



California
**ELECTRIC
HOMES**

EPRI

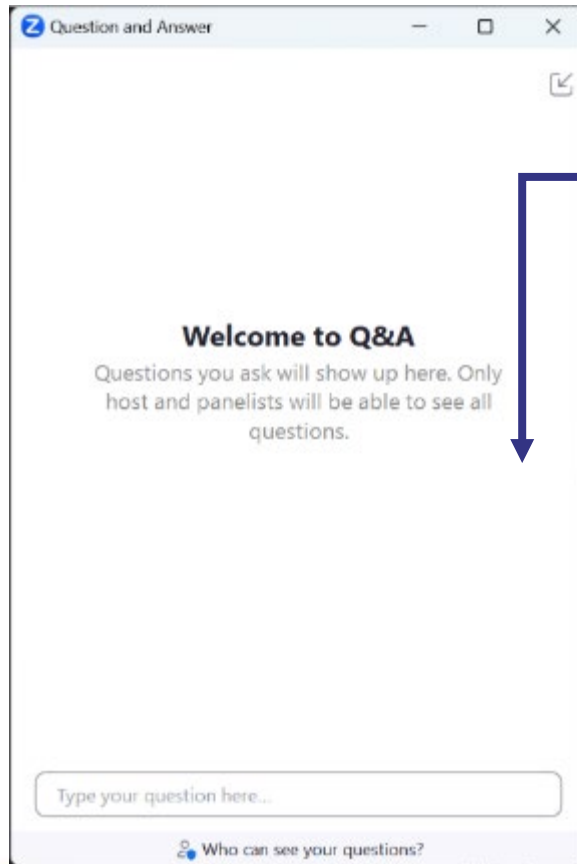
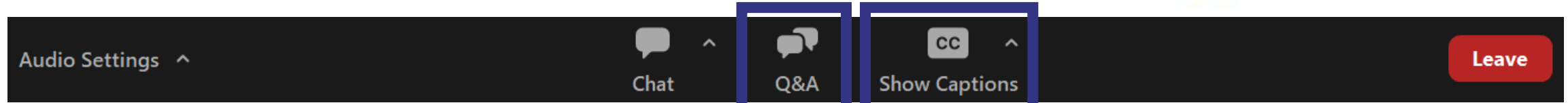


Empowering Homes with Energy Storage

Dave Stevens – Electric Power Research Institute
Melinda Dinin – California Electric Homes

December 12, 2024

HOW TO PARTICIPATE IN ZOOM



Q&A

Enter Questions in Q&A window. Questions will be answered at the end.

Show Captions

Click "Show Captions" to enable captions and select arrow (^) to select language.

INTRODUCTIONS

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AGENDA

- Welcome and Introductions ✓
- About CalEHP
- California Energy Storage Overview
- Benefits
- Extra Information, Tips, & Tricks
- Incentives from CalEHP
- Discussion



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ABOUT CalEHP



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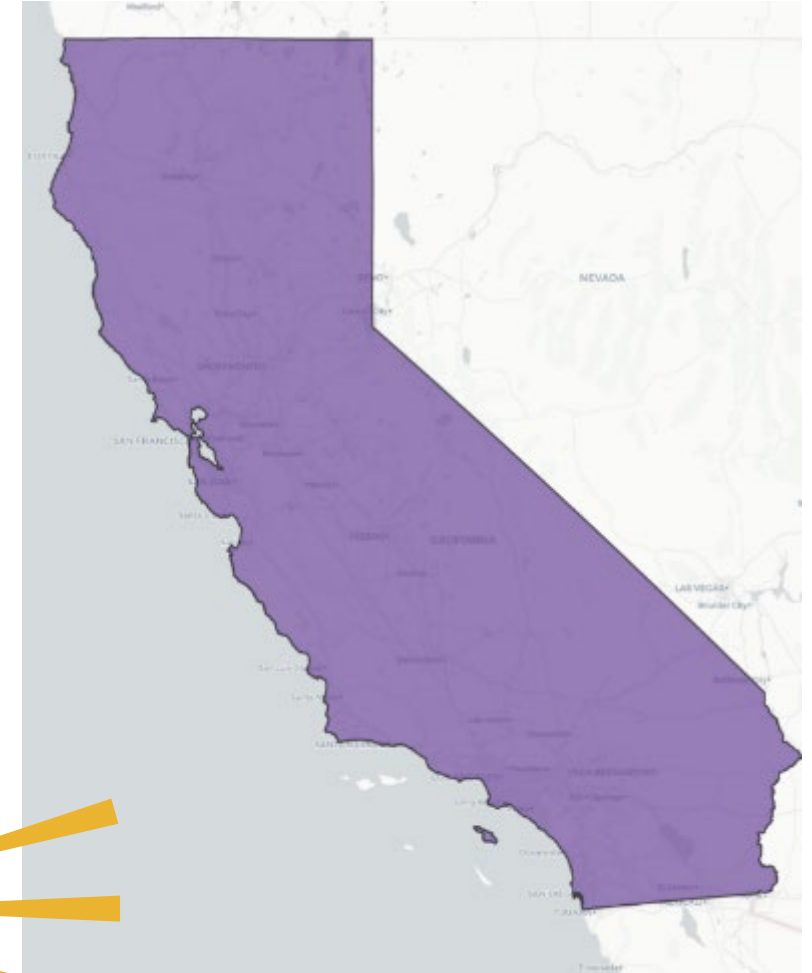
Eligibility: All-electric residential new construction

- **Territory:** All of California
- **Building Type:** Single family, duplexes, triplexes, condos, low-rise and high-rise multifamily, ADUs, modular, and manufactured homes
- **Income Restrictions:** Market-rate



Incentive Funding from the CEC: \$58M total available funding that includes \$10M designated for energy storage

- **Energy Storage**
- **Bonus Incentives:** Envelope and mechanical packages, DAC/HTR, load management
- **Technical Assistance for battery storage & more**





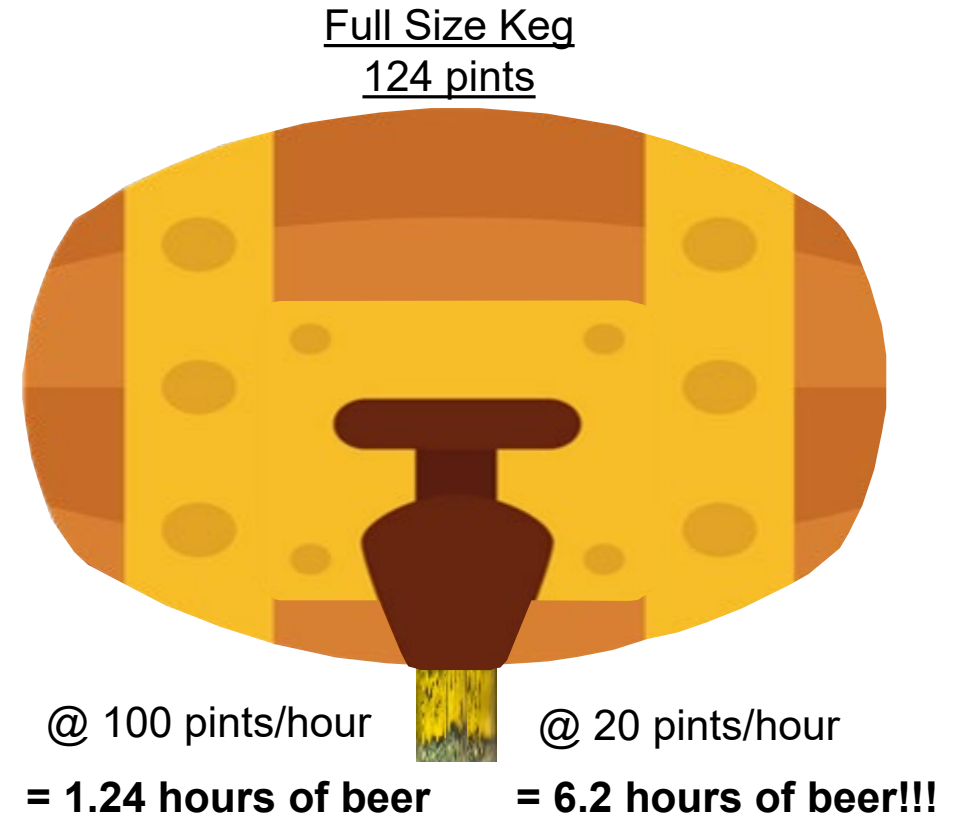
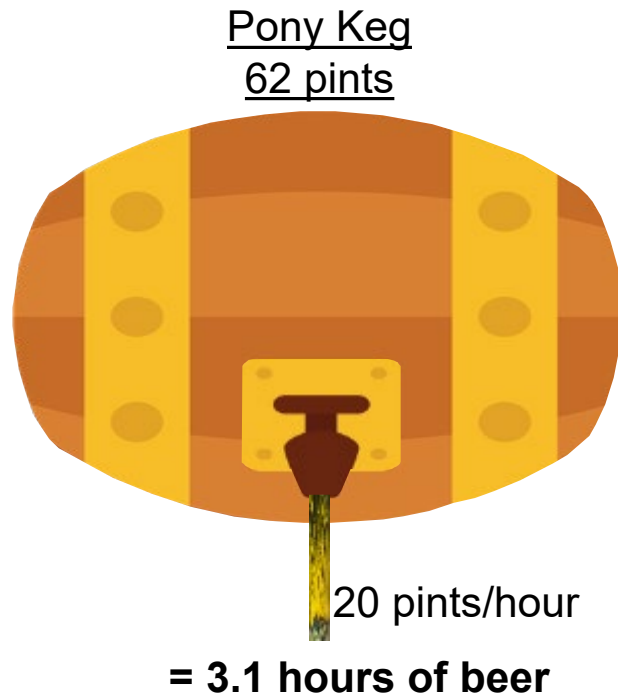
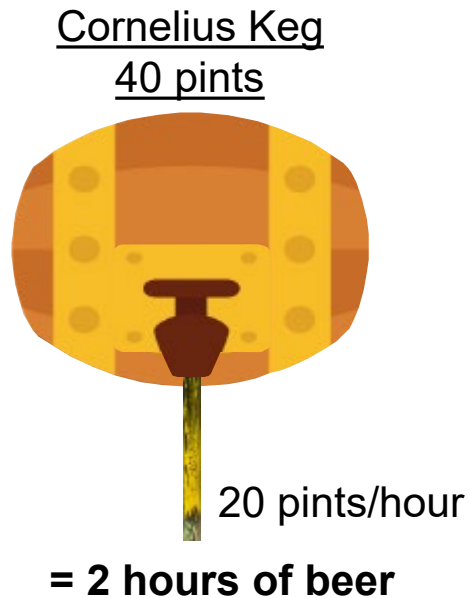
California Energy Storage Overview

