



Opinion **Dynamics**

TECH CLEAN CALIFORNIA: INCREMENTAL COST STUDY

Final Phase I Findings

February 12, 2024

Incremental Cost Study – Overview

Increasing Rigor

- Phase I
 - Rapid turnaround HVAC Contractor Survey
- Phase II
 - Mystery Shopping
 - Ground Truth Survey Data by Collecting Cost Quotes in the Field
 - Develop Bid Packages
- Phase III
 - Collect Bids from Contractors to Ground Truth Mystery Shopping Data (allowing for greater generalizability & geographic comparisons in price estimates)





Phase I Overview

Research Objective: Develop initial incremental cost estimates for residential single-family space conditioning heat pump and non-heat pump scenarios.

All scenarios assume no equipment relocation, no panel upgrades necessary, and no ductwork needed to be replaced. All heat pumps are code-minimum 14 SEER.

Six Scenarios:

1. Central AC like-for-like replacement
2. Gas Furnace like-for-like replacement
3. Central AC & Gas Furnace like-for-like replacements
4. Central AC to Central, Ducted Heat Pump (Furnace Backup)
5. Central AC & Gas Furnace to Central, Ducted Heat Pump
6. Gas Furnace to Central, Ducted Heat Pump



Phase I Overview

- **Method:** Quick Turnaround Online Survey
- **Sample Frame:** 974 Registered TECH HVAC Contractors
- **Recruitment Approach:** E-mail
- **Incentive:** \$150
- **Average Survey Completion Time:** 44 Minutes
- **Survey Dates:** 12/7/2023 – 12/29/2023
- **Survey Completes:** 64
- **Response Rate:** 6.9%



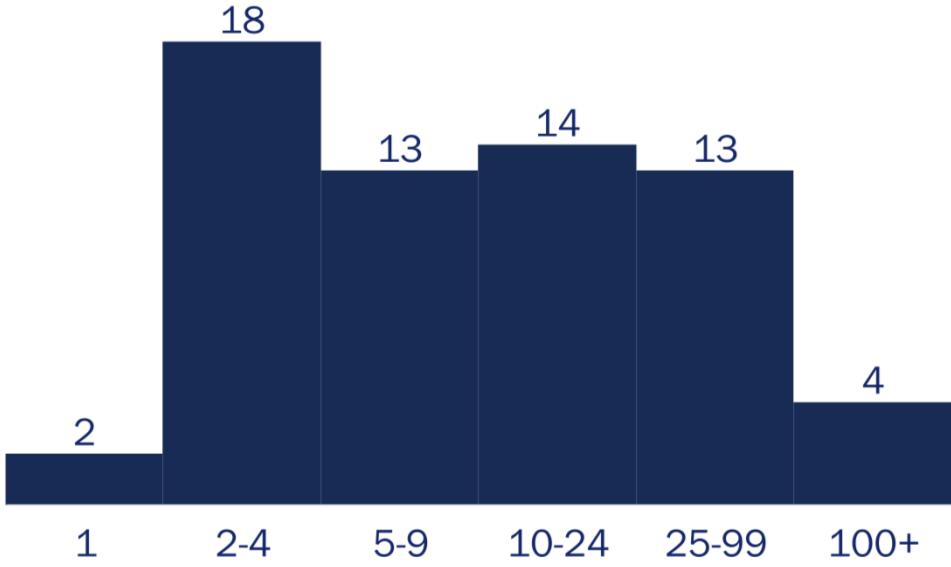
Opinion **Dynamics**

SAMPLE DESCRIPTION

Sample Description

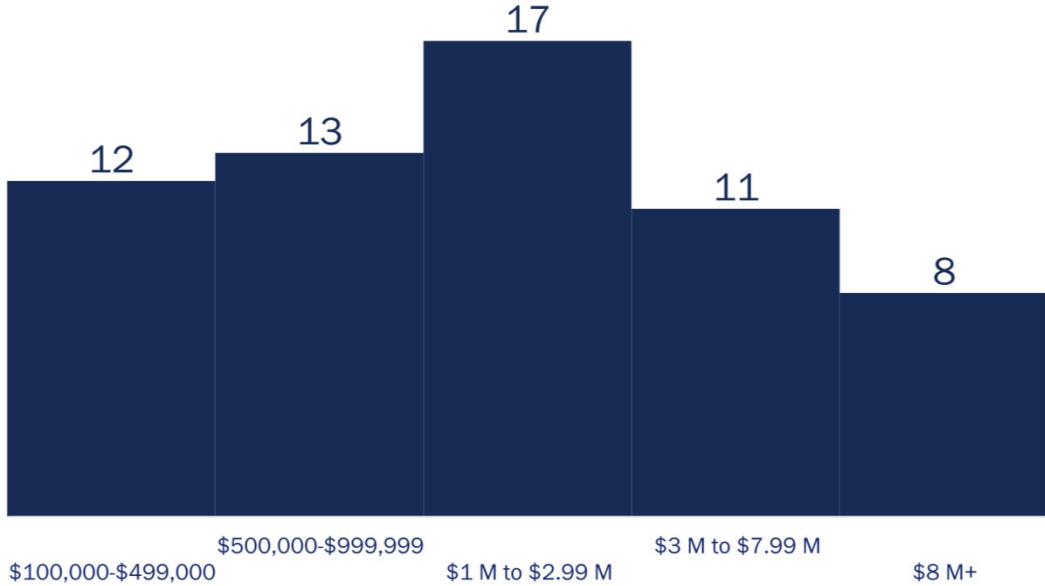
- No. of Respondents: 64

- Employee Size:



- Firms' staff in a labor union: 2

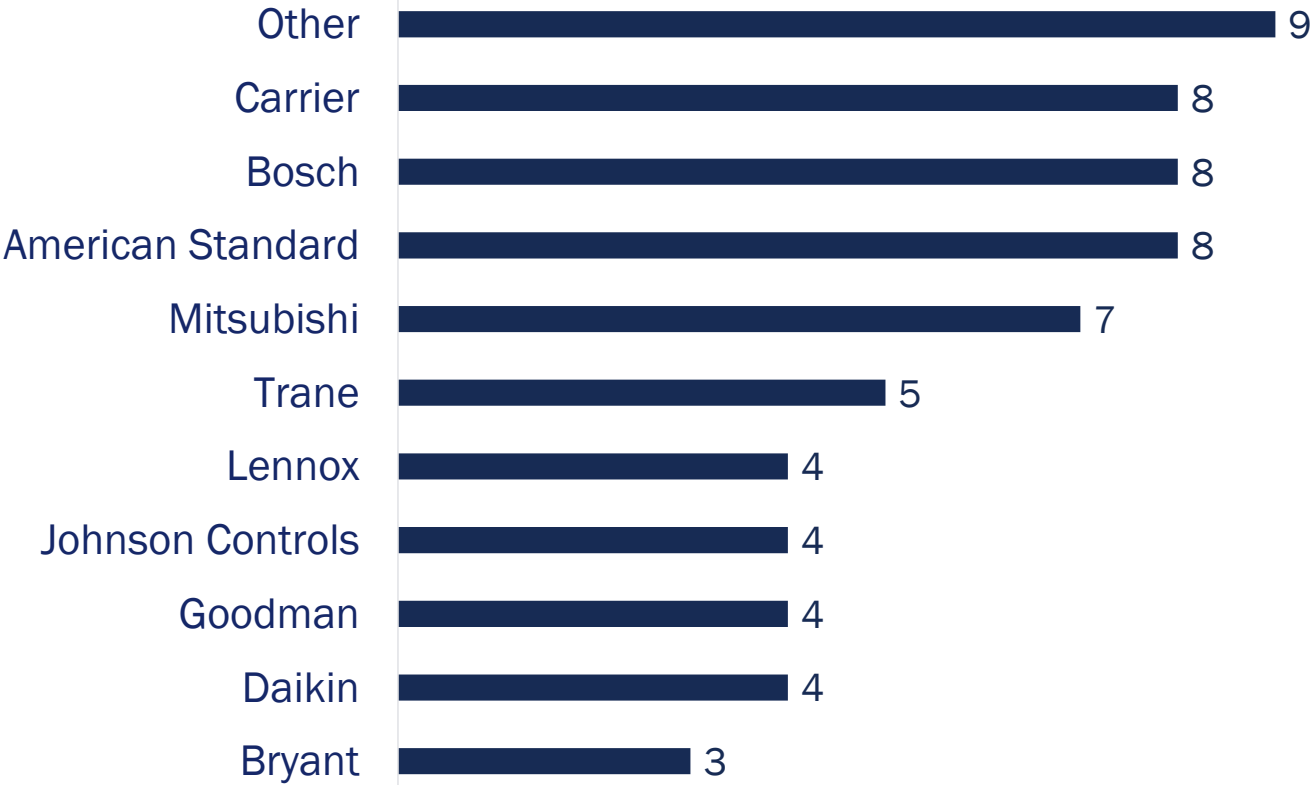
- Revenue Size:



Note: 3 responded, "Don't Know"

Sample Description

Preferred Line of Equipment

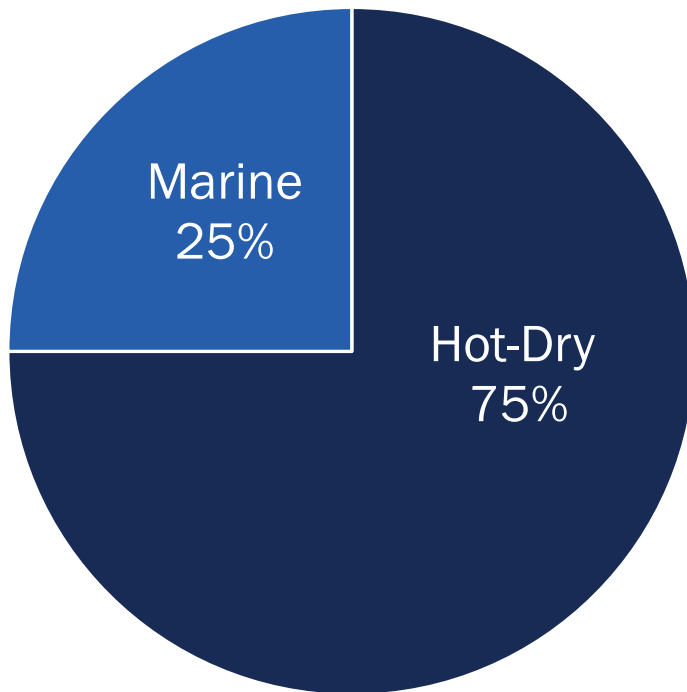


The “Other” Category Includes:

- Allied
- Amana
- Day and Night
- Fujitsu
- Innovair
- “Private Label”
- Ruud
- Rheem

