ET Summit 2024

Presented by

Residential Electrical Service Upgrade Decision Tools

Individual Home Calculation Tool & Building Stock Assessment Tool

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Project Members and Funding

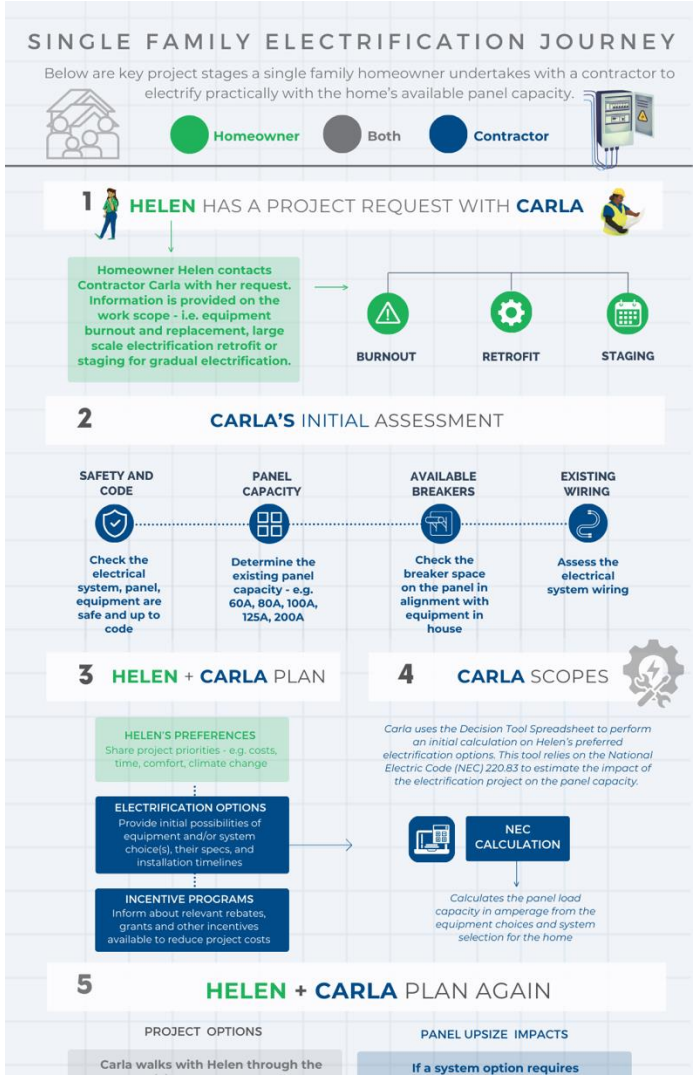
- TRC Energy Services
  - Project lead
  - Main tool development
- Build it Green (BIG)
  - Educational & marketing materials
  - Stakeholder outreach
- San Francisco Bay Area Planning and Urban Research Association (SPUR)
  - Market data collection
  - Market potential model

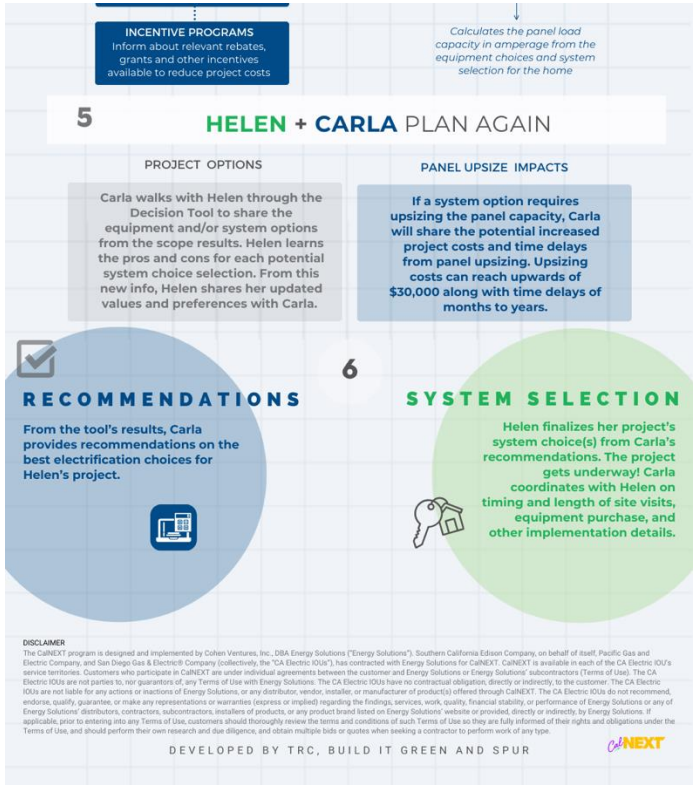
This project was funded through CalNEXT; a targeted funding resource of the California IOUs to support market innovation and energy efficiency adoption efforts.