Power, Energy, and Beer

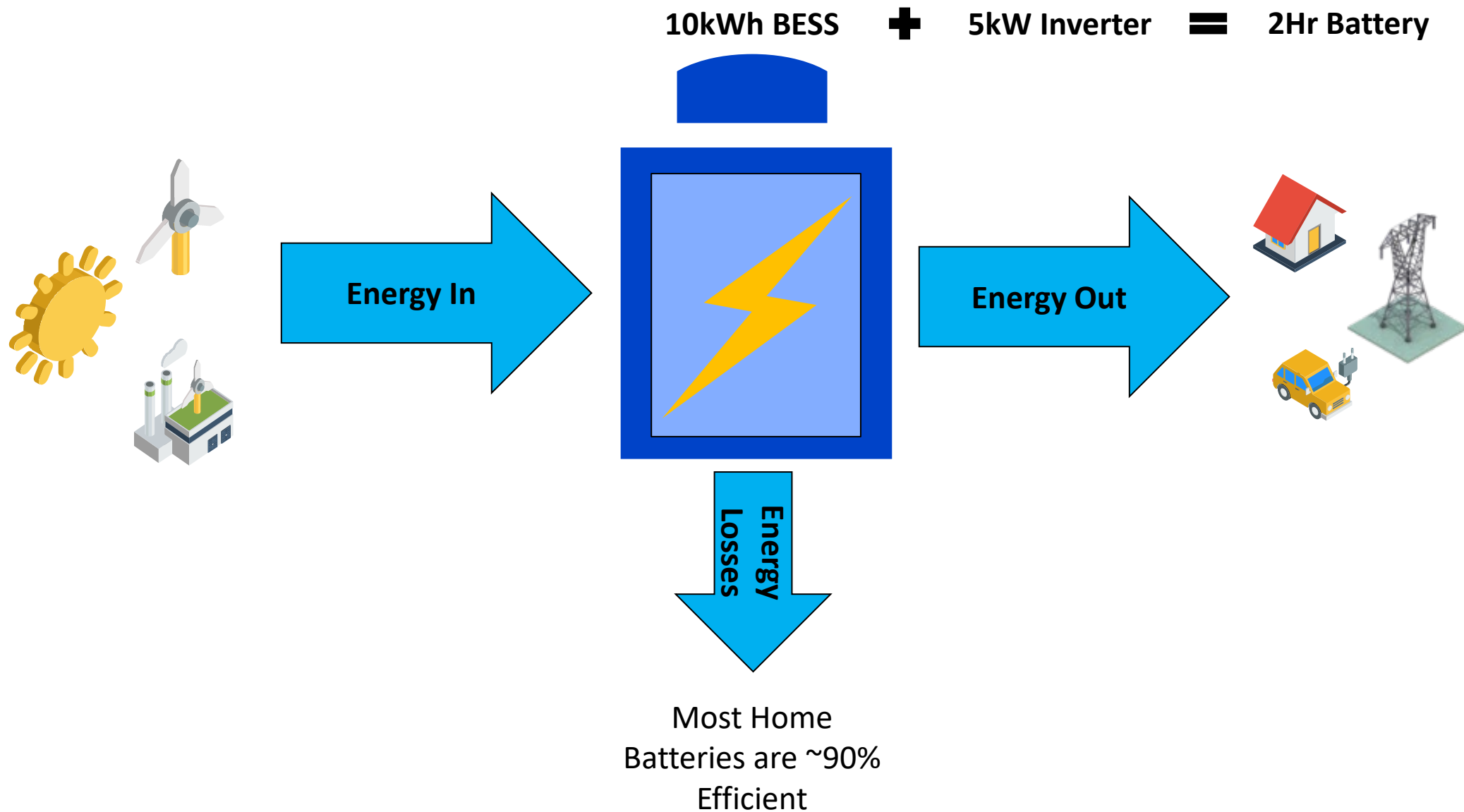
Energy (kilowatt-hours) is analogous to the **keg size** (pints)

Power (kilowatts) is analogous to the keg's **flow rate** (pints/hour)

- Knowing the power (keg flow rate) and energy (amount of beer) we know how long we will have electricity (beer)

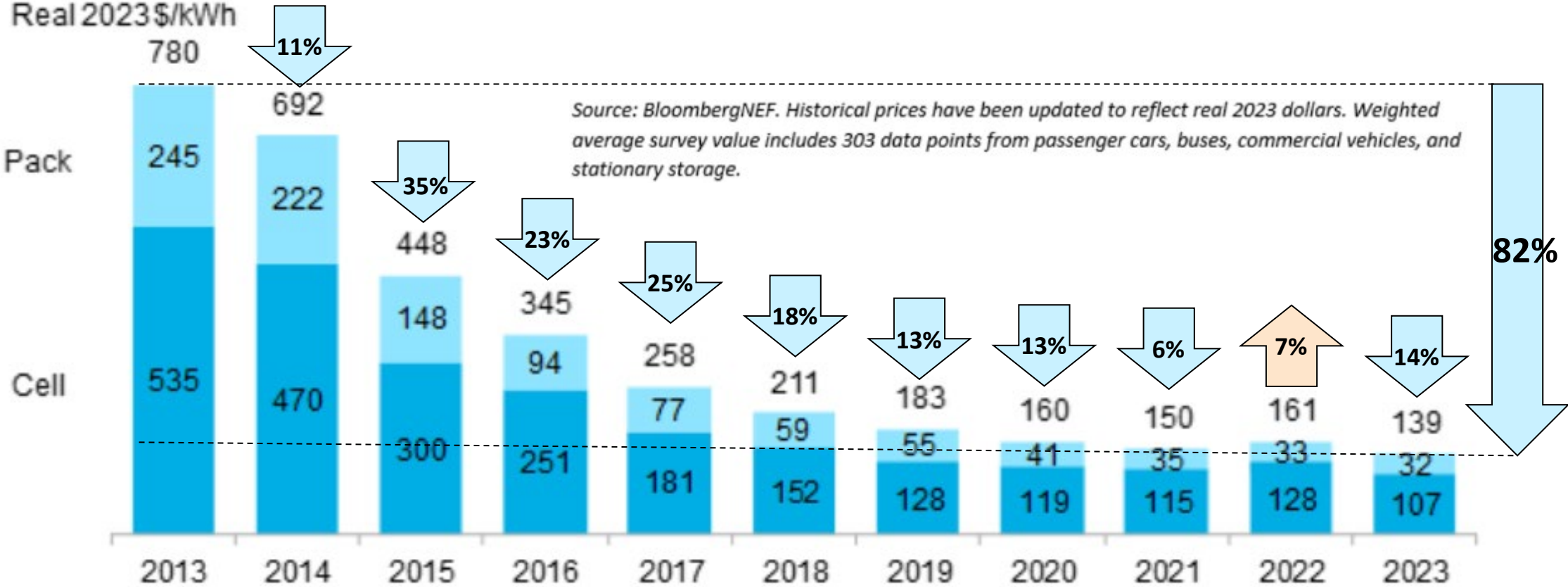


What is Energy Storage?



