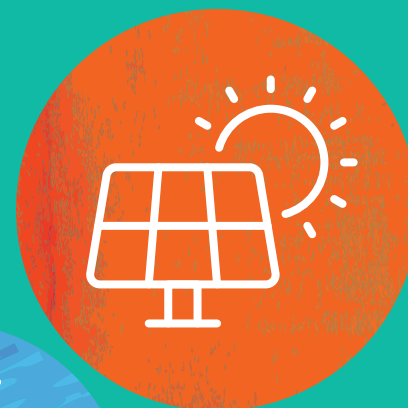


SINGLE-FAMILY HOME DECARBONIZATION CASE STUDY

# BELMONT 3-ZONE HOME



OFFICE OF  
SUSTAINABILITY  
COUNTY OF SAN MATEO

FUNDED BY



Updated 3/1/2023

# CONTENTS

## **HOME ASSESSMENT ..... 3**

Specs .....	4
Initial Home Assessment/Intake .....	6
Floor Plans Without Upgrades .....	7
Floor Plans With Upgrades.....	8

## **ELECTRICAL UPGRADES ..... 9**

Electric Panel Upgrade.....	10
Garage Subpanel .....	11
Wiring .....	12
EV Charging .....	13
Cooking .....	14
Clothes Drying.....	15
Contractor Quotes .....	16

## **PLUMBING UPGRADE .....17**

Water Heater.....	18
Contractor Quotes .....	19

## **HVAC UPGRADE .....20**

Space Heating/Cooling .....	21
Contractor Quotes.....	22

## **INSULATION UPGRADES ..... 23**

Building Shell Improvements.....	24
Contractor Quotes.....	25

## **OPTIONAL SOLAR & BATTERY UPGRADES ..... 26**

Solar & Battery.....	28
----------------------	----

## **COST SUMMARY ..... 29**

## **CONTACT .....30**

# HOME ASSESSMENT





## BELMONT 3-ZONE HOME

 2,000 Square Feet

 5 Occupants

 Built in 1965

 3 Bedrooms

 2 Baths

 One-story Main House  
Connected by Breezeway  
to a Two-story Bedroom Wing,  
and Detached Garage

### The Homeowners are Interested in


Electric Vehicle Charging

Induction Cooktop

Heat Pump Water Heater

Heating/Cooling

Solar/Battery



**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.

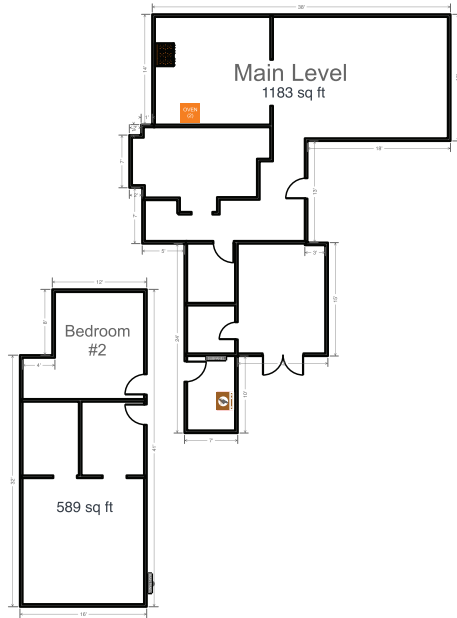


## INITIAL HOME ASSESSMENT/INTAKE

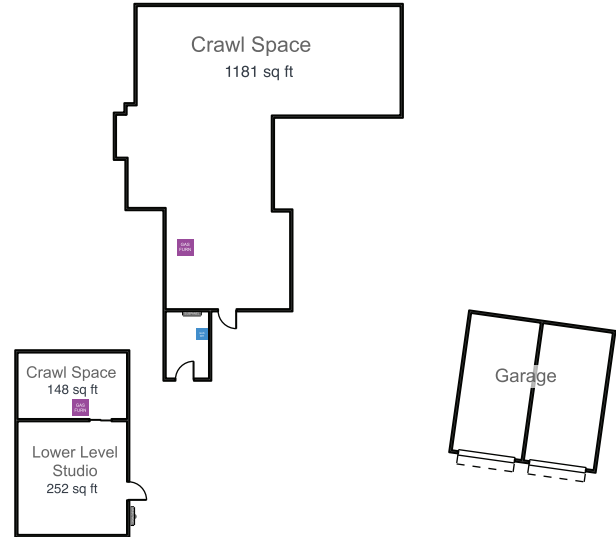
- Remodeled 9-10 yrs ago: insulated roof and walls, new windows, new ducts
- 2 gas furnaces, one 15-yr-old centrally ducted furnace and one 70+ yr old gravity fed wall furnace
- Tankless gas water heater in 40" crawl space where typical unitary heat pump water heater will not fit
- Spouse likes gas cooktop and not ready to change to induction stove
- Circuit to detached garage not sufficient for level-2 EV charger
- Rebates from Inflation Reduction Act Household (IRA) not included in financial analysis, as household income assumed to exceed cutoff (\$224,500 for family of 5)