Electrification Guide

Goals of Guide

- Provide consumer-level guidance documents for the home electrification process.
- Make the project flow understandable and clear what the contractor's and owner's roles are in normal electrification projects.
- Assist contractors new to electrification projects to become more proficient.





Individual Home Calculation Tool

Goals for this tool

- Provide guidance on current approaches to low power electrification
- Assist contractors to make low-power electrification recommendations
- Provide a way to show the client how panel load calculations can be impacted by low power options

Enter Existing Building System Information Below

Select "Y" if System Exists in Home	Description	Type	Main Energy Source	Assumed Size	Electrical Characteristics of System: Default Voltage	Assumed Nameplate Power (VA)	Use Default?	Manual Voltage	Manual Amperage	Existing Loads: Volt-Amps (VA)
Y	Space Heating	Central forced air	NG, Propane, Fuel oi	2.5 ton	120	100	Y			100
Y	Space Cooling	Central forced air	Electric	2.0 ton	240	4080	Y			4080
Y	Ventilation	Air Handler	Electric	600 watts	240	600	Y			600
N	Reserved for HP Backup	Strip Heat	Electric				Y			
Y	Clothes Washer	Side by Side Full size	Electric	480 watts	120	480	Y			480
Y	Clothes Dryer	Side by Side Full size	NG, Propane	480 watts	120	480	Y			480
Y	Range (cooktop and oven)	30" CT/Oven	NG, Propane	480 watts	120	480	Y			480
N	Oven (seperates) - Single						Y			
N	Oven (seperates) - Double						Y			
N	Cooktop (seperates)						Y			
Y	Water Heater	Tank < 50gal	NG, Propane	305 watts	120	305	Y			305
N	Water heater 2						Y			
N	EV Charger						Y			
N	Other Large Loads 1									
N	Other Large Loads 2									
N	Other Large Loads 3									

Other Existing Electric Loads (not impacted by electrification retrofit)

General Loads

	Description	Notes	Quantity	Default Voltage	Default Power	Use Default?	Manual Volt-Amps	Volt-Amps (VA)
Req'd	Lighting Circuits		2	120	3	Y		4500
Req'd	Small Appliance Circuits (2 circuits minimum)		1	120	1500	Y		3000
Req'd	Laundry Circuit (1500 VA minimum)			120	1500	Y		1500

Fixed Appliances

Exists in Home?	Description	Notes	Quantity	Default Voltage	Default Power	Use Default?	Manual Volt-Amps	Volt-Amps (VA)
Y	Refrigerator			120	750	Y		750
Y	Garbage Disposal			120	600	Y		600
Y	Dishwasher			120	1200	Y		1200
Y	Microwave			120	1500	Y		1500
Y	Kitchen Hood			120	250	Y		250
Y	Bathroom Fan		2	120	150	Y		300
N	Other Appliance 1			120				
N	Other Appliance 2			120				
N	Other Appliance 3			120				

