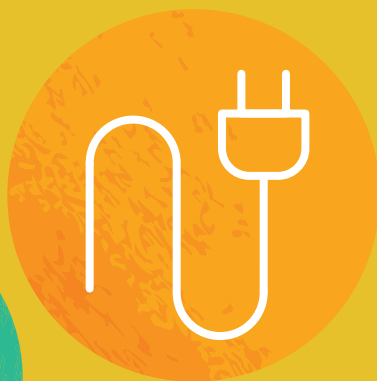
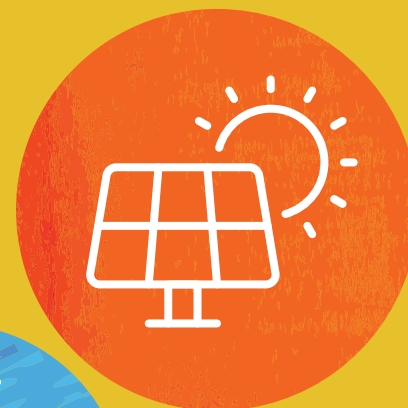


SINGLE-FAMILY HOME DECARBONIZATION CASE STUDY

REDWOOD CITY RANCH HOME



OFFICE OF
SUSTAINABILITY
COUNTY OF SAN MATEO

FUNDED BY



Updated 3/1/2023

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HOME ASSESSMENT





REDWOOD CITY RANCH HOME

 **1,950 Square Feet**

 **4 Occupants**

 **Built in 1960s**

 **4 Bedrooms**

 **2 Bathrooms**

The Homeowners are Interested in

Solar/Battery

Electric Vehicle Charging


Induction Range

Heat Pump Dryer

Heat Pump Water Heater

Heating/Cooling

Insulation



All recommendations are made to eliminate carbon emissions, increase energy efficiency, and optimize the electric panel.

Panel optimization calls for fitting all the new electric appliances on the panel without having to upgrade the panel and adequately using unused panel space. This is done by careful selection of appliances based on amps and efficiency.



INITIAL HOME ASSESSMENT/INTAKE

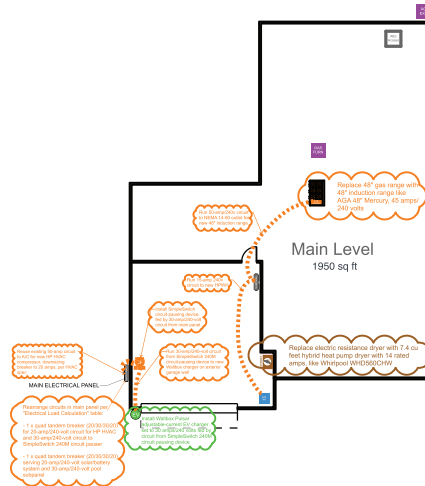
- Already has some electric appliances: electric resistance dryer, electric double wall ovens, 50A/240V circuit to existing AC
- Interested in replacing 48" gas range with induction range
- Some insulation in attic and walls
- Getting a rooftop solar system
- Gas furnace currently located in mech closet in center of house
- EV charging demands: ~150 miles/week