# FLOOR PLANS WITHOUT UPGRADES

Current Condition



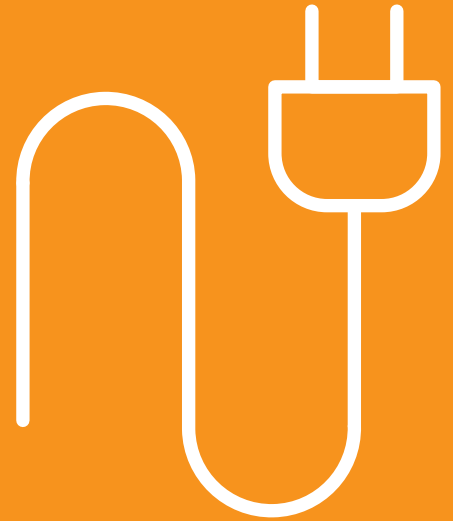
Current Condition







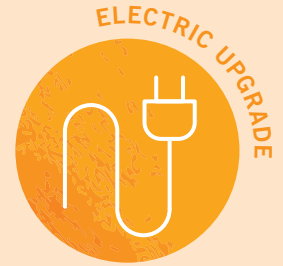
# ELECTRICAL UPGRADES



# MAIN ELECTRICAL PANEL



Existing  
200-amp main  
electrical panel



## RECOMMENDED

**No Change**



### Lowest Bid

Cost without incentives.....\$0

Cost with incentives .....\$0

# GARAGE SUBPANEL



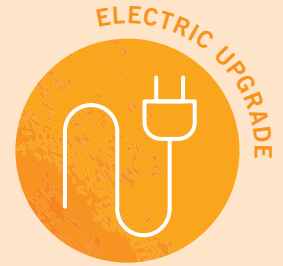
Existing  
100-amp laundry room  
subpanel



Recommended



Existing  
50-amp garage  
subpanel



RECOMMENDED

## 50-amp Subpanel

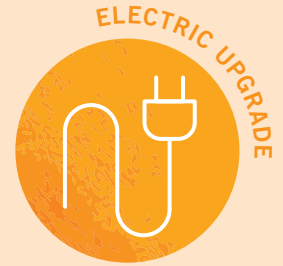
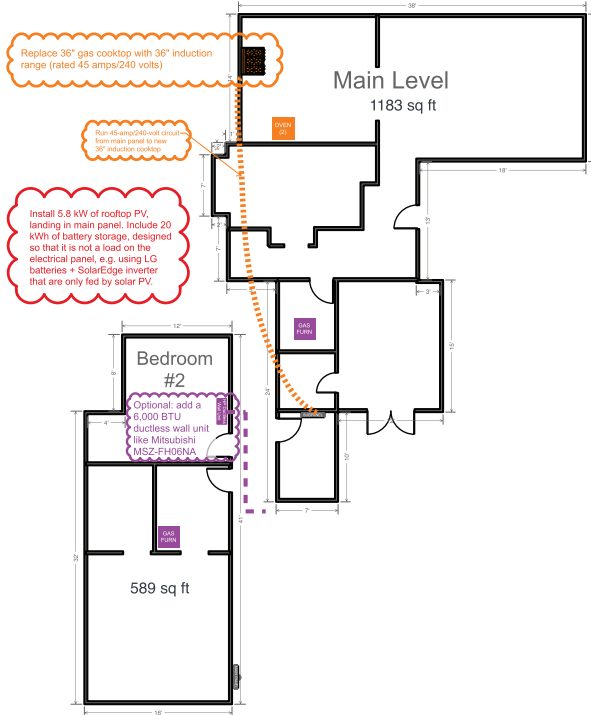


