TRI-COUNTY REGIONAL ENERGY NETWORK

SAN LUIS OBISPO • SANTA BARBARA • VENTURA

March 20, 2025

Batteries: Options and implementation for a building's energy storage system

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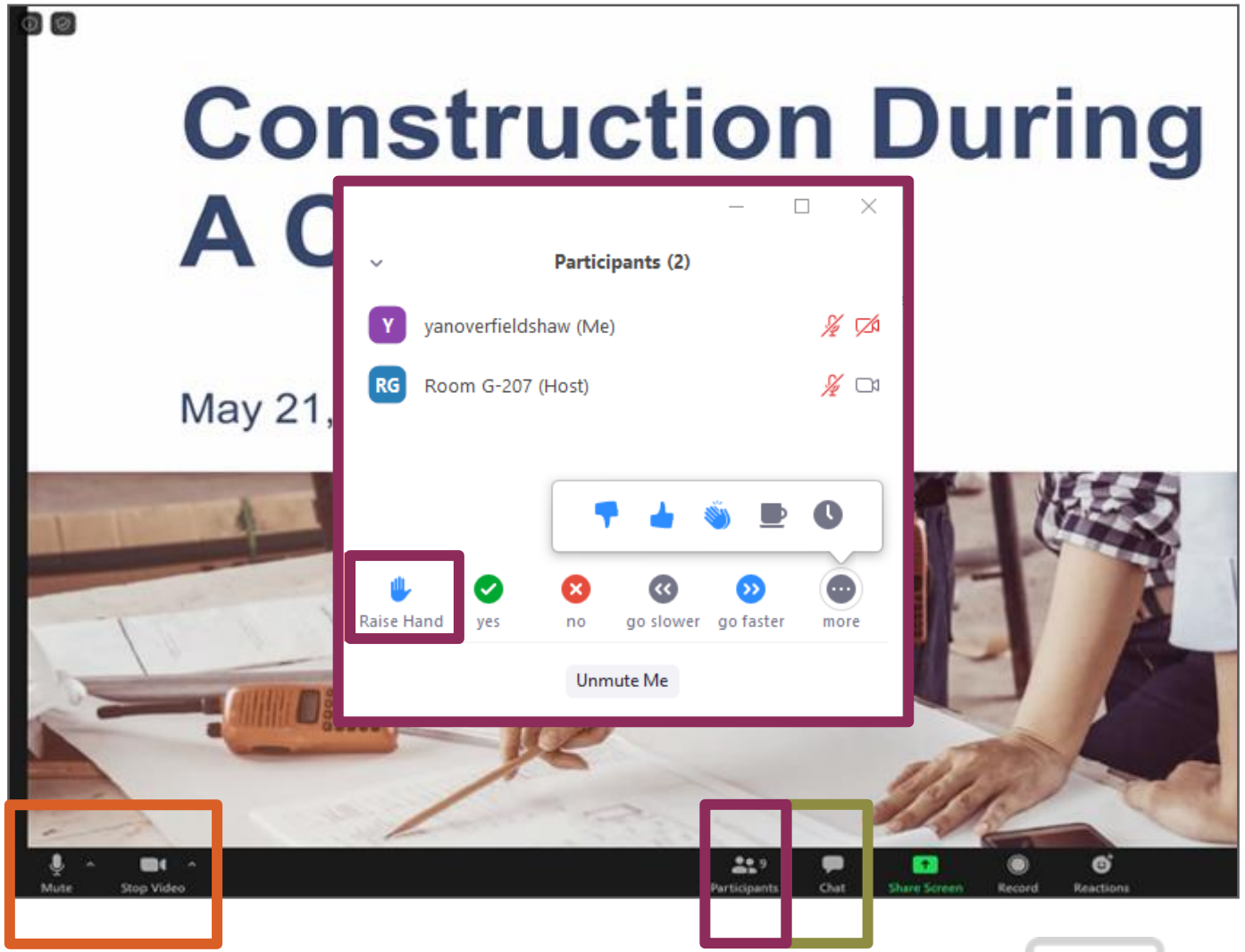
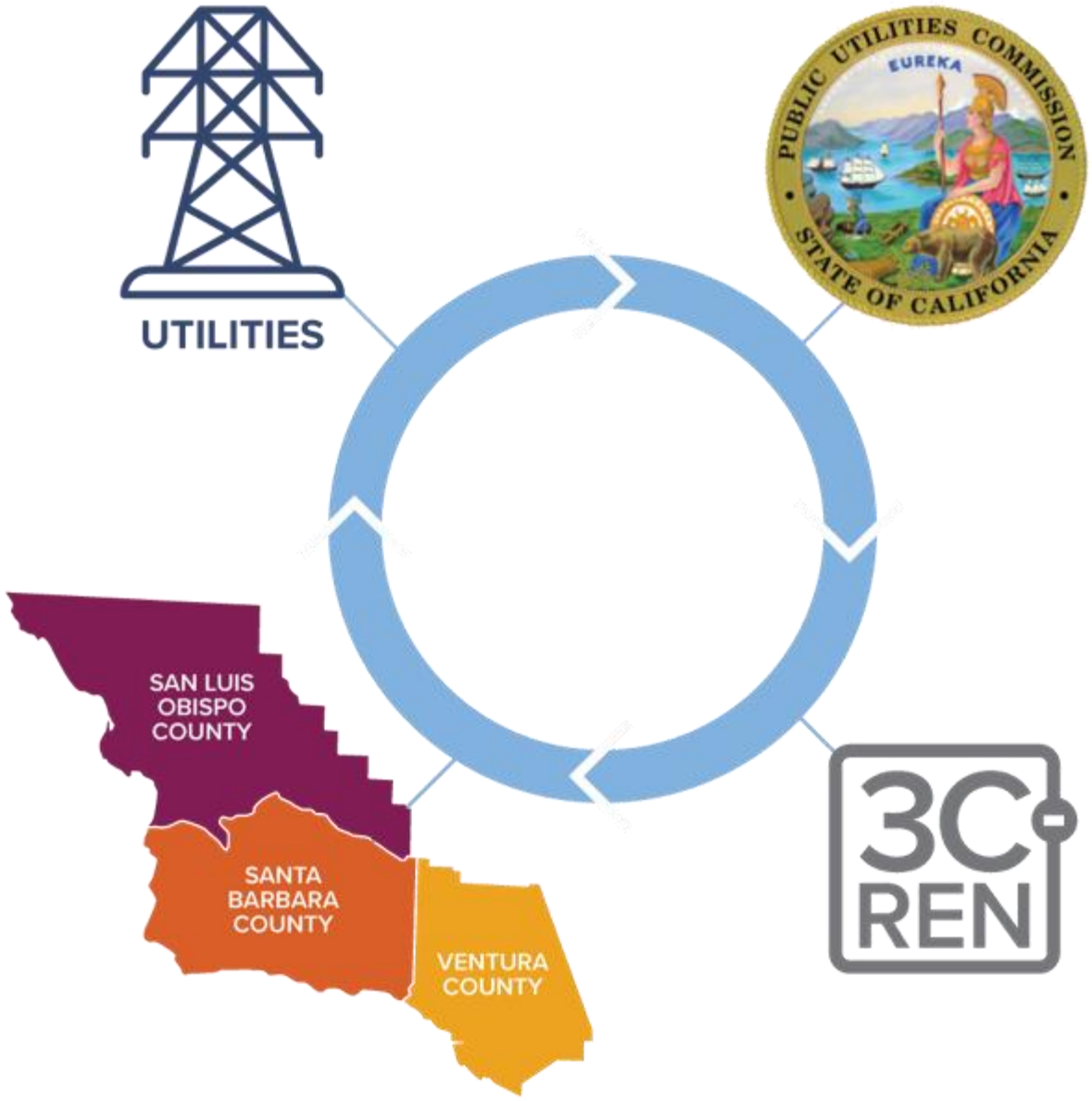
Grant Murphy, CEA, In Balance Green Consulting

Zoom Orientation

- Add an **introduction** in the chat.
  Be sure **full name** is displayed.
- Did you call in? Please **share** first and last name with us.
- Please **mute** upon joining
- Use the "**Chat**“ to share questions or comments
- Under "**Participant**" select "**Raise Hand**" to share a question or comment verbally
- Session may be **recorded** and posted to 3C-REN's on-demand page
- Slides/recording are **shared** after most events





Tri-County Regional Energy Network

3C-REN is a collaboration between the tri-counties

Our programs reduce energy use for a more sustainable, equitable and economically vibrant Central Coast

Our free services are funded via the CPUC, bringing ratepayer dollars back to the region

Our Services

Incentives

HOME ENERGY SAVINGS

3c-ren.org/for-residents
3c-ren.org/multifamily

COMMERCIAL ENERGY SAVINGS

3c-ren.org/commercial

Contractors can enroll at
3c-ren.org/contractors

Training

BUILDING PERFORMANCE TRAINING

3c-ren.org/events
3c-ren.org/building

ENERGY CODE CONNECT

3c-ren.org/code

View past trainings at
3c-ren.org/on-demand

Technical Assistance

AGRICULTURE ENERGY SOLUTIONS

3c-ren.org/agriculture

ENERGY ASSURANCE SERVICES

3c-ren.org/assurance

3C REN

3C-REN Achievements

4,000+

Individuals Attended Training

1,374

Energy-Saving Projects Completed

334

Title 24/CalGreen Questions Answered

$155M

Secured for investment in the tri-county region through 2028

Data from 2019-2023 for three programs

Learning Objectives

- Understand different battery types and their applications for buildings
- Know the process for sizing batteries and when they are required
- Review cost implications for battery use when paired with on-site renewable energy
- Understand practical integration of batteries into project design and construction

Learning Units

- 1.5 AIA LUs approved for this course
- 0.15 ICC CEUs approved for this course

Agenda

1. Battery Energy Storage
2. Residential Singe Family
3. Nonresidential and High-Rise Residential

Battery Energy Storage (and Solar PV)

Battery – Energy Storage Systems (BESS) (ESS)

SunGrow Power Titan

https://primuspower.com/en/energy-storage/

Batteries for Grid Scale Applications Must Last Decades and Deliver Long Duration Energy Discharge On-Demand

Utility Scale –Grid Stabilization and In Front of the Meter Micro-grids

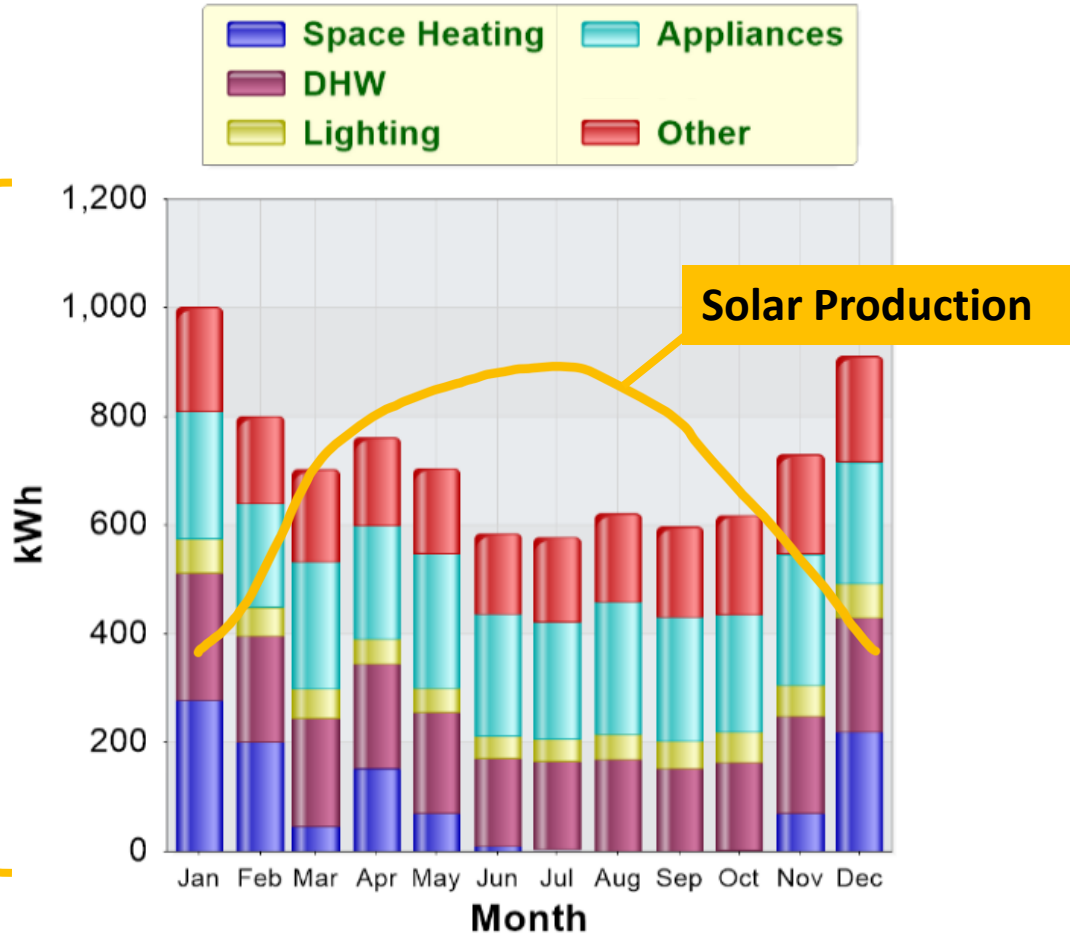
Commercial and Industrial

Multifamily and Non-Res and Behind the Meter Micro-grids

Private Homes

The Electric Grid was the Seasonal ‘Battery’ for Solar PV…

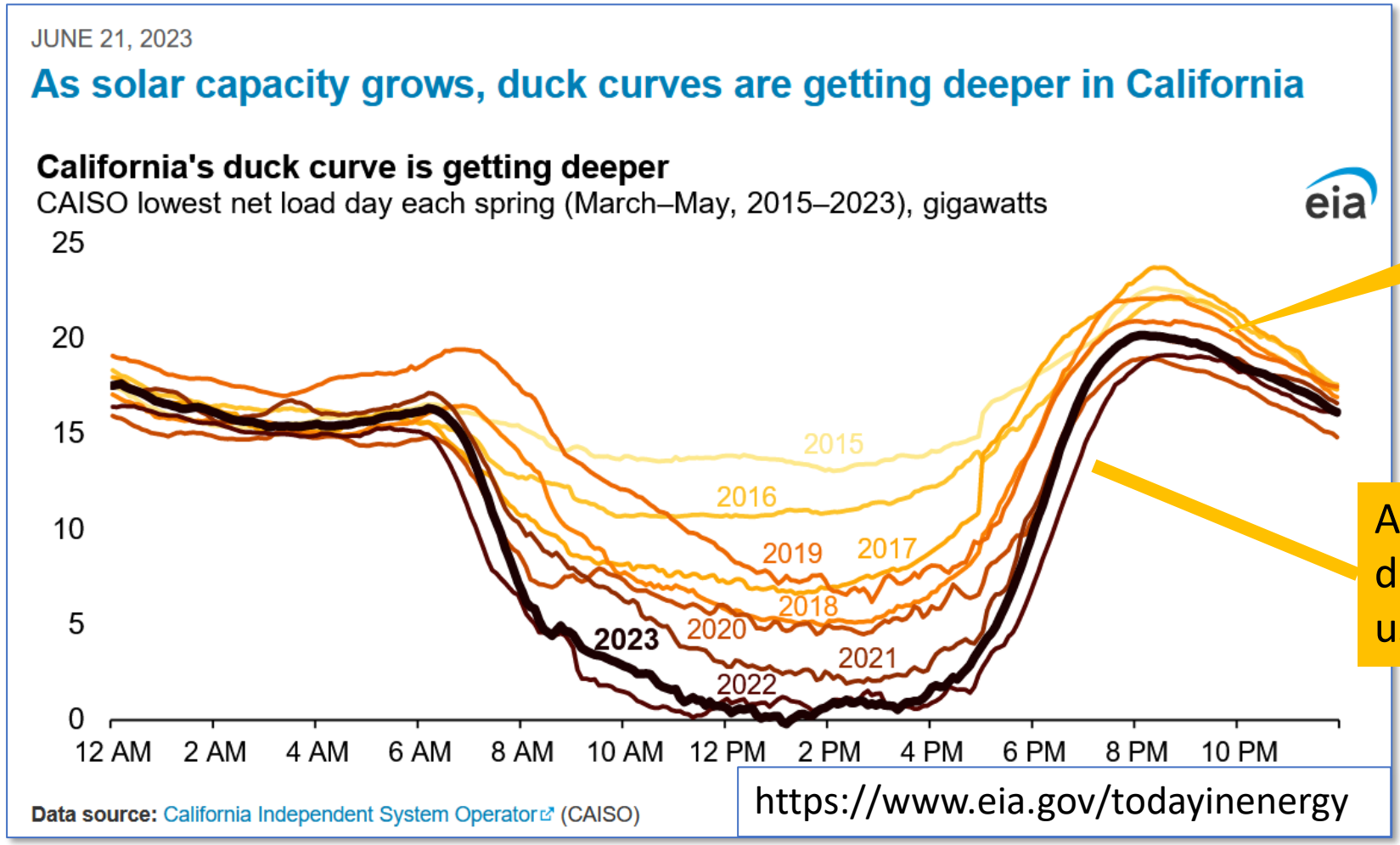
Predicted Electricity Energy-Use in Kilo-Watt Hours (kWh) per Month



Grid-Tied solar systems were designed to use the ‘Grid’ as a seasonal battery.

