine Corps Air Ground Combat Center, Marine Air Ground Task Force Training  
Command 29 Palms

Utilities and Energy Management Supervisor  
Gary Morrisett

[gary.morrisett@usmc.mil](mailto:gary.morrisett@usmc.mil) 760-830-5128



# MCAGCC Overview







# MCAGCC Energy Program

Sun Shade PV Systems



Photovoltaic Arrays



Cogeneration Plants



Centralized Chiller Plants



Solar Lights



Day Lighting







# Utilities



- Electricity
  - Base owned system
  - 34.5KV primary 12.47KV secondary
  - 13 Substations
  - 60+ electrical grid switches
    - Monitoring and control functions
  - Ability to self generate 90%+ electricity
  - 130,000 MWH required
  - 123,000 MWH potential generation
- Water
  - Base owned system
  - 11 wells
  - Treatment facilities
  - Storage facilities
- Wastewater
  - Base owned system
  - Fermentation pit with secondary treatment
  - High re-use of reclaimed water
  - Holding ponds
- Natural gas
  - Southern California Gas
  - Low pressure systems base owned
- Chilled water
  - 7000 ton capacity
  - High efficiency systems
  - ½ summer loads
  - 7 plants
- High Temperature Hot Water
  - 300 PSI with 350F water
  - Supplies 80% of buildings with hot water, heating, and steam
  - Two main plants



# Co-Generation



- **Cogeneration**

- Natural gas generation of electricity and collection and use of waste heat
- Winter peak 15 MW / Summer 28 MW
- Ability to island mode with Cogen and PV during SCE power loss
  - High efficiency- 80-85% vs. standard industry 35-40%
  - Cogen has lower emissions than grid power



- **Cogen Plant 1**

- 7.2 MW Solar Turbine Taurus 70
- Generates 55% of base load  
55,000 MWH / year
- Collects 35MBTU/Hr heat for heating and cooling of 60% of the base. Transfers heat to Central Heat Plant and Chiller Plants

- **Cogen Plant 2 (Utility Plant)**

- 8.4 MW / Twin 4.2MW
- Twin turbine for peak following
- (2) 20 MBTU/hr boilers
- Chillers (1) Electric Centrifugal  
(2) Absorption
- Expected generation full year 57,000 MWH

- **Working toward Solar power export**

- Cogen power inadvertent export control



# Solar Generation

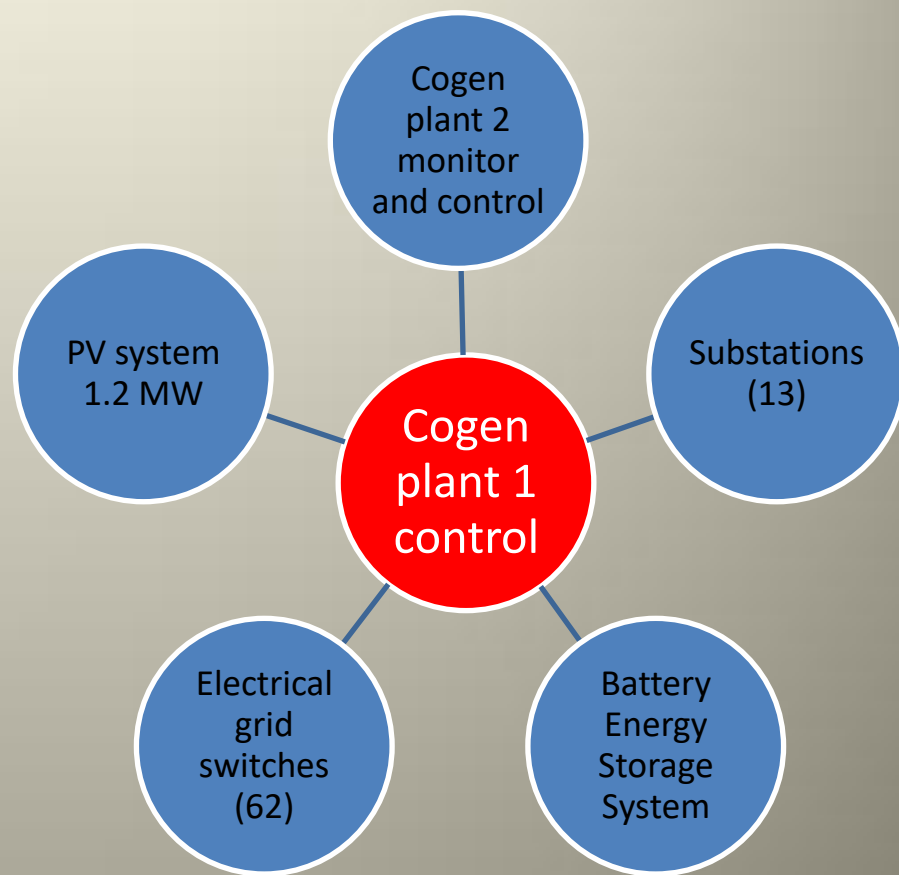
- **Aggressive solar program**
  - Produce over 7,000 MWH/year
  - End of CY 15 over 8.9 MW installed
  - Required real time data to SCE
  - PV metering
- **SB 83 and NEM 2.0**
  - Working to export power from PV systems to allow Cogeneration plants to fully load
- **Outside and congressional pressure to develop on base sites**
  - Multiple inquiries on use of available space and land resources
- **Photovoltaic Systems - 30KW to 1200 KW**
  - Currently 4.1MW on line at 50+ locations
    - Large effort to utilize existing shade structures and roofs
  - Additional 2.4 MW to be repaired and back on line end of year for over 8 MW
  - 2.2 MW awaiting interconnect agreement





# Microgrid

- Currently have 10 MW Microgrid
  - Provides overarching control of existing complex control systems
  - Looks for most efficient and cost effective operation
  - Provides full automation, recommendation, or manual operation for grid tied or islanded operations
- Future base wide system
  - Two plants parallel system
  - Manage loads at substation level
  - 20+ MW generation capacity with 25MW load
- Challenges
  - Communications infrastructure
  - Cyber Security
  - Load Management with 30% PV

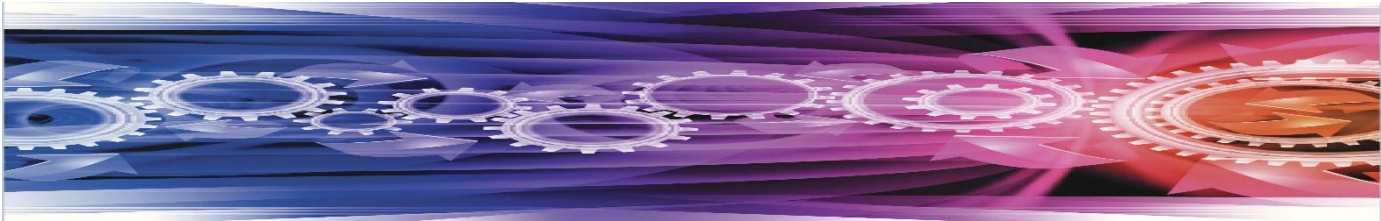






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