### Lowest Bid

Cost without incentives.....\$3,550

Cost with incentives .....\$1,450

# WIRING



## RECOMMENDED

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



#### Lowest Bid

Cost without incentives.....\$2,005

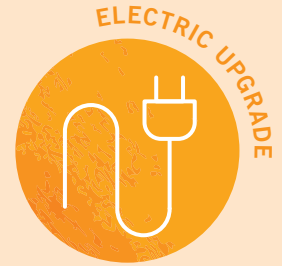
Cost with incentives .....\$2,005

# EV CHARGING



Recommended


  
Existing



RECOMMENDED

## EV Charger

## Energy Management System

 **Lowest Bid**

Cost without incentives.....\$1,810

Cost with incentives .....\$1,810

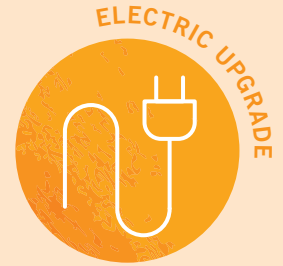
# COOKING



Recommended



Existing  
5-burner 36" gas cooktop



RECOMMENDED

## 5-burner 36" Induction Cooktop



**Lowest Bid**

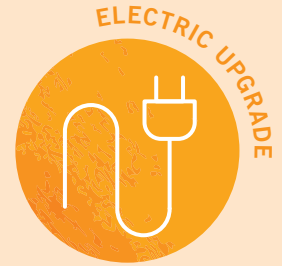
Cost without incentives.....\$1,308

Cost with incentives .....\$558

# CLOTHES DRYING



**Existing**  
7.5 cu ft electric  
resistance dryer



RECOMMENDED

**No Change**



**Lowest Bid**

Cost without incentives.....\$0

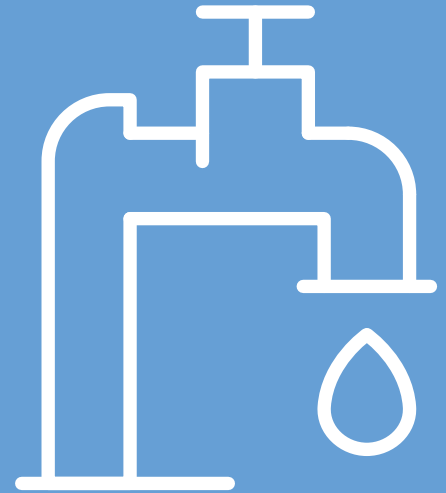
Cost with incentives .....\$0

# 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 and 100-amp laundry room subpanel	200-amp main electrical panel, 100-amp laundry room subpanel, and 50-amp garage subpanel	\$0	\$3,550	\$1,450	\$3,550	\$1,450	\$4,280	\$2,180	\$5,815	\$3,175
No 240-volt circuits to water heater, HVAC, cooktop	3 240-volt circuits to water heater, HVAC, cooktop	\$0	\$2,005	\$2,005	\$2,005	\$2,005	\$3,750	\$3,750	\$4,488	\$4,488
No at-home fueling for 2 gas cars: 12k miles/year	EV charger and energy management system	\$0	\$1,810	\$1,810	\$1,810	\$1,810	\$1,853	\$1,853	\$2,200	\$2,200
5-burner 36" gas cooktop	5-burner 36" induction cooktop	\$1,308	\$1,308	\$558	\$1,308	\$558	\$1,308	\$558	\$3,205	\$2,455
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>\$8,673</b>	<b>\$5,823</b>	<b>\$8,673</b>	<b>\$5,823</b>	<b>\$11,191</b>	<b>\$8,341</b>	<b>\$15,708</b>	<b>\$12,318</b>



# PLUMBING UPGRADE



# WATER HEATER



Recommended



Existing

167,000 BTU tankless  
gas water heater



## RECOMMENDED

### 43-gallon, Split Heat Pump Water Heater



#### Lowest Bid

Cost without incentives.....\$9,813

Cost with incentives .....\$4,069

# 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
167,000 BTU tankless gas water heater	43-gallon split heat pump water heater	\$3,538	\$4,500	\$350	\$9,813	\$4,069	\$9,813	\$4,069	\$10,471	\$4,727
<b>Total</b>		<b>\$3,538</b>	<b>\$4,500</b>	<b>\$350</b>	<b>\$9,813</b>	<b>\$4,069</b>	<b>\$9,813</b>	<b>\$4,069</b>	<b>\$10,471</b>	<b>\$4,727</b>

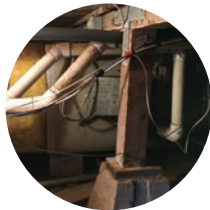
# HVAC UPGRADE



# SPACE HEATING/COOLING



Recommended



Existing  
Gas furnace



Existing  
Gravity-fed floor furnace

## RECOMMENDED

### 36,000 BTU Multi-zone Heat Pump HVAC System With 2 Ducted Air Handlers and MERV 13 Filter

#### Why

Uses 1/3 the energy of a gas furnace



#### Lowest Bid

Cost without incentives.....\$18,392

Cost with incentives .....\$11,642

# 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 gravity-fed floor furnace	36,000 BTU multi-zone heat pump HVAC system with 2 centrally ducted air handlers, and MERV 13 filter	\$11,524	\$9,615	\$3,406	\$18,392	\$11,642	\$26,423	\$19,673	\$27,025	\$20,275
<b>Total</b>		<b>\$11,524</b>	<b>\$9,615</b>	<b>\$3,406</b>	<b>\$18,392</b>	<b>\$11,642</b>	<b>\$26,423</b>	<b>\$19,673</b>	<b>\$27,025</b>	<b>\$20,275</b>