…now, the Grid Needs a Battery

A look at the daily swing of net energy demand



ESS will help California flatten the bottom of the duck curve and provide stored energy in the evenings when most needed.

As solar energy production drops off, household energy use steeply ramps up.

Peak Loads –Daily Load Shifting and Grid Relief

Resiliency and Load Shifting (Single Fam and all Occupancies)

- Load Shifting –Use battery when electric rates are highest cost
- Resiliency –Use battery when electric power goes out
- Grid Stability –Distributed Resources and Virtual Power Plant (VPP) Battery Programs through the Electric Utility or Battery Provider/Brand Partner
- Self Utilization –Store excess on-site Solar Energy for later use

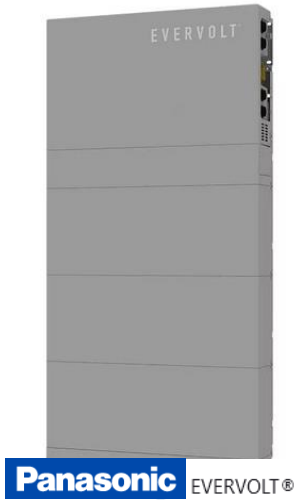
Code Requirement (High-Rise Multifamily and Non-Res)

- Multifamily 4 Stories or Greater
- Commercial Occupancies
- Only Required if a PV System is Triggered
  - Grid Tied
  - Minimum Size Threshold – Exemptions

Residential Single Family
(and Small Commercial Scale Projects)

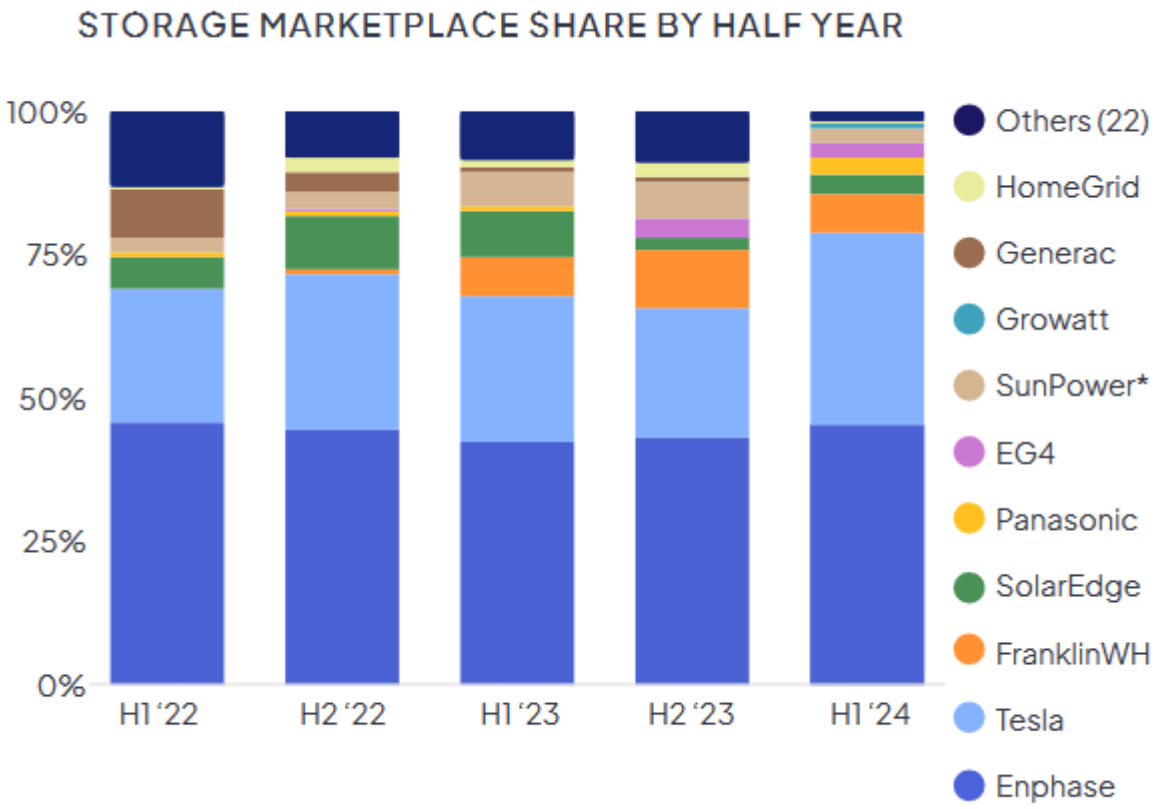
Home Battery Systems – Large Market

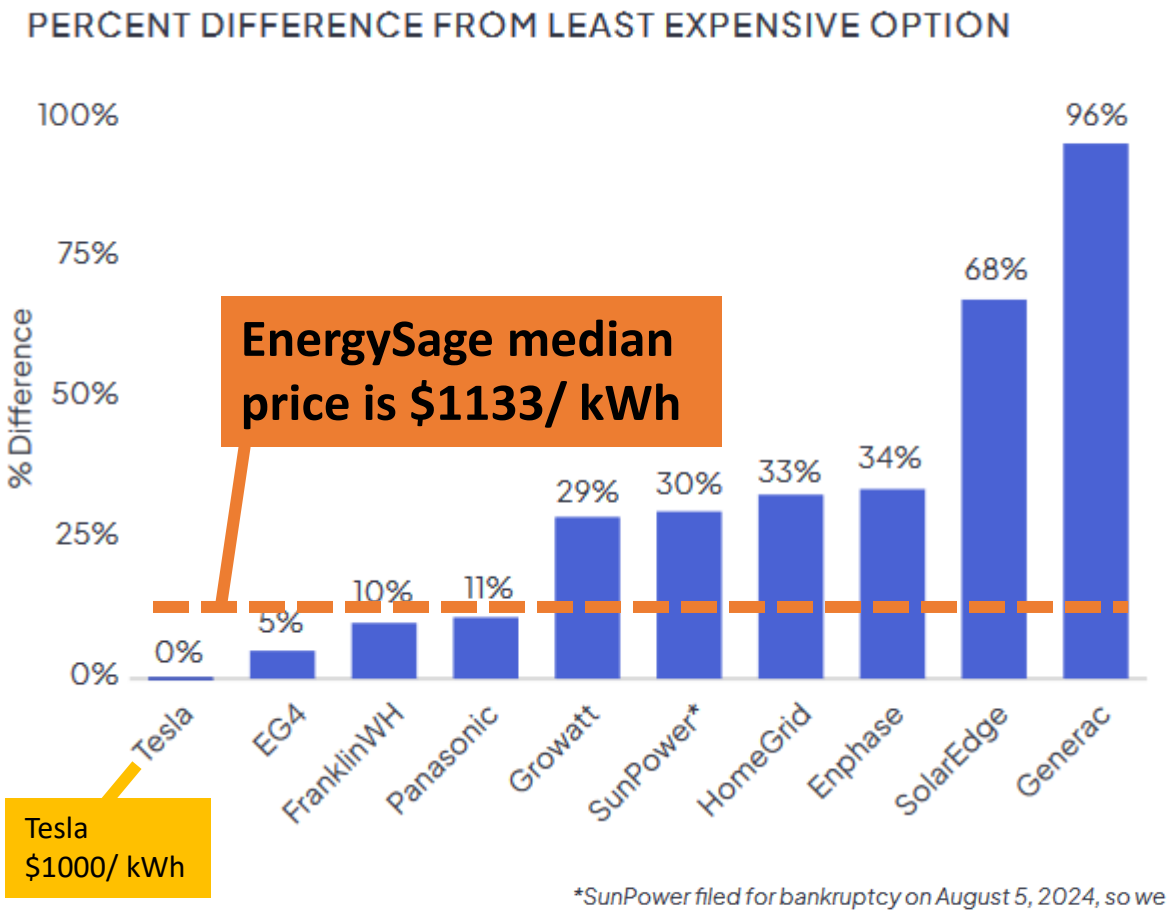
Some popular examples, but there are many others coming to market every day:



Market Share – Excerpt from EnergySage Data Set

www.energysage.com





*SunPower filed for bankruptcy on August 5, 2024, so we expect this to be the last report including its products.

energysage

Solar & Storage Marketplace Report

intel@energysage.com

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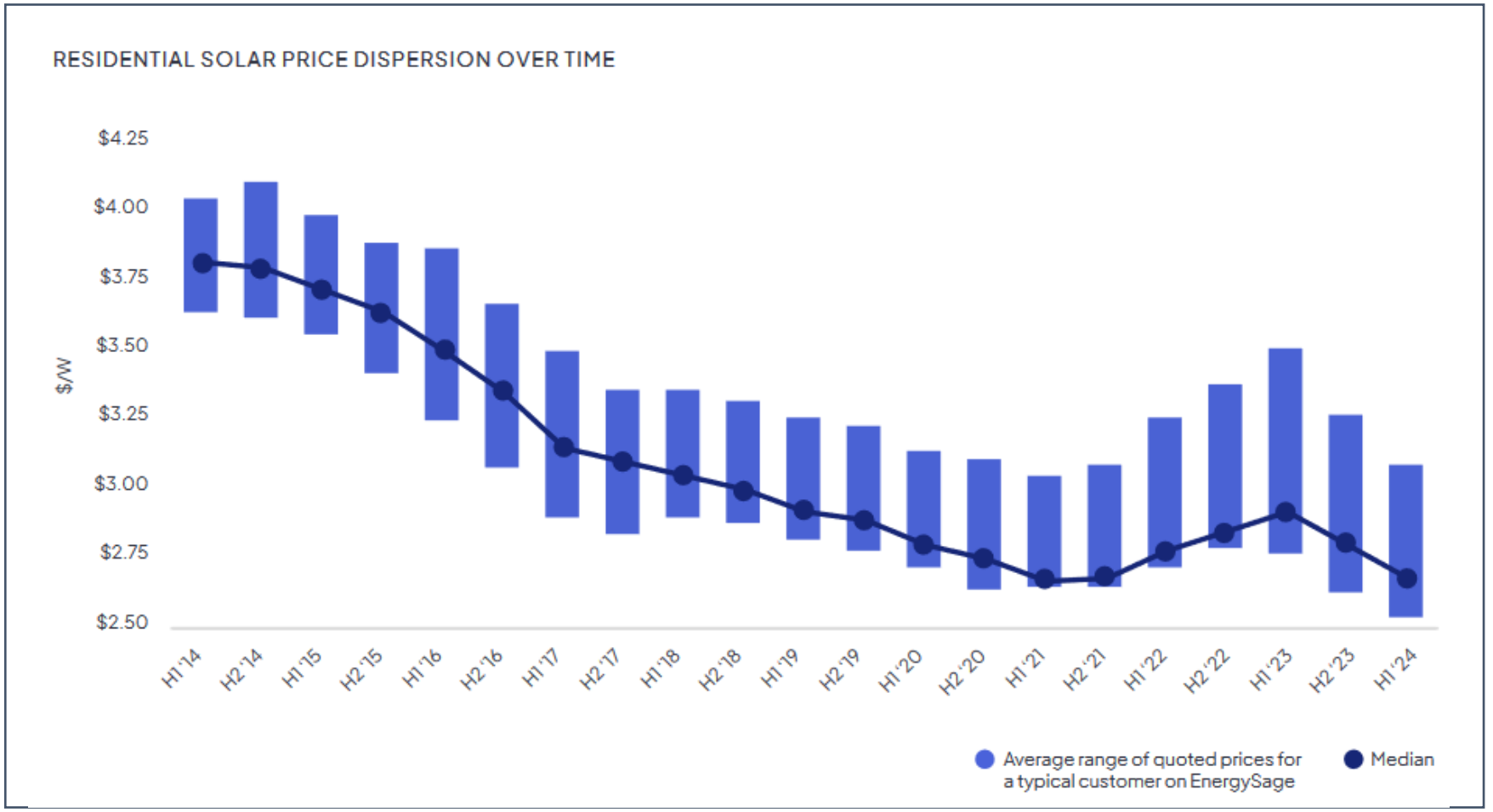


energysage

Solar & Storage Marketplace Report

intel@energysage.com

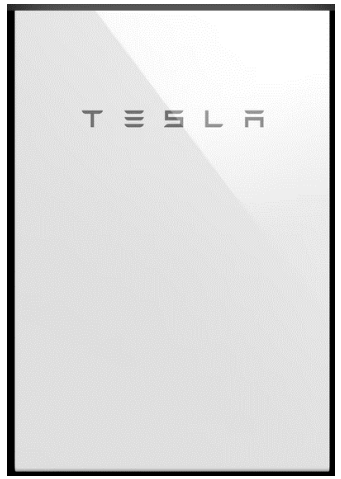
Common Battery Chemistry

Lithium-Ion

Typically: LNMC – Li, Ni, Mg, & Co

Thermal Runaway Possible

High-Power Density



< PowerWall 2

Lithium Ferro (Iron) Phosphate

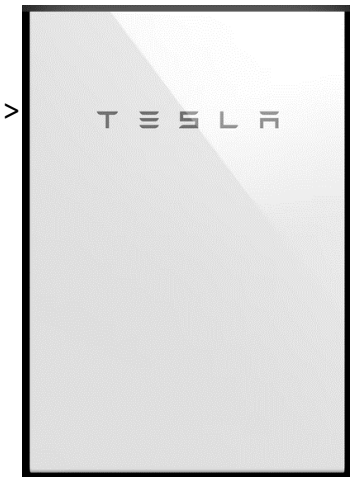
LFP – Li, Fe, PO4

Non-combustible

High-Power Density

Cobalt (Co) Free

PowerWall 3 >



Lithium Titanate Oxide

LTO – Li & Ti

Non-combustible

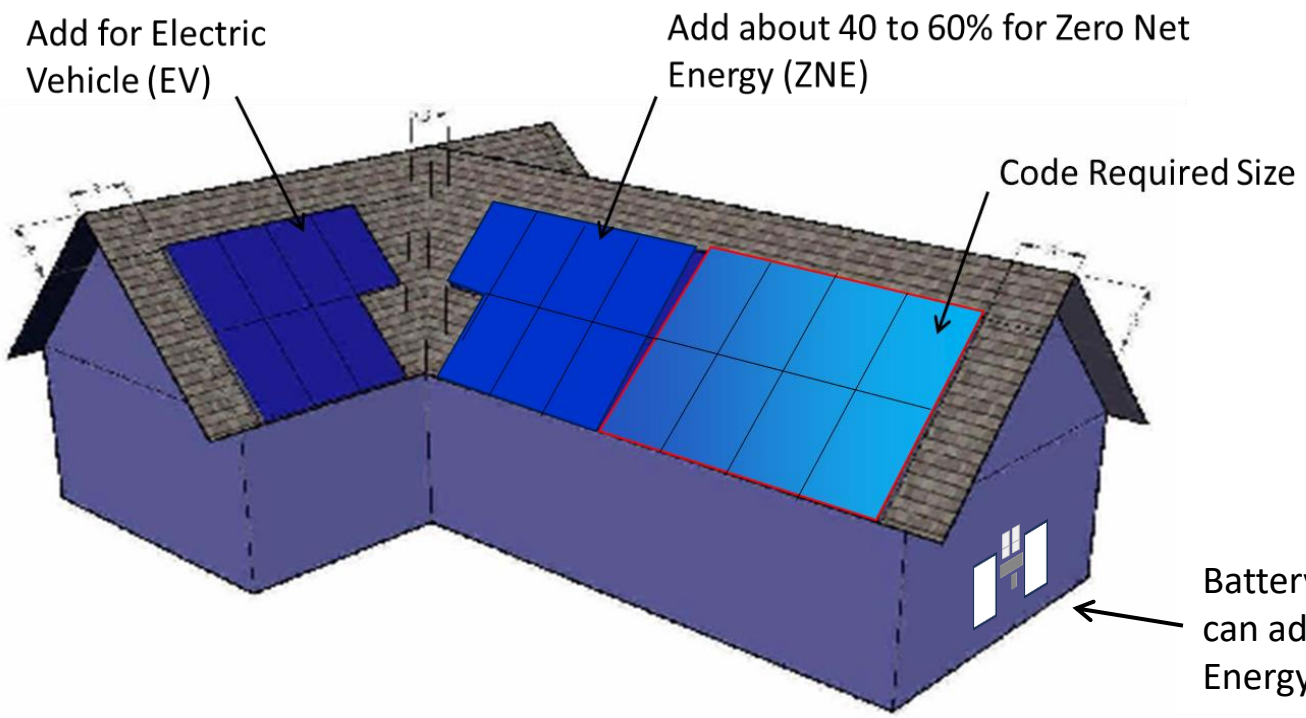
Lower-Power Density

Cobalt (Co) Free

Design Considerations for Battery Installations

- Functionality – Supporting Equipment and Space Needs
- Fire Safety –NFPA 855
- Energy Code –Title 24 Part 6:
  - Desired –Single Family, or
  - Required –Non-Res

How much solar (and battery storage) does a household need?



Under the new electric pricing system (NEM 3), a solar PV system with battery storage can be more cost effective than a PV System alone for a ZNE home.

For Example: New Construction 2000 SF home in Atascadero (climate zone 4) a 2.38 kW system would be required.
Santa Barbara and Ventura coastal areas would be slightly less.