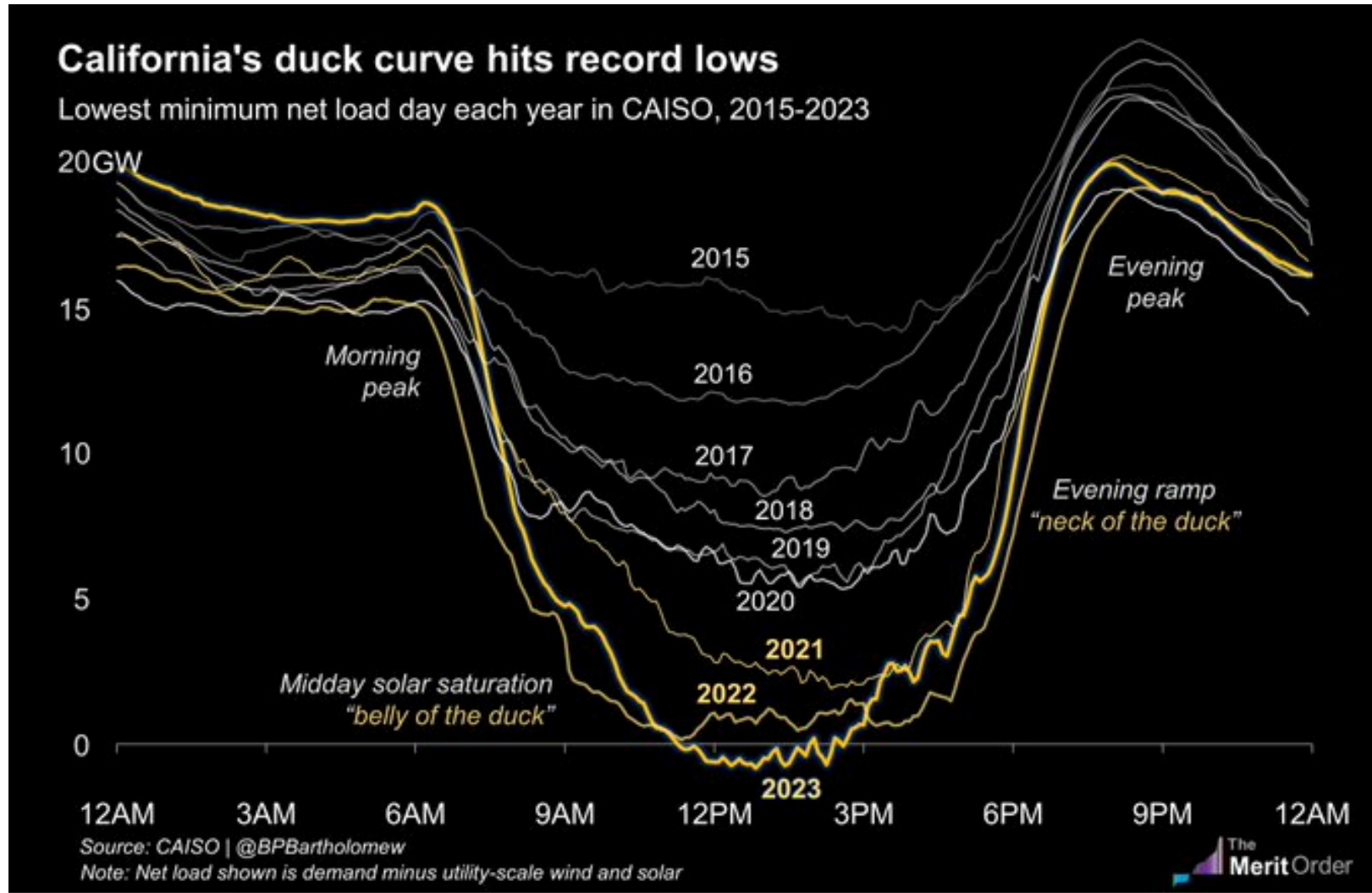
Rapid Cost Reductions in Energy Storage Batteries

PRICE OF A LI-ION BATTERY PACK, VOLUME-WEIGHTED AVERAGE
 Real 2023 \$/kWh



Massive R&D investment and manufacturing scale-up drive costs down for lithium-ion battery storage

California's Duck Curve Leads to New Tariffs & Incentives



Energy Storage reduces:

- Ramp rates
- Energy price variations

Customer-Sited Storage can:

- Improve individual customer economics
- Help to reduce ramp rates and energy price variations in the aggregate

What is the Net Billing Tariff (Also Called 'NEM 3')?

- Applies to customers submitting new interconnection applications to PG&E, SCE, and SDG&E
- Energy sold to the grid from PV is compensated at the avoided cost of generation
- Requires customers to sign up for Time of Use (TOU) Tariff
- Payback periods generally range from 6-9 years (longer than under NEM 2)

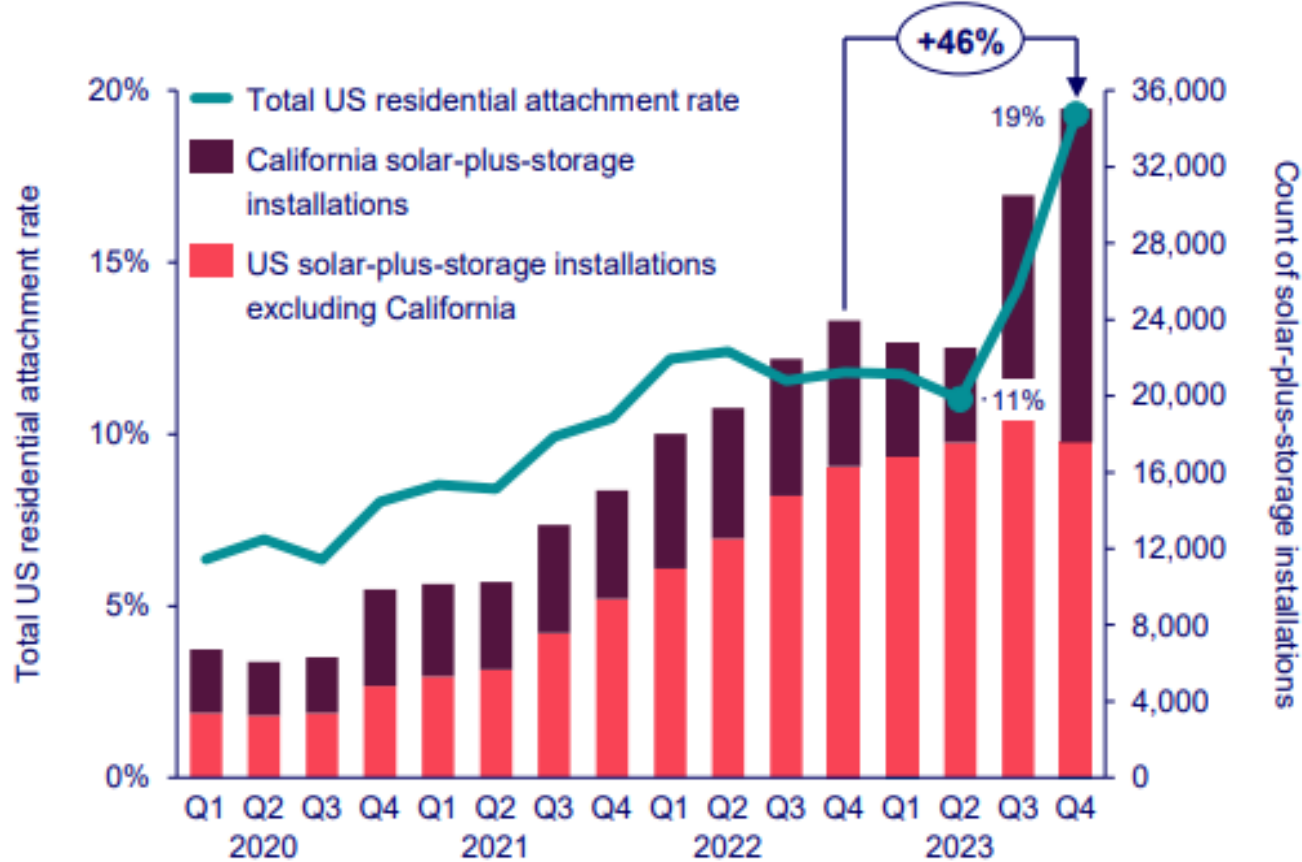
Example of Export Rates (\$/kWh) Under NEM 3.0
(9-year lock-in period offered)

