



# How To: Residential Service Upgrade Decision Tool

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## Tool Purpose and Users

This tool helps contractors and homeowners plan home electrification projects while minimizing or avoiding electrical panel or service upgrades. Homeowners set project priorities, and contractors verify tool data and site conditions. While standard electrification often requires panel upgrades, this tool identifies strategies to optimize electrification and avoid unnecessary upgrades.

Using estimated National Electrical Code (NEC) load calculations, the tool assesses the need for panel upgrades based on user input. If upgrades seem necessary, it offers three optimization options to potentially enable electrification without panel or service upgrades.

## Contractor Collaboration Request

To support accurate results and useful recommendations, we encourage contractors to complete this tool with the homeowner or, if needed, on their behalf. Many homeowners may find certain required inputs, such as electrical panel specifications or system nameplate data, difficult to locate or understand.

Contractor involvement helps:

- Improve the accuracy of load calculations
- Identify more effective electrification strategies
- Avoid unnecessary panel or service upgrades

## Process Flow for Using the Tool

Here is a modular, step-by-step process flow based on the provided procedure.

### Step 1: Start a New Project

- **Action:** Open the tool and begin with a blank template file.
- **Instruction:** Save a new copy of the file to your computer using a unique project name e.g., ServiceUpgradeDecisionTool\_MulberrySt\_MM-DD-YY
- **Outcome:** A dedicated file for the specific project is created and saved.

## Step 2: Enter Property Information

- **Navigate to:** The "Property Information" tab.
- **Action:** Input the following required details about the property:
  - ☐ County
  - ☐ Year of construction
  - ☐ Square feet of conditioned living area
  - ☐ Panel voltage rating
  - ☐ Existing main panel disconnect rating
- **Optional Inputs:** Additional property details can be entered as needed.
- **Tip:** Refer to the detailed guidance provided on the tab "Property Information" for clarification on specific fields.

**Tip:** Panel information should be located in your main electrical panel. The panel voltage rating will be 120 V or 240 V.

The panel disconnect may be located on the label or a master breaker and is likely 200, 100, or 60 amps.

**Outcome:** Accurate property data is entered to calculate default loads and panel results.

Required input entries are highlighted in blue throughout the document.

|  |                |
|--|----------------|
| <b>Customer Information</b>                  |                |
| Name   | Jane Doe       |
| Address                                      | 123 Any Street |
| Address 2                                    |                |
| City   | Any Town       |
| State  | California     |
| County                                       | Sacramento     |
| ZIP Code                                     | 95670          |
| <b>Residence Information</b>                 |                |
| Type of residence                            | Detached SF    |
| Year of construction                         | Before - 1975  |
| Square feet living space                     | 1500           |
| Local Electrical Utility                     | Local POU      |
| <b>Existing Electrical Panel Information</b> |                |
| Panel Name                                   | Main Panel     |
| Panel Voltage Rating                         | 240/120 V      |
| Existing Main Panel Disconnect Rating        | 100            |
| Size of Panel (number of slots)              | 24             |

Figure 1. Property and Panel Information

## Step 3: Document Existing Systems and Loads

- **Navigate to:** The "Existing Systems and Loads" tab.
- **Action:** Input all existing building systems and electrical loads.
  - To Complete the "Existing System and Loads" tab work **left to right, starting with the Yes/No Column** on the far left. Then, continue across each row through the remaining fields (e.g., Type/Main Energy Source/Use Default).
  - **Default Values:** The tool will pre-fill typical values for HVAC and other systems based on home characteristics.
  - **User Input:** Replace default values with actual nameplate system sizing wherever available.
  - **Update:** Review and adjust the "Other Existing Electrical Loads" section to reflect the home's current conditions.



**Outcome:** The tool accurately accounts for the home's existing system and loads.

| Select "Y" if System Exists in Home | Description               | Type                   | Main Energy Source    | Assumed Size | Electrical Characteristics of System |                   |              | Manual Voltage | Manual Amperage | Existing Loads<br>Volt-Amps (VA) |
|-------------------------------------|---------------------------|------------------------|-----------------------|--------------|--------------------------------------|-------------------|--------------|----------------|-----------------|----------------------------------|
|                                     |                           |                        |                       |              | Default                              | Assumed Nameplate | Use Default? |                |                 |                                  |
| Y                                   | Space Heating             | Central forced air     | NG, Propane, Fuel oil | 3.0 ton      | 120                                  | 100               | Y            |                |                 | 100                              |
| Y                                   | Space Cooling             | Central forced air     | Electric              | 2.5 ton      | 240                                  | 5100              | Y            |                |                 | 5100                             |
| 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       |                        |                       |              |                                      |                   |              |                |                 |                                  |

Figure 2. Document Existing System and Loads

## Validate and verify

- **Are actual nameplate values for systems available?**
  - **Yes:** Enter the actual values to improve accuracy.
  - **No:** Use the tool's default values but review them for reasonableness.
- **Are there additional property details that could impact calculations?**
  - **Yes:** Enter optional details in the "Property Info" tab.
  - **No:** Proceed with required inputs only.