FLOOR PLANS WITH AND WITHOUT UPGRADES

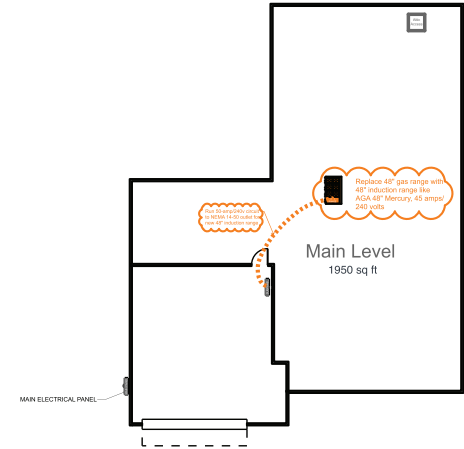
Current Condition



All Electrical Work

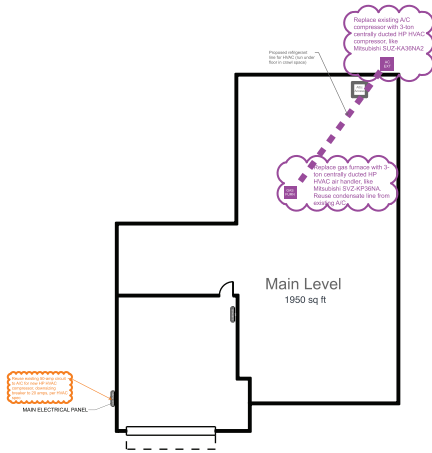


Kitchen Range Work

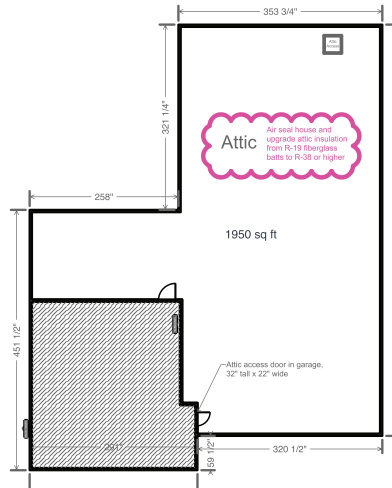


FLOOR PLANS WITH UPGRADES

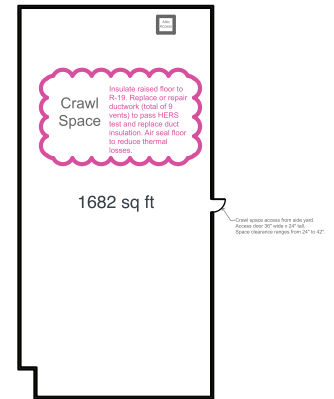
HVAC Work



Attic Insulation Work



Floor Insulation Work

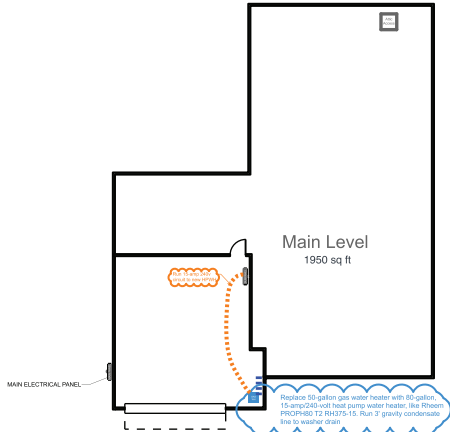


*Information for contractors

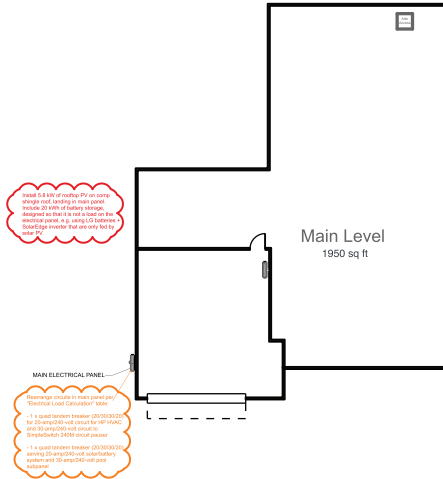


FLOOR PLANS WITH UPGRADES

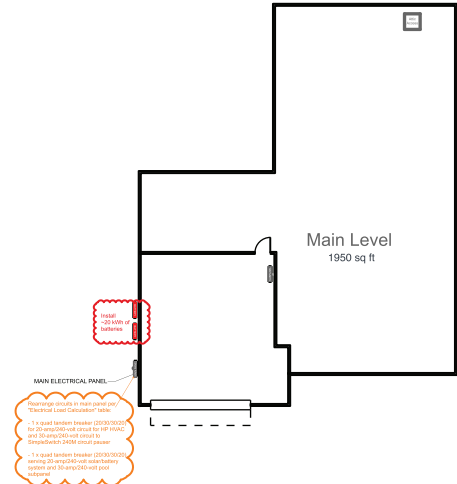
Water Heater Work



Solar PV Work