Row Labels	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
12 AM	0.0572607	0.0603192	0.0517182	0.0517621	0.0553632	0.0541977	0.0552421	0.0595731	0.0609727	0.056859	0.0584614	0.0581411
1 AM	0.0530161	0.0564404	0.0490361	0.0473973	0.0505739	0.0504177	0.0529701	0.0541422	0.0535998	0.0507967	0.0539569	0.0524662
2 AM	0.0526839	0.0563979	0.0497902	0.0477421	0.0513661	0.0516027	0.0528458	0.0529497	0.052467	0.0503899	0.0537331	0.0517031
3 AM	0.0513968	0.0559796	0.0500653	0.0460838	0.0502081	0.0522688	0.0509103	0.052564	0.0514483	0.0494744	0.0520549	0.0505008
4 AM	0.0502645	0.0555054	0.0498508	0.0459529	0.0502416	0.0525424	0.0505569	0.051834	0.0501756	0.0487013	0.0513466	0.0502217
5 AM	0.0499387	0.0556218	0.0504667	0.0485715	0.0525861	0.0512732	0.0509231	0.0514598	0.0496324	0.0484712	0.0517534	0.0491788
6 AM	0.0509258	0.0556982	0.050634	0.0487533	0.0490711	0.0523598	0.0525486	0.051073	0.0513398	0.0496709	0.0536846	0.0509769
7 AM	0.0555452	0.0562454	0.049956	0.0336527	0.0295119	0.0499977	0.051131	0.0533393	0.0513448	0.0503767	0.055658	0.0545902
8 AM	0.055771	0.0564679	0.0432656	0.0139295	0.0163262	0.0374833	0.0428251	0.0507162	0.0452741	0.0466765	0.0556927	0.0595691
9 AM	0.0500871	0.0434614	0.0281427	0.0092895	0.0084537	0.032643	0.0420945	0.0498574	0.038991	0.0384539	0.0436795	0.053165
10 AM	0.0421613	0.0291639	0.0177133	0.0115155	0.0107262	0.0342518	0.0439819	0.0504948	0.0400941	0.0385607	0.0433184	0.0481144
11 AM	0.0409581	0.0263743	0.0177381	0.0103717	0.0128302	0.0364832	0.0461605	0.050865	0.0402198	0.0399464	0.0400173	0.0452409
12 PM	0.0420871	0.0274796	0.0178394	0.0063886	0.0107471	0.0367686	0.0458257	0.0510986	0.0414971	0.0406644	0.0379855	0.0427441
1 PM	0.0405065	0.026795	0.0172185	0.0044961	0.0090792	0.0394021	0.0538735	0.0641728	0.0477897	0.0453097	0.0389521	0.042246
2 PM	0.0407548	0.0275721	0.0167293	0.0041383	0.0083469	0.0552065	0.0657118	0.0980978	0.0604251	0.0481661	0.0402265	0.043316
3 PM	0.0431194	0.0281182	0.0188171	0.0023794	0.0081107	0.0686814	0.0903948	0.1312451	0.0752273	0.0628607	0.0455678	0.0460577
4 PM	0.0507613	0.0394564	0.0284375	0.0067427	0.0159773	0.0938039	0.114239	0.1465236	0.0885797	0.0822145	0.0676903	0.0584693
5 PM	0.0613419	0.0615607	0.0497494	0.0199897	0.0321663	0.099842	0.1239395	0.1802352	0.1040568	0.0850751	0.0681733	0.0625484
6 PM	0.0625645	0.0628564	0.0651842	0.0623756	0.0664644	0.0961895	0.1229769	0.2462423	2.3827573	0.1620993	0.0691172	0.0669744
7 PM	0.0670258	0.0668336	0.0759554	0.0705306	0.0737727	0.0958233	0.1910631	0.5052448	2.7016144	0.1602095	0.0716868	0.069745
8 PM	0.0664806	0.0675932	0.0779577	0.0880488	0.0902477	0.0900782	0.1294321	0.2252602	0.2001279	0.0697752	0.0687501	0.0705314
9 PM	0.0647323	0.0668457	0.0703483	0.0672598	0.0780538	0.0810639	0.0871449	0.2197317	0.0924671	0.0635755	0.0661366	0.0675964
10 PM	0.0616097	0.0634118	0.060115	0.0581423	0.0606931	0.0721444	0.0835791	0.1814098	0.0845276	0.0590267	0.0628945	0.0651817
11 PM	0.0581613	0.0610875	0.0537566	0.0551965	0.0572503	0.0589165	0.0576361	0.0631459	0.0622437	0.0558083	0.0605636	0.0586008

Credit: Enphase

BESS Attachment Rates in California are Increasing

US total residential attachment rate and solar-plus-storage installations



Source: Wood Mackenzie



- California has greatest number of customer-sited energy storage units & 2nd highest attachment rate (only Hawaii is higher)
- California Net Billing Tariff (NBT) is expected to drive higher solar+storage installation rates in California
- Between Q4 of 2022 and Q4 2023, solar+storage deployments were up 46%
- As of Q2 2024, the attachment rate for customers under the NBT is greater than 95%
- NEM 2.0 systems will continue to be connected into 2025

When to Consider Installing Storage in California?

- Considering Storage (and PV) during design will ensure proper sizing of breaker panels and other electrical equipment.
- New interconnection agreements for PV systems will be implemented under NEM 3.0 and will require storage for economic viability.
- Investment Tax Credits (30% or greater for low-income) could be repealed by new administration.
- Backup Power (Resilience) provides homeowner value.