Sample Description

Climate Regions

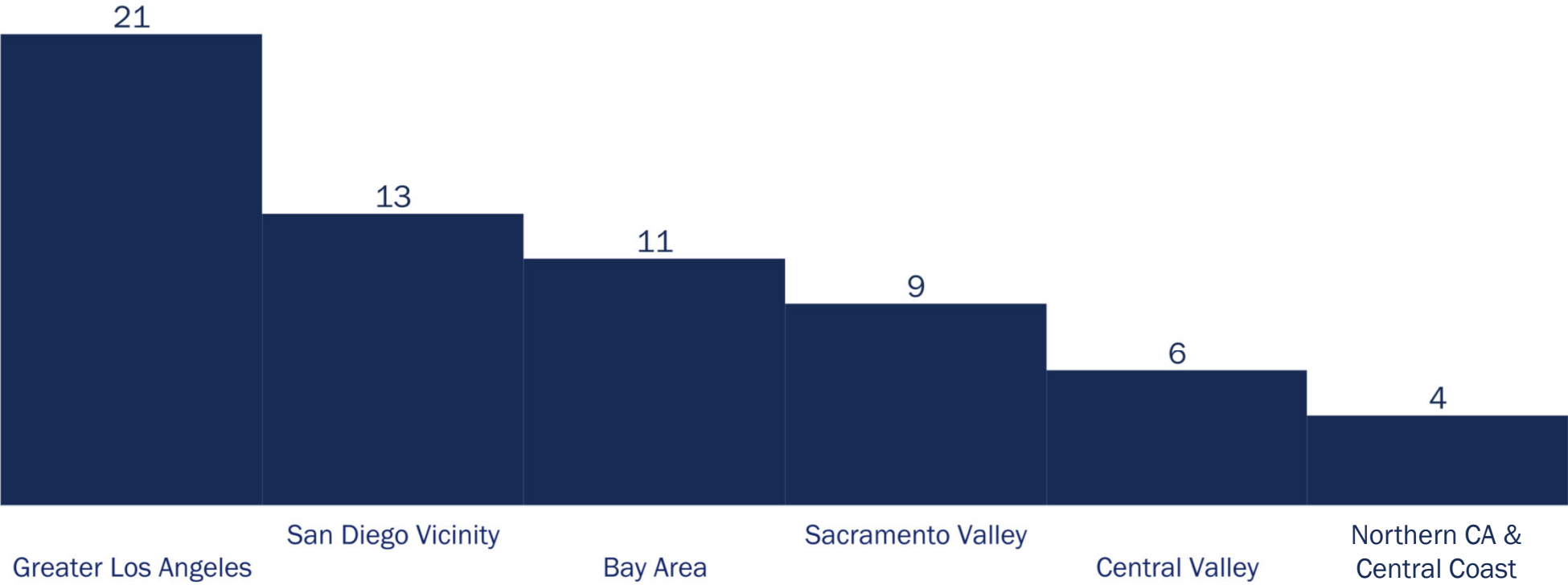


Climate Zones in each Climate Region

- Marine:
 - 1-6
- Hot-Dry:
 - 7-15
- Cold (none in sample)
 - 16

Sample Description

Service Areas





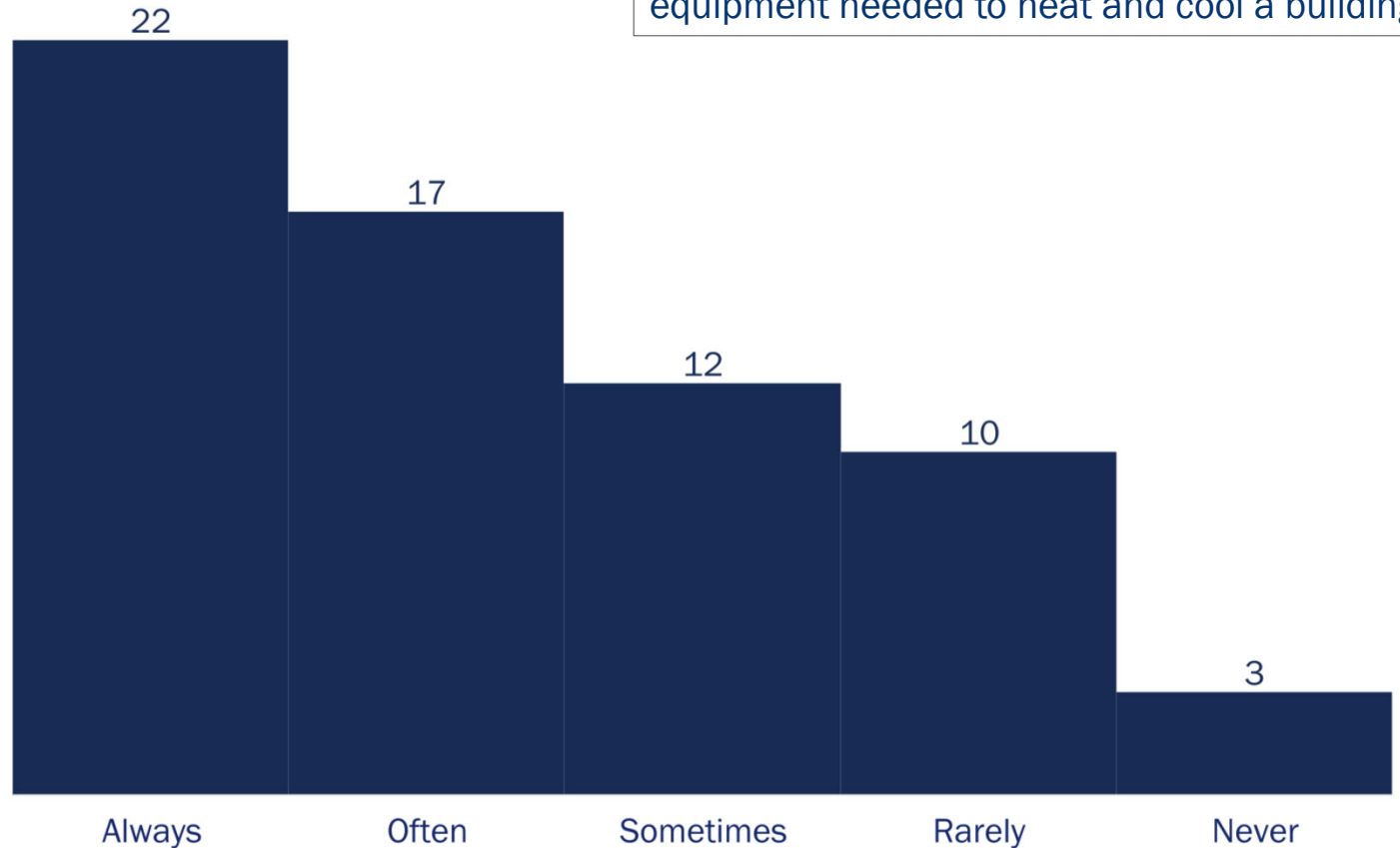
Opinion **Dynamics**

FINDINGS

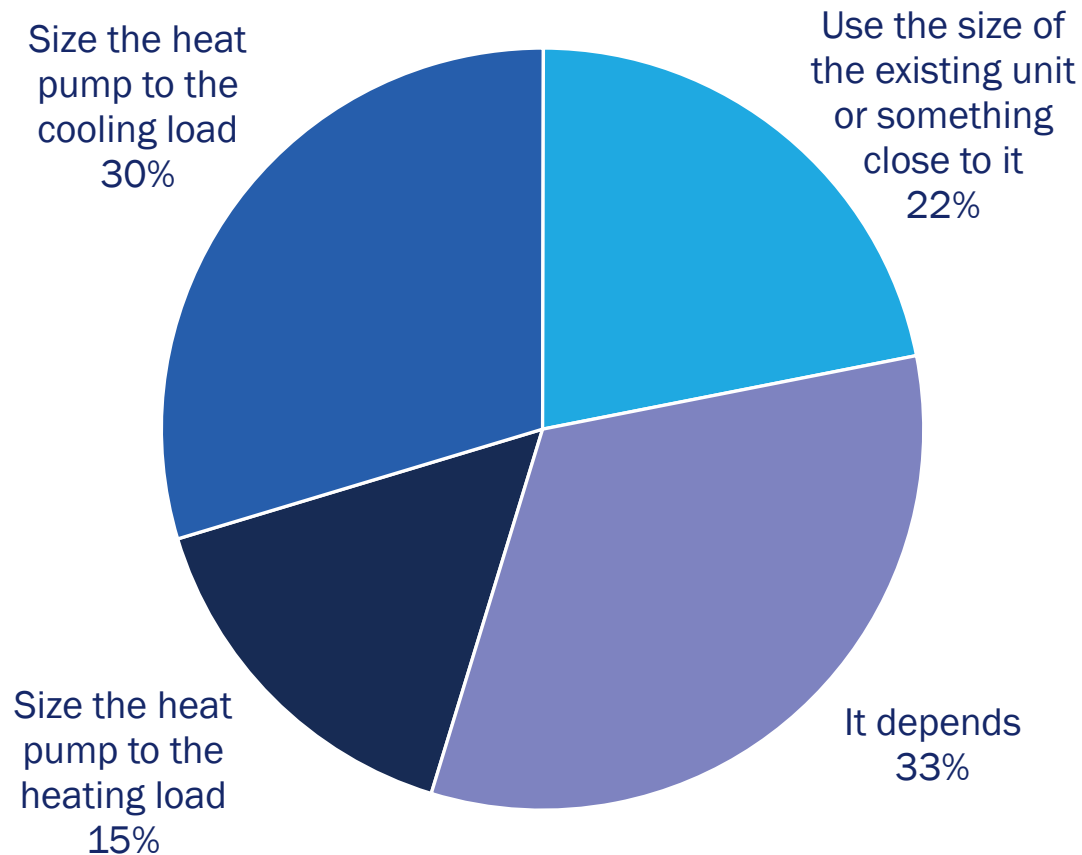
Heat Pump Practices: Manual J Load Calculation (n=64)

- Most TECH contractors in our sample “always” or “often” perform Manual J load calculations (39 of 64; 61%)
- 20% (13 of 64) “rarely” or “never” do

The calculation determines the appropriate size of equipment needed to heat and cool a building.



Heat Pump Practices: Sizing



- Those who answered “It depends” consider the following factors:
 - Home location, climate zone
 - Home square footage
 - Ductwork
 - Envelope (insulation & windows)
 - Heating or cooling load
 - Home design & layout
 - Existing system
 - Customer needs, preferences

Heat Pump Practices: Sizing by Service Area

| Service Area | Sizing to the Heating Load | Sizing to the Cooling Load | Use Size of Existing Unit (or something close to it) | Depends on Various Factors (on prior slide) |
|-----------------------------------|----------------------------|----------------------------|--|---|
| Greater Los Angeles (n=21) | | 2 | | 1 |
| San Diego Vicinity (n=13) | | | 1 | 2 |
| Bay Area (n=11) | 1 | 2 | 2 | |
| Sacramento Valley (n=9) | | 2 | | 1 |
| Central Valley (n=6) | | 1 | | 2 |
| Northern CA & Central Coast (n=4) | 2 | 2 | | 1 |

A “1” indicates the most-often reported approach for that service area and a “2” is the next most-often reported sizing approach.

Average Costs by Project Type: 3-Ton Units

| Scenario | Project Type | Total Cost | Equipment Cost | Labor Cost | Misc. Cost |
|----------|--|------------|----------------|------------|------------|
| 1 | Central AC → Central AC | \$9,777 | \$5,880 | \$3,196 | \$854 |
| 2 | Gas Furnace → Gas Furnace (60,000 Btu/h) | \$5,951 | \$3,301 | \$2,151 | \$599 |
| 3 | Central AC & Gas Furnace → Central AC & Gas Furnace | \$12,698 | \$7,856 | \$4,063 | \$969 |
| 4 | Central AC → Central, Ducted Heat Pump | \$11,201 | \$6,767 | \$3,495 | \$1,103 |
| 5 | Central AC & Gas Furnace → Central, Ducted Heat Pump | \$13,281 | \$7,761 | \$4,284 | \$1,371 |
| 6 | Gas Furnace → Central, Ducted Heat Pump | \$14,909 | \$8,185 | \$5,029 | \$1,854 |

Average Costs by Project Type: 4-Ton Units

| Scenario | Project Type | Total Cost | Equipment Cost | Labor Cost | Misc. Cost |
|----------|--|------------|----------------|------------|------------|
| 1 | Central AC → Central AC | \$10,431 | \$6,400 | \$3,313 | \$875 |
| 3 | Central AC & Gas Furnace → Central AC & Gas Furnace | \$13,808 | \$8,770 | \$4,213 | \$1,022 |
| 4 | Central AC → Central, Ducted Heat Pump | \$12,347 | \$7,795 | \$3,611 | \$1,110 |
| 5 | Central AC & Gas Furnace → Central, Ducted Heat Pump | \$14,529 | \$8,797 | \$4,456 | \$1,418 |
| 6 | Gas Furnace → Central, Ducted Heat Pump | \$15,555 | \$8,750 | \$5,176 | \$1,793 |

