

SUMMARY OF KEY POINTS AND RECOMMENDATIONS

E² Energy & Environment panel

Cash Upton, Brighton Solar, and Central Coast Green Building Council

Michelle Zimney, In Balance Green Consulting

Dave Intner, Architect, and Southern California Edison

Chuck Lech, Conejo Simi Moorpark Association of Realtors (moderator)



BIO

- Dave Intner is with Southern California Edison's Building Electrification and Codes & Standards team, is a Licensed Architect, LEED AP and Certified Energy Manager. Dave is a graduate of Cal Poly SLO and provides education and outreach supporting Building Decarbonization and Energy Code Compliance Improvement. Dave has 28 years of professional experience split between architectural practice and utility program delivery.
- Cash Upton is Design & Sales Coordinator for Brighton Solar Co. and president of the Central Coast Green Building Council. Cash is a UC Berkeley graduate, and has been working with solar since 2014, when he installed an array atop his shipping container home using salvaged panels. As an advocate for education, Cash can be found at local elementary school science nights getting kids excited about solar.
- Michelle Zimney is the Senior Sustainability Consultant with In Balance Green Consulting, is a LEED AP, Living Future Associate, and Certified Passive House Consultant. She is a graduate of Stanford University. She helps projects define and implement strategies that maximize resource efficiency and create healthy spaces in which to live and work. She also lectures regularly on topics related to green building, net zero energy and carbon, and biophilic design.

BASICS

- Energy sources for California electricity? Natural Gas provides 50% of California's needs, Solar 17%, Nuclear 8%, Wind 8%, Hydroelectric 8%, Geothermal 6%, Imports as needed
- Is California required to proceed to 100% electrification for all homes?
 - No. California is said to be moving towards 100% electrification, but more accurately current law dictates a move toward 100% renewable electricity to be produced and sold to users. This does not require 100% electric homes, but some cities are reading the law to push in that direction.
 - An NPR article published in 2018, California Sets Goal of 100 Percent, discusses SB100 signed by Jerry Brown. It requires 50% of California electricity to be produced by renewable resources by 2025, 60% by 2030, and 100% by 2045.
 - The California grid operator estimates that 44.9% of the load on the grid supplied by renewable energy was already achieved in May 2023, coming close to the 2025 goal of 50%.

NATURAL GAS IN HOMES

- Many cities are limiting or preventing natural gas use in new construction. City General Plans are currently being revised to prevent natural gas use in new construction.
- Is Natural Gas use unhealthy?
 - Cleaner than coal and currently provides 50% of California's electricity.
 - Fumes from burning natural gas in open flame cooking, furnaces, water heaters, etc. include Benzene and Formaldehyde.

RENEWABLE vs CARBON FREE

- Another goal, different from Renewable, is the move to Carbon-Free.
- California's electricity mix is already more than 50% carbon free. About 25% of that comes from renewable sources, predominantly wind and solar.
- The difference between carbon free and renewable is mainly the addition of nuclear energy.

- California has one remaining nuclear power plant, Diablo Canyon, still in operation, providing 8% of our electricity. It was scheduled to shut down in 2025. In March 2023, Federal regulators granted an exemption that will allow the Diablo Canyon to stay operating while it pursues permission to keep operating past 2025.
- The decision by the U.S. Nuclear Regulatory Commission means Diablo Canyon can keep running under its current license as Pacific Gas & Electric seeks full approval to extend its lifespan. PG&E has until 12/31/2023 to submit its renewal application, which must outline issues related to safety and integrity of the aging reactors.
- PG&E said it will seek permission to keep the plant operating for up to 20 additional years — the full extent that is customary for a nuclear power plant application.

ELECTRICAL DISTRIBUTION

- A 2021 report from the California Energy Commission highlights the need to roughly triple the current capacity of the electricity grid. It also calls for building up to 6 gigawatts (GW) of new renewable and storage resources annually. Over the last decade, the state has built an average of 1.0 GW of solar and 0.3 GW of wind per year.

LEGISLATIVE CHANGES

- Rebate Changes in Electric Vehicle and Home SOLAR now favor lower income.
- Homeowners have been major investors in solar and EVs. Switching to lower income will change the dynamics. For example, homeowners can charge cars in their home garages, whereas lower income often park on the street or in large parking garages without hookups.
- Rebates for solar are changing, away from solar support and moving to battery support.
- Most of the solar incentives and what was presented during the session focused on Single Family Residence; however, since the majority of building permits being pulled these days (and moving forward) is for multi-family construction, there is a need to shift the programs/incentives and focus less on SFRs.

BUILD AND MODIFY A HOME

- New construction: how to implement it into a home, what does it look like, design considerations.
- Low carbon design choices
- Retrofit: Single-family, Multi-family residential retrofits (& commercial)
- How do architects play a role in designing energy efficiency for homeowners.
- What to expect (up-coming technology in generation, storage, smart-use, policy)



PANEL: E² ENERGY & ENVIRONMENT

Hueneme room

Discuss the impact all-electrification efforts have on housing and affordability. Understand these policies/codes and why they are deemed necessary; benefits, consequences, and ways to minimize any negative repercussions; leveraging resources; grid, technology, storage, and infrastructure readiness; and how to integrate into single- and multi-family homes with new and retrofit construction.