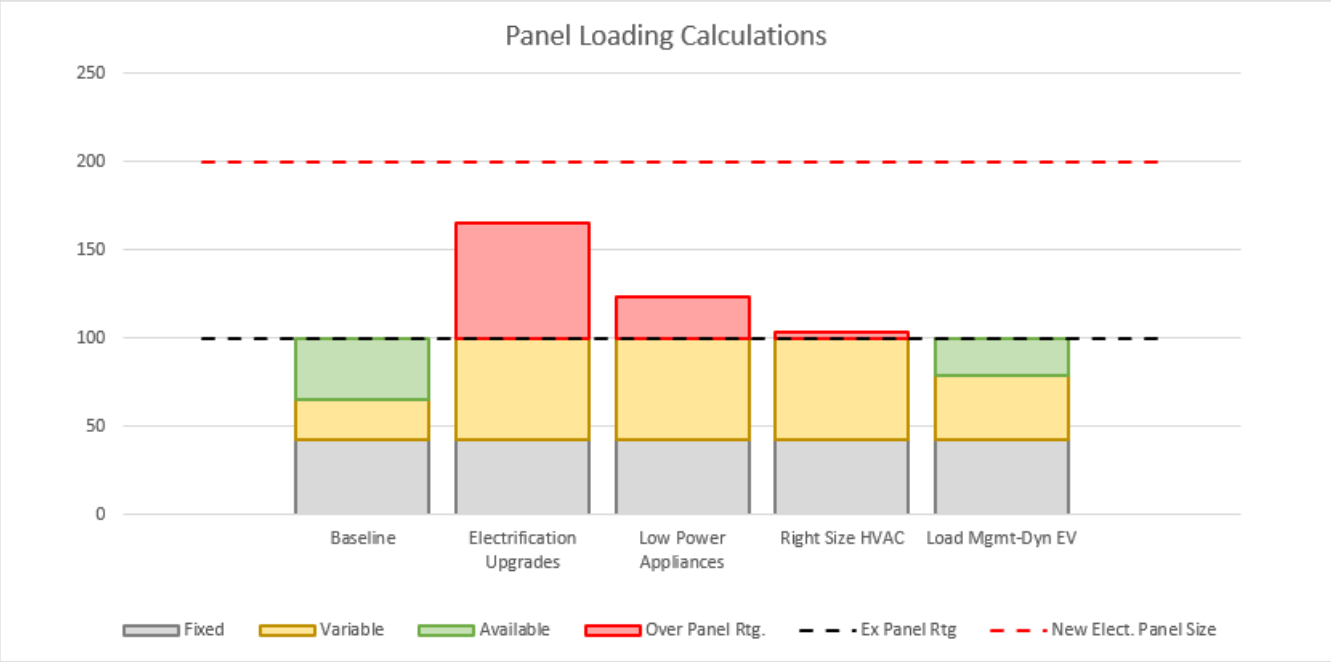
Individual Home Calculation Tool – Upgrade Options

Select Building System Electrification Goals

Default electrification systems reflect Standard Practice 1:1 replacements for the existing gas systems. If system details are known, enter in the Manual Input cells. System details on this page may imply a need for panel and service upgrades. Use the optimization tabs to identify potential strategies to avoid panel upgrades.

Exists in Home?	Upgrade/Electrify System?	Description	Type	Main Energy Source	Assumed Size	Electrical Characteristics of New System					
						Default Voltage	Assumed Nameplate Power (VA)	Use Default?	Manual Input Voltage	Manual Input Amperage	Volt-Amps (VA)
Y	Y	Space Heating	Central forced air	Electric - Heat Pump	2.5 ton	240	4800	Y			4800
Y	Y	Upgraded with Heating	Central forced air	Electric				Y			
Y	Y	Ventilation	Air Handler	Electric	500 watts	240	500	Y			500
N	Y	Backup Strip Heat	Strip Heat	Electric	5760 watts	240	5760	Y			5760
Y	N	Clothes Washer	Side by Side Full size	Electric				Y			
Y	Y	Clothes Dryer	Side by Side Full size	Electric - Heat Pump	4000 watts	240	4000	Y			4000
Y	Y	Range (cooktop and oven)	30" CT/Oven	Electric - Induction	4800 watts	240	4800	Y			4800
N	N	Oven (seperates) - Single						Y			
N	N	Oven (seperates) - Double						Y			
N	N	Cooktop (seperates)						Y			
Y	Y	Water Heater	Tank < 50gal	Electric - Heat Pump	4500 watts	240	4500	Y			4500
N	N	Water Heater 2	Tankless 3gpm					Y			
N	Y	EV Charger	50 Amp	Electric	12000 watts	240	12000	Y			12000
N	N	Other Large Loads 1		Electric							
N	N	Other Large Loads 2		Electric							
N	N	Other Large Loads 3		Electric							

Individual Home Calculation Tool – Results Tab



	Baseline	Electrification Options	Opt #1 - Low Pwr Appliances	Opt #2 - Right-Size HVAC	Opt #3 - Load Mgmt
Baseline Amperage	65.1				
Amperage of Full Electrification		165.8			
Amps Saved by Options			42.6	62.2	87.2
% Amps Saved			25.7%	37.5%	52.6%
Total Amperage		**165.8**	**123.2**	**103.6**	**78.6**

Panel Electrification Results

The existing main electrical panel is 100 Amps.