Average Total Project Cost by Climate Region: 3-Ton Units

Average project costs for 3-ton units were very similar or slightly lower in the Marine climate region compared to Hot-Dry

| Project Type | Hot-Dry | Marine |
|--|----------|----------|
| Central AC → Central AC | \$10,081 | \$8,885 |
| Gas Furnace → Gas Furnace (60,000 Btu/h) | \$6,123 | \$5,434 |
| Central AC & Gas Furnace → Central AC & Gas Furnace | \$12,779 | \$12,455 |
| Central AC → Central, Ducted Heat Pump | \$11,323 | \$10,834 |
| Central AC & Gas Furnace → Central, Ducted Heat Pump | \$13,478 | \$12,702 |
| Gas Furnace → Central, Ducted Heat Pump | \$14,891 | \$14,961 |

Average Total Project Cost by Climate Region – 4-Ton Units

Average costs for 4-ton projects were nearly the same in Hot-Dry and Marine climate regions

| Project Type | Hot-Dry | Marine |
|--|----------|----------|
| Central AC → Central AC | \$10,674 | \$9,717 |
| Central AC & Gas Furnace → Central AC & Gas Furnace | \$13,742 | \$14,004 |
| Central AC → Central, Ducted Heat Pump | \$12,535 | \$11,784 |
| Central AC & Gas Furnace → Central, Ducted Heat Pump | \$14,824 | \$13,662 |
| Gas Furnace → Central, Ducted Heat Pump | \$15,395 | \$16,024 |

Average Incremental Cost of Heat Pump Installation (3-Ton)

| Scenario | Average Incremental Cost of Heat Pump Installation (versus like-for-like replacements) |
|--------------------------------------|---|
| Central AC Replacement | \$1,424 |
| Gas Furnace Replacement | \$8,958 |
| Central AC & Gas Furnace Replacement | \$583 |



Opinion **Dynamics**

SCENARIO-SPECIFIC FINDINGS

Scenario #1: Central AC Like-for-Like Replacement

| HVAC Replacement Scenario | Home Type | Square Footage | Home Levels | System Efficiency | Service Needed |
|---------------------------|---------------|----------------|--------------|-------------------|---|
| Central AC → Central AC | Single-Family | 1700 sqft | Single-Story | 14 SEER | Disconnect, remove, and discard old CAC and indoor coil. Install and connect new CAC & indoor coil. |

This scenario does not require:

- Electrical Panel Upgrade
- Equipment Relocation
- Duct Replacement

Scenario #1: Central AC Like-for-Like Replacement

| Average Cost | 3-Ton CAC Unit | 4-Ton CAC Unit |
|----------------|----------------|----------------|
| Equipment Cost | \$5,886 | \$6,400 |
| Labor Cost | \$3,196 | \$3,313 |
| Misc. Cost | \$854 | \$875 |
| Total Cost | \$9,784 | \$10,431 |

- Miscellaneous costs most frequently driven by code compliance requirements:
 - Permits and inspections
 - HERS/Title 24 duct testing
 - Duct sealing
- Contractors also mentioned:
 - Cost of miscellaneous materials, including new registers
 - Labor warranty

Scenario #1: Central AC Like-for-Like Replacement

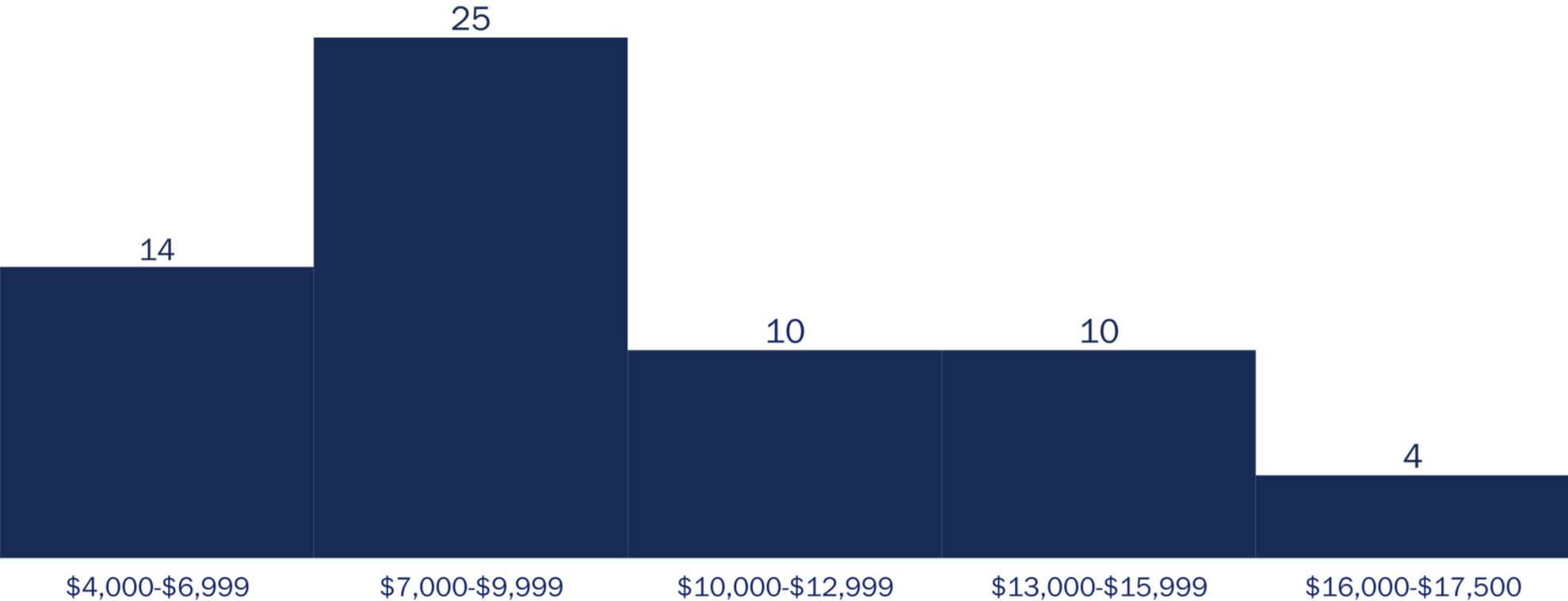
Distribution of Respondents Who Mentioned Permit Costs by Service Area

- None in San Diego, few in the Bay Area and Central Valley
- Most common in Los Angeles and Sacramento, plus Central Coast and Northern CA

| Service Area | % Mentioned Permit Costs |
|-----------------------------|--------------------------|
| Northern CA & Central Coast | 50% (2 of 4) |
| Sacramento Valley | 44% (4 of 9) |
| Greater Los Angeles | 24% (5 of 21) |
| Central Valley | 17% (1 of 6) |
| Bay Area | 9% (1 of 11) |
| San Diego Vicinity | 0% (0 of 13) |

Scenario #1: Central AC Like-for-Like Replacement

Total Project Cost Distribution (3-Ton Units)



Scenario #2: Gas Furnace Like-for-Like Replacement

| HVAC Replacement Scenario | Home Type | Square Footage | Home Levels | System Size | System Efficiency | Service Needed |
|---------------------------|---------------|----------------|--------------|--------------|-------------------|--|
| Gas Furnace → Gas Furnace | Single-Family | 1700 sqft | Single-Story | 60,000 Btu/h | 80% AFUE | Disconnect, remove, and discard old furnace; install and connect new furnace |

This scenario does not require:

- Electrical Panel Upgrade
- Duct Replacement

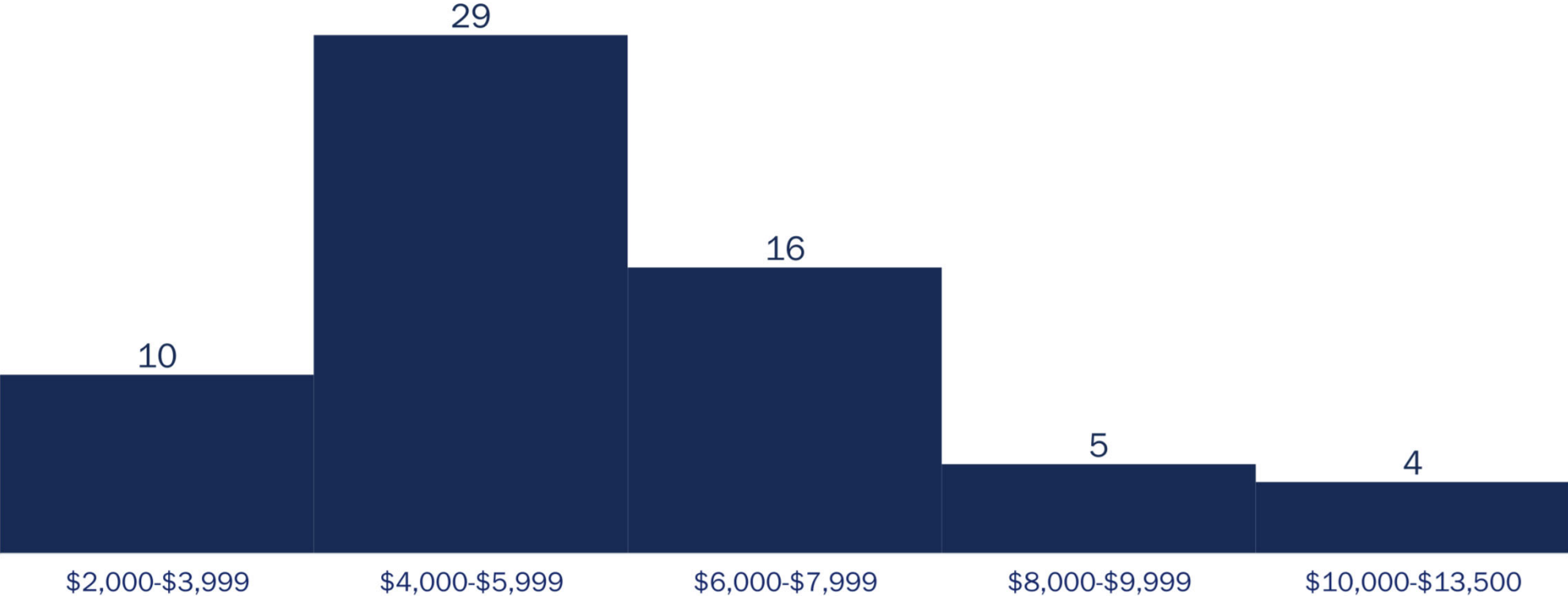
Scenario #2: Gas Furnace Like-for-Like Replacement

| Average Cost | 60,000 Btu/h Unit |
|----------------|-------------------|
| Equipment Cost | \$3,301 |
| Labor Cost | \$2,151 |
| Misc. Cost | \$599 |
| Total Cost | \$5,951 |

- Miscellaneous costs driven by code compliance requirements:
 - Permits and inspections
 - HERS/Title 24 Duct Testing
 - Duct sealing
 - Ultra Low NOx requirements (required in LA area)
- Contractors also mentioned:
 - Cost of miscellaneous materials, such as filter rack, drip leg, sediment trap
 - Replacing gas flex with shutoff valve
 - Venting work, return air modifications

Scenario #2: Gas Furnace Like-for-Like Replacement

Total Project Cost Distribution (60,000 Btu/h Unit)



Scenario #3: Central AC & Gas Furnace Like-for-Like Replacements

| HVAC Replacement Scenario | Home Type | Square Footage | Home Levels | System Efficiency | Service Needed |
|---|---------------|----------------|--------------|---------------------|---|
| Central AC & Gas Furnace → Central AC & Gas Furnace | Single-Family | 1700 sqft | Single-Story | 14 SEER 80% AFUE | Disconnect, remove, and discard old CAC, coil, and furnace. Install and connect new CAC, coil, and furnace. |

This scenario does not require:

- Electrical Panel Upgrade
- Duct Replacement

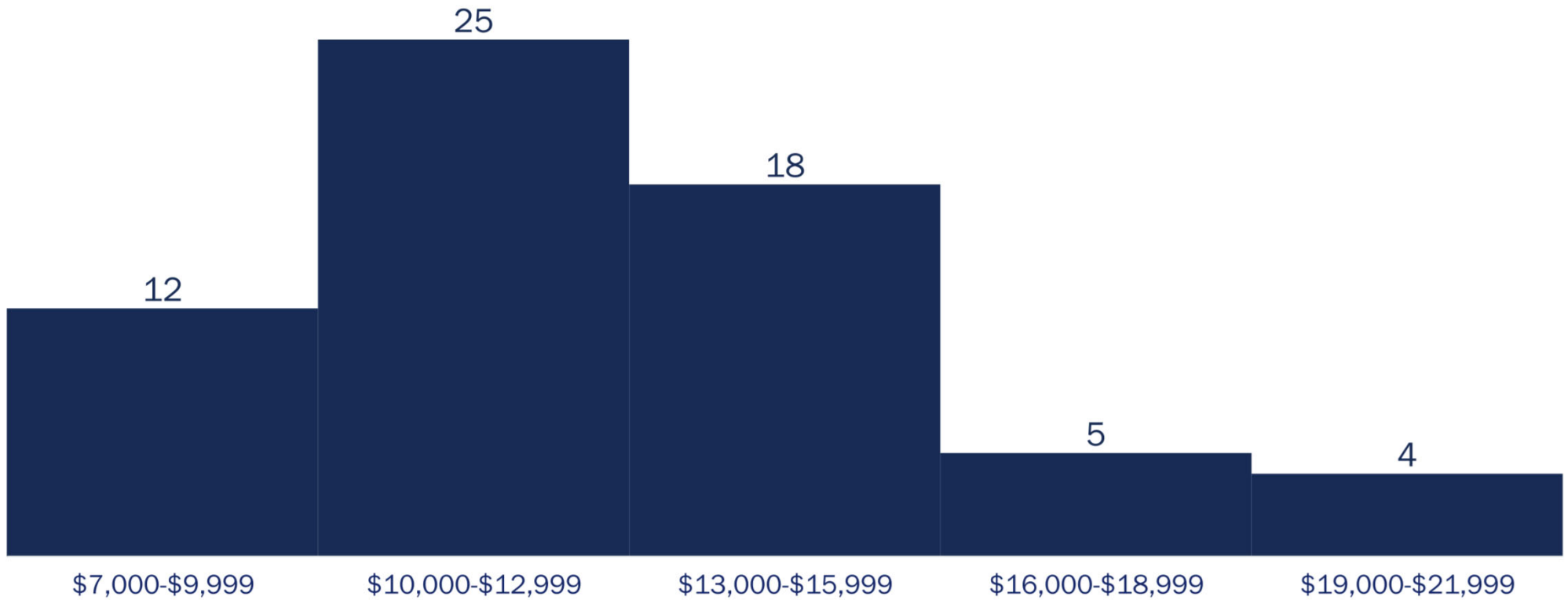
Scenario #3: Central AC & Gas Furnace Like-for-Like Replacements

| Average Cost | 3-Ton CAC Unit | 4-Ton CAC Unit |
|----------------|----------------|----------------|
| Equipment Cost | \$7,856 | \$8,770 |
| Labor Cost | \$4,063 | \$4,213 |
| Misc. Cost | \$969 | \$1,022 |
| Total Cost | \$12,698 | \$13,808 |