Dave Intner, AIA,
Southern
California Edison



Michelle Zimney,
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Cash Upton,
Brighten Solar &
Central Coast Green
Building Council



Chuck Lech,
Conejo Simi Moorpark
Association of Realtors
(moderator)

DELVE DEEPER

<https://pirg.org/edfund/resources/gas-stoves-a-hidden-health-risk-in-plain-sight/>
www.caranddriver.com/features/a44022888/electric-car-battery-recycling/
[Rebates & Tax Credits](#)
www.rewiringamerica.org/app/ira-calculator
www.sce.com/residential/rebates-savings/rebates
www.3c-ren.org



ENERGY AND THE ENVIRONMENT

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ENERGY AND THE ENVIRONMENT

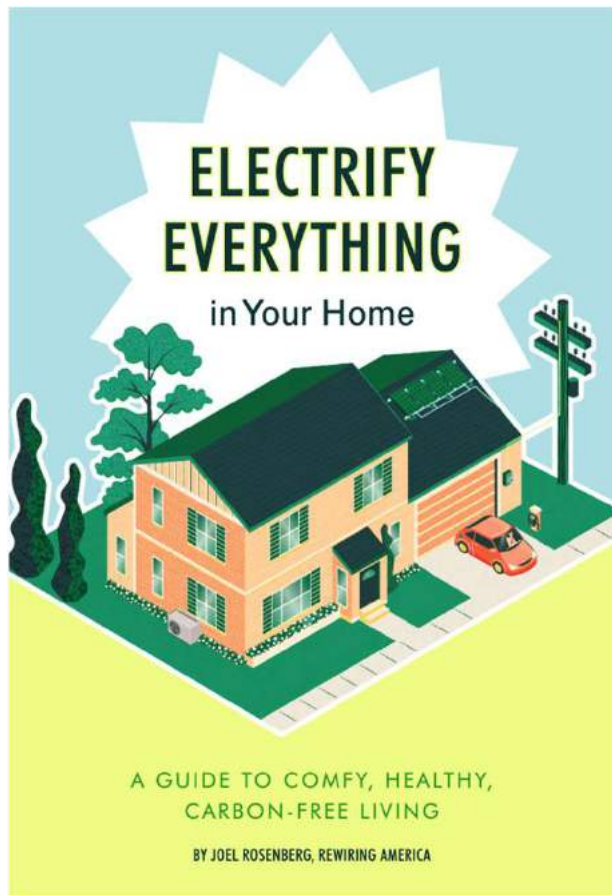
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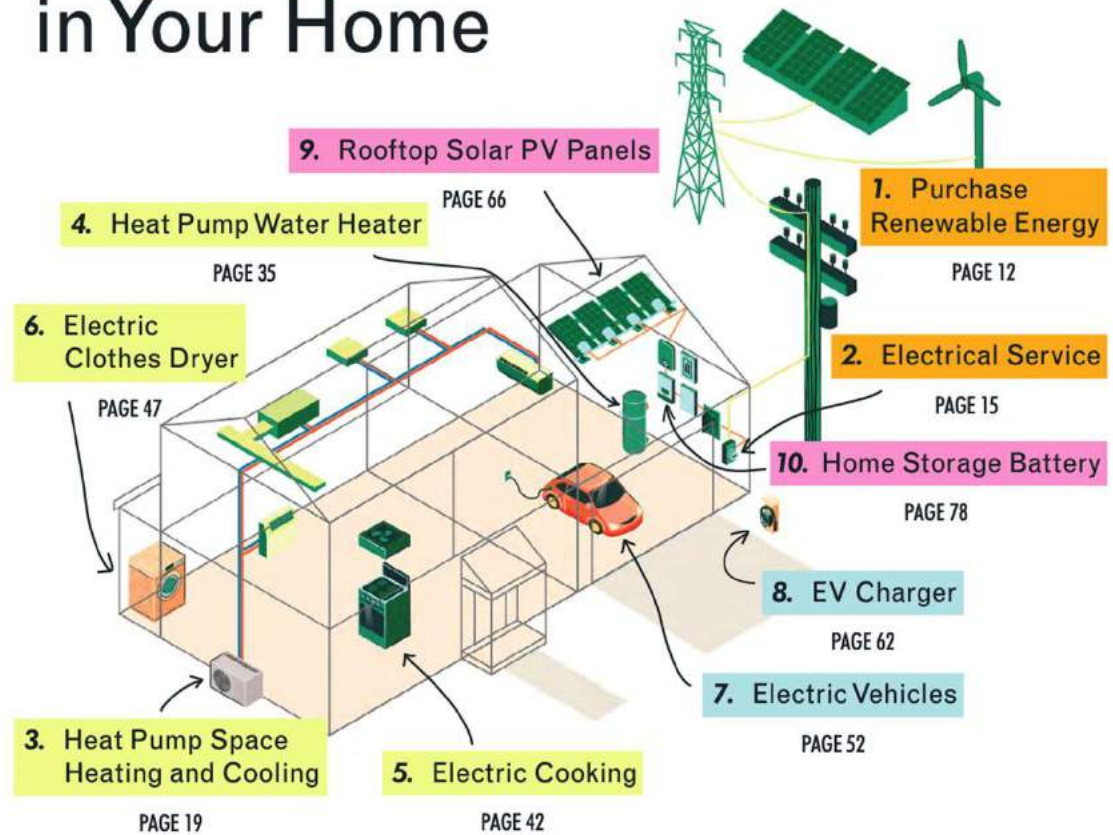
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IMPLEMENTATION OF ELECTRIFICATION STRATEGIES

STRATEGIES



Where to Electrify Everything in Your Home



Source: "Rewiring America"

Slide 6

MZ1

Michelle Zimney, 10/16/2023

TECHNOLOGIES – HEAT PUMPS

SPACE CONDITIONING

- Ducted Systems



- Ductless Systems



WATER HEATING



Single Family



Single Family or Multifamily



Commercial

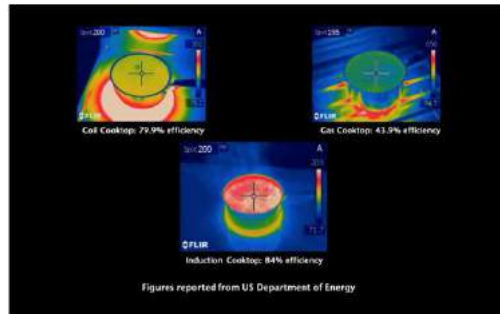


CLOTHES DRYER



COOKING AND TRANSPORTATION

COOKING



- More efficient
 - (84% vs 45% for gas)

