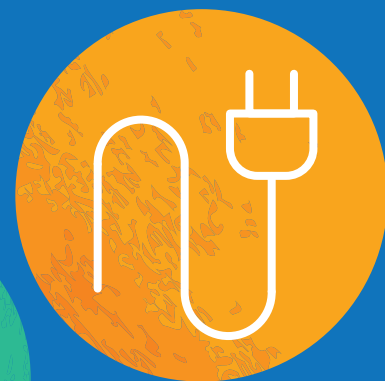
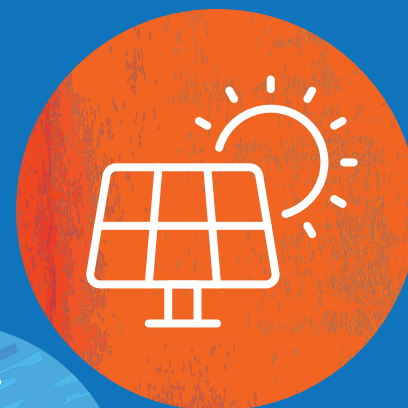


SINGLE-FAMILY HOME DECARBONIZATION CASE STUDY

# SAN CARLOS 2-STORY HOME



OFFICE OF  
SUSTAINABILITY  
COUNTY OF SAN MATEO

FUNDED BY



Updated 3/1/2023.2

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# HOME ASSESSMENT





## SAN CARLOS 2-STORY HOME

 **2,100 Square Feet**

 **2 Occupants**

 **Built in 1940**

 **3 Bedrooms**

 **2 Bathrooms**

### **The Homeowners are Interested in**


Solar/Battery

Induction Cooktop

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.

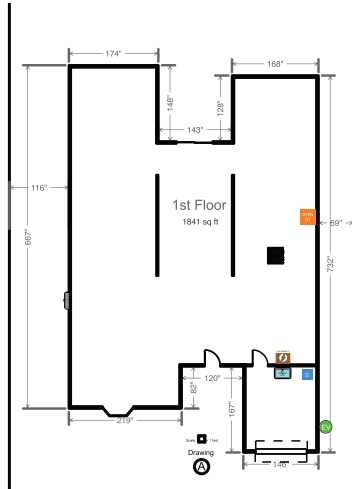


## INITIAL HOME ASSESSMENT/INTAKE

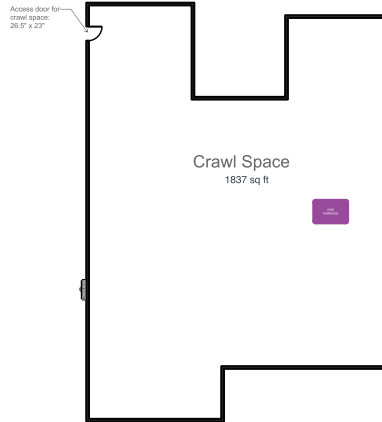
- Already has some electric appliances: electric resistance dryer, electric double wall ovens, 50A/240V outlet for charging EV in garage
- EV charging demands: ~150 miles/week
- Some insulation in attic and walls
- New gas cooktop
- Already have a rooftop solar system
- Gas furnace currently located in crawl space under house