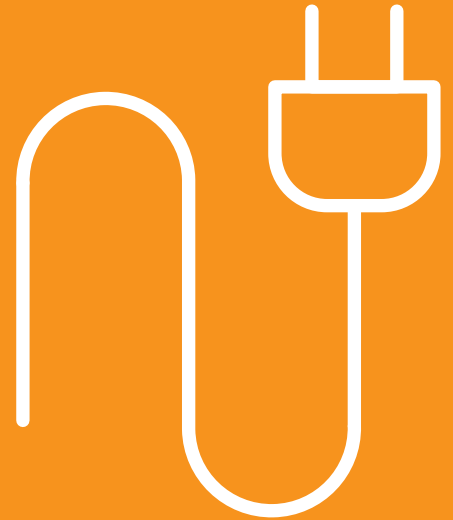
Battery Storage Work



*Information for contractors



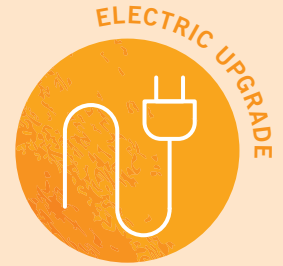
ELECTRICAL UPGRADES



MAIN ELECTRICAL PANEL



Existing
100-amp main electrical panel



RECOMMENDED

100-amp Electrical Panel



Lowest Bid

Cost without incentives*\$940

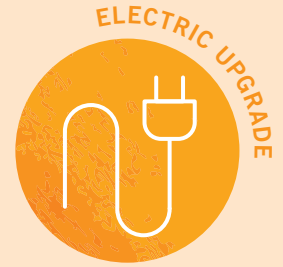
Cost with incentives*\$0

*Cost includes new garage subpanel

GARAGE SUBPANEL



Existing
100-amp subpanel



RECOMMENDED

100-amp Subpanel



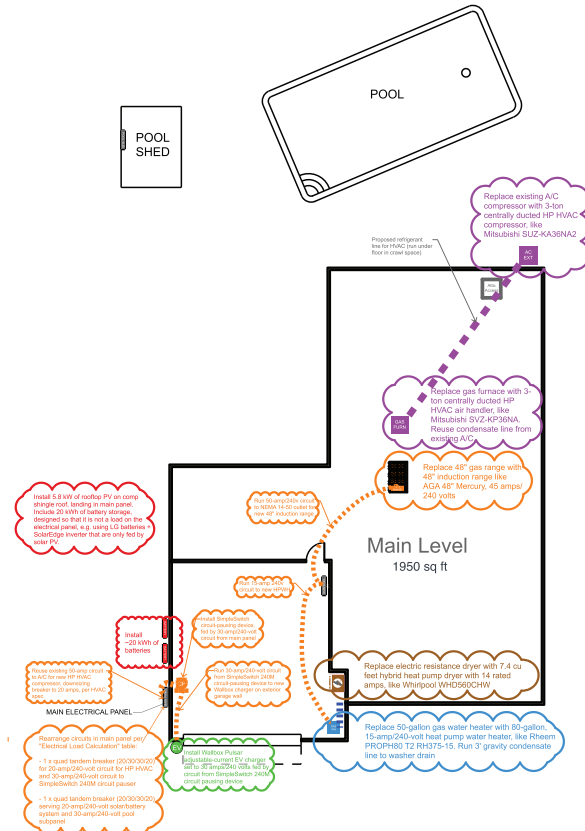
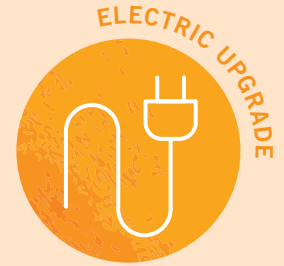
Lowest Bid