- Miscellaneous costs driven by code compliance requirements:
 - Permits and inspections
 - HERS/Title 24 Duct Testing
 - Duct sealing
 - Ultra Low NOx Requirements (required in LA area)
- Contractors also mentioned:
 - Cost of miscellaneous materials, including sheet metal, flue pipe, MERV 13 filters
 - Gas line upgrade, gas flex line
 - Venting work, evacuation, startup testing

Scenario #3: Central AC & Gas Furnace Like-for-Like Replacements

Total Project Cost Distribution (3-Ton & 60,000 Btu/h Units)



Scenario #4: Central AC to Central, Ducted Heat Pump (Furnace Backup)

| HVAC Replacement Scenario | Home Type | Square Footage | Home Levels | System Efficiency | Service Needed |
|---|---------------|----------------|--------------|-------------------|--|
| Central AC → Central, Ducted Heat Pump (Gas Furnace Backup) | Single-Family | 1700 sqft | Single-Story | 14 SEER | Disconnect, remove, and discard CAC and coil. Install and connect Heat Pump. Configure thermostat to communicate between Heat Pump & existing Furnace. |

This scenario does not require:

- Electrical Panel Upgrade
- Equipment Relocation
- Duct Replacement

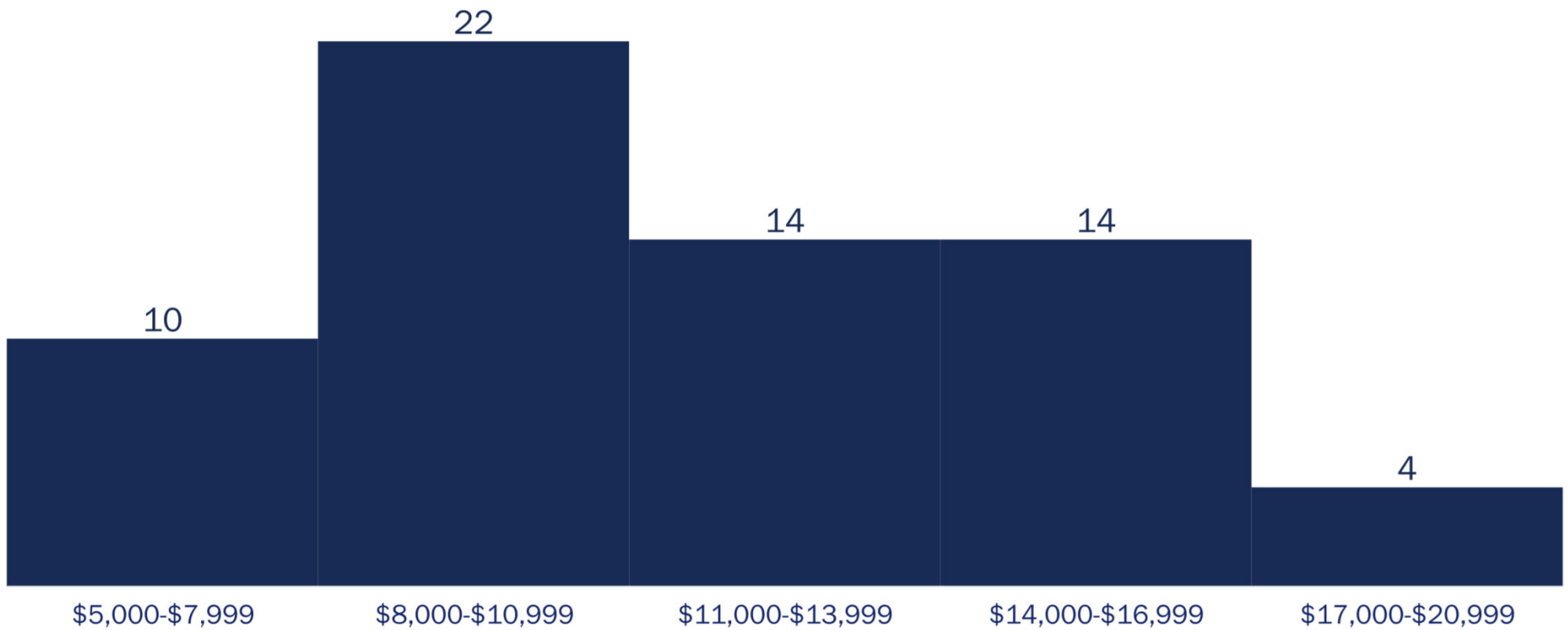
Scenario #4: Central AC to Central, Ducted Heat Pump (Furnace Backup)

| Average Cost | 3-Ton Heat Pump Unit | 4-Ton Heat Pump Unit |
|----------------|----------------------|----------------------|
| Equipment Cost | \$6,767 | \$7,795 |
| Labor Cost | \$3,495 | \$3,611 |
| Misc. Cost | \$1,103 | \$1,110 |
| Total Cost | \$11,201 | \$12,347 |

- Thermostat costs were the most-often mentioned miscellaneous cost
- Code compliance requirements also frequently mentioned:
 - Permits
 - HERS/Title 24 testing
 - Duct sealing
- Contractors also mentioned:
 - Costs of electrical work, such as new wires for thermostat

Scenario #4: Central AC to Central, Ducted Heat Pump (Furnace Backup)

Total Project Cost Distribution (3-Ton Units)



Scenario #5: Central AC & Gas Furnace to Central, Ducted Heat Pump

| HVAC Replacement Scenario | Home Type | Square Footage | Home Levels | System Efficiency | Service Needed |
|--|---------------|----------------|--------------|-------------------|--|
| Central AC & Gas Furnace → Central, Ducted Heat Pump | Single-Family | 1700 sqft | Single-Story | 14 SEER | Disconnect, remove, and discard CAC and furnace. Install and connect Heat Pump and condensate drain. |

In this scenario, the cost for a condensate drain is incorporated into the labor cost estimate.

This scenario does not require:

- Electrical Panel Upgrade
- Equipment Relocation
- Duct Replacement

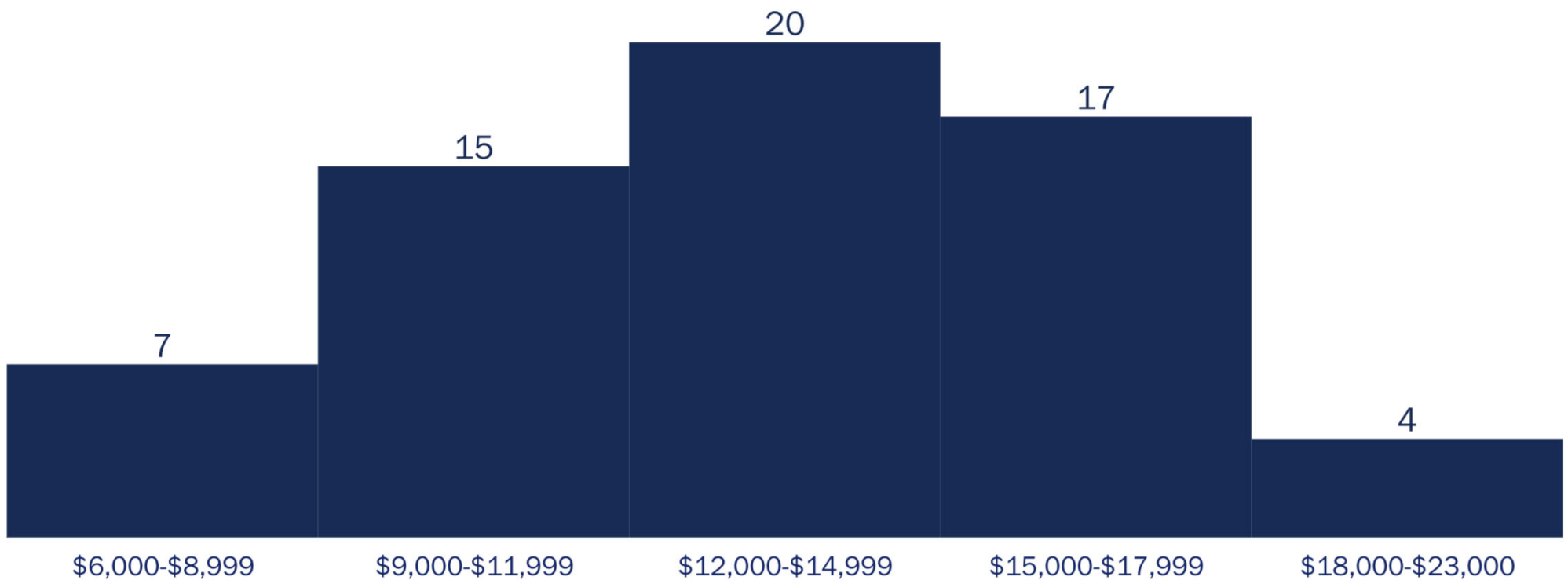
Scenario #5: Central AC & Gas Furnace to Central, Ducted Heat Pump