# FLOOR PLANS WITHOUT UPGRADES

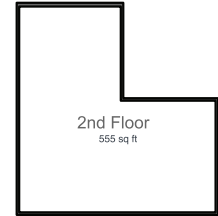
Current Condition



Current Condition  
Crawl Space

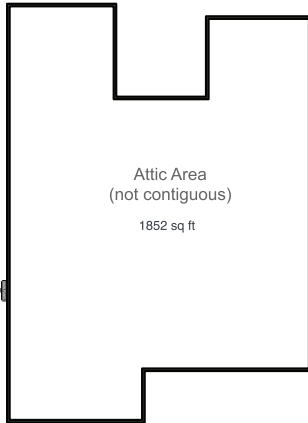


Current Condition  
2nd Floor

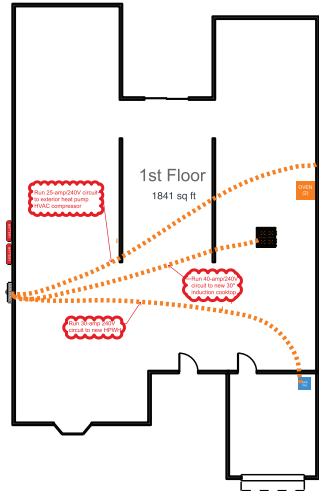


# FLOOR PLANS WITH AND WITHOUT UPGRADES

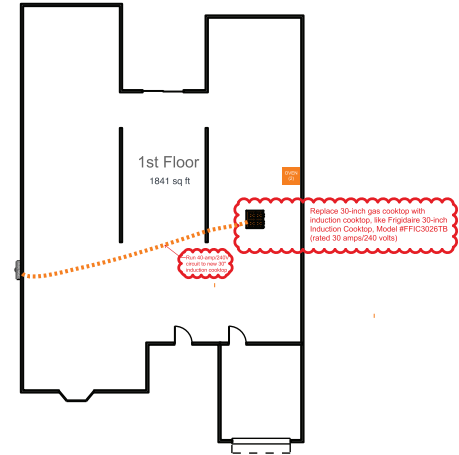
Current Condition  
Attic



All Electrical Work



Kitchen Range Work



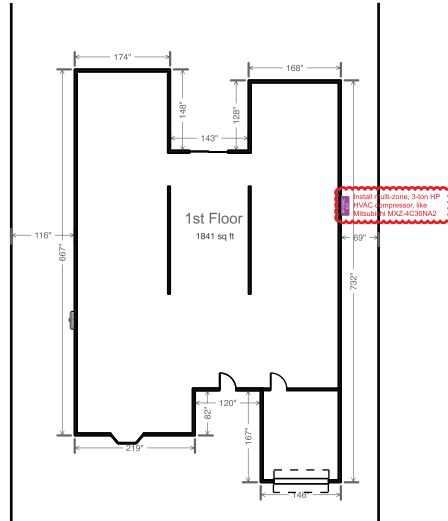
\*Information for contractors



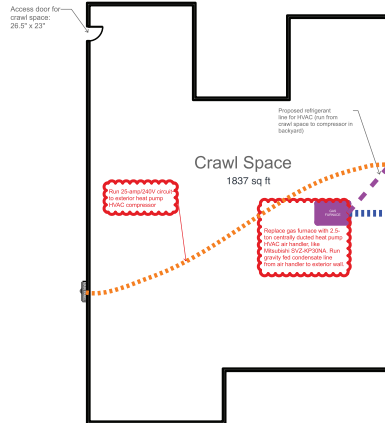


# FLOOR PLANS WITH UPGRADES

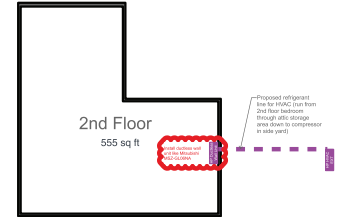