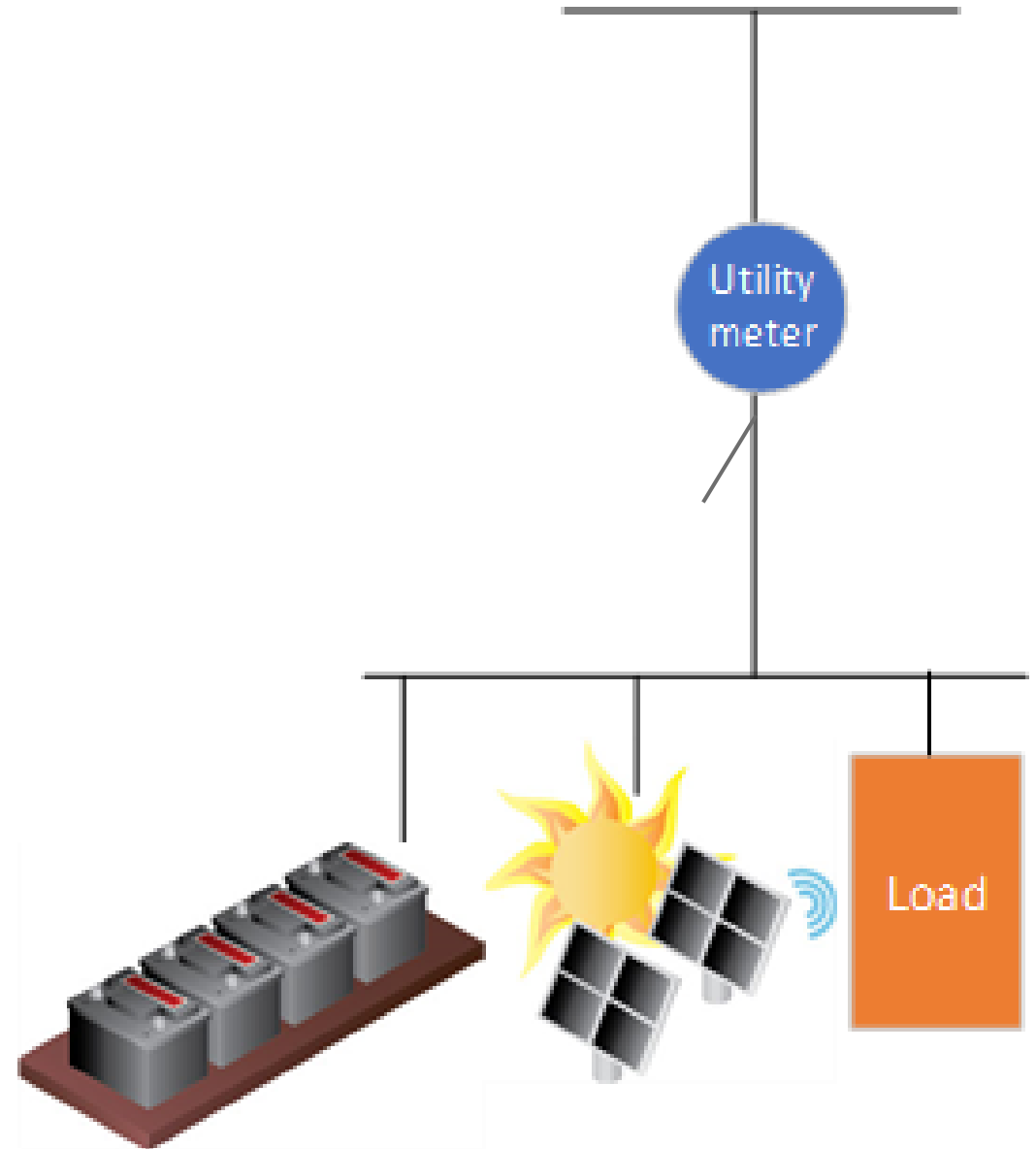
Energy Storage Benefits

Backup Power and Resilience

AC (Alternating Current) coupling allows customer to charge from the grid when not enough solar generation exists.

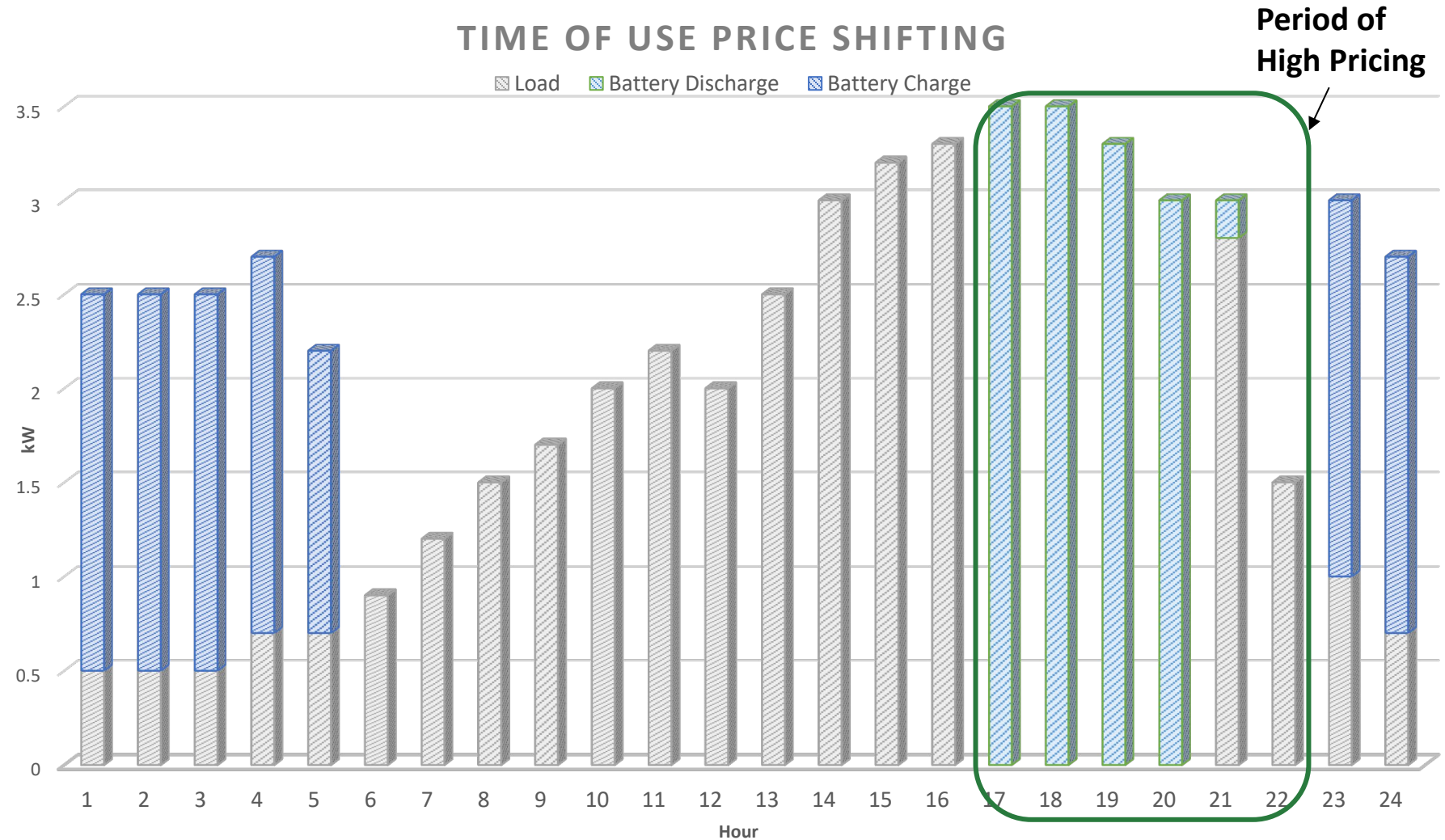
- Better for demand response (DR) programs, and sometimes mandatory
- Better for resilience and time of use (TOU) applications
- Easier for retrofits and remodels

DC (Direct Current) coupled systems have higher efficiencies but may not qualify for all DR programs.