With all the electrification measures chosen in the 'Electrification Upgrades' tab, the minimum size electrical panel and service will need to be 200 Amps.

The optimizations selected will permit electrification without increasing the panel and service size.

Panel Optimization Recommendations

The electrification upgrades selected will require a panel and service upgrade, but follow the optimization options recommendations below to mitigate this impact.

The currently selected optimizations will meet the existing panel capacity and no panel upgrade is required.

Low Power Appliances - The LPA options selected will reduce the panel size, but not enough to eliminate a panel size increase. Continue to the next optimization tabs for further options.

Right-Size HVAC - The HVAC options selected will reduce the panel size, but not enough to eliminate a panel size increase. Continue to the next optimization tab for further options.

Load Management - The LM selections now fit within your existing panel capacity. You DO NOT need a panel upgrade. However, using more efficient equipment choices may reduce energy consumption and peak load to save on electric bills.

The optimized main electrical panel is 100 Amps.

Note: All tool results and calculations must be confirmed by a qualified contractor, verifying conditions on site. Contractor to verify that selected strategies and calculation approach are allowable by the local permitting agency.

Building Stock Assessment Tool

Goals for this tool

- Provide jurisdictions, utilities, and regulators information on the impacts of electrification to the existing building stock
- Allows user to compare impacts of several different low power choices compared to a “full electrification” option

Select the Counties for Analysis

Y	**ameda**	N	Inyo	N	Monterey	N	San Mateo	N	Tulare
N	Alpine	N	Kern	N	Napa	N	Santa Barbara	N	Tuolumne
N	Amador	N	Kings	N	Nevada	N	Santa Clara	N	Ventura
N	Butte	N	Lake	N	Orange	N	Santa Cruz	N	Yolo
N	Calaveras	N	Lassen	N	Placer	N	Shasta	N	Yuba
N	Colusa	N	Los Angeles	N	Plumas	N	Sierra		
N	Contra Costa	N	Madera	N	Riverside	N	Siskiyou		
N	Del Norte	N	Marin	N	Sacramento	N	Solano	N	**Statewide**
N	El Dorado	N	Mariposa	N	San Bernardino	N	Sonoma		*(overrides all county selections)*
N	Fresno	N	Mendocino	N	San Diego	N	Stanislaus		
N	Glenn	N	Merced	N	San Francisco	N	Sutter		
N	Humboldt	N	Modoc	N	San Joaquin	N	Tehama		
N	Imperial	N	Mono	N	San Luis Obispo	N	Trinity		

Dashboard displays "Full Electrification" and "Full Electrification w/ EV Charger" calculations.

Selections for the A La Carte electrification and optimization options are made on the "A La Carte Dashboard" tab.

Building Stock Assessment Tool – Full Electrification Results

Total Home Stock

14,443,400 SF & MF Residences Statewide

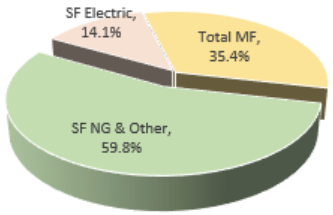
9,330,900 SF Residences Statewide

372,300 SF Homes in Selected Counties

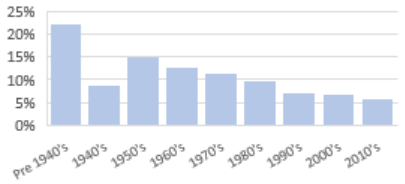
297,100 Candidate Homes

All counts for homes built before 2020

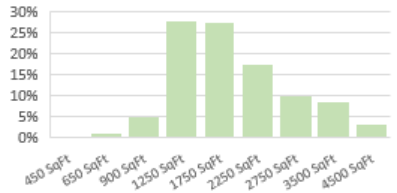
Statewide SF Electrification Potential



Selected Counties SF Vintage by Decade

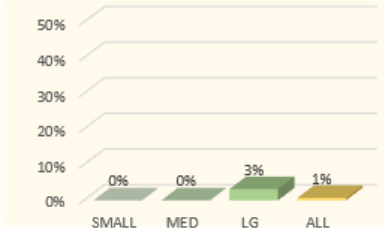


Candidate Residence Size Histogram



Code Compliance Results

Red column and values are the % being upgraded



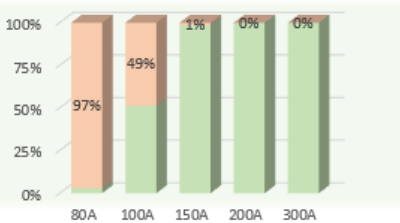
Percent values are of total in the size category.