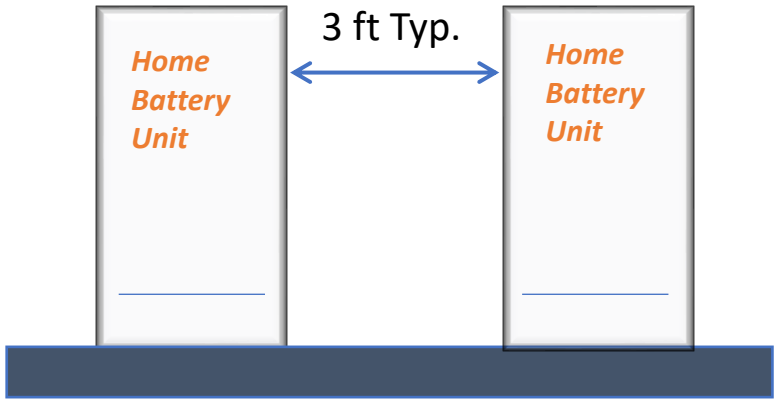
General Design Considerations

- Outdoor and indoor installations are possible
- Protect from impact damage
- Protect from temperature extremes
- Protect from adverse weather
- Maintain 3 ft distance from paths of travel, doors and windows
- Follow manufacture’s installation requirements

Fire Safety – NFPA 855

Highlights from Chapter 15 – One and Two Family Units and Townhouses:

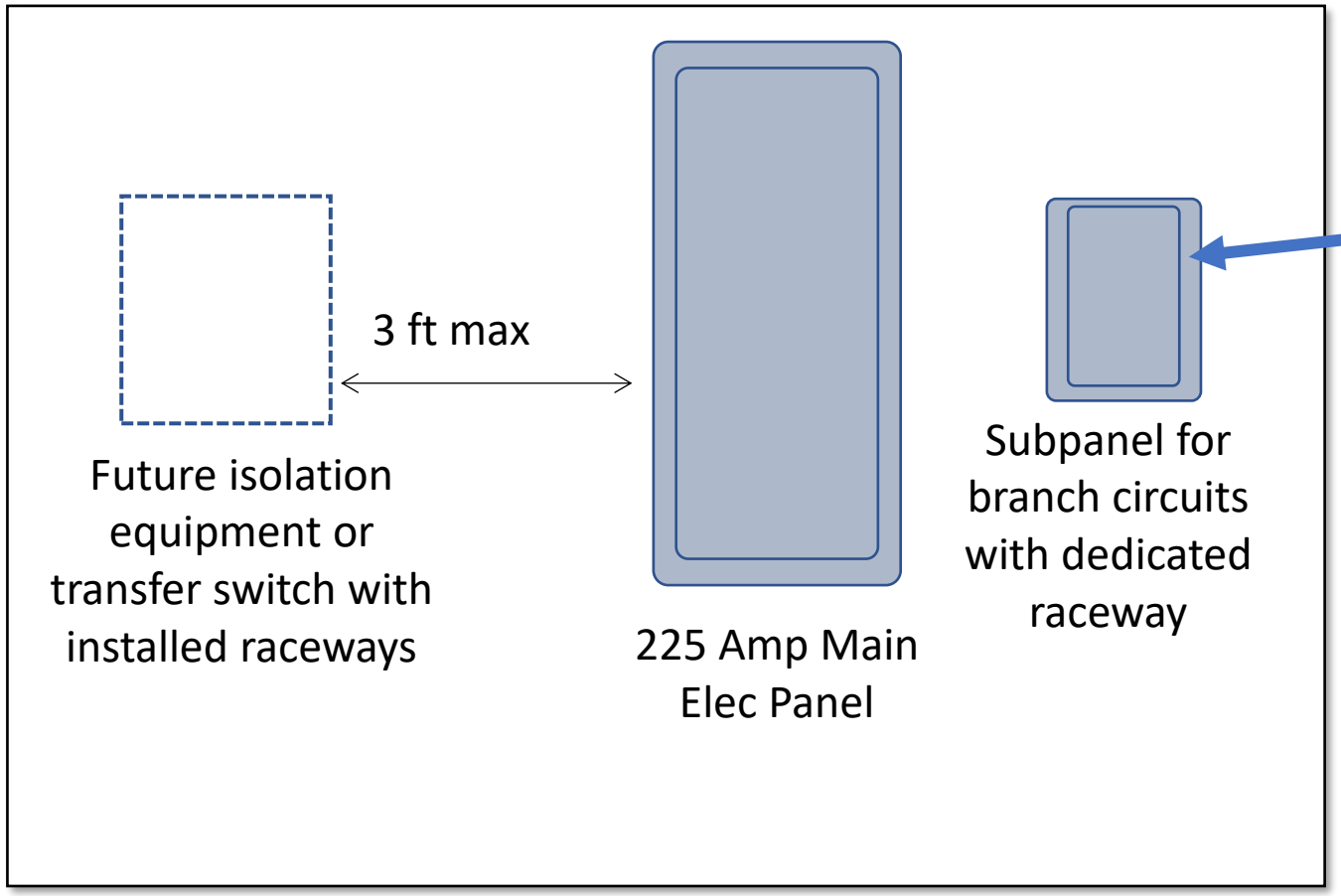
- Individual ESS units max 20 kWh stored energy
- Separate individual units by 3 ft
- Aggregate capacity shall not exceed:
  - 40 kWh within utility closets or storage spaces
  - 80 kWh in garages and/or detached accessory structures
  - 80 kWh on exterior walls or in outdoor installations
- Utility closets/spaces and/or garage shall have 5/8” Type X gypsum board ceilings and walls
- Interconnected smoke alarms shall be installed through out the dwelling and attached garage (or when appropriate an interconnected heat alarm)
- Maintain 3 ft clearance from all windows and doors



Batteries maybe installed closer if it can be shown to the AHJ that the battery manufacture has complied with proper fire testing and has specified the minimum distance.

2022 Energy Code – Single Family (Townhouses and Duplexes)

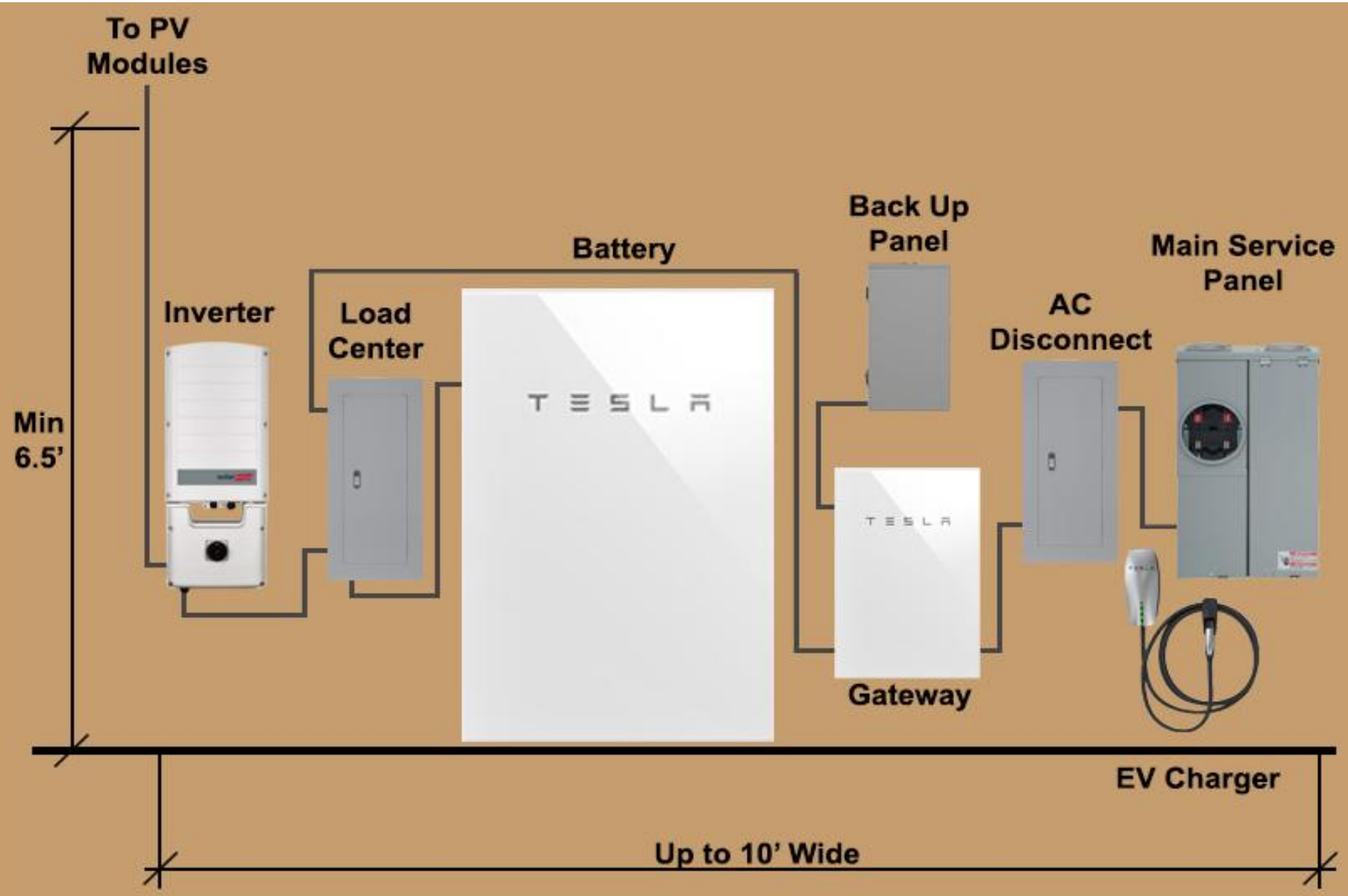
Reminder: Battery storage is optional; “Battery Ready” is required for new construction only



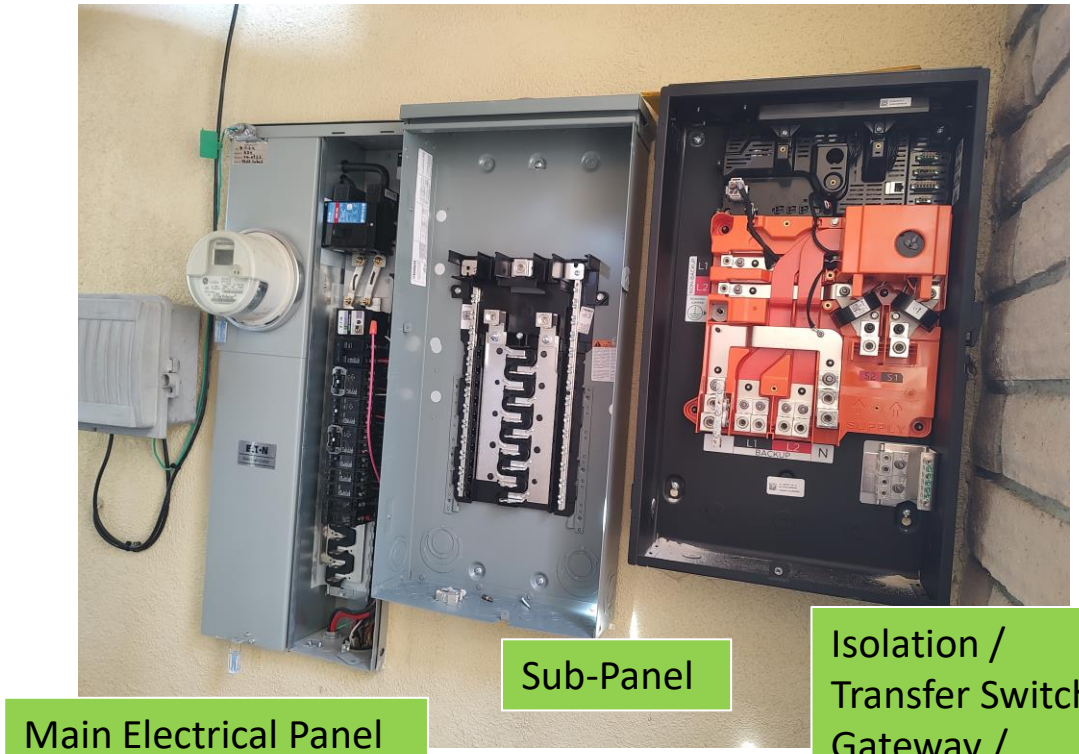
‘Critical Loads’ Subpanel *– A* ***minimum of 4 branch circuits*** *shall be identified feeding:*

- **Refrigerator**
- **Lighting circuit near the primary egress**
- **Sleeping room receptacle outlet**
- **Owner choice**

Common Equipment for a Solar + Battery System



Existing Homes: Solar PV and Battery Systems



Main Panel, Subpanel and BESS Isolation Equipment

225 Amp Main Elec Panel

Tesla Gateway (Approx. 16” x 26”) Transfer/Isolation Equipment Purpose is to isolate the building from the electrical grid during a power outage.

Subpanel “Back-up Loads” with 4 branch circuits minimum – can have more, can be the whole house.

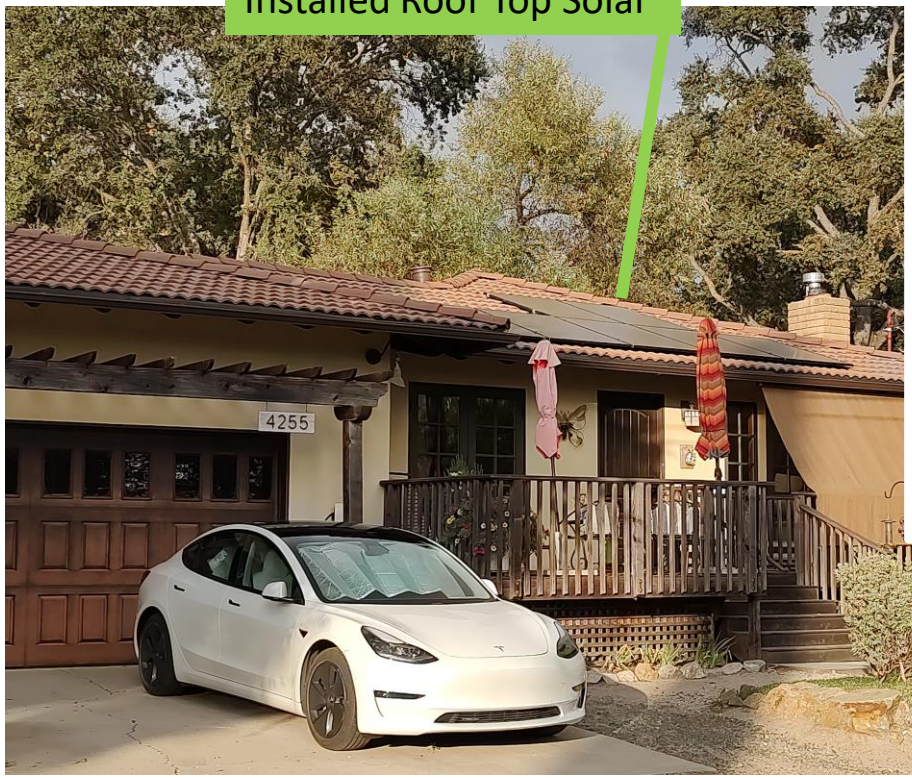
Inverter, Disconnect/Load Center, and Battery

Inverters
(from PV Panels)

Home Load Center
and Disconnect
(Houses the Solar
Panel Array/Inverter
Breakers -20amp
each)

Tesla PowerWall
13.5 kWh Capacity and
11.3 kW max continuous
Power Supply.
(Approx. 33” x 46”)
Can be ground or wall
mounted.

Occupant Habits: Energy Usage, Solar PV and Battery Systems

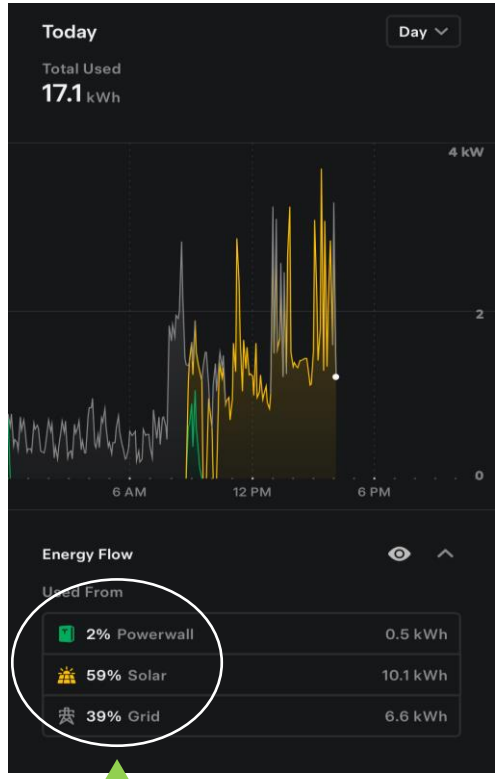


Installed Roof Top Solar

Depending on one's driving milage, electric cars can add significant loads.