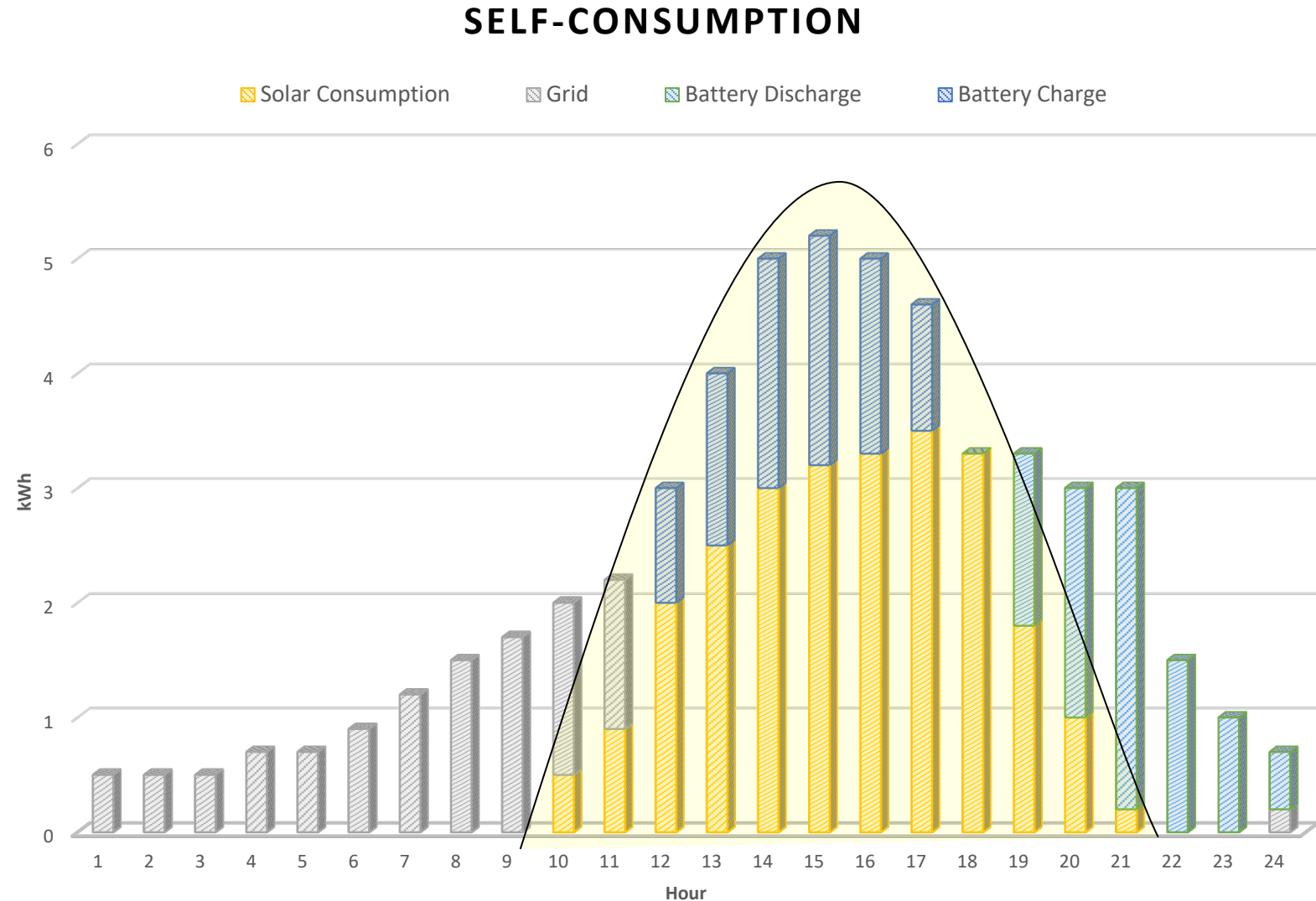
Time of Use Price Time Shifting

- Example of TOU Shifting without solar generation
- Goal is to charge the battery on low-cost energy and consume that energy when prices are highest (ex: 4-9pm)



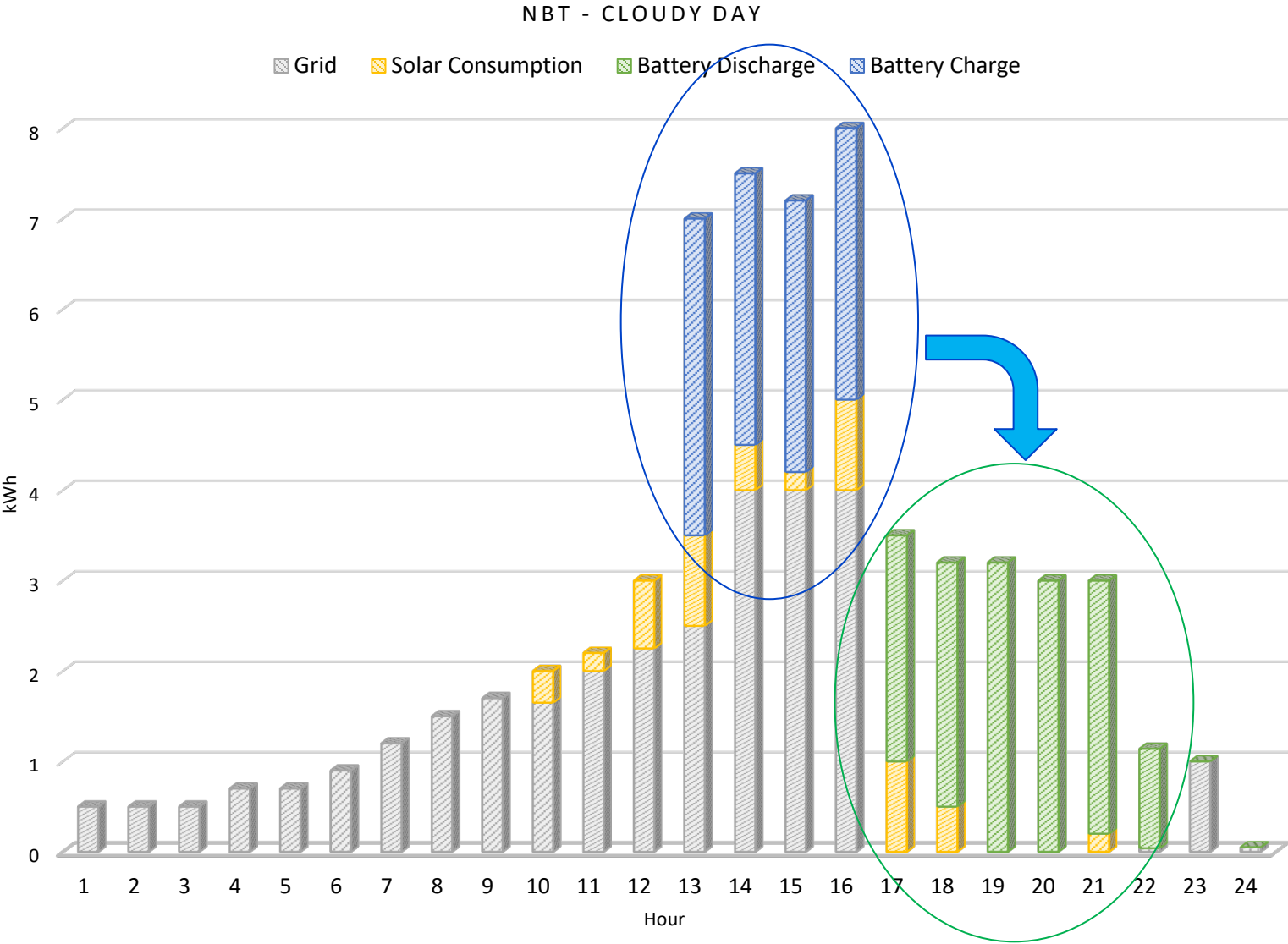
Self-Consumption

- Allows homeowners/residents to consume their own solar energy without dispatching to the grid
- Helps homeowners/residents avoid TOU charges by consuming solar energy from early in the day and during periods of high pricing



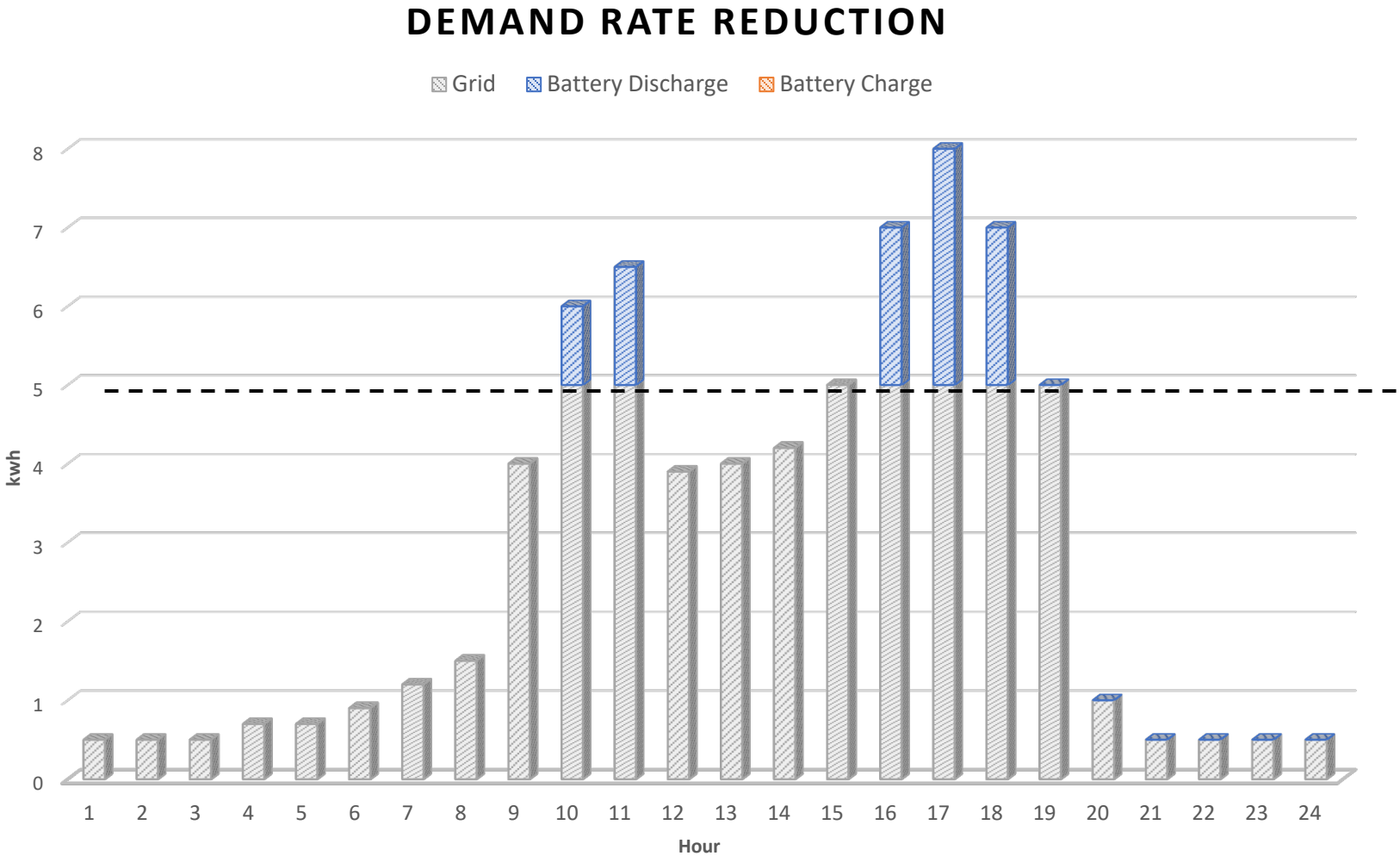
Example of Net Billing Tariff (NBT) on a Cloudy Day