## HVAC Work



## HVAC Work Crawl Space

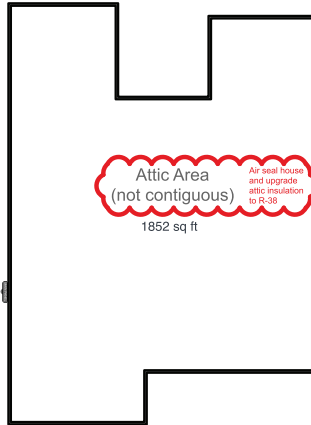


## HVAC Work 2nd Floor

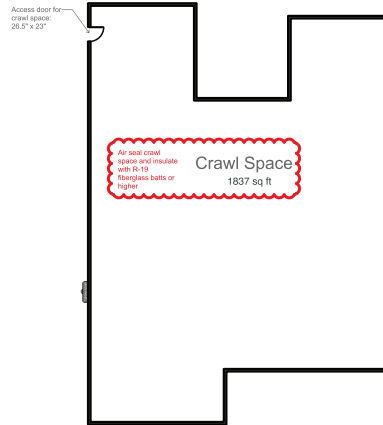


# FLOOR PLANS WITH UPGRADES

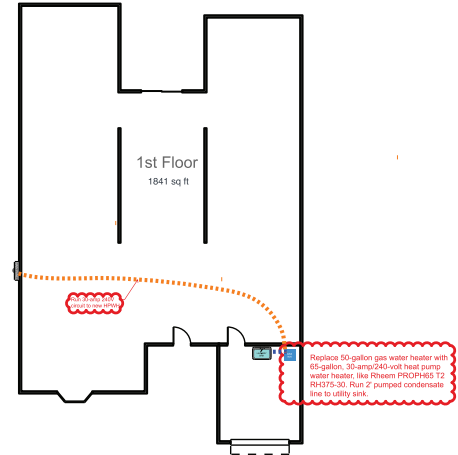
## Attic Insulation Work



## Floor Insulation Work



## Water Heater Work

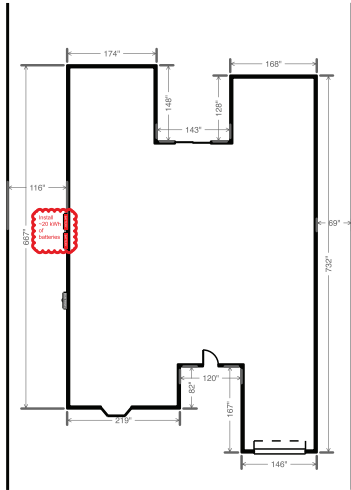


\*Information for contractors

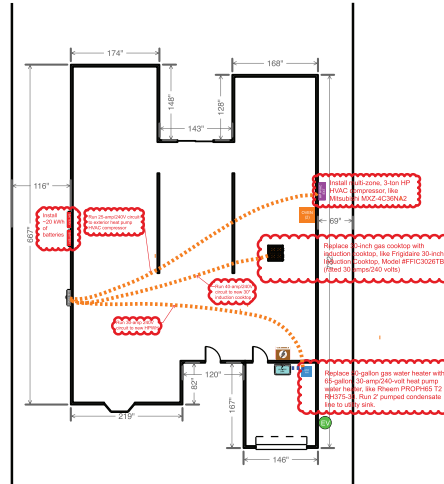


# FLOOR PLANS WITH UPGRADES

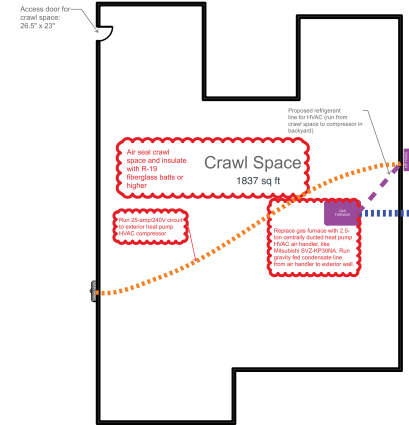