A small percentage of homes are likely to require a panel and service upgrade due to the existing panel being insufficient to meet current NEC code calculations.

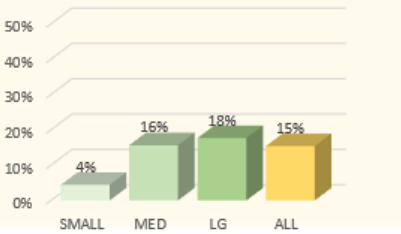
This change will likely be needed if any substantial work is being done on the panel that requires an inspection and review by the AHJ.

These calculations exclude panels and wiring that require replacement due to unsafe condition, age, or equipment failure.

Full Electrification Results (No EV Charger)



Red column and values are the % being upgraded



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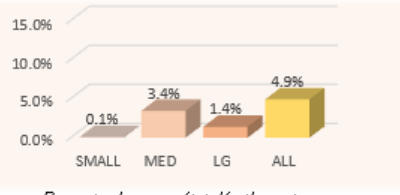
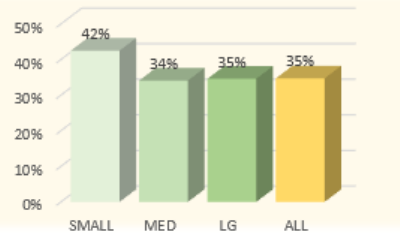


Percent values are of total for the system.

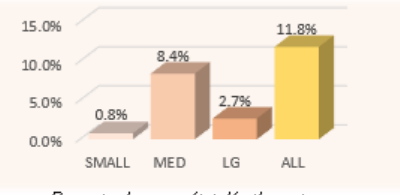
This approach increases the grid power design load by 2.4 Megaamps, (4.9%) @ 240V

Full Electrification Results (With 32A EV Charger)

Red column and values are the % being upgraded



Percent values are of total in the size category.



Percent values are of total for the system.

This approach increases the grid power design load by 5.8 Megaamps, (11.8%) @ 240V

Panel Upgrade Percent as Loads Increase

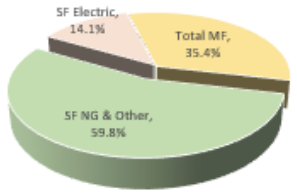
Percent Homes Needing Panel Upgrade

Increased Power Requirements

Building Stock Assessment Tool – A la Carte Results

Total Home Stock
14,443,400 SF & MF Residences Statewide
9,330,900 SF Residences Statewide
372,300 SF Homes in Selected Counties
297,100 Candidate Homes
All counts for homes built before 2020

Statewide SF Electrification Potential



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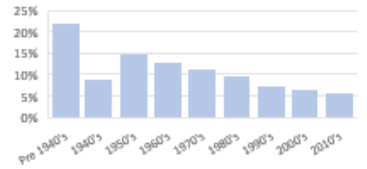
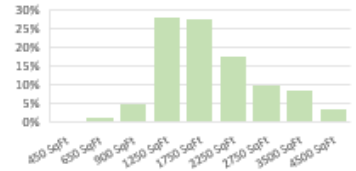


Candidate Residence Size Histogram



Select Upgrade Measures for A La Carte Electrification

Electrify	Optimize	Manage
		Only select one of the below
Y Heating System (Heat Pump)	Y Right-Size HVAC Y No Backup Heat Strip	Y Dynamic EV Chargin *This option will be shown in graph*
		N Circuit Share (EV & Dryer
Y Water Heater (Heat Pump) Y Dryer (Resistance Electric) Y Stove (Induction Cooktop)	Y 120V HP Water Heater Y 120V HP Dryer Y 120V Induction Stove w/ Battery	N Smart Panel or Circuits
Y Add 32A EV Charger	Y 20A 240V EV Charger	