| Average Cost | 3-Ton Heat Pump Unit | 4-Ton Heat Pump Unit |
|----------------|----------------------|----------------------|
| Equipment Cost | \$7,761 | \$8,797 |
| Labor Cost | \$4,284 | \$4,456 |
| Misc. Cost | \$1,371 | \$1,418 |
| Total Cost | \$13,281 | \$14,529 |

- Cost of electrical work was the most-often mentioned miscellaneous cost, including changing the power to a 220V to accommodate a 3-ton air handler
- Code compliance requirements also frequently mentioned:
 - Permits
 - HERS/Title 24 testing
 - Duct sealing
- Contractors also mentioned:
 - Thermostat costs

Scenario #5: Central AC & Gas Furnace to Central, Ducted Heat Pump

Total Project Cost Distribution (3-Ton Units)



Scenario #6: Gas Furnace to Central, Ducted Heat Pump

| HVAC Replacement Scenario | Home Type | Square Footage | Home Levels | System Efficiency | Service Needed |
|---|---------------|----------------|--------------|-------------------|--|
| Gas Furnace → Central, Ducted Heat Pump | Single-Family | 1700 sqft | Single-Story | 14 SEER | Disconnect, remove, and discard furnace. Install Heat Pump. Install 240V circuit and disconnect for Heat Pump. |

In this scenario, there is a need to install a new 240V circuit and disconnect. This is included in the labor cost.

Scenario #6: Gas Furnace to Central, Ducted Heat Pump

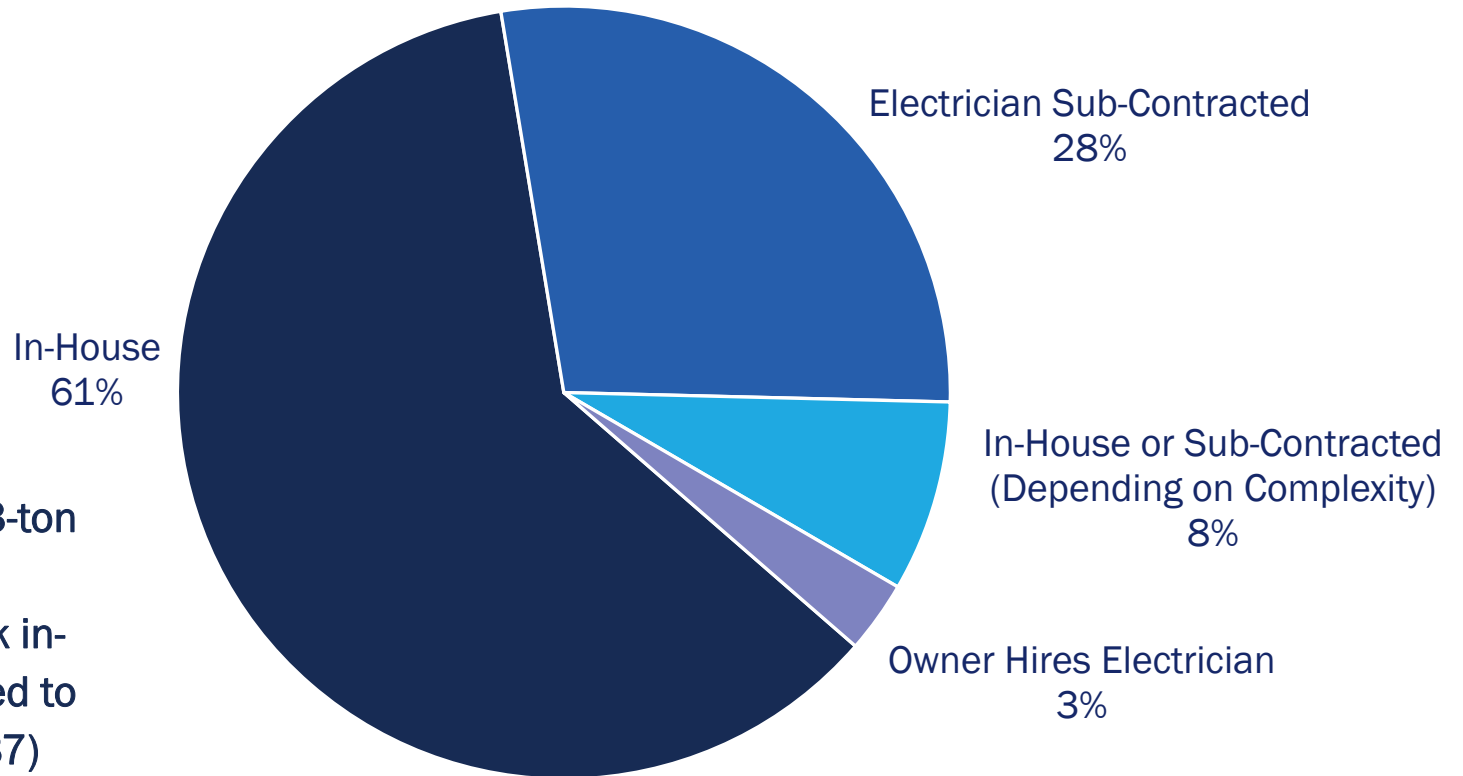
| Average Cost | 3-Ton Heat Pump Unit | 4-Ton Heat Pump Unit |
|----------------|----------------------|----------------------|
| Equipment Cost | \$8,185 | \$8,750 |
| Labor Cost | \$5,029 | \$5,176 |
| Misc. Cost | \$1,854 | \$1,793 |
| Total Cost | \$14,909 | \$15,555 |

- Cost of electrical work was the most-often mentioned miscellaneous cost, including installing 240V circuits and disconnects.
- Code compliance requirements were also frequently mentioned:
 - Permits
 - HERS/Title 24 testing
 - Duct sealing
- Contractors also mentioned:
 - Thermostat costs
 - Costs of miscellaneous materials