- Lack of solar production means battery charges from the grid so it can offset high energy prices in the afternoon.
- If there are periods of time where NBT export rate is high, the battery will export energy to the grid instead of simply offsetting energy consumption.
- Minimum SOC settings (20%+) will allow for energy to be available for evening resilience.



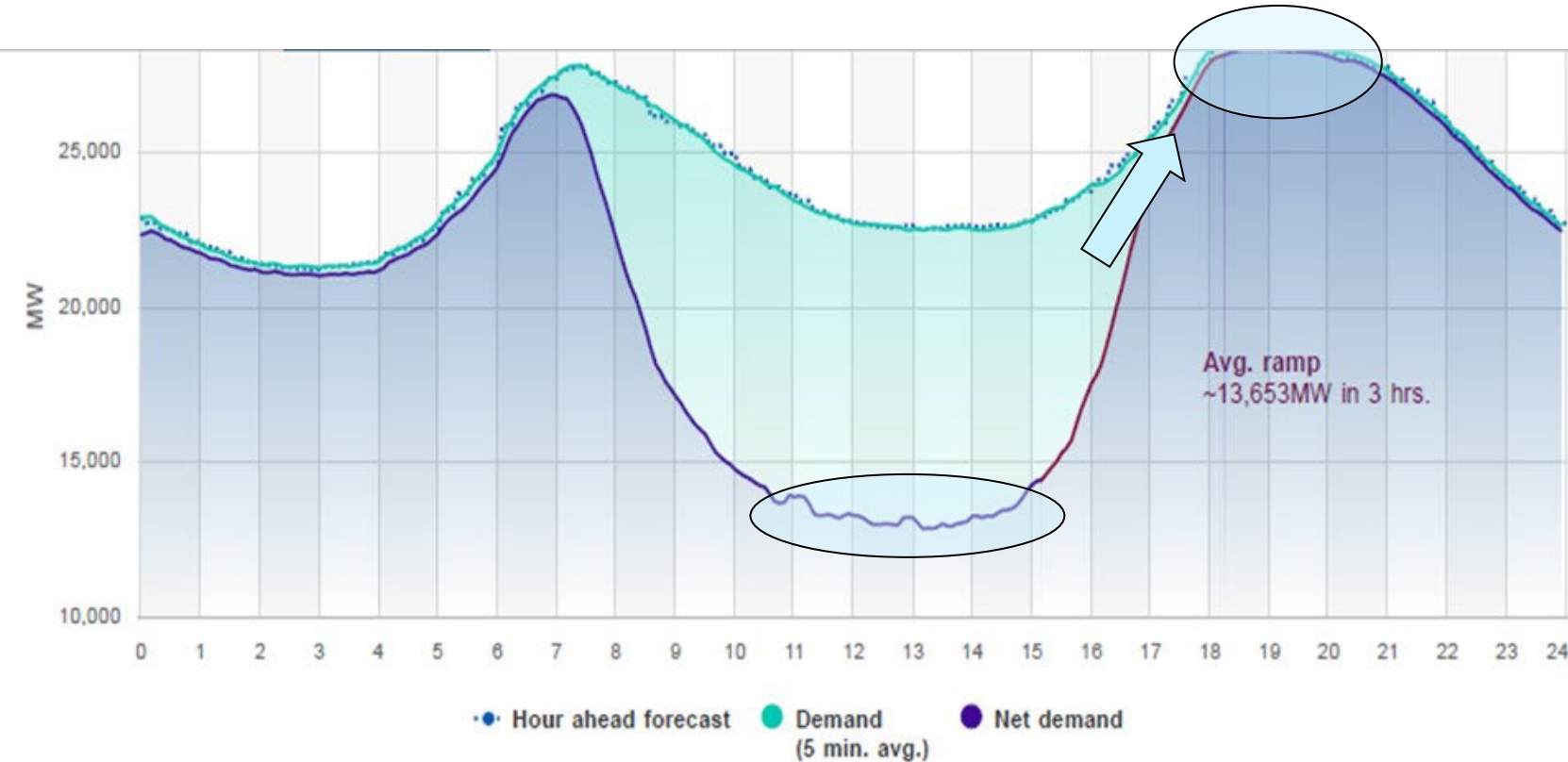
Demand Charge Reduction

- Demand charges are not applicable to most residential customers
- Goal is to reduce demand charges by keeping monthly peak power consumption below a certain threshold



Demand Response

- Demand Response aggregates various assets to reduce grid demand at peak (or during periods of significant ramp).
- Energy storage systems are one of the best demand response assets, as they are reliable and do not require customers to change their electricity usage.
- Sometimes these aggregation programs are referred to as Virtual Power Plants (VPP).



The Duck: CAISO Total Demand and Net (of Solar and Wind) Demand for Feb 7, 2019
(source: <http://www.caiso.com/TodaysOutlook/Pages/default.aspx>)



Extra Info, Tips, and Tricks

Examples of Popular Residential Battery Systems

Tesla Powerwall 3



- 13.5 kWh
- 5.8 kW
- 10 Yr. Warranty
- 41% PV+BESS market share

Enphase IQ



- 5 – 10 kWh
- 3.84 kW
- 10 Yr. Warranty
- 22% PV+BESS market share

SolarEdge



- 10 kWh
- 5 kW
- 10 Yr. Warranty
- 12% PV+BESS market share

LG Prime
(formerly RESU)



- 9.6 - 16 kWh
- 5 - 7 kW
- 10 Yr. Warranty
- 10% PV+BESS market share

- Some units will have more customer-friendly interfaces than others
- Some units will have access to more demand response programs than others
- Consider discharge power (as listed above), but also peak power which is normally limited to ~10 seconds
- Make sure to include inverter and transfer switch in price, when necessary
- Systems may integrate more easily with manufacturer associated PV panels