## Step 4: Define Electrification Goals

- **Navigate to:** The "Electrification Upgrades" tab.
- **Action:** Input building electrification goals.
  - To complete the "Electrification Upgrades" tab, work **left to right, starting with the Yes/No Column highlighted in blue**. Then, continue across each row through the remaining fields (e.g., Upgrade/Electrify System/Type/etc.)
  - **Default Settings:** The tab assumes all gas/propane appliances will be electrified and includes one EV charger.
  - **User Adjustments:** Modify goals to match project objectives.
  - **Optional Inputs:** Replace default values with actual system and appliance preferences if known.

**Tip:** If the intention is to add a system that wasn't existing prior indicate this in the "Upgrade/Electrify System" column with a "Y".



**Outcome:** Electrification goals are defined based on project needs.

| Exists in Home? | Upgrade/Electrify System? | Description               | Type                   | Main Energy Source   | Assumed Size | Electrical Characteristics of New System |                              |              | Manual Input Voltage | Manual Input Amperage | Volt-Amps (VA) |
|-----------------|---------------------------|---------------------------|------------------------|----------------------|--------------|--|------------------------------|--------------|----------------------|-----------------------|----------------|
|                 |                           |                           |                        |                      |              | Default Voltage                          | Assumed Nameplate Power (VA) | Use Default? |                      |                       |                |
| Y               | Y                         | Space Heating             | Central forced air     | Electric - Heat Pump | 3.0 ton      | 240                                      | 5760                         | Y            |                      |                       | 5760           |
| 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             | 7200 watts   | 240                                      | 7200                         | Y            |                      |                       | 7200           |
| 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 (separates) - Single |                        |                      |              |  |                              | Y            |                      |                       |                |
| N               | N                         | Oven (separates) - Double |                        |                      |              |  |                              | Y            |                      |                       |                |
| N               | N                         | Cooktop (separates)       |                        |                      |              |  |                              | Y            |                      |                       |                |
| Y               | Y                         | Water Heater              | Tank < 50gal           | Electric - Heat Pump | 4500 watts   | 240                                      | 4500                         | Y            |                      |                       | 4500           |
| N               | N                         | Water Heater 2            |                        |                      |              |  |                              | 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             |              |  |                              |              |                      |                       |                |

Figure 3. Electrification Upgrades

## Step 5: Assess Panel Impacts

- **Navigate to:** The "Panel Impacts and Rec's" tab.
- **Action:** Review the bar chart to assess the impact of electrification goals on the electrical panel.
  - **Red Segments:** Indicate loads exceeding panel capacity.
  - **Next Steps:** If upgrades exceed capacity, proceed to optimization tabs sequentially.
- **Outcome:** Initial panel capacity results are determined.

## Step 6: Optimize with Low-Power Appliances

- **Navigate to:** The "Opt-1 - Low Power Appliances" tab.
- **Action:** Select power-efficient appliance options as alternatives to default electrification choices. If applicable, **select "Y"** (highlighted in blue) to **indicate you are choosing a more power-efficient appliance** option instead of the default. This helps reduce the total amps in the baseline calculation in the "Panel Impacts and Rec's" tab.
  - Examples: 120v heat pump water heaters, combined washer-dryer appliances, lower amperage EV chargers.
  - **Tip:** Refer to detailed guidance on the tab for more information.
- **Next Steps:** Check the "Panel Impacts and Rec's" tab to assess results.