Battery Storage: Two batteries are providing whole home back-up – for the most part…

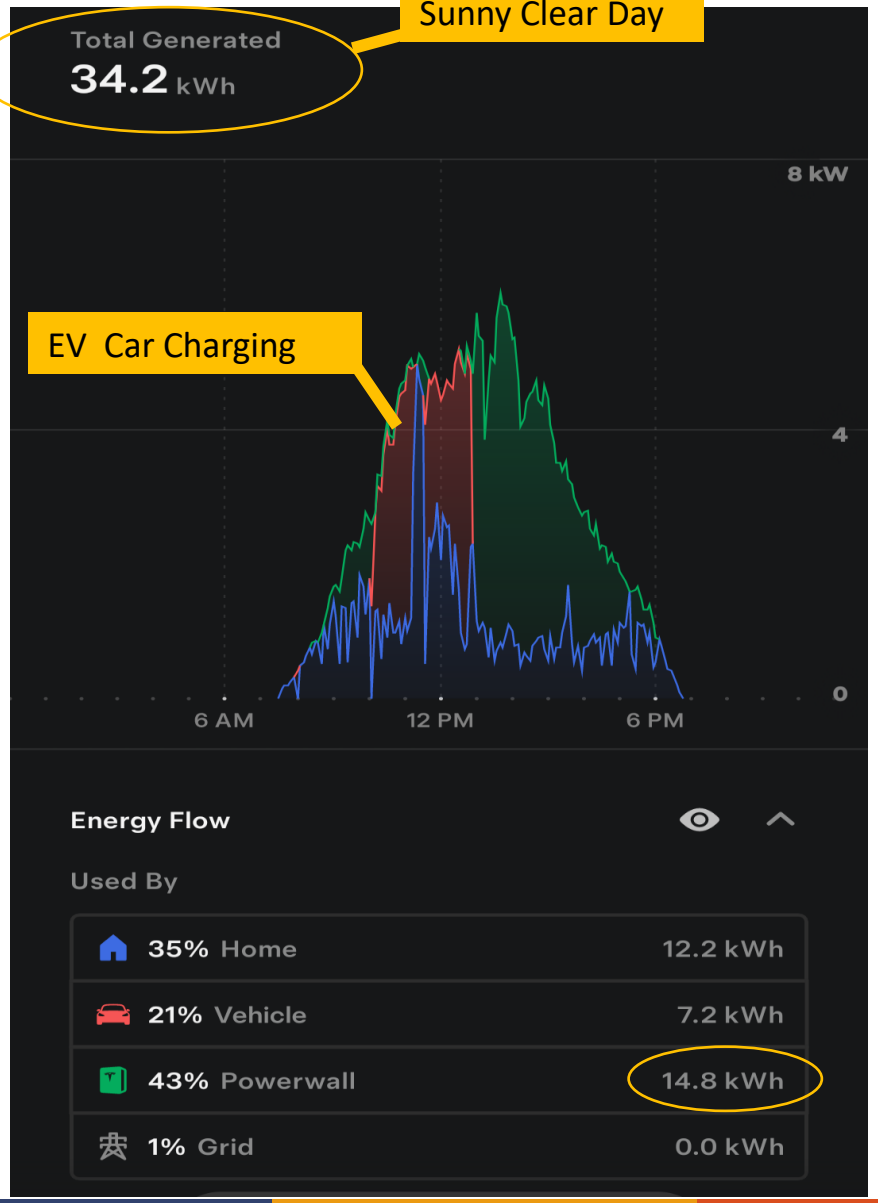
Electric dryer – Multiple consecutive use can add significant electric load, pulling energy from the grid.



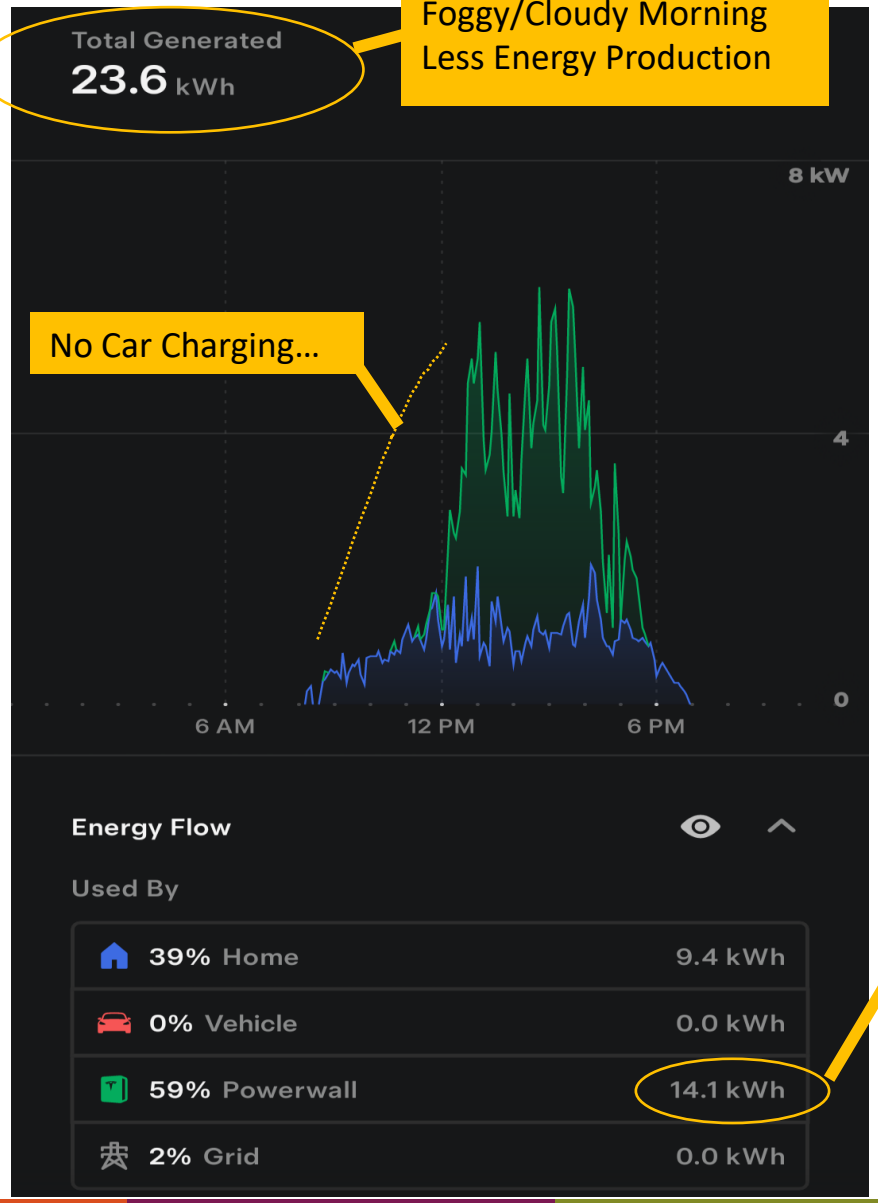
"Laundry Day"– Solar only met 59% of the need that day –battery recharge has "priority" on solar energy.

Energy Production and Energy Flow – Charge the Car or the Battery?

Sunny Clear Day

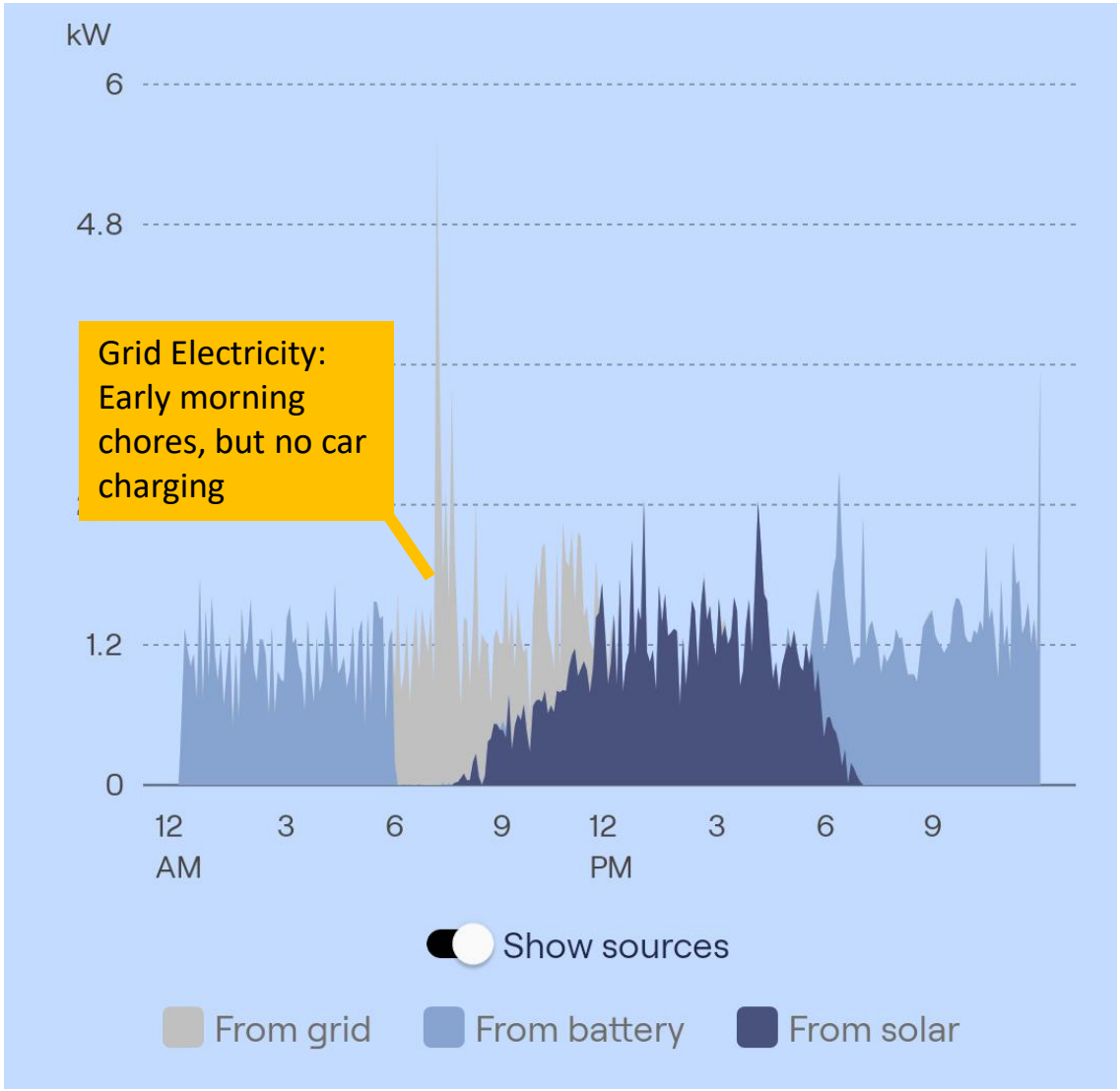


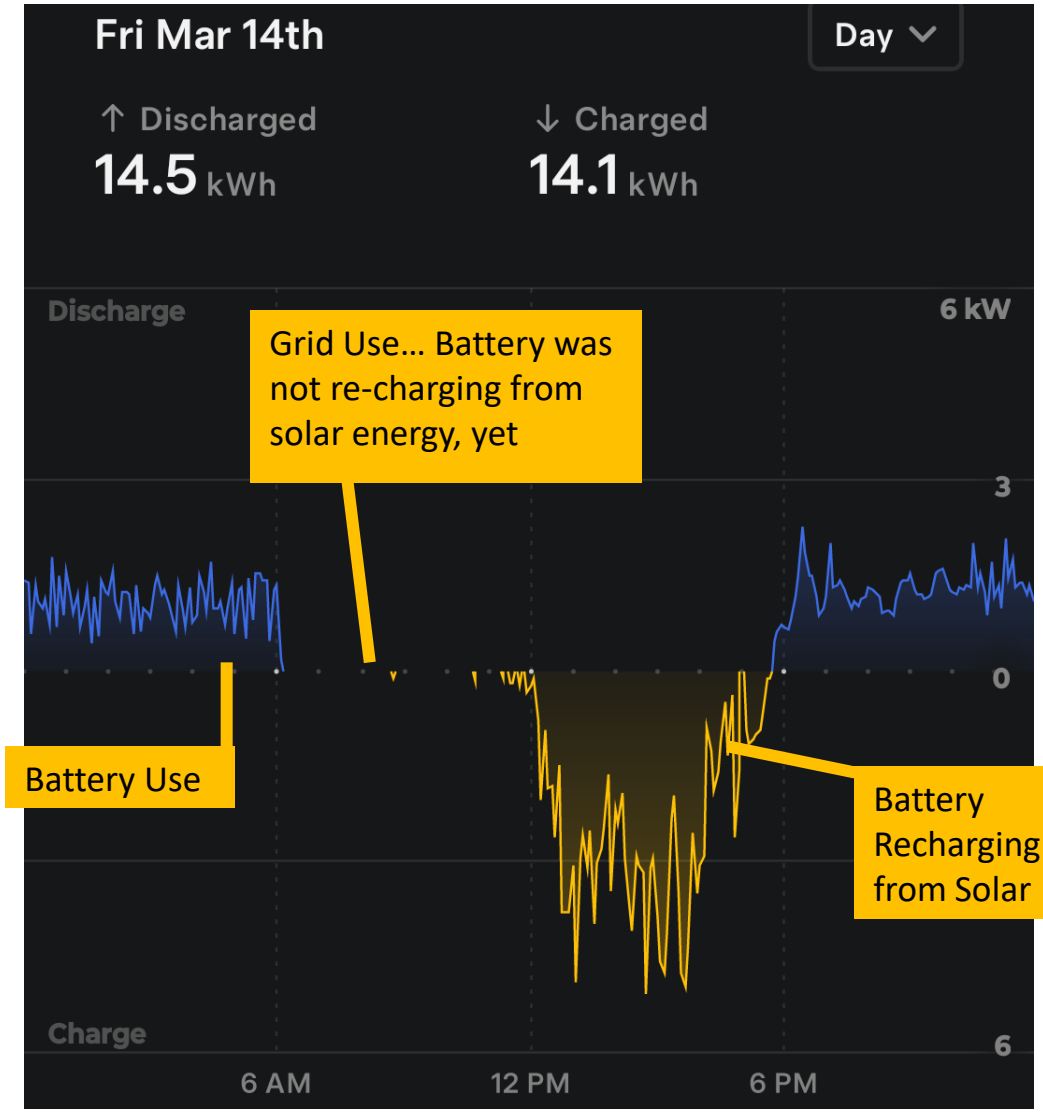
Foggy/Cloudy Morning
Less Energy Production



Battery receives about the same amount of energy on both days

Energy Usage –Grid vs Battery vs Solar Direct





Battery Resources: Sizing, Cost, Savings

Industry Websites

- Tools for battery sizing based on typical household energy use
- Provide average appliance kWh and time-use estimates
- EnergySage connects homeowners to vetted contractors