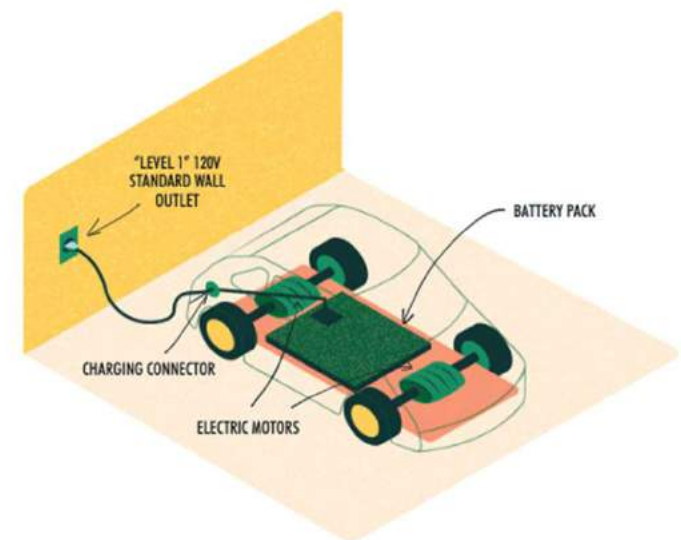
- Healthier air quality
 - Leakage and nitrogen dioxide production

Measured NO ₂ Emissions from Gas Stoves	Peak (ppb)	Indoor Guidelines for NO ₂	
Baking cake in oven	230	Canada	1-hr average (ppb)
Roasting meat in oven	296		
Frying bacon	104	World Health Organization	106
Boiling water	184		
Gas cooktop - no food	82-300		
Gas oven - no food	130-546		

Source: Rocky Mountain Institute

- Link to childhood asthma
- Requires 240v (40-50amp)

ELECTRIC VEHICLES



Source: "Rewiring America"

- Can be programmed to charge at night (cheap rates) or
- during the day when there is excess solar energy generation

REAL LIFE INSTALLATIONS



Garage



(Exterior)
Compressor

(Interior)
Air Handler



My mom's kitchen



Under stairs



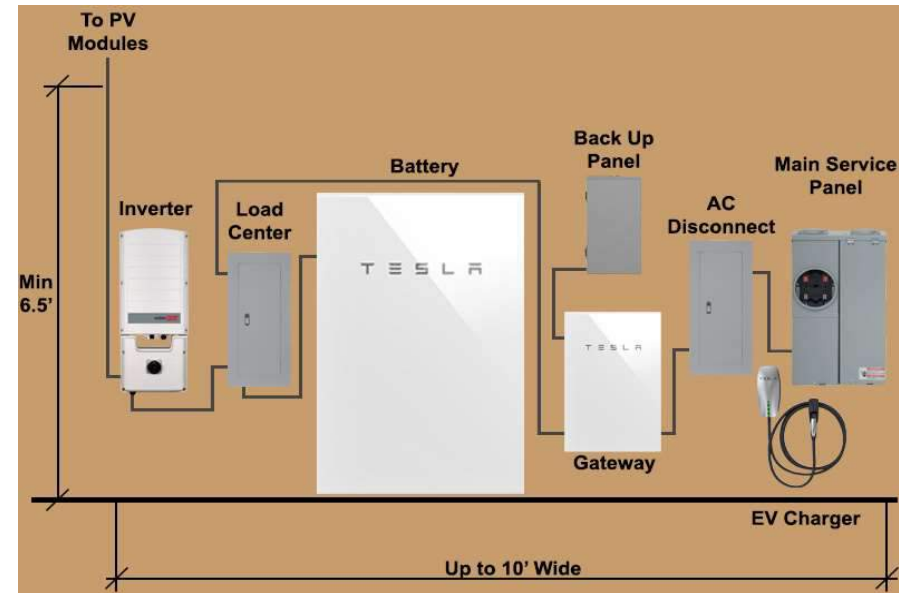
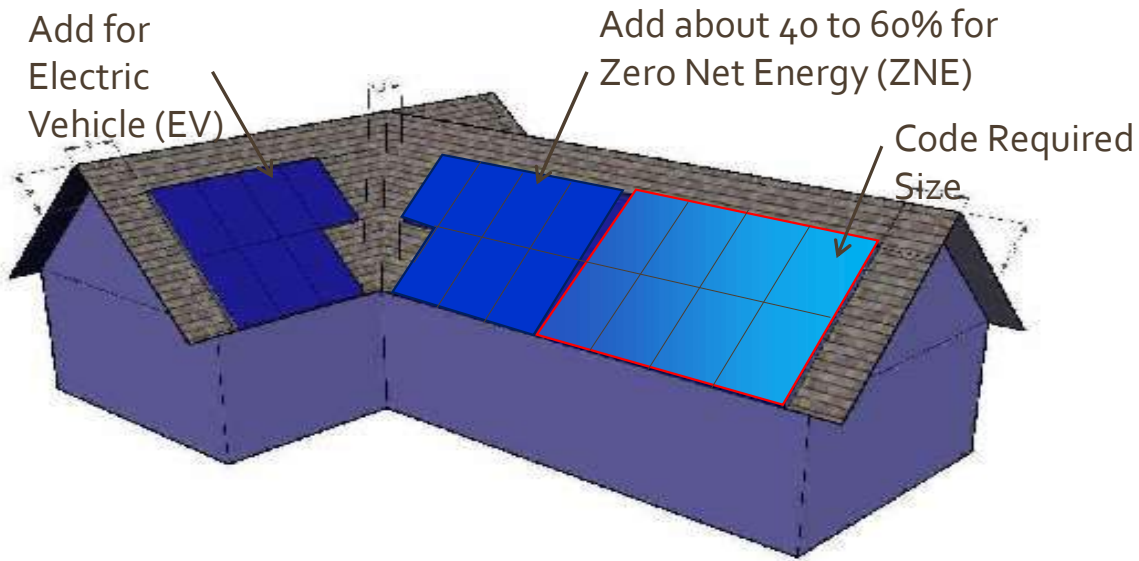
Closet



Air
Flow



PV AND EQUIPMENT



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.

*Note: NEW construction is assuming new appliances, LED lighting, energy efficient envelope, etc. ZNE offset will vary depending on occupant behavior.

Designate space for solar and battery equipment in protected area like garage or similar.

RESOURCES: INCENTIVES & REBATES

3C-REN Incentive Finder tool

https://www.3c-ren.org/programs-incentives?utm_source=res&utm_medium=email

Results are based on your home address and utility providers and include robust 3C-REN incentives as well as other regional, state and federal incentives and rebates that can often be stacked to increase your savings.