## Battery Storage Work



## All Electrification Projects

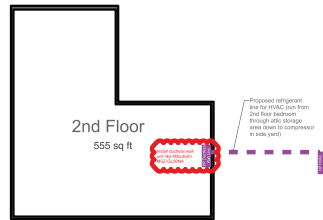


## All Electrification Projects Crawl Space

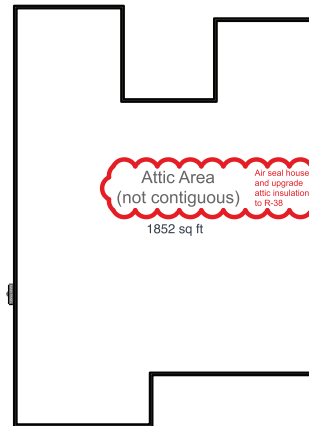


# FLOOR PLANS WITH UPGRADES

All Electrification Projects  
2nd Floor



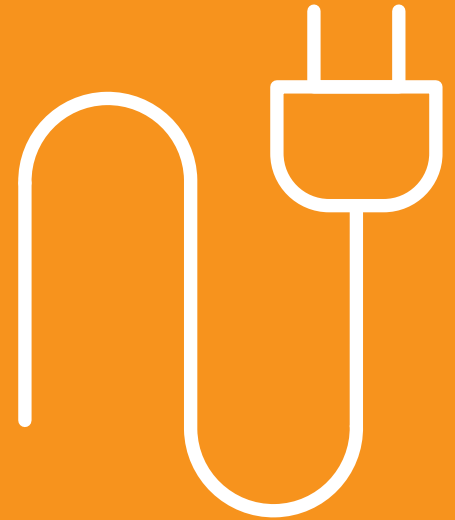
All Electrification Projects  
Attic



\*Information for contractors



# ELECTRICAL UPGRADES

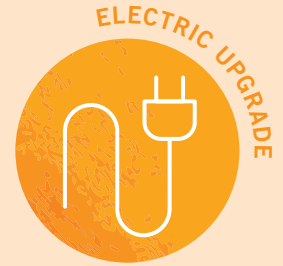




# SUBPANEL



Existing



RECOMMENDED

**No Change**

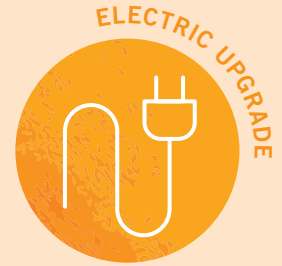
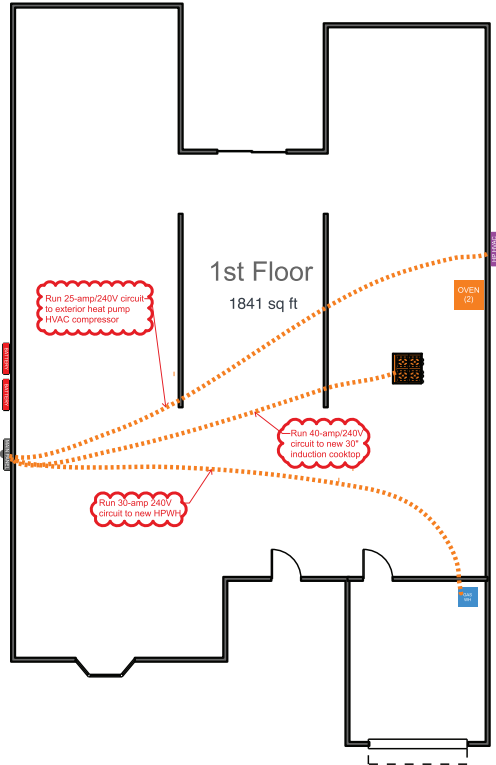