Cost without incentives*\$0

Cost with incentives*\$0

*Cost included with main panel work

WIRING



RECOMMENDED

2 240-volt Circuits to Water Heater, Range



Lowest Bid

Cost without incentives.....\$1,535

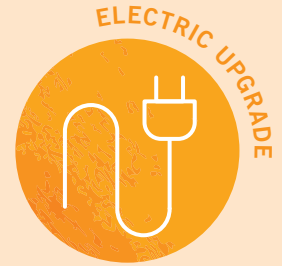
Cost with incentives\$285

EV CHARGING



Recommended


Existing



RECOMMENDED

EV Charger

Energy Management System



Lowest Bid

Cost without incentives.....\$1,771

Cost with incentives\$1,771

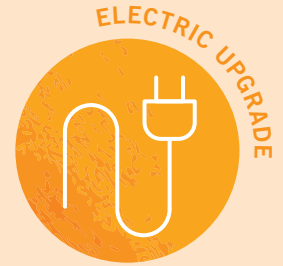
COOKING



Recommended



Existing
8-burner 48" gas range



RECOMMENDED

8-burner 48" Induction Range

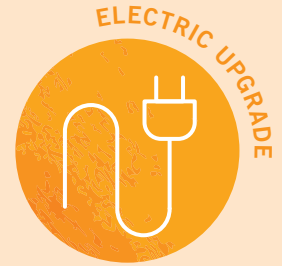


Lowest Bid

Cost without incentives.....\$10,259

Cost with incentives\$9,089

CLOTHES DRYING



Recommended



Existing

7.5 cu ft electric resistance dryer

RECOMMENDED

7.4 cu ft Hybrid Heat Pump Dryer



Lowest Bid

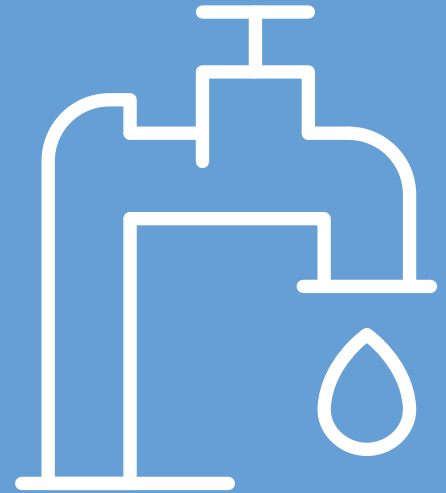
Cost without incentives.....\$1,394

Cost with incentives\$674

CONTRACTOR QUOTES

| Existing Condition | Proposed Electrification | Replace Existing (gas) | DIY | DIY With Incentives | Low Bid | Low Bid With Incentives | Mid Bid | Mid Bid With Incentives | High Bid | High Bid With Incentives |
|---|---|------------------------|-----------------|---------------------|-----------------|-------------------------|-----------------|-------------------------|-----------------|--------------------------|
| 100-amp main electrical panel and 100-amp garage subpanel | 100-amp main electrical panel and 100-amp garage subpanel | \$0 | \$940 | \$0 | \$940 | \$0 | \$940 | \$0 | \$940 | \$0 |
| No 240-volt circuits to water heater, range | 2 240-volt circuits to water heater, range | \$0 | \$1,535 | \$285 | \$1,535 | \$285 | \$2,773 | \$1,523 | \$8,761 | \$7,511 |
| No at-home fueling for 2 gas cars: 12k miles/year | EV charger and energy management system | \$0 | \$1,771 | \$1,771 | \$1,771 | \$1,771 | \$2,500 | \$2,500 | \$3,756 | \$3,756 |
| 8-burner 48" gas range | 8-burner 48" induction range | \$13,000 | \$10,259 | \$9,089 | \$10,259 | \$9,089 | \$10,259 | \$9,089 | \$15,389 | \$14,219 |
| 7.5 cu ft electric resistance dryer | 7.4 cu ft hybrid heat pump dryer | \$1,079 | \$1,394 | \$674 | \$1,394 | \$674 | \$1,394 | \$674 | \$1,394 | \$674 |
| Total | | \$14,079 | \$15,899 | \$11,819 | \$15,899 | \$11,819 | \$17,866 | \$13,786 | \$30,240 | \$26,160 |

PLUMBING UPGRADE



WATER HEATER



RECOMMENDED

80-gallon Heat Pump Water Heater

Why

Uses 1/3 the energy of a gas water heater

Lowest Bid

Cost without incentives.....\$5,632

Cost with incentives\$530



Existing
50-gallon gas
water heater



Recommended

CONTRACTOR QUOTES

| Existing Condition | Proposed Electrification | Replace Existing (gas) | DIY | DIY With Incentives | Low Bid | Low Bid With Incentives | Mid Bid | Mid Bid With Incentives | High Bid | High Bid With Incentives |
|----------------------------|----------------------------------|------------------------|----------------|---------------------|----------------|-------------------------|----------------|-------------------------|----------------|--------------------------|
| 50-gallon gas water heater | 80-gallon heat pump water heater | \$2,754 | \$4,200 | \$0 | \$5,632 | \$530 | \$5,741 | \$639 | \$7,042 | \$1,940 |
| Total | | \$2,754 | \$4,200 | \$0 | \$5,632 | \$530 | \$5,741 | \$639 | \$7,042 | \$1,940 |