Rewiring America

<https://www.rewiringamerica.org/app/ira-calculator>

Tax credit and rebate finder from IRA program

YOUR PERSONALIZED INCENTIVES:

ENERGY EFFICIENCY AND ELECTRIFICATION UPGRADES

- 3C-REN Single Family Home Energy Savings**
Receive up to 75% off total project cost by working with a participating contractor. Can be stacked with 3CE or TECH, and IRA tax credits.
- TECH Clean California - HVAC**
Rebates available for heat pump HVAC systems. Must work with a TECH enrolled contractor. Can be stacked with rebates from 3C-REN and IRA Tax Credits.
- Southern California Edison**
Small rebates for individual appliances and tools. Cannot be claimed in conjunction with 3C-REN rebates.
- Inflation Reduction Act Tax Credits**
Claim significant tax credits for a number of energy efficiency and electrification upgrades.
- TECH Clean California - Water Heaters**
Rebates available for heat pump water heaters. Must work with a TECH enrolled contractor. Can be stacked with rebates from 3C-REN and IRA Tax Credits.
- SoCalGas Appliance Rebates**
Small rebates for individual appliances and tools. Cannot be claimed in conjunction with 3C-REN rebates.

SCE Rebates and Incentives

<https://www.sce.com/residential/rebates-savings/rebates>

Household Electrification Incentives All the savings you may be eligible for!			
Tax Credits			
ITEM	AMOUNT	TIMELINE	
Battery Storage Installation	30%	Available Now!	More Info >
Geothermal Heating Installation	30%	Available Now!	More Info >
Electric Panel	\$600	Available Now!	More Info >
Electric Vehicle Charger	\$1,000	Available Now!	More Info >
New Electric Vehicle	\$7,500	Available Now!	More Info >

Your Home — [Home > Your Home > Rebates Incentives & Saving Tips > Rebates & Incentives](#)

Demand Response

Rebates Incentives & Saving Tips — **Current Rebates**

Residential Solar Programs

Smart Energy Program

Rebates & Incentives

Summer Discount Plan

Multifamily Property Resources

Mobile Home Upgrade Program

Home & Business Area Network

Budget Assistant

Energy Saving Tips

Energy Management Center

Ways to Save with Time-of-Use Rates

Save More with SCE Rebates and Incentives
Find out about rebates and incentives that can help you conserve energy and save money.

California Statewide Residential Resources, Rebates and Incentives
[The Switch Is On - Home Electrification](#)

Switching to a home that is all-electric can lower your energy costs, modernize your home, and reduce your carbon footprint. Plus, thousands of dollars in incentives could be available in your area through state-funded programs. With information on all your home appliances, including high-efficiency HVAC, heat pump water heaters, induction cooktops, and more, see what options could be right for you. Learn more about electrification, incentives, and certified contractors in your area.

The Switch Is On is a consumer inspiration campaign funded by the [Building Decarbonization Coalition](#), of which Southern California Edison is a member. The Switch Is On provides information, resources, and tools to support customers to electrify their homes.

Golden State Rebates

Golden State Rebates provides instant rebate coupons for Air Conditioners, Smart Thermostats, Electric Heat Pump Water Heaters and Gas Water Heaters. Rebate coupons can be redeemed at participating retail locations (in-store or online).

PULLING IT ALL TOGETHER

LIFE IN YEARS	ELECTRICAL UPGRADE	UP FRONT COST BEFORE REBATES	ANNUAL OPERATING SAVINGS	HARDER	% HOME EMISSIONS	IMPROVES AIR QUALITY	RENTER CONTROLS
1. Purchase Renewable electricity							
		\$0					R
2. Electrical Service							
20-25 YRS <input type="checkbox"/>		\$750-4,000		✓			
3. Heat Pump Space Heating and Cooling							
15-20 YRS <input type="checkbox"/>	AT INSTALL	\$1,000 DIY, TO \$20,000+	\$\$\$	✓	25%	🌿 🏠	R
4. Heat Pump Water Heater							
10-15 YRS <input type="checkbox"/>	MAYBE	\$1,500 DIY, \$4,000 INSTALLED	\$		10%	🌿 🏠	
5. Electric Cooking							
13-15 YRS <input type="checkbox"/>	YES	\$2,000-3,000			5%	🌿 🏠	R
6. Electric Clothes Dryer							
10-13 YRS <input type="checkbox"/>	MAYBE	\$1,000-2,000	\$\$		3%	🌿 🏠	R
7. Electric Vehicles							
20-25 YRS <input type="checkbox"/>		\$10K (USED) AND UP	\$\$\$		50%	🌿	R
8. EV Charger (240V EVSE)							
10-15 YRS <input type="checkbox"/>	YES	\$500-2,500					R
9. Rooftop Solar PV Panels							
20-30 YRS <input type="checkbox"/>	AT INSTALL	\$15,000-30,000	\$\$\$	✓	HELPS ALL	🌿	
10. Home Battery Storage							
5-15 YRS ^a <input type="checkbox"/>		\$10,000-20,000	\$	✓	HELPS ALL	🌿	

KEY:

\$ SAVE \$50+ PER YEAR
 \$\$ SAVE \$200+ PER YEAR
 \$\$\$ SAVE \$500+ PER YEAR

🏠 INDOOR & OUTDOOR
 🌿 OUTDOOR

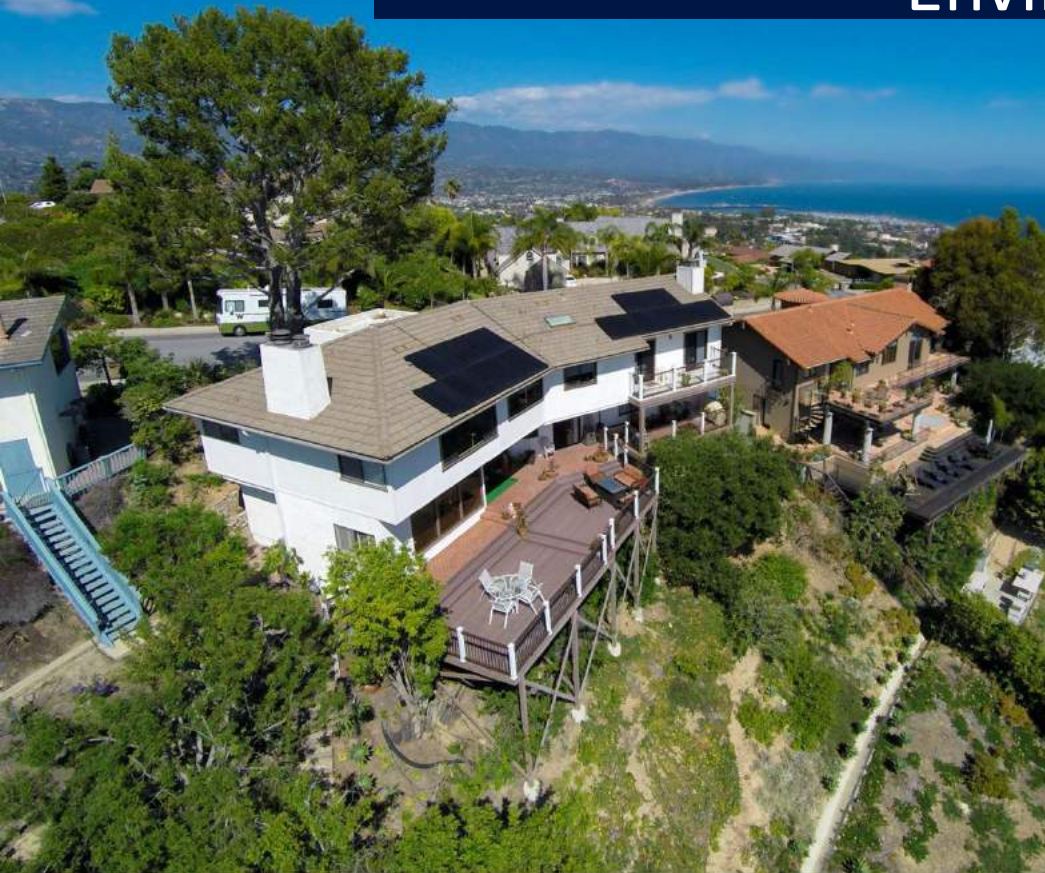
Source: "Rewiring America"

Cash Upton

Design & Sales Coordinator, Brighten Solar
President, Central Coast Green Building Council



Decarbonizing the Built Environment



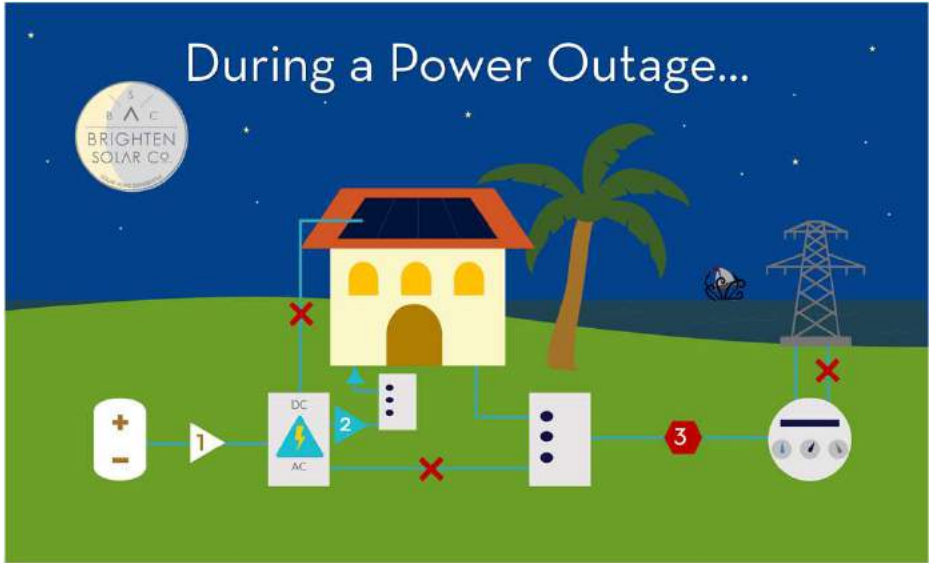
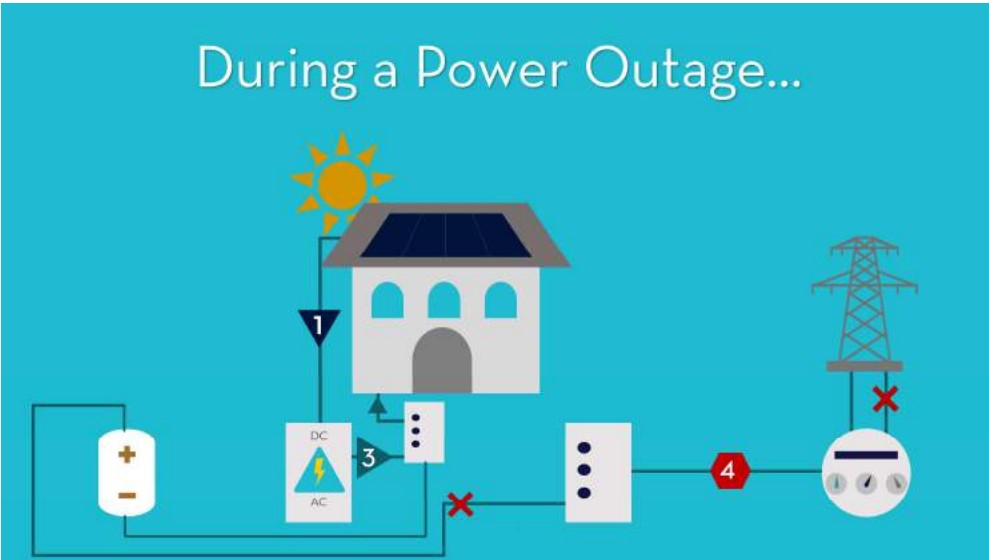
- Electrification
 - Induction cook tops
 - Heat pumps
 - Electric Vehicles
- Decarbonizing Construction
 - Building with less carbon
 - Alternative building materials
 - Usually less toxic



Back-up vs. Off-grid

“I WANT TO GO OFF-GRID”

In a Power Outage, Solar + Batteries Functions Like an Off-Grid System



Incentives and rebates

- **Incentive Tax Credit:** The battery system and any panel upgrades qualify for the 30% federal tax credit (also known as the ITC). The amount of tax credit you can receive for your battery is based on how often the battery is charged by your solar panels.
- **California's Self Generation Incentive Program, or SGIP:** as of Spring 2021, SGIP incentives for residential systems are \$200/kWh for PG&E and SCE but step down as the available funding is used. For example, a 10 kWh battery is currently eligible for a rebate of \$2,000 and is available at a first come, first served basis.