**Lowest Bid**

Cost without incentives.....\$0

Cost with incentives .....\$0

# WIRING



## RECOMMENDED

### 3 240-volt Circuits to Water Heater, HVAC, Cooktop



#### Lowest Bid

Cost without incentives.....\$3,851

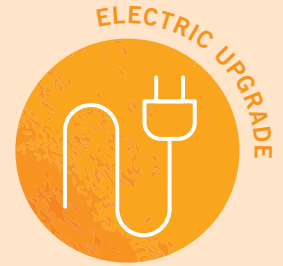
Cost with incentives .....\$2,601



# EV CHARGING



Existing  
50A/240V outlet  
for EV in garage



## RECOMMENDED

### No Change



#### Lowest Bid

Cost without incentives.....\$0

Cost with incentives .....\$0

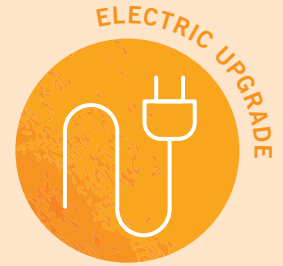
# COOKING



Recommended



Existing  
5-burner  
36" gas cooktop



RECOMMENDED

## 5-burner 36" Induction Cooktop



**Lowest Bid**

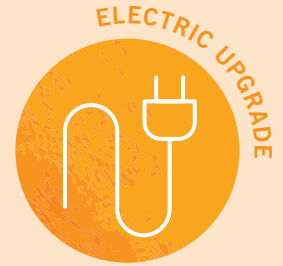
Cost without incentives.....\$1,308

Cost with incentives .....\$138

# CLOTHES DRYING



Existing  
7.5 cu ft electric  
resistance dryer



RECOMMENDED

**No Change**



**Lowest Bid**

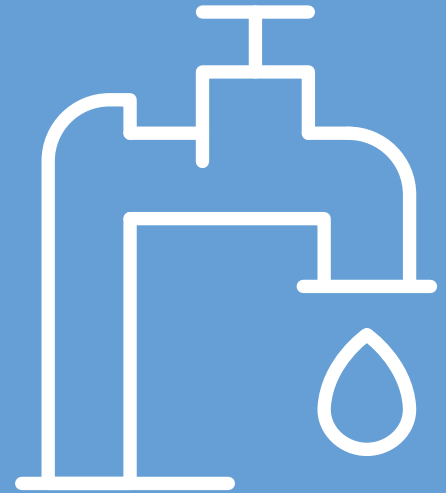
Cost without incentives.....\$0

Cost with incentives .....\$0

# 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
200-amp main electrical panel	No Change	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
No 240-volt circuits to water heater, HVAC, cooktop	3 240-volt circuits to water heater, HVAC, cooktop	\$0	\$3,851	\$2,601	\$3,851	\$2,601	\$5,198	\$3,948	\$6,200	\$4,950
At-home fueling for 2 EVs: 12k miles/year	No Change	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
5-burner 36" gas cooktop	5-burner 36" induction cooktop	\$1,308	\$1,308	\$138	\$1,308	\$138	\$1,308	\$138	\$1,661	\$491
7.5 cu ft electric resistance dryer	No Change	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>Total</b>		<b>\$1,308</b>	<b>\$5,159</b>	<b>\$2,739</b>	<b>\$5,159</b>	<b>\$2,739</b>	<b>\$6,506</b>	<b>\$4,086</b>	<b>\$7,861</b>	<b>\$5,441</b>

# PLUMBING UPGRADE



# WATER HEATER



Existing  
50-gallon gas  
water heater



Recommended



RECOMMENDED

## 65-gallon Heat Pump Water Heater

### Why

Uses 1/3 the energy of a gas water heater



### Lowest Bid

Cost without incentives.....\$4,311

Cost with incentives .....\$0

# 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	65-gallon heat pump water heater	\$2,652	\$3,809	\$0	\$4,311	\$0	\$5,544	\$1,233	\$7,820	\$3,509
<b>Total</b>		<b>\$2,652</b>	<b>\$3,809</b>	<b>\$0</b>	<b>\$4,311</b>	<b>\$0</b>	<b>\$5,544</b>	<b>\$1,233</b>	<b>\$7,820</b>	<b>\$3,509</b>

# HVAC UPGRADE





# SPACE HEATING/COOLING



Recommended

## RECOMMENDED

**36,000 BTU Multi-zone Heat Pump HVAC System with 30,000 BTU Ducted Air Handler and 6,000 BTU Ductless Wall Unit**



## Lowest Bid

Cost without incentives.....\$15,367

Cost with incentives .....\$4,632



Existing

80% efficient centrally ducted gas furnace

# 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	36,000 BTU multi-zone heat pump HVAC system with 30,000 BTU ducted air handler and 6,000 BTU ductless wall unit	\$4,808	\$6,956	\$0	\$15,367	\$4,632	\$19,849	\$9,114	\$22,630	\$11,895
<b>Total</b>		<b>\$4,808</b>	<b>\$6,956</b>	<b>\$0</b>	<b>\$15,367</b>	<b>\$4,632</b>	<b>\$19,849</b>	<b>\$9,114</b>	<b>\$22,630</b>	<b>\$11,895</b>