*Market Share Info Courtesy of Wood Mackenzie

Permitting Tips

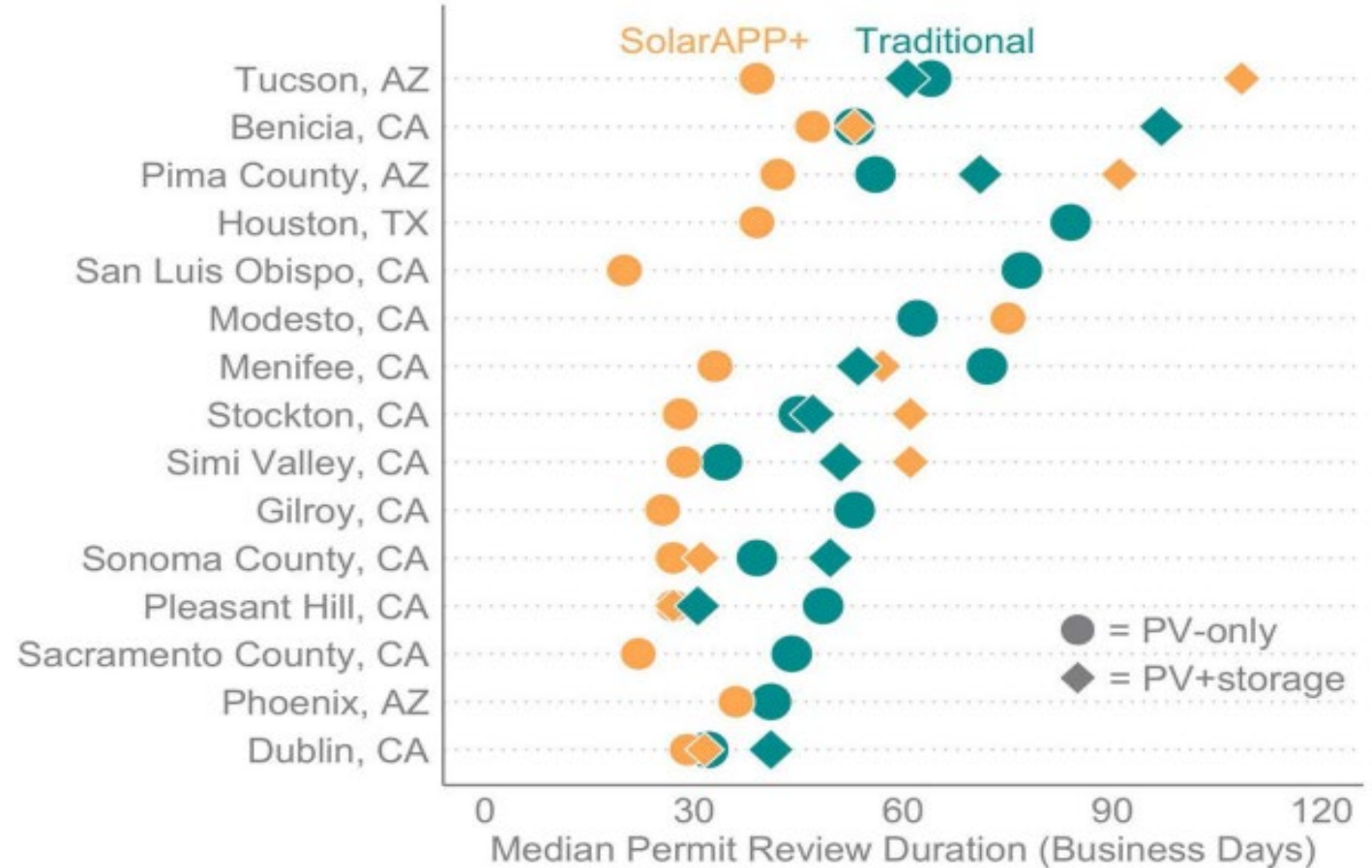
[Draft Energy Storage Permitting Guidebook \(Version 1\)](#) includes

relevant codes for behind-the-meter energy storage installation

- Single family & low-rise multifamily must install PV and be “battery ready”
- High-rise multifamily must install both PV and energy storage

[SolarApp+ Electronic Permitting System](#)

- Automates [JA12 equipment listings for solar inverters and energy storage systems](#)
- Verifies circuit parameters



Median project time from permit submission to passed inspection by AHJ (2022)

[SolarAPP+ Performance Review \(2022 Data\) \(nrel.gov\)](#)

Interconnection Tips

Each investor-owned utility (IOU) is responsible for administration of Rule 21 in its service territory and maintains its own version of the rule

For more information, visit [Electric Rule 21: Generating Facility Interconnections \(ca.gov\)](https://www.cpuc.ca.gov/Electricity/Pages/Electric-Rule-21-Generating-Facility-Interconnections)

Utility	Tariff	Interconnection Website
PG&E	Rule 21 Tariff	Interconnection Website
SCE	Rule 21 Tariff	Interconnecting Generation Website
SDG&E	Rule 21 Tariff	Overview of Generation Interconnections Website
Bear Valley	Rule 21 Tariff	Interconnection & Net Energy Metering Website
Liberty	Rule 21 Tariff	Homes/Business Solar Website
PacifiCorp	N/A	Customer Generation Website

- Fast Track applications allow for faster reviews of interconnection requests not requiring a detailed study.*
- Integrated Capacity Analysis (ICA) maps allow integrators to understand areas of the grid where DER integration is most simple.*

Installation Tips

Do

- Begin the interconnection process with your local utility ASAP
- Use licensed electricians that have been certified by the ESS manufacturer
- Install ESS outdoors to limit safety risks
- Mount ESS on non-flammable materials, such as masonry, metal, gypsum, etc.
- Ensure ESS is installed above typical maximum snow levels
- Call technical support or qualified technicians in case of abnormal behavior, damage or swelling of the ESS equipment

Do Not

- Install the ESS in areas subject to extreme temperatures, such as near heating equipment or on south-facing walls
- Install ESS in areas subject to flooding, water runoff, and snow accumulation
- Install ESS in areas subject to interference from children, pets, wildlife, or falling items
- Install ESS in areas that could be impacted by a vehicle
- Install ESS in proximity to flammable vegetation or other flammable materials



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AVAILABLE INCENTIVES

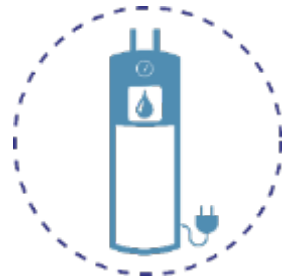


INCENTIVE ELIGIBILITY

100% all-electric residential buildings with the following:



Heat Pump Space Heating



Heat Pump Water Heating



Induction Cooking



Thermostatic Mixing Valves



Segregated Circuits



Communicating Thermostats

These requirements must be met to qualify for any incentives in CalEHP including both the base and bonus incentives.



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BASE ELECTRIFICATION INCENTIVES



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Incentive Levels per Participating Dwelling Unit ¹	2024	2025	2026	2027
Market Rate				
SF/duplex/triplex/townhome	\$3,000	\$3,000	\$2,500	\$2,500
MF/condo/ADU	\$1,600	\$1,600	\$1,400	\$1,400
Manufactured Housing	\$5,500	\$5,500	\$5,000	\$5,000
Disadvantaged Community (DAC) or Hard-to-Reach (HTR) adder				
SF/duplex/triplex/townhome	\$3,500	\$3,500	\$3,000	\$3,000
MF/condo/ADU	\$1,950	\$1,950	\$1,750	\$1,750
Manufactured Housing	\$6,000	\$6,000	\$5,500	\$5,500



Eligibility Specification:
Projects located in jurisdictions with active all-electric reach codes or ordinances that prohibit natural gas infrastructure are **not eligible** for base electrification incentives.

¹ Incentive level set by year the dwelling unit is completed

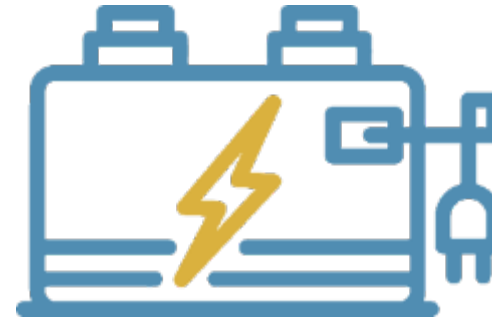
All projects must submit complete incentive request packages including incentive request forms and certificates of occupancy for each completed lot or building by November 15 to receive that program year's incentives.

BASE ENERGY STORAGE INCENTIVES

CalEHP has \$10M dedicated to incentivize energy storage

Incentives:

- \$250/kWh for battery storage
- \$300/kWh for battery storage in all-electric reach code jurisdictions
- Additional energy storage incentives coming in 2025



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BONUS INCENTIVES



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Bonus Incentives per Dwelling Unit	Single Family/Duplex/Triplex/Townhome	Multifamily/Condo/ADU	Manufactured Housing
Envelope Package	\$1,000	\$600	\$ -
Mechanical Package	\$300	\$300	\$2,000
Envelope + Mechanical Adder	\$400	\$250	\$ -
Smart Panel or HEMS	\$1,500	\$1,500	\$1,500
HPWH Controller	\$600	\$600	\$600
Resiliency/DR Ready Adder	\$1,000	\$750	\$1,000
ENERGY STAR	\$ -	\$ -	\$1,000
Heat Pump Pool Heater	\$ -	\$1,000	\$ -



Projects located in jurisdictions with active all-electric reach codes or ordinances prohibiting natural gas infrastructure for residential new construction **are eligible** for battery storage and bonus incentives.



DISCUSSION

CALIFORNIA ELECTRIC HOMES RESOURCES



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- caelectrichomes@trccompanies.com
- caelectrichomes.com



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