Optimization Savings Opportunity

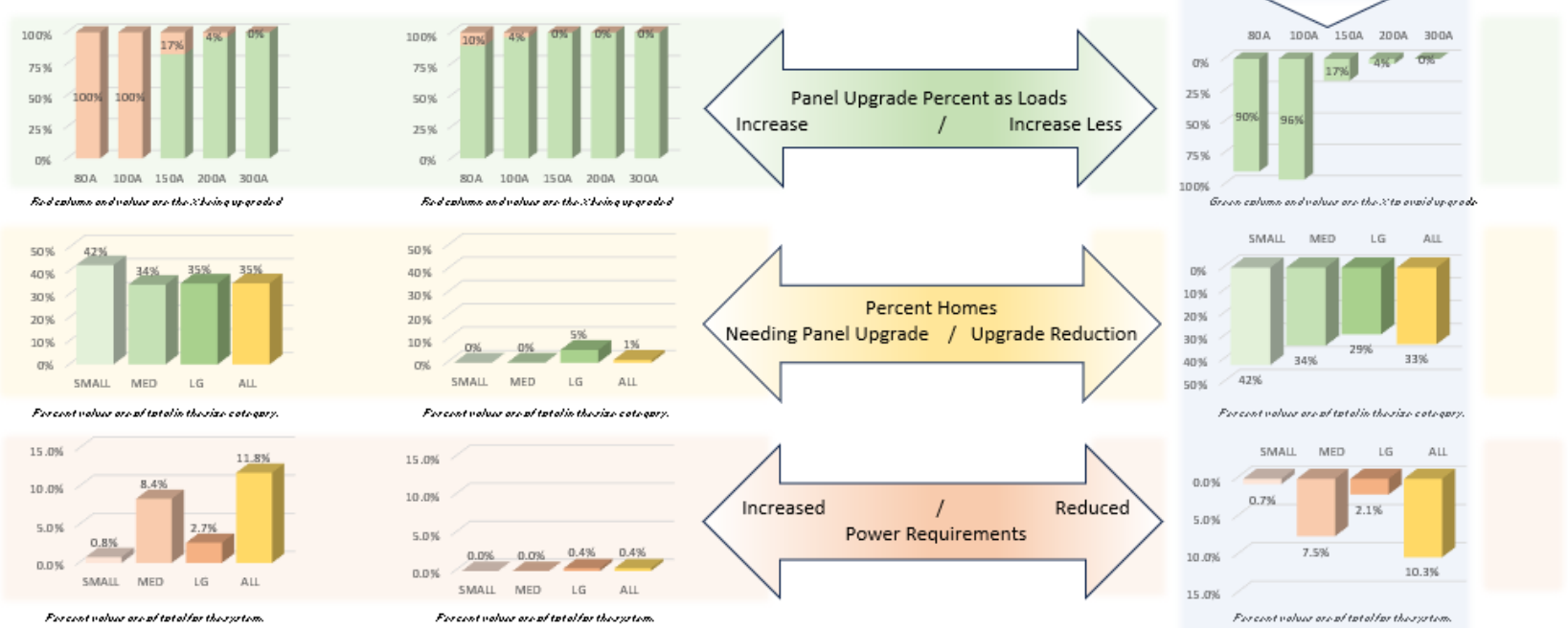
The electrification choices selected to the far left will increase the design load on the grid for the candidate homes in the selected counties by approximately 5.8 Megaamps, (11.8%)

The optimization options selected will reduce the design load by 5.6 Megaamps, which reduces the increase by 96.9% to 0.2 Megaamps.

These optimizations result in approximately 99,491 homes, (96.5%) that will avoid a necessary panel and service upgrade using the optimizations.

"Traditional" Electrification
(All electrification steps above, but no optimization)

A La Carte Electrification
(All choices selected above included)



Tool Availability

- Report – Available now!

  https://calnext.com/wp-content/uploads/2024/09/ET23SWE0021_Residential-Electrical-Service-Upgrade-Decision-Tool_Final-Report.pdf

- Homeowner Guide, Individual Home Calculation Tool & Building Stock Assessment Tool

  …Will be available for download soon!

Thank you to the project team:

- David Douglass-Jaimes, Desyana Halim & Abhijeet Pande – TRC
- Laura Feinstein & Sam Fishman – SPUR
- Jenny Low & Deepti Hossain – BiG
- Jenny Chen – SCE, Sr. Contract Administrator

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