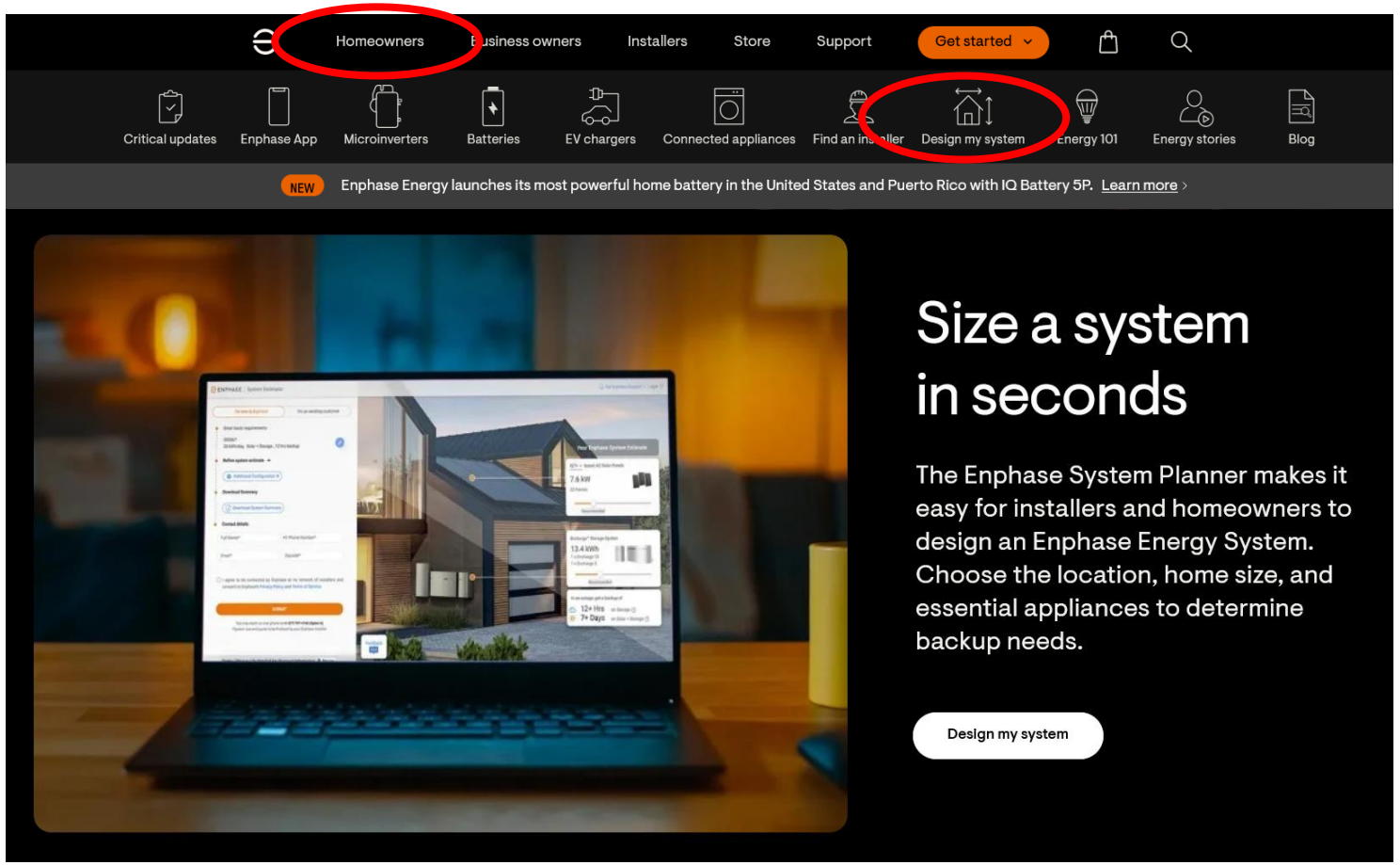
Utility Company Websites

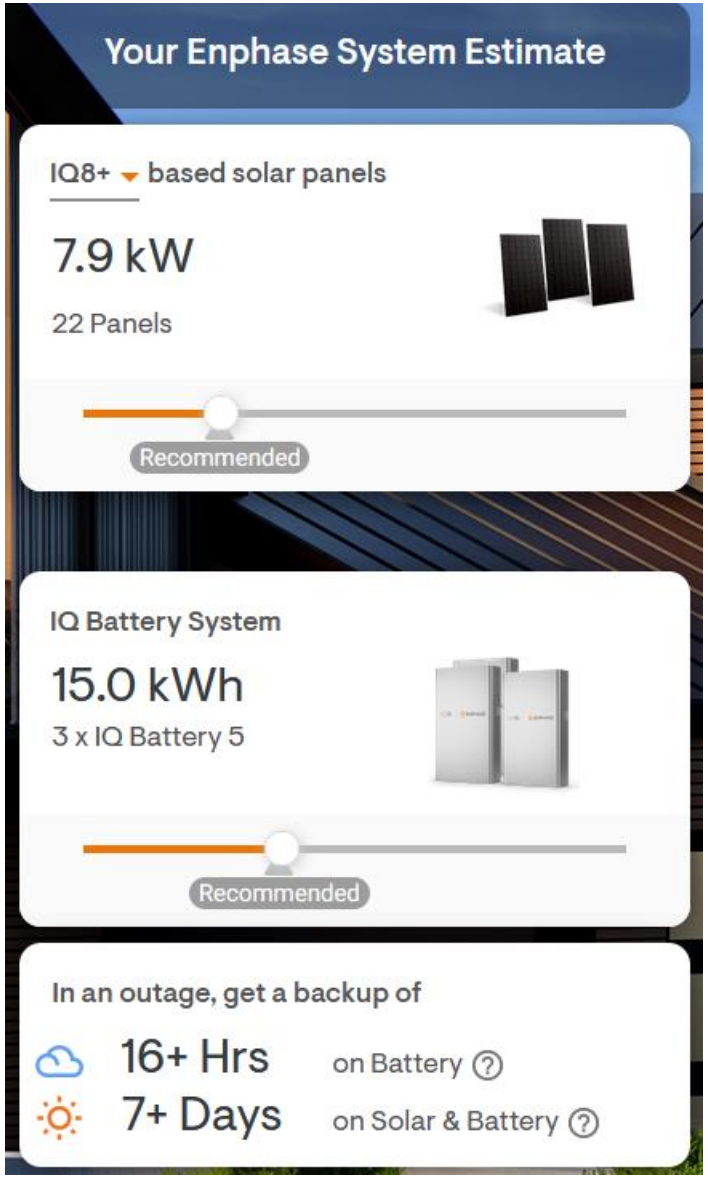
- Links to Battery and Self-Utilization Incentives
- PG&E links to a ‘Solar Calculator’ tool that includes battery storage

Size a Battery for your Home

Enphase Website Example: https://enphase.com/homeowners

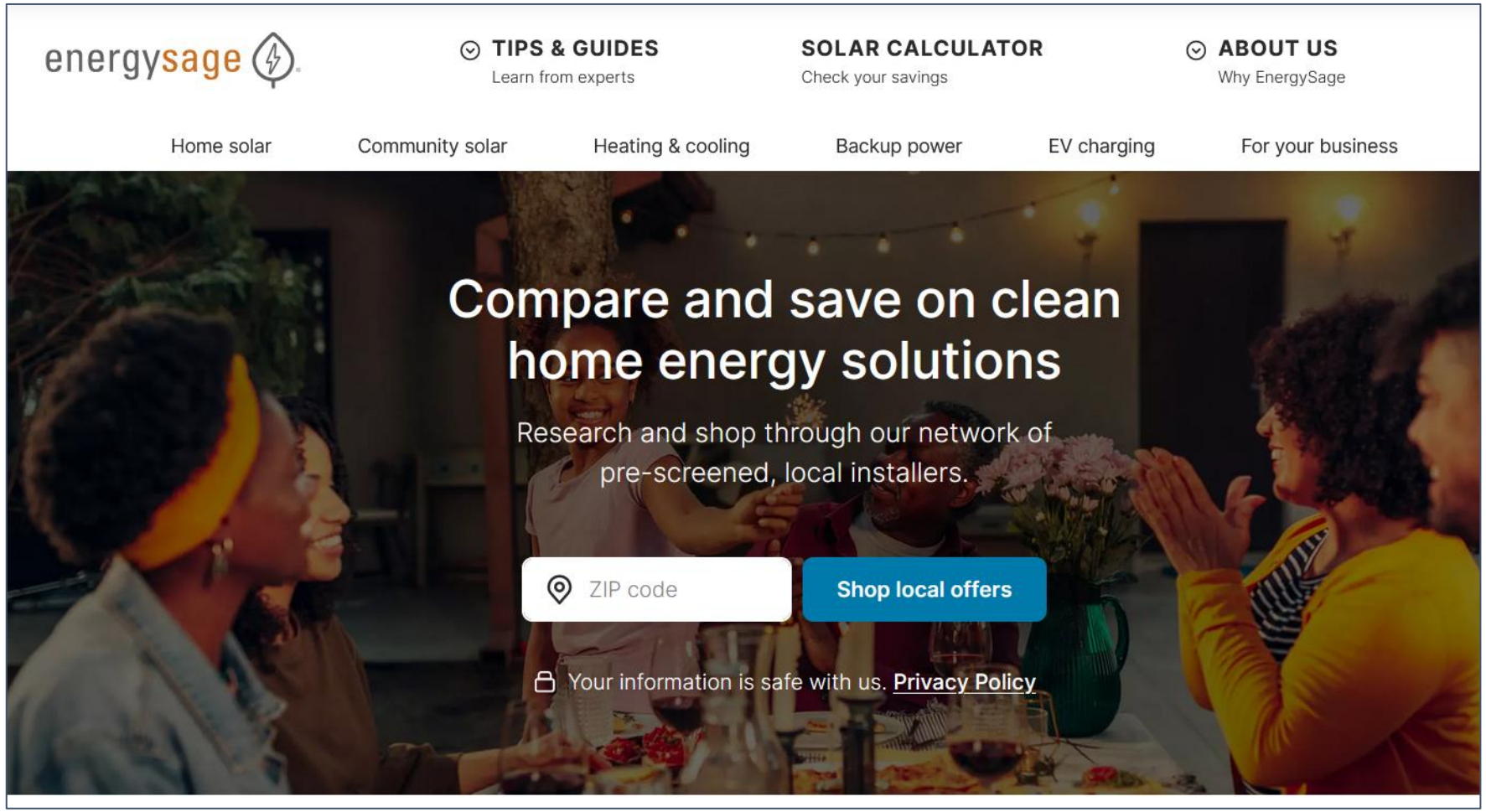
Click *Homeowners*, and then *Design my system*



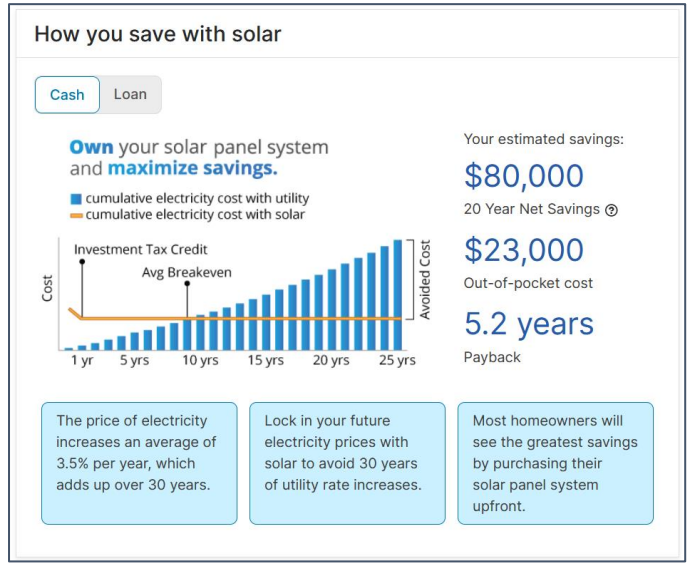


EnergySage: Information Hub, Pre-screen Installers

https://www.energysage.com/



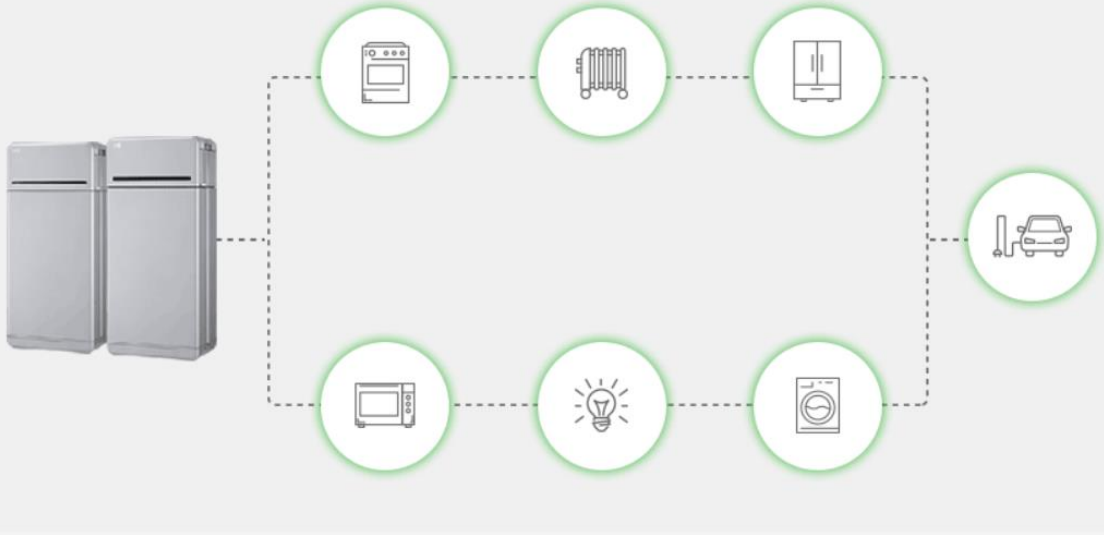
Sample Results from the 'Solar Calculator"



Manufactures often show estimates for their products' use:

This is useful information for a basic understanding of the capacity and duration of use for a battery system.

LG Energy Solution
ESS Battery Division



	16H x 2ea	**10H** x 2ea
Capacity	32 kWh	19.2 kWh
Power	14 kWh	10 kWh

GOALZERO

One Yeti PRO 4000 gives you 4,000 watt hours of backup power! That's enough to keep the essentials running for a whole day.

Power these devices simultaneously for a day with one Yeti PRO 4000.

Full Size Refrigerator
Run time: 24 Hours
(Uses about 67 W/hr):

WIFI Router
Run time: 24 Hours
(Uses about 25 W/hr):

60" TV
Run time: 4 Hours
(Uses About 80 W/hr):

Microwave
Run time: 15 Mins
(Uses 1000 W/hr):

4 LightBulbs
Run Time: 4 Hours
(Uses about 44 W/hr):

Phone
Charges 2
(Uses about 12 Wh per):

Laptop
Charges 2
(Uses about 51 Wh per):

Coffee Maker
1 Pot
(250 w/hr per):

Sizing and Cost Savings – Solar Calculator ‘WattPlan’

https://guide.pge.com

PG&E RESOURCES

Explore resources for PG&E Customers

Everything you need to reduce costs and maximize savings

RESET ALL

Solar Calculator

Make an informed decision about rooftop solar for your home. Calculate your solar savings potential with a personalized assessment with PG&E's Solar Calculator.

GENERATE SOLAR POWER | TOOLS AND CALCULATORS

Start Estimate >

Disadvantaged Communities – Single-Family Solar Homes (DAC-SASH) program

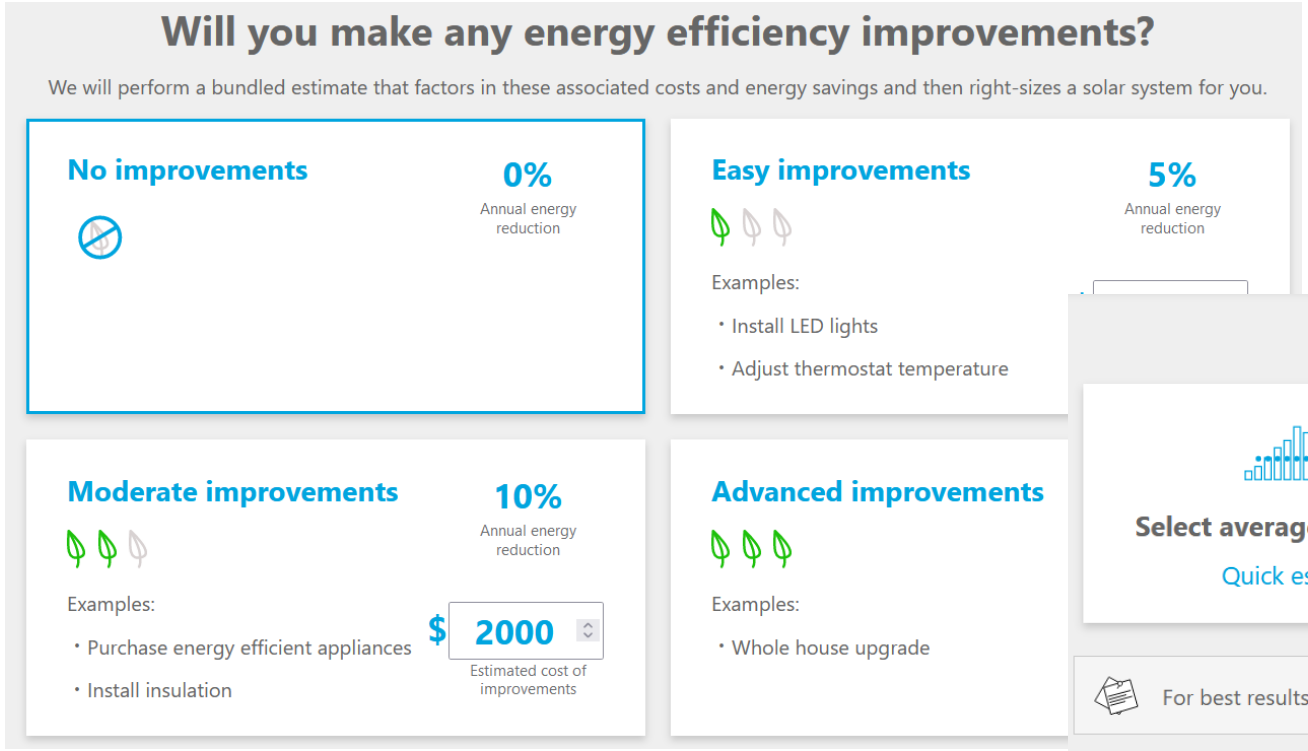
Learn more about available programs for income qualified customers in disadvantage communities

GENERATE SOLAR POWER | PROGRAMS, REBATES

Get Started >

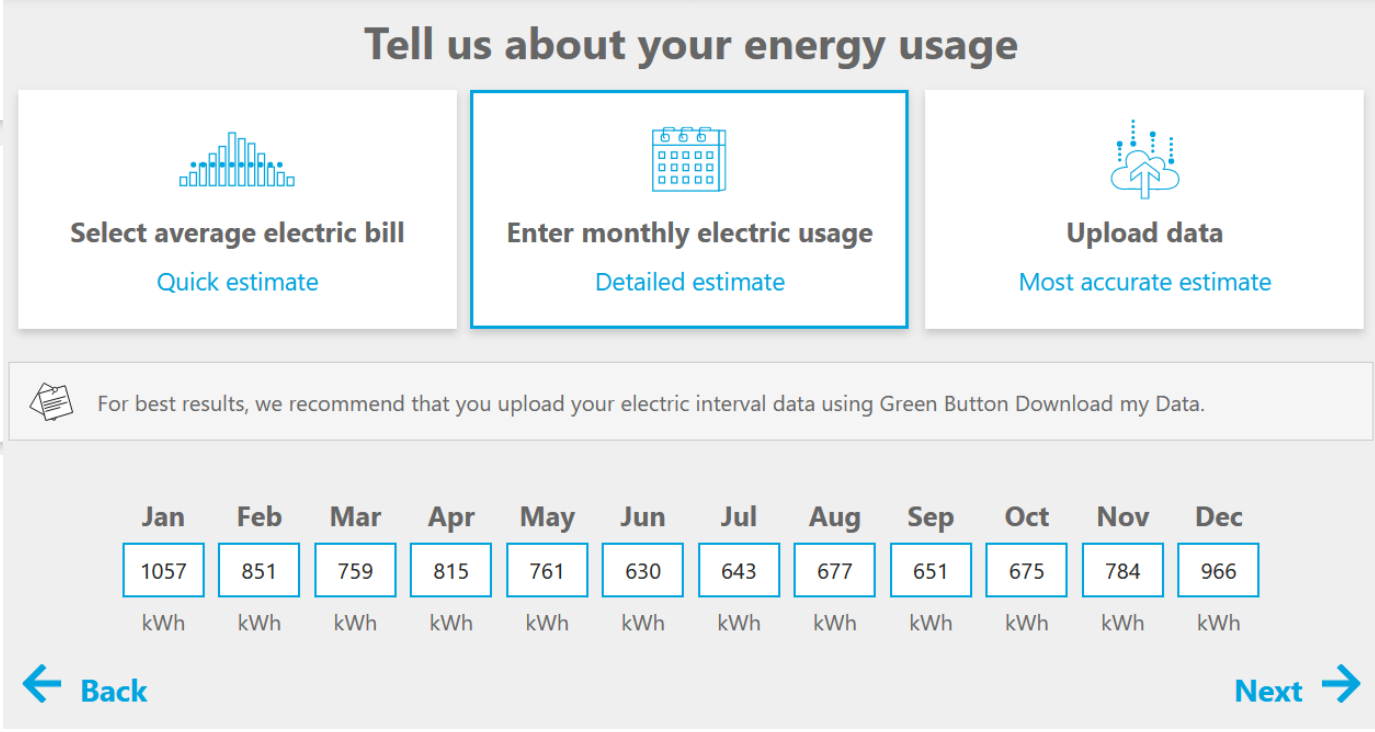
‘WattPlan’ - Information Gathering

https://pge.wattplan.com



Energy improvements can be accounted for in the financial calculations

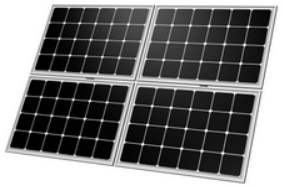
I entered monthly energy-use



Solar and Battery Details

My new plan

Electricity comes from utility & solar



5.3 kW
System size (DC)

14
Number of panels

5.320 kW
System size (DC)

4.549 kW
System size (AC)

9,099 kWh
System annual electricity production

My new plan

Solar is stored for use in the evening when energy costs are highest

13.5 kWh
Battery capacity

5.0 kW
Power, max continuous

Select an option

User can fine tune the battery parameters and costs

Storage

Storage can increase the amount of usage you can cover with generation from your solar system.