# INSULATION UPGRADES



# BUILDING SHELL IMPROVEMENTS



Existing  
Attic,  
some insulation

Existing  
Ductwork,  
good condition



## RECOMMENDED

**Attic: Air Seal, R38 Insulation**

**Ductwork: Seal and Insulate as Needed**



### Lowest Bid

Cost without incentives.....\$5,663

Cost with incentives .....\$2,013

# BUILDING SHELL IMPROVEMENTS



Existing  
Floor,  
no insulation

Existing  
Walls,  
no insulation



## RECOMMENDED

Floors: No Change

Walls: No Change



### Lowest Bid

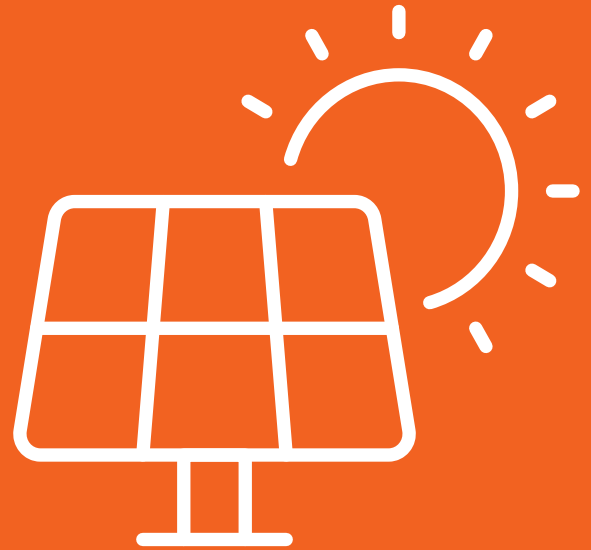
Cost without incentives.....\$0


Cost with incentives .....\$0

# 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	\$1,440	\$448	\$3,300	\$1,050	\$3,884	\$1,634	\$4,200	\$1,950
Ductwork: good condition	Ductwork: sealed and insulated, as needed	\$2,363	\$963	\$2,363	\$1,763	\$2,363	\$963	\$2,363	\$963	\$2,363	\$963
Insulation: floor – none	No Change	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Insulation: walls – none	No Change	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>Total</b>		<b>\$2,363</b>	<b>\$963</b>	<b>\$3,803</b>	<b>\$2,211</b>	<b>\$5,663</b>	<b>\$2,013</b>	<b>\$6,247</b>	<b>\$2,597</b>	<b>\$6,563</b>	<b>\$2,913</b>

# 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



Existing  
Rooftop solar system



RECOMMENDED

## 10 kWh Battery



### 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	\$1,308	\$1,308	\$5,159	\$2,739	\$5,159	\$2,739	\$6,506	\$4,086	\$7,861	\$5,441
Plumbing	\$2,652	\$2,652	\$3,809	\$0	\$4,311	\$0	\$5,544	\$1,233	\$7,820	\$3,509
HVAC	\$4,808	\$4,808	\$6,956	\$0	\$15,367	\$4,632	\$19,849	\$9,114	\$22,630	\$11,895
Insulation	\$2,363	\$963	\$3,803	\$2,211	\$5,663	\$2,013	\$6,247	\$2,597	\$6,563	\$2,913
<b>Total</b>	\$11,131	\$9,731	\$19,727	\$4,950	\$30,500	\$9,384	\$38,146	\$17,030	\$44,874	\$23,758

## 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: ~3 kW	No Change	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Home battery: none	Home battery: 10 kWh	\$0	\$14,675	\$10,272	\$14,675	\$10,272	\$16,790	\$11,753	\$25,575	\$17,903
<b>Total</b>		\$0	\$14,675	\$10,272	\$14,675	\$10,272	\$16,790	\$11,753	\$25,575	\$17,903

For more information about incentives, please visit [www.smcsustainability.org/energy-water/decarbonizing-homes/incentives](http://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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