# INSULATION UPGRADES



# BUILDING SHELL IMPROVEMENTS



Existing  
Attic,  
some insulation

Existing  
Ductwork,  
good condition

Existing  
Floor,  
no insulation

Existing  
Walls,  
some insulation



RECOMMENDED

**No Change**



**Lowest Bid**

Cost without incentives.....\$0

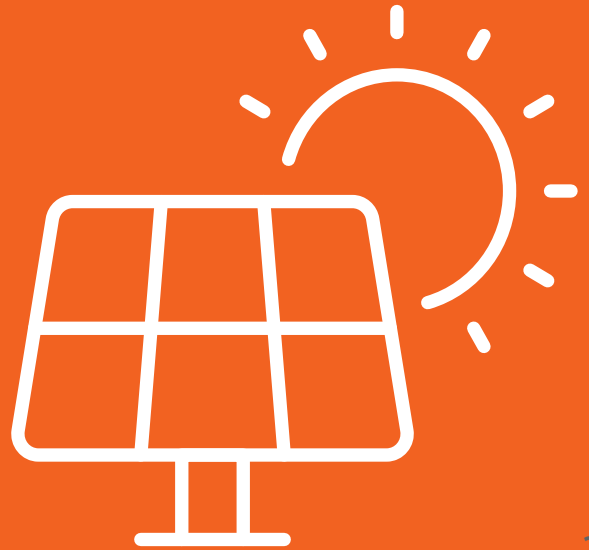
Cost with incentives .....\$0




# 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
Insulation: attic – some	No Change	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Ductwork: good condition	No Change	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Insulation: floor – none	No Change	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Insulation: walls – some	No Change	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>Total</b>		<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>

# OPTIONAL SOLAR & BATTERY UPGRADES



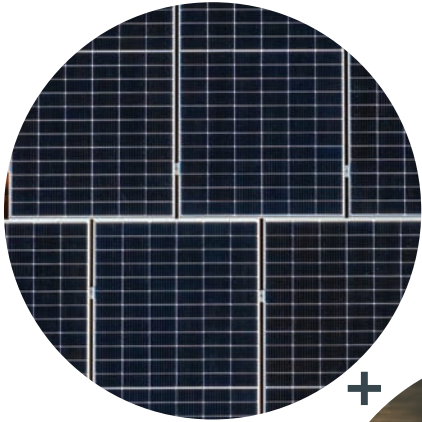


**Decarbonizing a home does not require adding solar or batteries, since the electricity in San Mateo County is 100% carbon emissions free.**

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



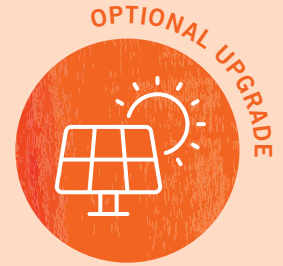
# SOLAR & BATTERY



Recommended



Existing



## RECOMMENDED

### 5.8 kW Rooftop Solar System 10 kWh Battery System



#### Lowest Bid Solar

Cost without incentives.....\$16,000

Cost with incentives .....\$11,200

#### Lowest Bid Battery

Cost without incentives.....\$12,000

Cost with incentives .....\$8,400

# COST SUMMARY

## ELECTRIFICATION COSTS

Subtotals of Upgrade by Trade	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
Electrical	\$1,308	\$8,673	\$5,823	\$8,673	\$5,823	\$11,191	\$8,341	\$15,708	\$12,318
Plumbing	\$3,538	\$4,500	\$350	\$9,813	\$4,069	\$9,813	\$4,069	\$10,471	\$4,727
HVAC	\$11,524	\$9,615	\$3,406	\$18,392	\$11,642	\$26,423	\$19,673	\$27,025	\$20,275
Insulation	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>Total</b>	\$16,370	\$22,788	\$9,579	\$36,878	\$21,534	\$47,427	\$32,083	\$53,204	\$37,320

## 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	\$16,000	\$11,200	\$16,000	\$11,200	\$24,717	\$17,302	\$26,384	\$18,469
Home battery: none	Home battery: 10 kWh	\$0	\$12,000	\$8,400	\$12,000	\$8,400	\$19,000	\$13,300	\$19,088	\$13,362
<b>Total</b>		\$0	\$28,000	\$19,600	\$28,000	\$19,600	\$43,717	\$30,602	\$45,472	\$31,831

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

ALERO MOJU  
AMOJU@SMCGOV.ORG

WWW.SMCSUSTAINABILITY.ORG



OFFICE OF  
SUSTAINABILITY  
COUNTY OF SAN MATEO

FUNDED BY