☑ Include storage?

Energy capacity: 13.5 kWh

0.5 — 27

Power, Max Continuous: 5.0 kW

1 — 10

Unit Price: $1,000 per kWh

100 — 2000

System Price: $13,500

Example of Additional Inputs and Assumption

Estimate assumptions	
Current annual electric bill	$4192, Time-of-Use (Peak Pricing 4-9 p.m. every day)
Installed solar unit price	$3 per W-DC
Storage system cost	$1000.0 per kWh

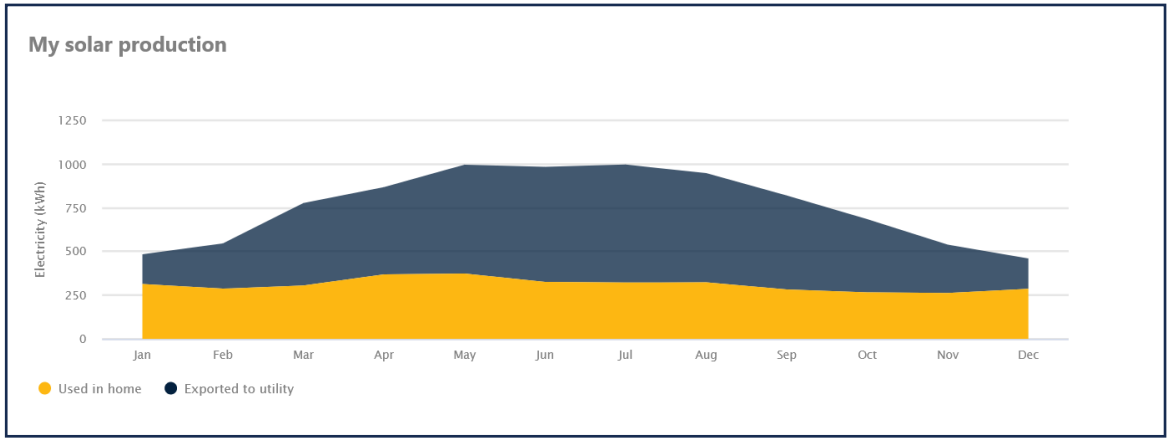
Summary	
Key financial results	
First year electric bill savings	$3,202
Breakeven year	7
Key assumptions	
Payment type	Cash
Solar system price	$15,960
Storage system price	$13,500
Utility rate increase	2% per year
Incentives available	
	$4,788 Federal Residential Solar Credit
	$4,050 Federal Battery Storage Credit
Next steps	
	Follow these steps to learn how to get started with installing solar today.

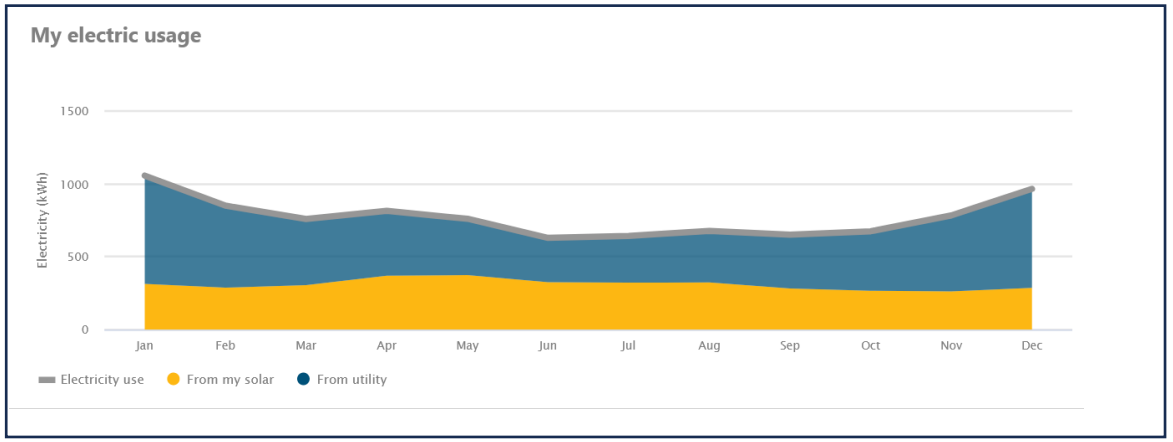
Includes ‘next steps’ for making a solar and/or battery system a reality

Graphic Results from ‘WattPlan’

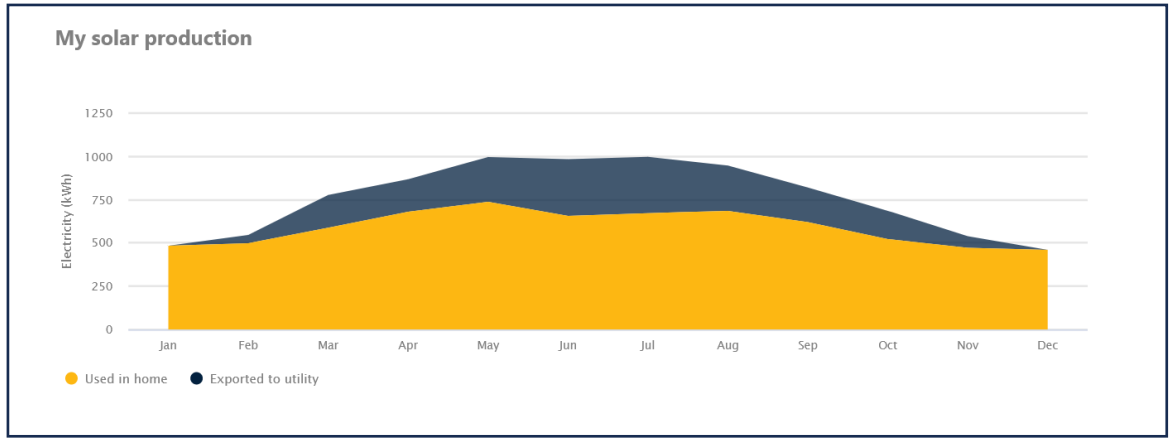
https://pge.wattplan.com

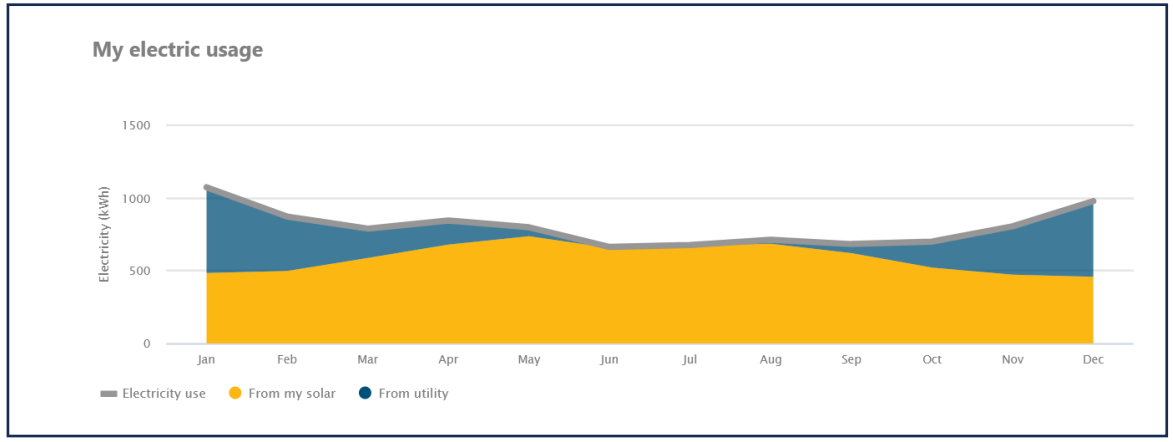
Solar without a Battery System





Solar with a Battery System





Same solar output and energy use, but the battery allows more of the produced energy to be used by ‘My’ household and not exported to the ‘Grid.’

Benefit of Battery Storage

If you can afford the upfront costs of the battery (assumed $13,500 installed):

- Save additional $9,307 over 20 yrs
- Additional year to ‘Breakeven’
- Very low utility bill (est. $82/mo)
- Power some critical loads during a power outage

Solar only

No	41%
Backup power	Solar energy used on site, not exported

Key financials

System cost	**$15,960**
Total incentives	**$4,788**
Net savings or (costs) over the next 20 years	**$33,184**
Breakeven	**Year 6**
Current average monthly bill	**$349**
Average monthly bill after solar	**$178**

Key features

- Solar system will export excess power to receive bill credits
- Solar generation shuts down during power outages unless special inverter is used

Solar and storage

Yes	78%
Backup power	Solar energy used on site, not exported

Key financials

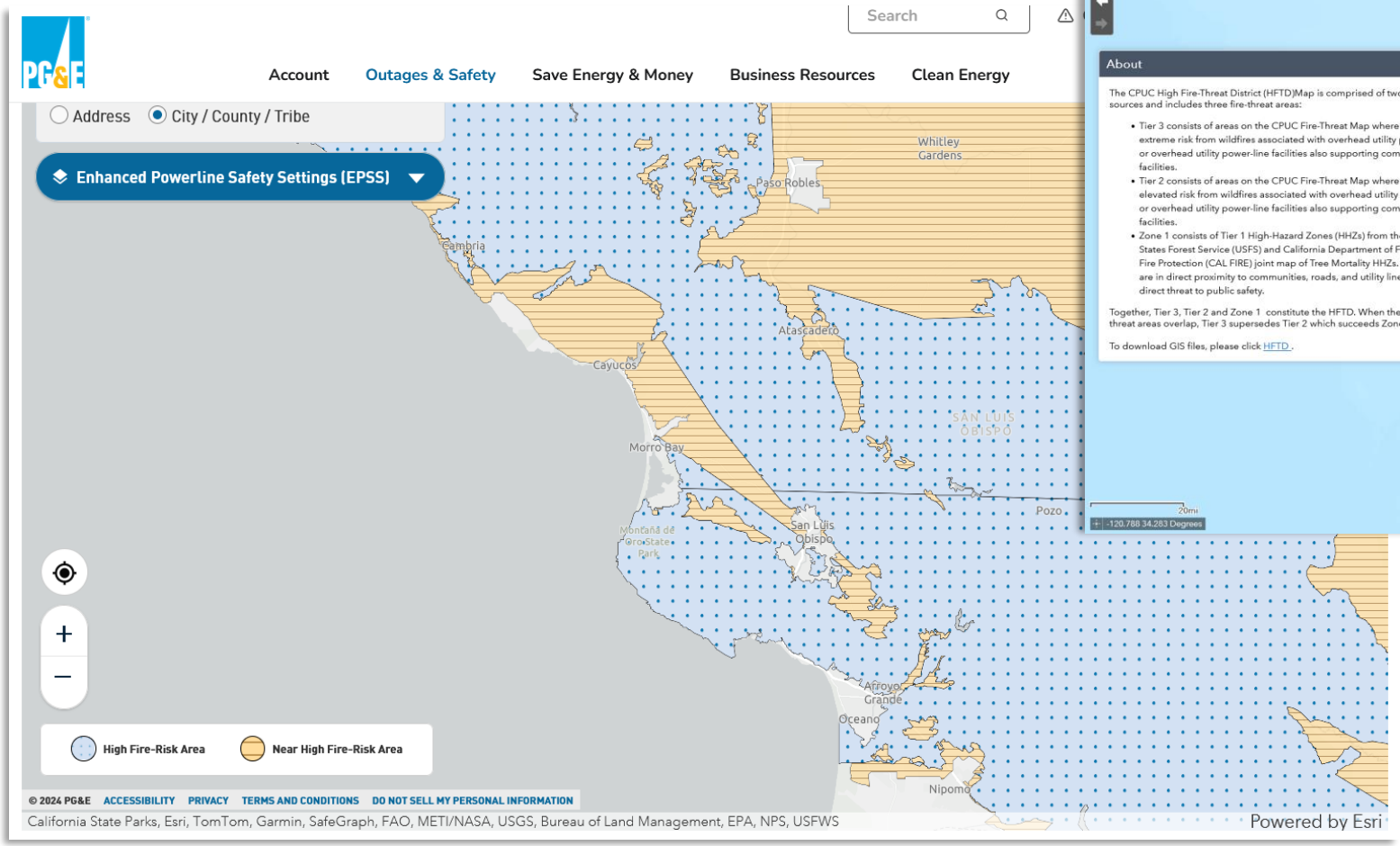
System cost	**$29,460**
Total incentives	**$8,838**
Net savings or (costs) over the next 20 years	**$42,491**
Breakeven	**Year 7**
Current average monthly bill	**$349**
Average monthly bill after solar + storage	**$82**

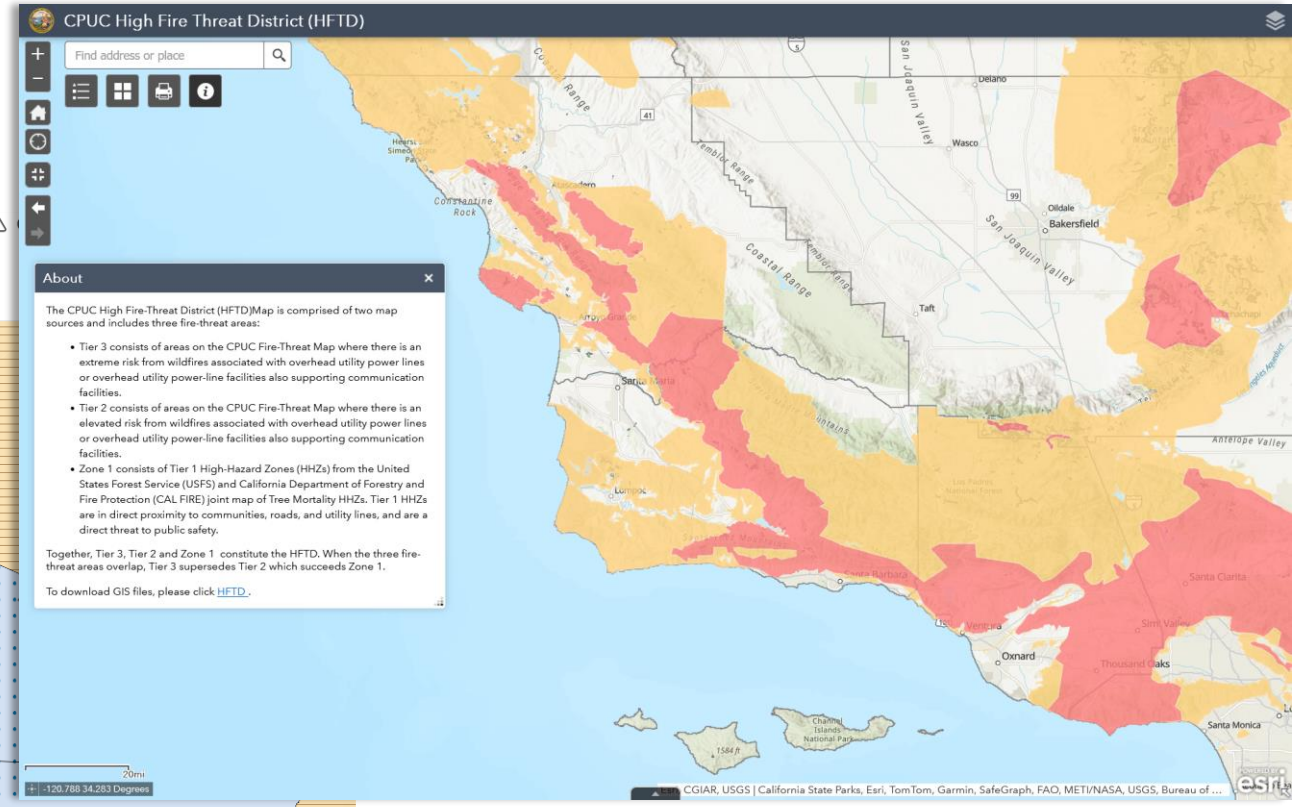
Key features

- Power critical appliances - or even your whole home - for a limited duration during power outages
- Use solar energy when the sun is shining, store excess solar power for use during evening peak hours, when electricity is most expensive

Battery Storage Rebates for Qualifying Utility Customers

Need to be in a Tier 2 or Tier 3 Fire Zones, and Enhanced Powerline Safety Settings districts – follow links to appropriate maps from PG&E website.