**Outcome:** Appliance options are optimized for lower power consumption.

### Consider a 120-volt Heat Pump water heater

A 120-Volt Heat Pump water heater will have a much smaller demand on the electrical panel, but it will come at the expense of increased recovery time for the hot water in the tank after the hot water has been depleted. This approach is viable in situations where the water heater is not serving a large number of occupants.

| Being Upgraded? | Modify to 120V Water Heater? | Description    | Type         | Main Energy Source | Assumed Size | Default Voltage | Default Power (VA) | Use Default? | Manual Voltage | Manual Amperage | Volt-Amps (VA) |
|-----------------|------------------------------|----------------|--------------|--------------------|--------------|-----------------|--------------------|--------------|----------------|-----------------|----------------|
| Y               | Y                            | Water Heater   | Tank < 50gal | Electric - HP 120V | 1440 watts   | 120             | 1440               | Y            |                |                 | 1440           |
| N               | N                            | Water Heater 2 |              |                    |              |                 |                    | Y            |                |                 |                |

Figure 4. Low Power Appliances – Option 1

## Validate and verify

- **Do electrification goals exceed panel capacity?**
  - **Yes:** Proceed to optimization tabs sequentially.
  - **No:** Finalize the electrification plan.

## Step 7: Optimize HVAC System Size

- **Navigate to:** The "Opt-2 - Right Size HVAC" tab.
- **Action:** Adjust HVAC system size and remove backup strip heat if unnecessary.
  - ☐ If applicable, **select "Y"** (highlighted in blue) to **indicate the HVAC sizing has been modified** for space heating, air conditioning, or ventilation.
  - ☐ **Considerations:** Account for building envelope improvements (e.g., air sealing or insulation) or correcting oversized systems.
  - ☐ **Tip:** Refer to detailed guidance on the "Opt. 2 – Right-Size HVAC" tab for more information.
- **Next Steps:** Check the "Panel Impacts and Rec's" tab to assess results.