HVAC UPGRADE



SPACE HEATING/COOLING



Recommended



Existing

80% efficient centrally ducted propane gas furnace and central air conditioner

RECOMMENDED

36,000 BTU Centrally Ducted Heat Pump HVAC System with MERV 13 Filter



Lowest Bid

Cost without incentives.....\$12,250

Cost with incentives\$2,450

CONTRACTOR QUOTES

| Existing Condition | Proposed Electrification | Replace Existing (gas) | DIY | DIY With Incentives | Low Bid | Low Bid With Incentives | Mid Bid | Mid Bid With Incentives | High Bid | High Bid With Incentives |
|--|---|------------------------|----------------|---------------------|-----------------|-------------------------|-----------------|-------------------------|-----------------|--------------------------|
| 80% efficient centrally ducted gas furnace and central air conditioner | 36,000 BTU centrally ducted heat pump HVAC system with MERV 13 filter | \$13,665 | \$5,300 | \$0 | \$12,250 | \$2,450 | \$13,900 | \$4,100 | \$31,562 | \$21,762 |
| Total | | \$13,665 | \$5,300 | \$0 | \$12,250 | \$2,450 | \$13,900 | \$4,100 | \$31,562 | \$21,762 |

INSULATION UPGRADES



BUILDING SHELL IMPROVEMENTS



Existing
Attic,
some insulation



Existing
Ductwork,
poor condition



RECOMMENDED

Attic: Air Seal, R38 Insulation Ductwork: Seal and Insulate



Lowest Bid

Cost without incentives.....\$8,650

Cost with incentives\$5,583

BUILDING SHELL IMPROVEMENTS



Existing
Floor,
no insulation



Existing
Walls,
no insulation



RECOMMENDED

Floors: Air Seal, R19 Insulation

Walls: Air Seal, R11 Insulation



Lowest Bid

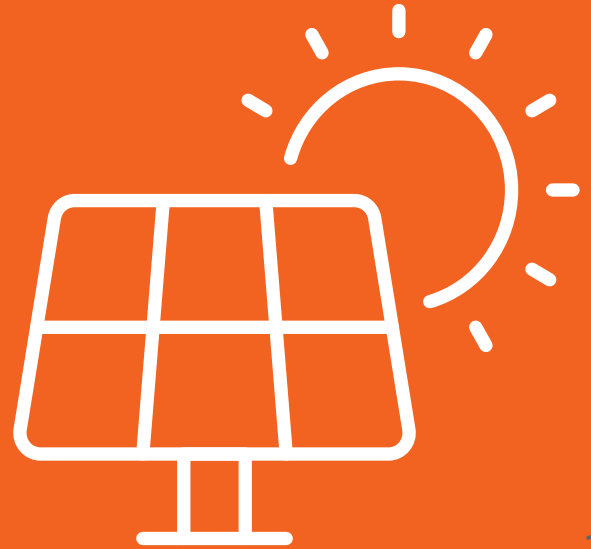
Cost without incentives.....\$6,600


Cost with incentives\$3,766

CONTRACTOR QUOTES

| Existing Condition | Proposed Electrification | Replace Existing (gas) | Replace Existing (gas) With Incentives | DIY | DIY With Incentives | Low Bid | Low Bid With Incentives | Mid Bid | Mid Bid With Incentives | High Bid | High Bid With Incentives |
|--------------------------|--------------------------------|------------------------|--|-----------------|---------------------|-----------------|-------------------------|-----------------|-------------------------|-----------------|--------------------------|
| Insulation: attic – some | Insulation: attic – R38 | \$0 | \$0 | \$1,365 | \$769 | \$3,250 | \$1,583 | \$3,333 | \$1,666 | \$4,095 | \$2,428 |
| Ductwork: poor condition | Ductwork: sealed and insulated | \$5,400 | \$4,000 | \$5,400 | \$4,800 | \$5,400 | \$4,000 | \$5,400 | \$4,000 | \$5,400 | \$4,000 |
| Insulation: floor – none | Insulation: floor – R19 | \$0 | \$0 | \$1,853 | \$1,110 | \$2,800 | \$2,133 | \$3,782 | \$3,115 | \$3,789 | \$3,122 |
| Insulation: walls – none | Insulation: walls – R11 | \$0 | \$0 | \$3,800 | \$1,633 | \$3,800 | \$1,633 | \$4,921 | \$2,754 | \$6,800 | \$4,633 |
| Total | | \$5,400 | \$4,000 | \$12,418 | \$8,312 | \$15,250 | \$9,349 | \$17,436 | \$11,535 | \$20,084 | \$14,183 |