Nonresidential and High-Rise Residential

Energy Code – Highrise and Non-Res

2022 Code Applicable Occupancy Types:

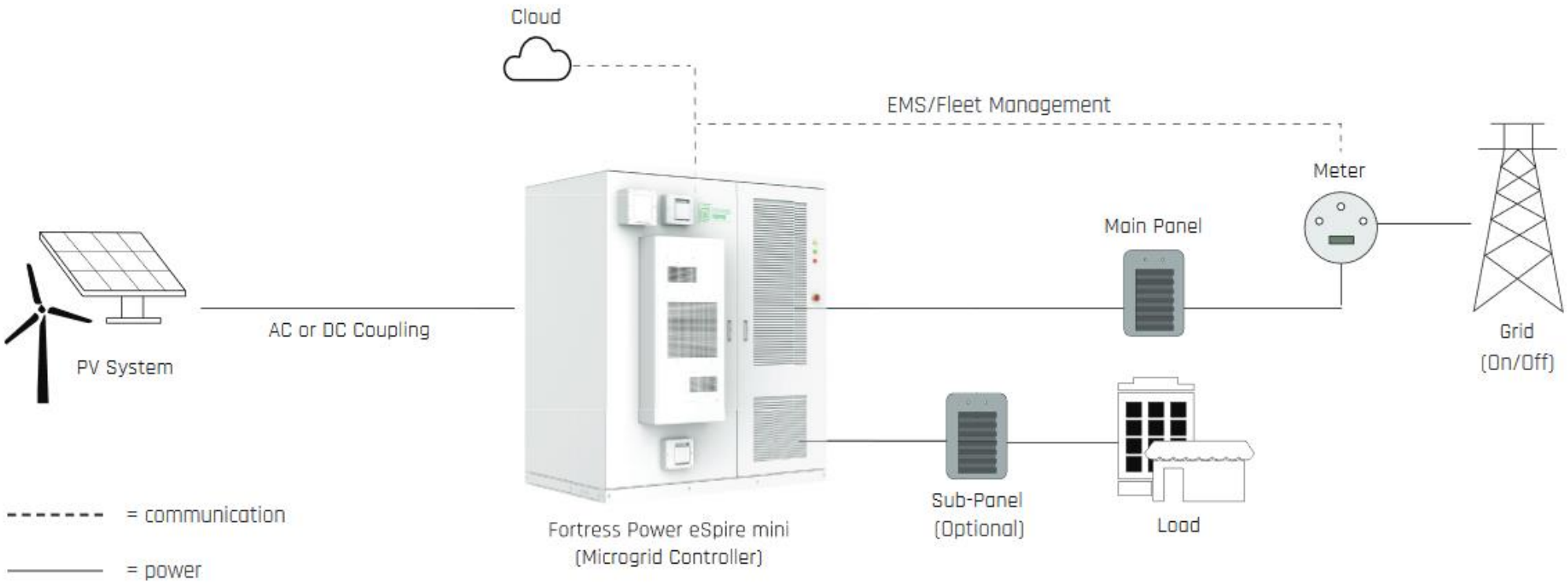
- High-Rise Residential
- Grocery
- Retail
- Restaurant
- Theater, Library
- School
- Warehouse
- Auditorium, Convention Center
- Hotel-Motel
- Office, Financial, or Unleased
- Clinic/Medical Office Building

Under the 2025 Code occupancies are expanded and some will have increased PV and Battery requirements. Restaurants for example have a dramatic increase.

Solar System size will depend on Occupancy Type, Conditioned Floor Area, etc. The Battery System size will depend on PV System Size.

Example of Commercial Scale System

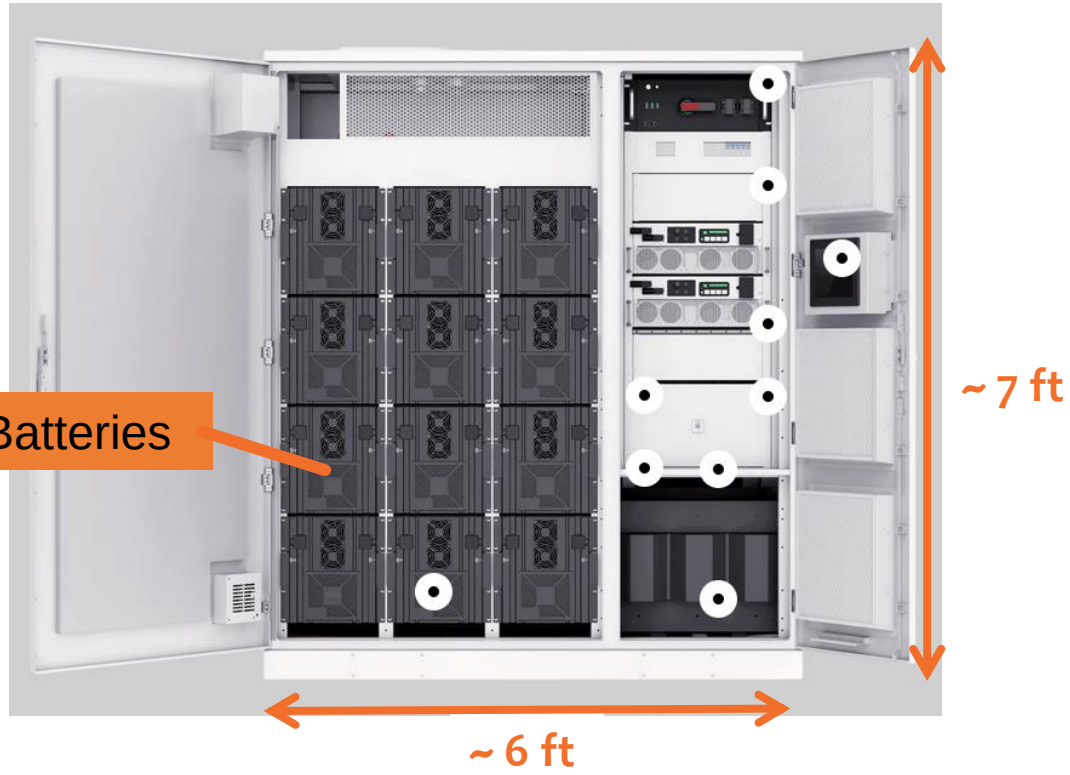
https://www.fortresspower.com



eSpireMini_022224

Integrated, Pre-configured Packaged
Battery Energy Storage System

Commercial Scale Battery Example



"Doors Open"

https://www.poshenergy.com

Stanford University EV Bus Fleet Solar with Battery Storage

Prescriptive Measure

PV System Size (kW_{dc}):

$$kW_{PV} = \frac{\textbf{CFA} \times \textbf{A}}{1000}$$

CFA: Conditioned Floor Area

A: Climate Zone Factor

or

kW_{PV} = 14 W/sq ft x **SARA**

SARA: Solar Accessible Roof Area

No PV required if:

- PV size < 4 kWdc;
- SARA < 80 sq ft contiguous or < 3% of the CFA
- Snow loading parameters

2025 Update:
PV Size = 14 W/sf x SARA, low-sloped roofs
PV Size = 18 W/sf x SARA, steep-sloped roofs

VTA Housing Ohlone Station, San Jose, CA (CZ 4)

Restaurant -- 2,000 sf
Retail – 3,500 sf
Office and Unleased – 7,000 sf

SARA = 4,500 sf

kW_{PV} = (**2000** x 0.44)+(**3500** x 2.91) +(**7000** x 3.13) /1000

kW_{PV} = 33 kW

OR

kW_{PV} = 14 W/sf x 4,500 sf /1000

kW_{PV} = 63 kW

Use for the 2022 Code:

Table 140.10-A – PV Capacity Factors

-	Factor A – Minimum PV Capacity (W/ft² of conditioned floor area)		
Climate Zone	**1, 3, 5, 16**	**2, 4, 6-14**	**15**
Grocery	2.62	2.91	3.53
High-Rise Multifamily	1.82	2.21	2.77
Office, Financial Institutions, Unleased Tenant Space	2.59	3.13	3.80
Retail	2.62	2.91	3.53
School	1.27	1.63	2.46
Warehouse	0.39	0.44	0.58
Auditorium, Convention Center, Hotel/Motel, Library, Medical Office Building/Clinic, Restaurant, Theater	0.39	0.44	0.58

Applies to new construction as **listed in Table 140.10-A** or mixed occupancy where one or more of these building types constitute at least 80% of the floor area of the building.

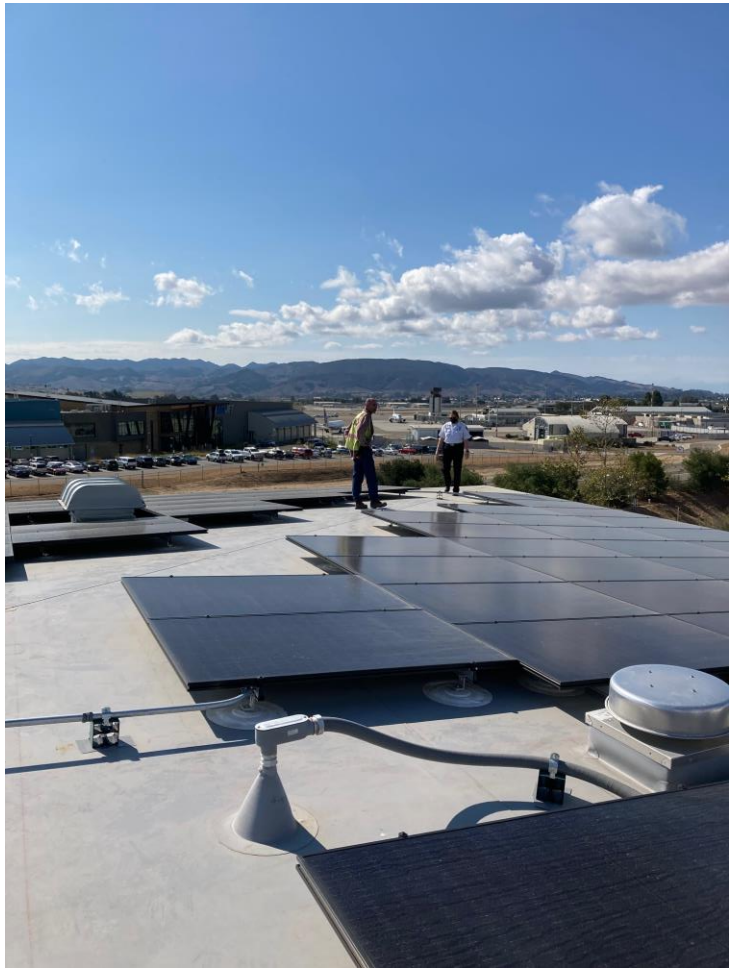
NEW Table for 2025 Code

Table 140.10-A – PV Capacity Factors (W/ft² of conditioned floor area)

Building Type	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16
Events & Exhibits	3.48	4.28	3.66	4.32	3.77	4.05	4.28	4.83	4.63	4.80	5.04	4.44	4.95	4.36	5.48	3.38
Library	0.39	3.23	2.59	3.25	2.48	2.74	3.04	3.49	3.32	3.69	3.79	3.32	3.79	3.37	4.49	2.84
Hotel/Motel	1.69	1.90	1.66	1.97	1.69	1.87	1.94	2.22	2.09	2.20	2.30	2.05	2.30	2.02	2.72	1.73
Office, Financial Institution, Unleased Tenant Space, Medical Office Building/Clinic	2.59	3.13	2.59	3.13	2.59	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.80	2.59
Restaurants	8.55	9.32	8.16	9.65	8.21	8.73	9.11	10.18	9.75	10.28	10.85	9.73	10.69	9.73	12.25	8.47
Retail, Grocery	3.14	3.49	3.01	3.61	3.05	3.27	3.45	3.83	3.65	3.81	4.09	3.64	3.99	3.71	4.60	3.21
School	1.27	1.63	1.27	1.63	1.27	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	2.46	1.27
Warehouse	0.39	0.44	0.39	0.44	0.39	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.58	0.39
Religious Worship	4.25	4.65	3.49	4.52	3.72	4.29	4.64	5.89	5.30	5.67	5.89	4.99	5.78	4.63	7.57	3.90
Sports & Recreation	2.47	1.97	1.54	2.03	1.60	1.84	1.98	2.63	2.47	2.60	2.75	2.20	2.72	2.15	4.03	1.81
Multifamily > 3 stories	1.82	2.21	1.82	2.21	1.82	2.21	2.21	2.21	2.21	2.21	2.21	2.21	2.21	2.21	2.77	1.82

Applies to new construction as **listed in Table 140.10-A** or mixed occupancy where one or more of these building types constitute at least 80% of the floor area of the building.

Solar Access Roof Area (SARA)



- Area of a buildings' roof space capable of supporting PV system
- Area of all roof space on covered parking areas, carports and other newly constructed structures onsite that are compatible with supporting a PV system per CBC 1511.2

Exceptions:

- Any roof area that has <70% annual solar access
- Occupied roof areas per CBC 503.1.4
- Roof area not otherwise available due to compliance with other State Building Code requirements, and local codes if confirmed by the Executive Director

Battery Storage - 2022 Code

All buildings **required** to have a **PV system** shall also have a **battery storage system**.

Reminder: Battery system must meet **both** rated **energy** capacity (kWh) and the rated **power** capacity (kW) Calculate the energy and power capacities for each occupancy type in mixed use buildings, and sum the values.

Rated Energy capacity :

$$kWh = kW_{PVdc} \times B / D^{0.5}$$

D is the rated single charge-discharge cycle AC to AC efficiency of the battery (Between 0.80 and 0.95 is common.)

Rated Power capacity:

$$kW = kW_{PVdc} \times C$$

Table 140.10-B – Battery Storage Capacity Factors

-	Factor B – Energy Capacity	Factor C – Power Capacity
Storage-to-PV Ratio	Wh/W	W/W
Grocery	1.03	0.26
High-Rise Multifamily	1.03	0.26
Office, Financial Institutions, Unleased Tenant Space	1.68	0.42
Retail	1.03	0.26
School	1.87	0.46
Warehouse	0.93	0.23
Auditorium, Convention Center, Hotel/Motel, Library, Medical Office Building/Clinic, Restaurant, Theater	0.93	0.23

Battery Storage

Exceptions:

- If installed PV system size < 15% of the size determined by Equation 140.10-A
- In buildings with system requirements with < 10 kWh rated capacity

Exemption removed under 2025

- ~~In climate zone 1, no battery storage system is required for offices, schools, and warehouses~~.

Note: For multi-tenant buildings the energy and power capacities of the battery storage system shall be based on the tenant spaces with more than 5,000 ft^2 of conditioned floor area.

Example of a Commercial System

eSpire 280 Energy Storage System

Safe Technology & Multi-level Protection

The solution uses the best-in-class Tier 1 Lithium Iron Phosphate (LFP) chemistry forthe highest level of safety, thermal stability, and reliability; An integrated, multi-levelBattery Management System (BMS) monitors, optimizes, and balances the system.