**Outcome:** HVAC system options are optimized for efficiency.

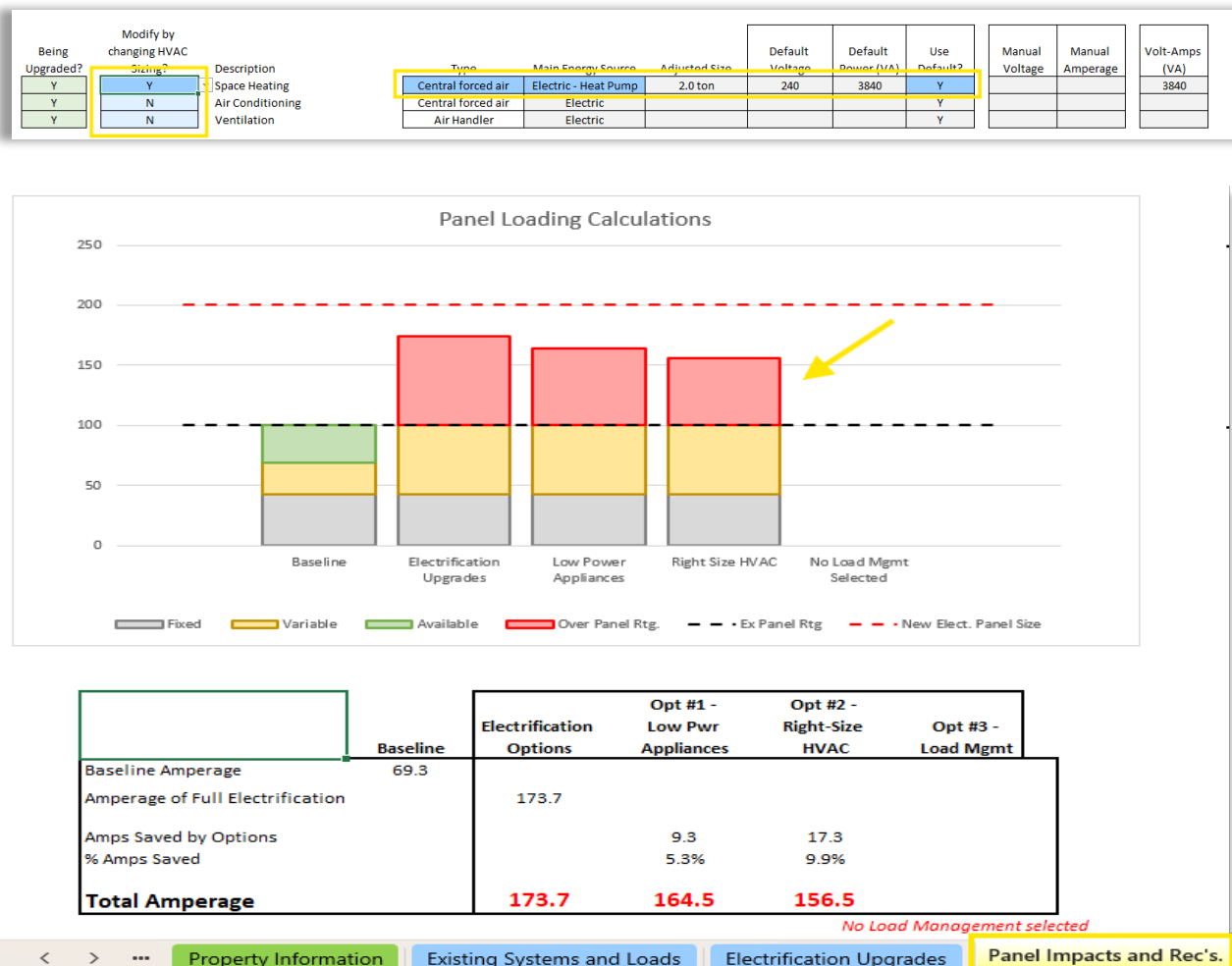


Figure 5. Right Size HVAC – Option 2



## Step 8: Implement Panel Load Management

- **Navigate to:** The "Opt-3 - Panel Load Mgmt." tab.
- **Action:** Select one of the following load management strategies:
  - ☐ Circuit sharing
  - ☐ Dynamic vehicle chargers
  - ☐ Smart electrical panels
  - ☐ **Tip:** Refer to detailed guidance on the tab for more information.
- **Next Steps:** Check the "Panel Impacts and Rec's" tab to assess results.



**Outcome:** Panel load management strategies are implemented.

|                               | Use This Approach? |   |
|-------------------------------|--------------------|---|
| EV Charger circuit sharing    | N                  |   |
| Dynamic EV charging           | Y                  | ▼ <i>This option will be shown in graph</i> |
| Smart Panel or Smart Breakers | N                  |   |

Figure 6. Panel Load Management – Option 3

## Step 9: Finalize Electrification Plan

- **Navigate to:** The "Panel Impacts and Rec's" tab.
- **Action:** Review the Measure Tracking Table for all system and optimization selections.
  - ☐ **Ideal Outcome:** Whole home electrification within existing panel capacity.
  - ☐ **Adjustments:** If capacity is exceeded, continue refining selections in previous tabs.

✓ **Outcome:** An optimal electrification plan is finalized for the home.

### Validate and verify

- **Are optimization strategies sufficient to meet panel capacity?**
  - ☐ **Yes:** Finalize the plan.
  - ☐ **No:** Implement panel load management strategies.

| Measure Tracking Table    |                        |                               |                          |                    |
|---------------------------|------------------------|-------------------------------|--------------------------|--------------------|
|                           | Elect. Initial Upgrade | Optimization Options Selected |                          |                    |
|                           |                        | Opt #1 - Low Pwr Appliances   | Opt #2 - Right-Size HVAC | Opt #3 - Load Mgmt |
| Space Heating             | Y                      | N/A                           | Y                        | Opt. 2             |
| Air Conditioning          | Y                      | N/A                           | Y                        | Opt. 2             |
| Ventilation               | Y                      | N/A                           | Y                        | Opt. 2             |
| Strip Heat Backup         | Y                      | N/A                           | N                        | Init. Upgrade      |
| Clothes Washer            | N                      | Y                             | Opt. 1                   | Opt. 1             |
| Clothes Dryer             | Y                      | Y                             | Opt. 1                   | Opt. 1             |
| Range (cooktop and oven)  | Y                      | N                             | Init. Upgrade            | Init. Upgrade      |
| Oven (seperates) - Single | N                      |                               |                          |                    |
| Oven (seperates) - Double | N                      |                               |                          |                    |
| Cooktop (seperates)       | N                      |                               |                          |                    |
| Water Heater              | Y                      | Y                             | Opt. 1                   | Opt. 1             |
| Water Heater 2            | N                      |                               |                          |                    |
| EV Charger                | Y                      | N                             | N                        | Opt. 1             |
| Other Large Loads 1       | N                      | N/A                           | N/A                      | N/A                |
| Other Large Loads 2       | N                      | N/A                           | N/A                      | N/A                |
| Other Large Loads 3       | N                      | N/A                           | N/A                      | N/A                |
| Circuit Sharing           |                        | N/A                           | N/A                      | N                  |
| Dynamic EV Charging       |                        | N/A                           | N/A                      | Y                  |
| Smart Panel               |                        | N/A                           | N/A                      | N                  |

Legend

Y This system has an upgrade or an optimization chosen at this step

N This system does not have an upgrade or an optimization chosen at this step

< > ... Existing Systems and Loads Electrification Upgrades **Panel Impacts and Rec's.** Opt. 1 - Low-Power A

Figure 7. Measure Tracking Table