OPTIONAL SOLAR & BATTERY UPGRADES



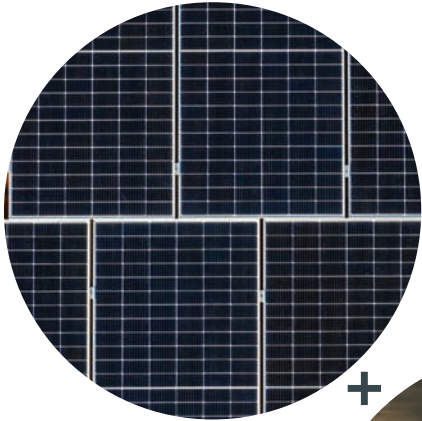


Decarbonizing a home does not require adding solar or batteries, since the electricity in San Mateo County is 100% carbon emissions free.

Instead, solar panels can make electrification more affordable and batteries provide resiliency during power outages.



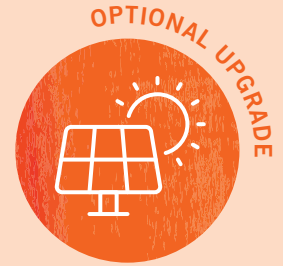
SOLAR & BATTERY



Recommended



Existing



RECOMMENDED

5.8 kW Rooftop Solar System 10 kWh Battery System



Lowest Bid Solar

Cost without incentives.....\$13,833

Cost with incentives\$9,683

Lowest Bid Battery

Cost without incentives\$14,675

Cost with incentives\$10,272

COST SUMMARY

ELECTRIFICATION COSTS

| Subtotals of Upgrade by Trade | Replace Existing (gas) | Replace Existing (gas) With Incentives | DIY | DIY With Incentives | Low Bid | Low Bid With Incentives | Mid Bid | Mid Bid With Incentives | High Bid | High Bid With Incentives |
|-------------------------------|------------------------|--|----------|---------------------|----------|-------------------------|----------|-------------------------|----------|--------------------------|
| Electrical | \$14,079 | \$14,079 | \$15,899 | \$11,819 | \$15,899 | \$11,819 | \$17,866 | \$13,786 | \$30,240 | \$26,160 |
| Plumbing | \$2,754 | 2,754 | \$4,200 | \$0 | \$5,632 | \$530 | \$5,741 | \$639 | \$7,042 | \$1,940 |
| HVAC | \$13,665 | 13,665 | \$5,300 | \$0 | \$12,250 | \$2,450 | \$13,900 | \$4,100 | \$31,562 | \$21,762 |
| Insulation | \$5,400 | \$4,000 | \$12,418 | \$8,312 | \$15,250 | \$9,349 | \$17,436 | \$11,535 | \$20,084 | \$14,183 |
| Total | \$35,898 | \$34,498 | \$37,817 | \$20,131 | \$49,031 | \$24,148 | \$54,943 | \$30,060 | \$88,928 | \$64,045 |

OPTIONAL SOLAR & BATTERY INVESTMENT*

| Existing Condition | Proposed Electrification | Replace Existing (gas) | DIY | DIY With Incentives | Low Bid | Low Bid With Incentives | Mid Bid | Mid Bid With Incentives | High Bid | High Bid With Incentives |
|------------------------|--------------------------|------------------------|----------|---------------------|----------|-------------------------|----------|-------------------------|----------|--------------------------|
| Rooftop solar PV: none | Rooftop solar PV: 5.8 kW | \$0 | \$13,833 | \$9,683 | \$13,833 | \$9,683 | \$13,833 | \$9,683 | \$20,875 | \$14,613 |
| Home battery: none | Home battery: 10 kWh | \$0 | \$14,675 | \$10,272 | \$14,675 | \$10,272 | \$16,790 | \$11,753 | \$19,000 | \$13,300 |
| Total | | \$0 | \$28,508 | \$19,955 | \$28,508 | \$19,955 | \$30,623 | \$21,436 | \$39,875 | \$27,913 |

For more information about incentives, please visit www.smcsustainability.org/energy-water/decarbonizing-homes/incentives

*Solar and batteries are not required for home and vehicle electrification. Peninsula Clean Energy already provides carbon-free electricity for its customers. Solar and batteries are an investment opportunity for any home to save on the electric bill and to increase electricity resilience.

CONTACT

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OFFICE OF
SUSTAINABILITY

COUNTY OF SAN MATEO

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