All batteries are not equal

Most important considerations

Chemistry:

- Lithium – ion technology is most common
- Nickel, Manganese, Cobalt, Ferrous-phosphate, etc.)
- At Brighten, we decided to stay away from cobalt made batteries
 - (Tesla Powerwall, LG Chem, etc.)

Ethical:

- Cobalt is one of the worst ethically mined minerals on the planet
- Only ferrous-phosphate batteries can be **100% recyclable**

Safety:

- Thermal runaway – can cause overheating and catch fire
- Requires cooling? Installation location constraints.
- Toxic elements?

Warranty:

- Cycles and guaranteed capacity
- Manufacturer viability & focus

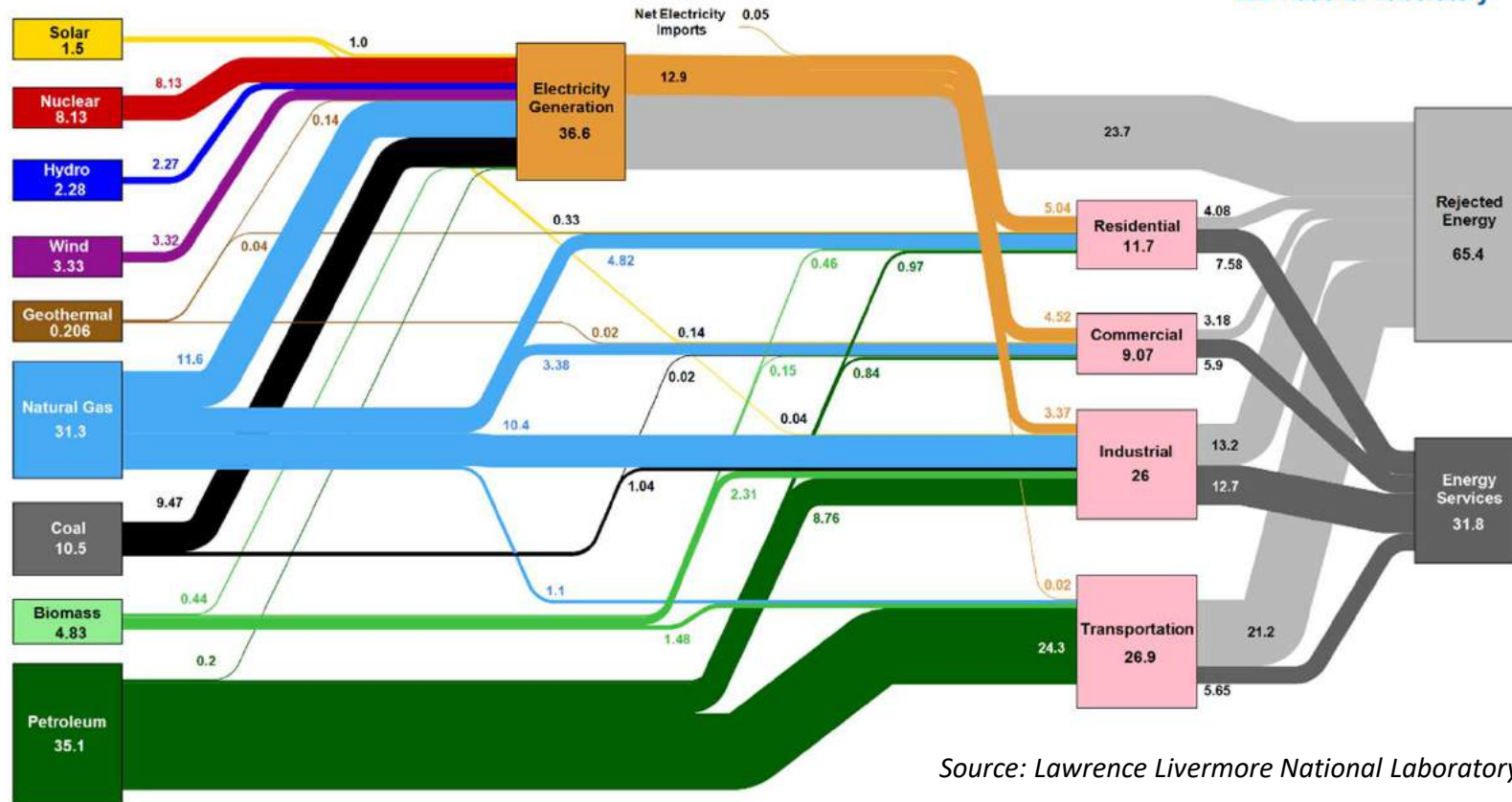


ELECTRICITY PRODUCTION AND THE GRID



Understanding energy flows in the United States

Estimated U.S. Energy Consumption in 2021: 97.3 Quads



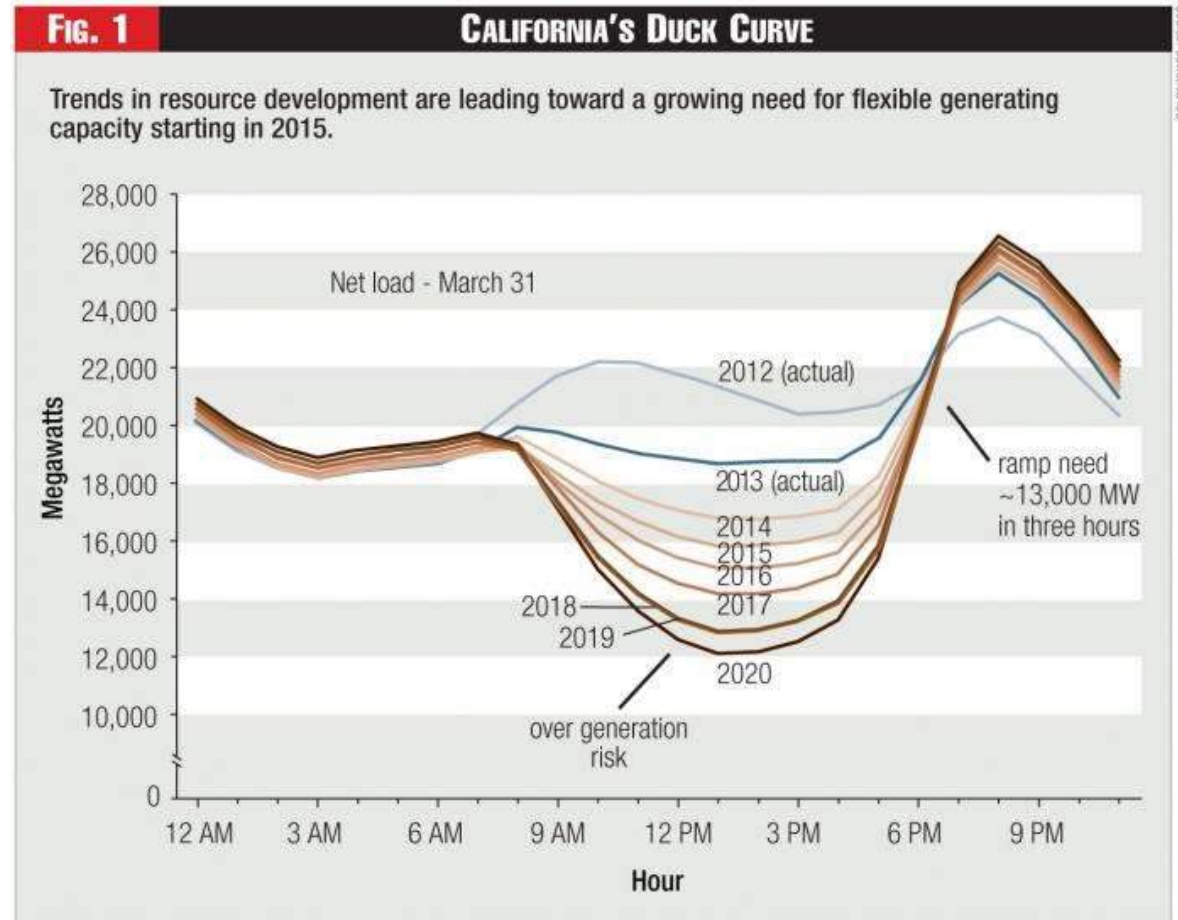
Source: Lawrence Livermore National Laboratory (LLNL)

SCE's delivered power is already **43%** carbon neutral; **52%** Statewide

2021 POWER CONTENT LABEL								
Southern California Edison								
www.sce.com								
Greenhouse Gas Emissions Intensity (lbs CO ₂ e/MWh)				Energy Resources	SCE Power Mix	SCE Green Rate 50% Option	SCE Green Rate 100% Option	2021 CA Power Mix
SCE Power Mix	SCE Green Rate 50% Option	SCE Green Rate 100% Option	2021 CA Utility Average	Eligible Renewable¹	31.4%	65.7%	100.0%	33.6%
580	290	0	456	Biomass & Biowaste	0.1%	0.0%	0.0%	2.3%
<p style="font-size: small;">Legend: ■ SCE Power Mix ■ SCE Green Rate 50% Option ■ SCE Green Rate 100% Option ■ 2021 CA Utility Average</p>				Geothermal	5.7%	2.8%	0.0%	4.8%
				Eligible Hydroelectric	0.5%	0.3%	0.0%	1.0%
				Solar	14.9%	57.5%	100.0%	14.2%
				Wind	10.2%	5.1%	0.0%	11.4%