2022 Code: Battery Size – Based on PV System Size

Restaurant -- 2,000 sf
Retail – 3,500 sf
Office – 7,000 sf

Take **Exemption**: Need only calculate for separate tenant space 5000 sf or more

kW_{PVdc} = (7000 x 3.13) /1000

= 21.9 kW

Energy Capacity:

kWh = kW_{PVdc} x B / $D^{0.5}$

= 21.9 x 1.68 / $.89^{0.5}$

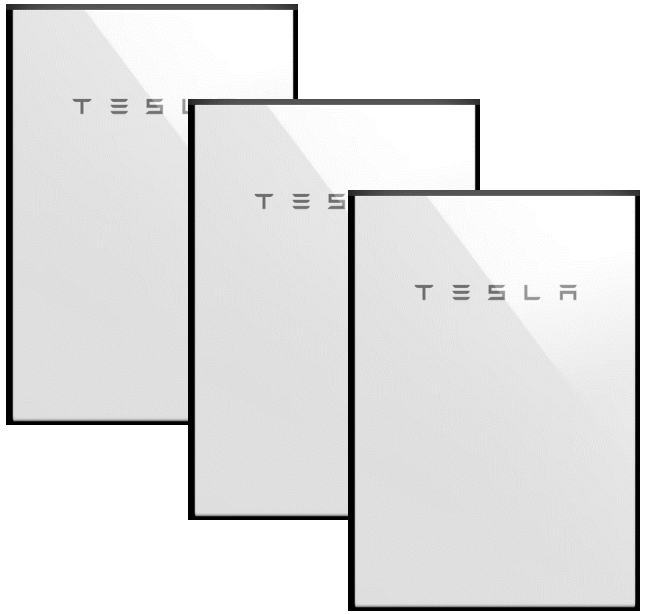
= 39.14 kWh

Power Capacity:

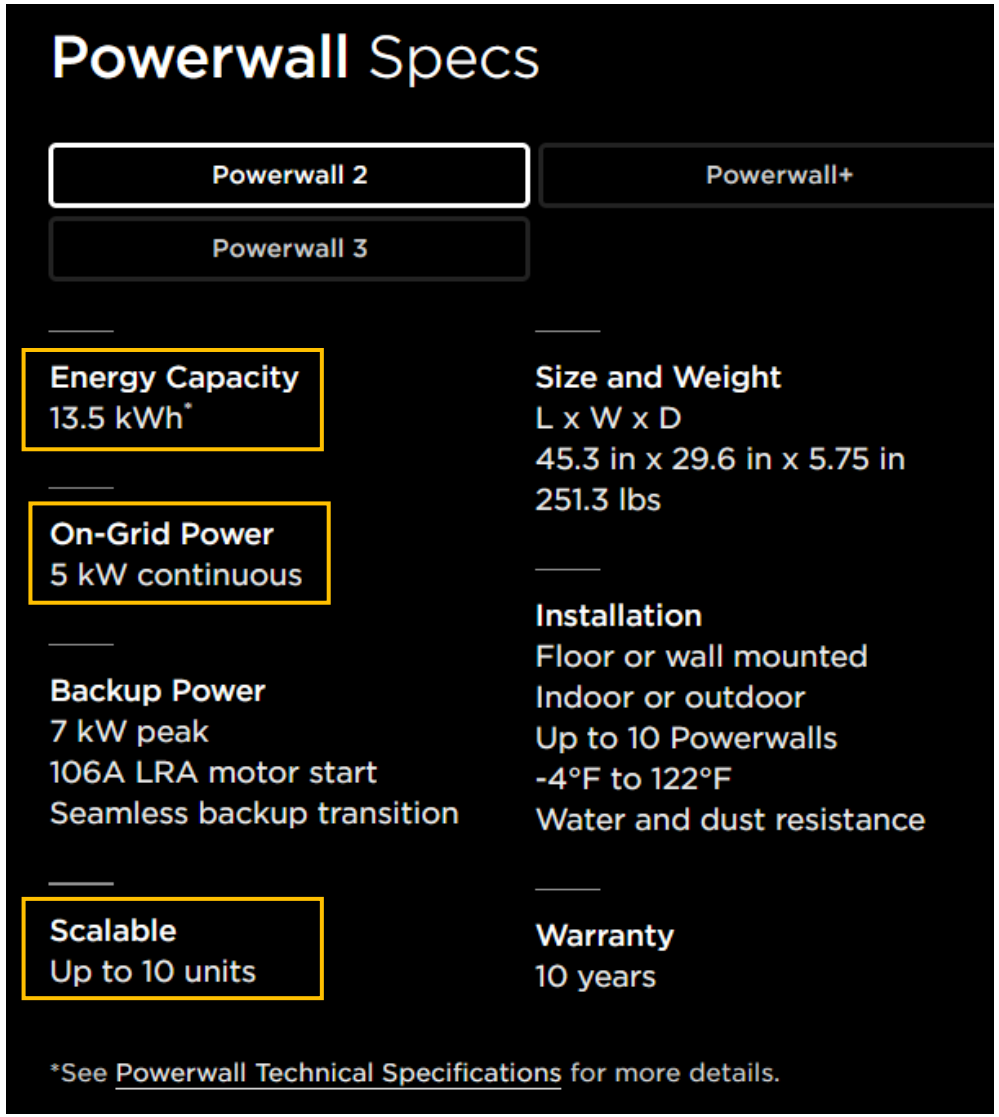
kW = kW_{PVdc} x C

= 21.9 x .42

= 9.20 kW



Consider (3) Power Walls



Battery Energy Storage System (BESS) – 2025 Code

All buildings **required** to have a **PV system** shall also have a **battery storage system**.

Reminder: Battery system must meet **both** rated **energy** capacity (kWh) and the rated **power** capacity (kW) Calculate the energy and power capacities for each occupancy type in mixed use buildings, and sum the values.

New formulas

Rated Energy Capacity :

$$kWh_{batt} = (CFA \times B) / (1000 \times C^{0.5})$$

CFA: Conditioned Floor Area
B: BESS Capacity Factor in Wh/sf from Table 140.10-B
C is the rated single charge-discharge cycle AC to AC efficiency of the BESS
(Between 0.80 and 0.95 is common.)

SARA Adjusted Rated Energy Capacity :

$$kWh_{batt} = ((CFA \times B) / (1000 \times C^{0.5})) \times (kW_{PVdc,SARA} / kW_{PVdc})$$

kW_{PVdc} : From PV Capacity calculation

Rated Power capacity:

$$kW_{batt} = kWh_{batt} / 4$$

NEW Table for 2025 Code

Table 140.10-B –BESS Capacity Factors (Wh/ft² of conditioned floor area)

Building Type	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16
Events & Exhibits	1.82	1.95	1.74	2.12	1.91	2.13	2.24	2.30	2.36	2.47	2.62	2.16	2.64	2.68	3.22	1.89
Library	0.37	7.17	5.97	6.75	5.64	6.08	6.19	7.13	7.18	7.56	7.17	6.93	6.88	6.81	7.93	6.40
Hotel/Motel	0.86	0.84	0.77	0.92	0.81	0.89	0.90	1.01	1.00	1.11	1.14	0.96	1.18	1.18	1.49	0.85
Office, Financial Institution, Unleased Tenant Space, Medical Office Building/Clinic	NR[1]	5.26	4.35	5.26	4.35	5.26	5.26	5.26	5.26	5.26	5.26	5.26	5.26	5.26	6.39	4.35
Restaurants	4.36	4.11	3.78	4.37	3.89	4.02	4.11	4.49	4.47	4.82	5.05	4.43	5.05	5.24	6.23	4.11
Retail, Grocery	1.89	1.82	2.70	1.82	1.72	1.80	1.76	1.92	1.97	2.05	2.22	1.95	2.16	2.29	2.66	1.91
School	NR[1]	3.05	2.38	3.05	2.38	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	4.60	2.38
Warehouse	0.37	0.41	0.37	0.41	0.37	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.54	0.37
Religious Worship	2.21	2.25	1.74	2.42	2.08	2.75	2.94	3.37	3.17	3.37	3.58	2.72	3.62	3.21	4.89	2.37
Sports & Recreation	1.26	0.98	0.76	1.14	0.86	1.20	1.23	1.57	1.53	1.65	1.83	1.27	1.86	1.57	3.02	1.13
Multifamily > 3 stories	1.88	2.27	1.88	2.27	1.88	2.27	2.27	2.27	2.27	2.27	2.27	2.27	2.27	2.27	2.85	1.88

Footnote to TABLE 140.10-B:

1. NR = Not Required

Photovoltaic (PV) and Battery – NRCC-SAB-E

Sample form with instructions is available on the CEC's website. Use the Energy Code Ace Forms Tool website for completing the NRCC-SAB-E form for permit.

STATE OF CALIFORNIA
Solar And Battery CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF COMPLIANCE		NRCC-SAB-E
Project Name: MG Rancho Mission Viejo East and West	**Report Page:**	**(Page 4 of 6)**
	Date Prepared:	2024-07-25T13:19:56-04:00

J. PHOTOVOLTAIC (PV) AND BATTERY SYSTEMS

This table documents compliance with prescriptive photovoltaic and battery system requirements in 140.10/ 170.2(g and h). Unless the project meets one of the listed exceptions, or trades-off PV in an energy model using performance path, 140.10/ 170.2(g and h) requires installed photovoltaic and battery systems for newly constructed buildings. The installed PV systems must meet the minimum requirements in Joint Appendix 11.

Photovoltaic (PV) System

01	02	03	04	05	06	07	08
Occupancy	Conditioned Floor Area (ft^2)	Area of New Roof[1] (ft^2)	Roof Area < 70% Solar Access[2] (ft^2)	Plansheet or Document showing Solar Access Calculations	Occupied Roof Area[3] (ft^2)	Solar Access Roof Area (SARA) (ft^2)	Min Size of PV System Required (kWdc)
High-Rise Residential	225,531	57,682	21,073	MEP roof plans	2,000	34,609	484.53
						Total Min Size PV System Required for all Spaces (kWdc):	484.53
						Total Size PV System in Design (kWdc):	500

[1]FOOTNOTES: Includes the area of the building's roof space capable of structurally supporting a PV system and the area of all roof space on covered parking areas, carports, and all other newly constructed structures on the site that are compatible with supporting a PV system per Title 24, Part 2 Section 1511.2.
[2]Solar access must be determined using CEC approved solar access calculation tools found at https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/solar-assessment-tools.
[3]As specified by CBC Section 503.1.4.

Battery Storage System

01	02	03	04	05
Space Type	Min Size of PV Applicable To Battery Sizing (kWdc)	Rated Single Charge-Discharge AC Efficiency of Battery System[1]	Min Battery Rated Energy Capacity Required (kWh)	Min Power Capacity of Battery Required (kWdc)
High-Rise Residential	484.53	0.92	520.31	125.97
		Total Min Energy (kWh) and Power (kW) Capacity Required	520.31	125.98
		Total Energy (kWh) and Power (kW) Capacity in Design	529	143

[1]FOOTNOTE: Rated single charge-discharge cycle AC to AC (round trip) efficiency of the battery storage system

Excerpt from the Ace Forms Tool interview:

Solar & Battery Scope

This form is used to demonstrate compliance with prescriptive PV and battery requirements in §140.10/§170.2 for nonresidential, multifamily and mixed-use buildings and prescriptive solar thermal requirements in §170.2(d)3C for multifamily and hotel/ motel occupancies.

Which of the following occupancy types are included in your project? (Select all that apply)

Gymnasium Building, High-Rise Residential, Office Building & 4 more

Which of the following choices best describes the scope of your roof project? §110.10

New construction

How many above grade stories are on this project?

Building 4-10 stories

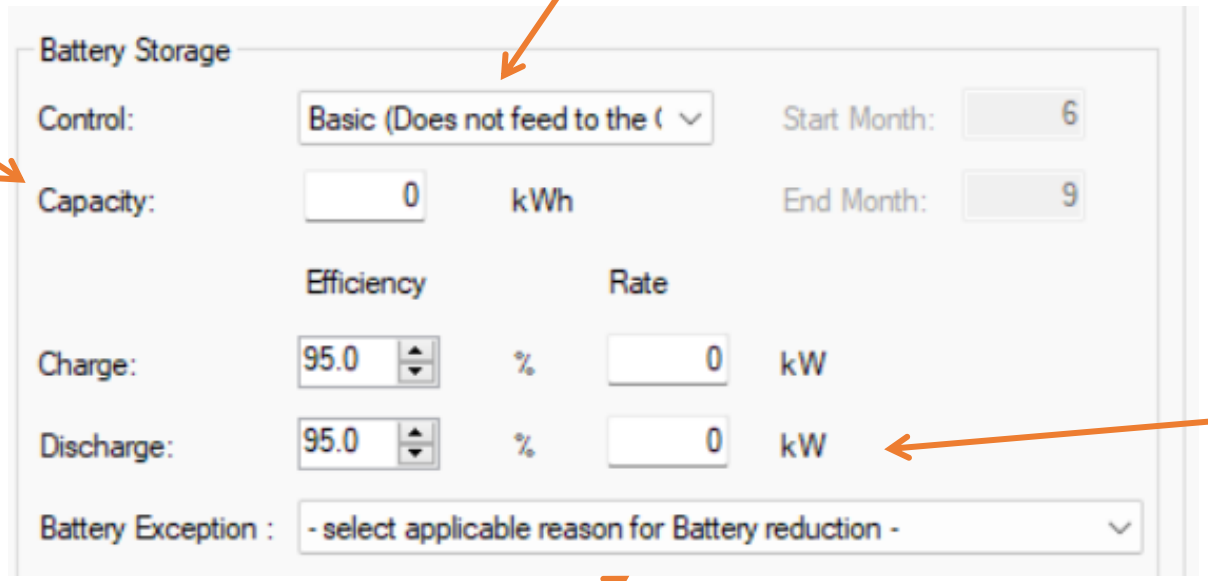
Performance Method –Example of EnergyPro v9 Input

Additional Credit can be used for reducing the “carbon” Source Metric

Control Options:

- **Basic** (Does not feed to the Grid)
- **Time of Use** [*need ‘Start Month’ and ‘End Month’*]
- **Advances DR Controls** [i.e., *Advanced Demand Response Controls / JA12 Advanced Demand Flexibility Control*]

Energy Capacity (kWh) is obtained from manufacture.



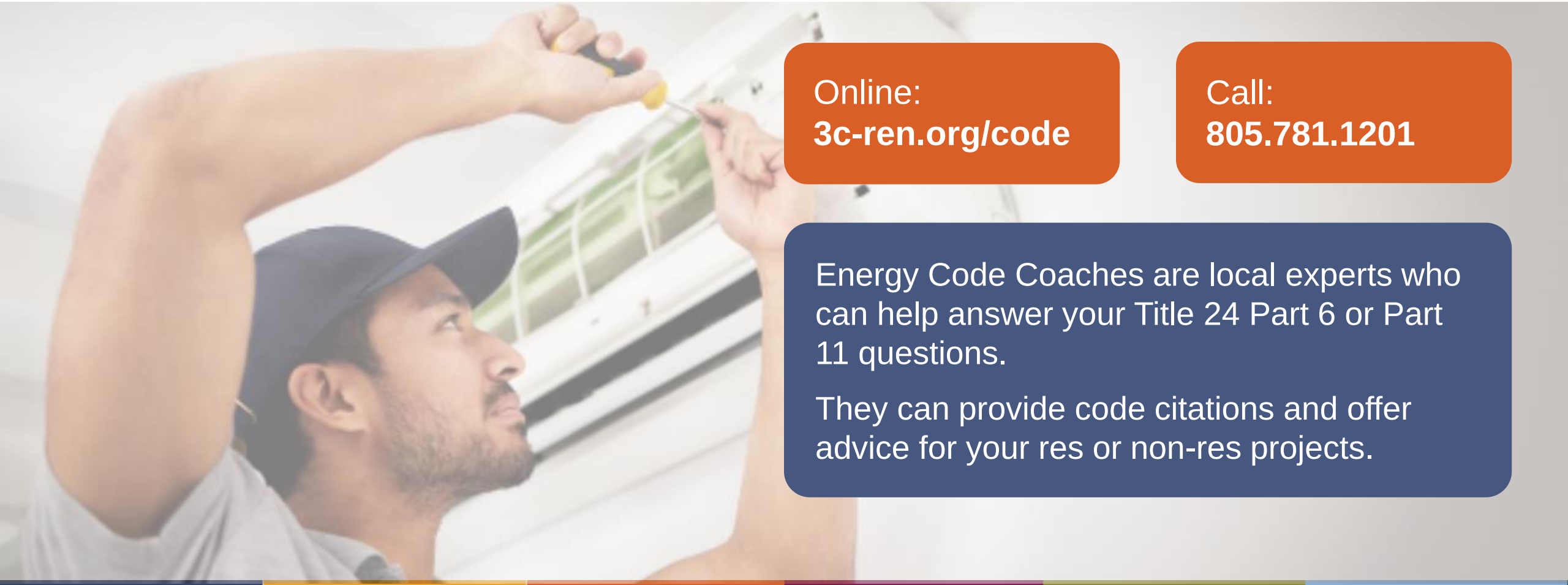
Battery Charge and Discharge Efficiency is a 95% default. [*Equivalent to 90% round trip efficiency]*

Rate of Charge and Discharge is obtained from manufacture.

Note: Battery Exceptions apply to Non-Res occupancies and Multi-Family high-rise buildings (greater than 3 stories).

Questions about Title 24?

3C-REN offers a *free* Code Coach Service



Online:
3c-ren.org/code

Call:
805.781.1201

Energy Code Coaches are local experts who can help answer your Title 24 Part 6 or Part 11 questions.

They can provide code citations and offer advice for your res or non-res projects.

Closing

Continuing Education Units Available

- Contact chloe.swick@ventura.org for AIA LUs

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- Slides, Recording, & Survey – Please Take It and Help Us Out!

Upcoming Courses:

- Certified Passive House Designer/Consultant Spring Cohort, 4/9
- Introduction to the Passive House Standard, 4/17
- Higher-Performance Residential Remodels, 4/24
- Practical Ways to Address Embodied Carbon, 5/1
- Electrification Products for the Central Coast Climate, 5/6

Any phone numbers who joined? Please share your name!

Thank you!

More info: **3c-ren.org**

Questions: **info@3c-ren.org**

Email updates: **3c-ren.org/newsletter**

3C-REN

TRI-COUNTY REGIONAL ENERGY NETWORK

SAN LUIS OBISPO • SANTA BARBARA • VENTURA