				Coal	0.0%	0.0%	0.0%	3.0%
				Large Hydroelectric	2.3%	1.1%	0.0%	9.2%
				Natural Gas	22.3%	11.1%	0.0%	37.9%
				Nuclear	9.2%	4.6%	0.0%	9.3%
				Other	0.2%	0.1%	0.0%	0.2%
				Unspecified Power²	34.6%	17.3%	0.0%	6.8%
				TOTAL	100.0%	100.0%	100.0%	100.0%
Percentage of Retail Sales Covered by Retired Unbundled RECs³:					3%	2%	0%	
<p>¹The eligible renewable percentage above does not reflect RPS compliance, which is determined using a different methodology.</p> <p>²Unspecified power is electricity that has been purchased through open market transactions and is not traceable to a specific generation source.</p> <p>³Renewable energy credits (RECs) are tracking instruments issued for renewable generation. Unbundled renewable energy credits (RECs) represent renewable generation that was not delivered to serve retail sales. Unbundled RECs are not reflected in the power mix or GHG emissions intensities above.</p>								
For specific information about this electricity portfolio, contact:					Southern California Edison			
					1-800-655-4555			
For general information about the Power Content Label, visit:					http://www.energy.ca.gov/pcl/			
For additional questions, please contact the California Energy Commission at:					Toll-free in California: 844-454-2906			
					Outside California: 916-653-0237			

The Duck Curve

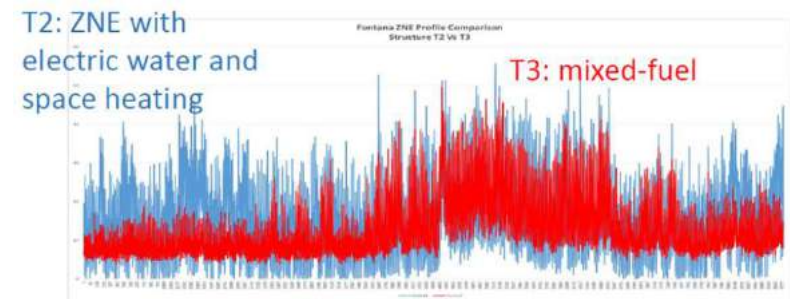
- A phenomenon due to an abundance of solar power production which has transformed the way we manage the grid; shifting peak from the middle of the day to the evening
- **“Flex Alerts”** where customers are asked to conserve electricity, primarily impact the hours of 4pm to 9pm, usually for a handful of days in the Summer or early Fall



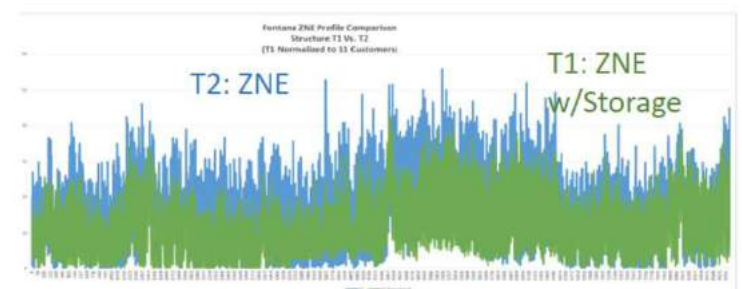
Source: California Independent System Operators (CAISO)

Grid Impacts of All-Electric Homes is Relatively Minimal

- The electric grid is designed to accommodate “peak demand,” plus a margin
- **All-electric neighborhoods do not have a noticeably higher peak** compared to mixed-fuel
- SCE conducted case studies on two all-electric neighborhoods, one in Fontana and one in Irvine
- All-electric homes do consume more electricity, but this additional consumption mostly occurs **during off-peak hours when there is abundant capacity on the grid**
- Results also showed that adding batteries can “flatten” the demand curve for all-electric homes even more, further reducing demands on the grid



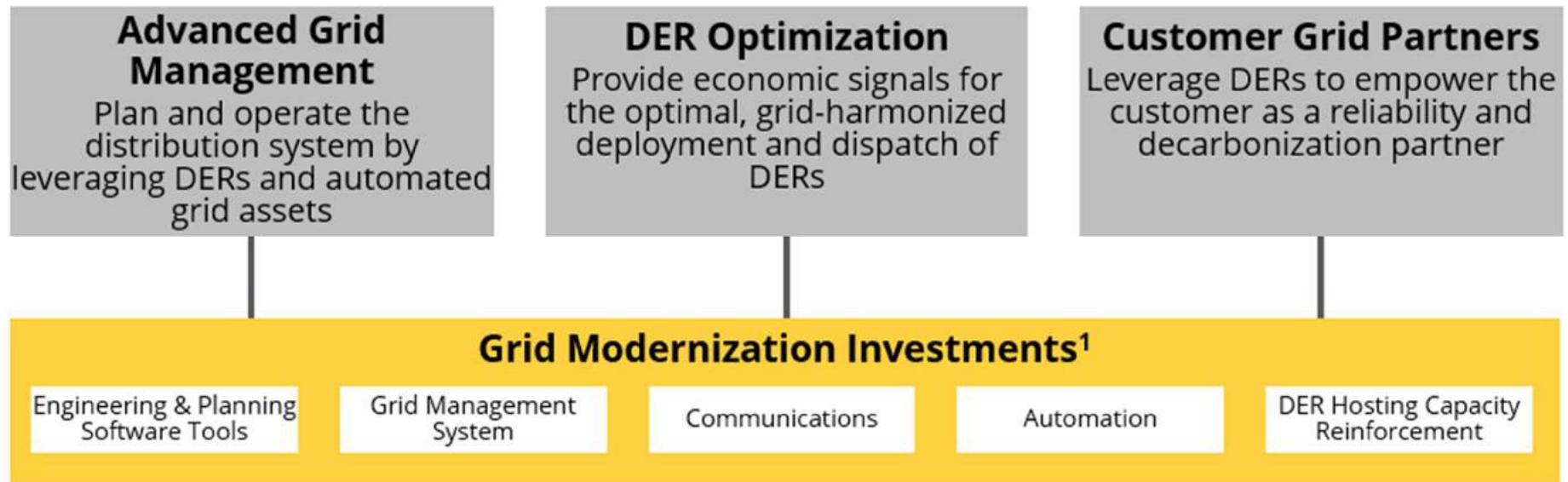
Results of Fontana case study, comparing demand profile of mixed-fuel (red) to all-electric (blue). Note how the two peaks are similar.



Results of Fontana case study, comparing demand profile of all-electric with only-solar (blue) to all-electric with solar-plus-storage (green).

SCE's Grid Modernization Vision

SCE is investing \$5 Billion per year to transform its distribution grid into a secure, flexible, networked platform that optimizes Distributed Energy Resource (DER) value, **supports customer electrification needs**, and ensures grid reliability and resiliency in the face of climate change





COUNTDOWN TO 2045

REALIZING CALIFORNIA'S PATHWAY TO NET ZERO



+80%
GROWTH IN
ELECTRICITY
DEMAND



90% OF
VEHICLES ARE
ELECTRIFIED



95% OF
BUILDINGS ARE
ELECTRIFIED



3X MORE
UTILITY-SCALE
CLEAN ENERGY
VS. TODAY



40% AVERAGE
SAVINGS ON
HOUSEHOLD
ENERGY EXPENSES

edison.com/countdownto2045

Updated: 9/19/23

Projected sources of SCE Generation in 2045

	2022 Existing CAISO Resources	Pathway 2045	Countdown 2045
CAISO Resource Capacity	86	154	192
Gas	31	10	17
Solar	23	63	63
Storage (4-hour equivalent)	8	8	18
Storage (8-hour equivalent)	0	24	14 ^{vi}
Onshore Wind	9	35	32
Offshore Wind	0	0	19
Clean firm	2	1	8
Other (e.g., hydro, biomass, demand response)	13	13	21
Incremental Cost (\$B)	N/A	\$217B	\$247B

Figure 2: Supply Resources (installed capacity in GW)

YOUR TURN

QUESTIONS FROM THE
AUDIENCE

WRAP UP

Final comments from our panel

What should we
be paying
attention to?