Scenario #6: Gas Furnace to Central, Ducted Heat Pump

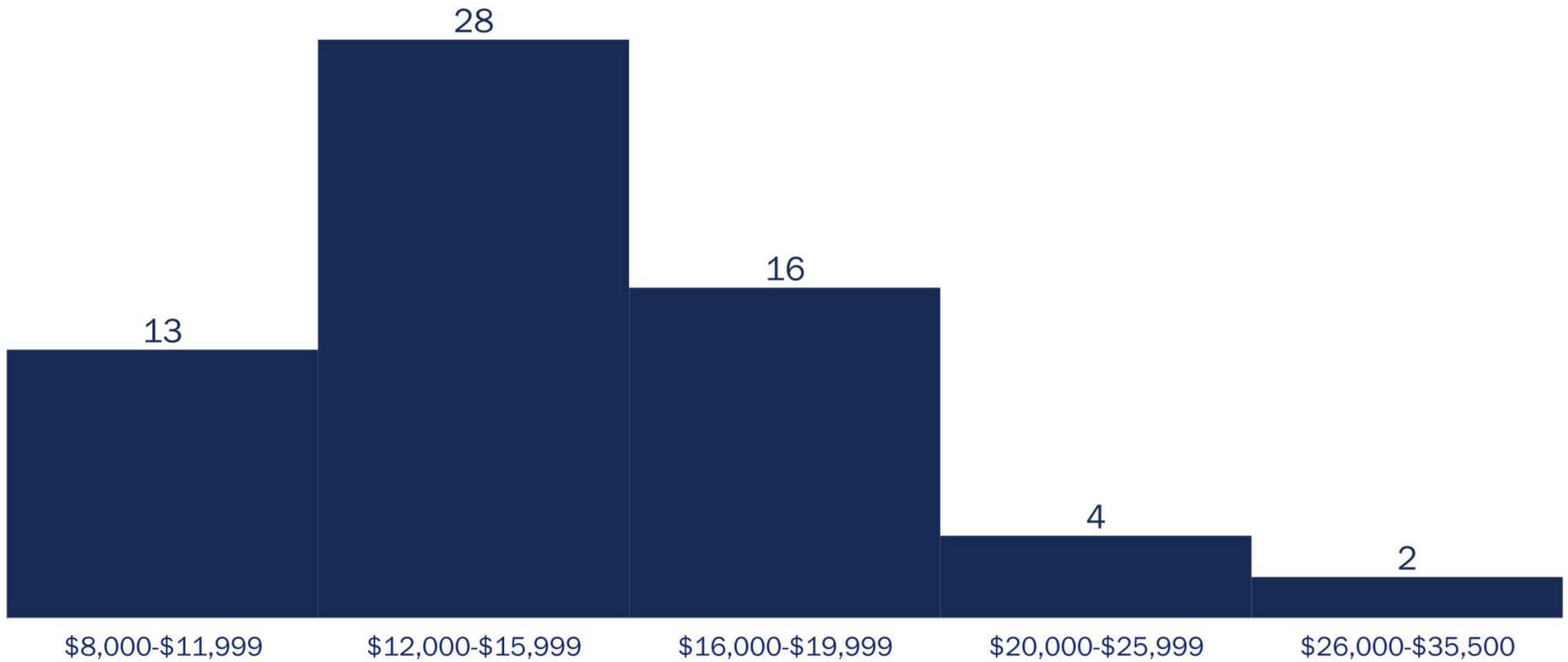
Who Performs the Electrical Work?

Average project costs for 3-ton units were lower when performing electrical work in-house (\$13,904) compared to sub-contracting (\$16,437)



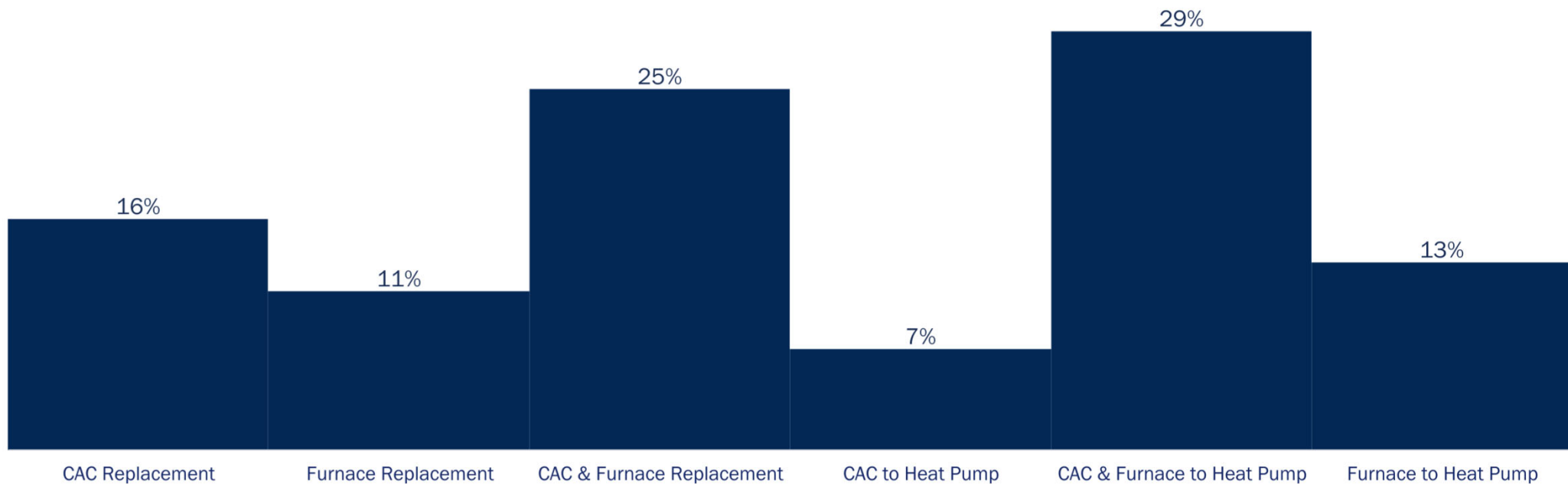
Scenario #6: Gas Furnace to Central, Ducted Heat Pump

Total Project Cost Distribution (3-Ton Units)



Average Proportion of Project Types Completed in 2023 (n=64)

Of all residential HVAC jobs in 2023, contractors more commonly had projects that replaced both the CAC and furnace, compared to other replacements





Opinion **Dynamics**

TAKEAWAYS

Key Takeaways

- Costs increase with complexity. Like-for-like replacements were less costly than heat pump replacements. Yet, the incremental cost for replacing a furnace and CAC with a heat pump over its like-for-like counterpart was very small.
 - No significant differences in total costs between Marine and Hot-Dry climate regions
- Code compliance requirements often drove miscellaneous costs.
 - New thermostats and electrical work were additional costs on heat pump projects.
- Project costs were lower when the electrical work was performed in-house.
- A majority of contractors perform Manual J sizing calculations. Many size the units based on home factors.
 - Otherwise, Bay Area contractors size to the heating load and Central Valley contractors size to the cooling load.



Opinion **Dynamics**

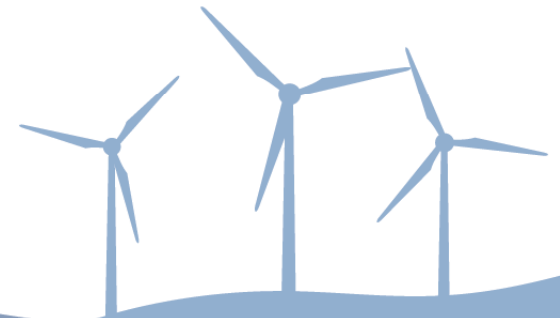
Contact:

Ellen Steiner, PhD

esteiner@opiniondynamics.com

Jen Loomis, PhD

jloomis@opiniondynamics.com



©2023 Opinion Dynamics. All Rights Reserved.
All product or company names that may be mentioned in this publication are
tradenames, trademarks, or registered trademarks of their respective owners.



Opinion **Dynamics**

APPENDIX

Appendix - Scenario #1: Central AC Like-for-Like Replacement

| 3-Ton Unit | Total Cost | Equipment Cost | Labor Cost | Misc. Cost |
|------------|------------|----------------|------------|------------|
| Mean | \$9,777 | \$5,880 | \$3,196 | \$854 |
| Median | \$8,950 | \$5,000 | \$2,800 | \$650 |
| Min. | \$4,140 | \$2,000 | \$500 | \$0 |
| Max. | \$17,440 | \$17,438 | \$9,541 | \$3,450 |

| 4-Ton Unit | Total Cost | Equipment Cost | Labor Cost | Misc. Cost |
|------------|------------|----------------|------------|------------|
| Mean | \$10,431 | \$6,400 | \$3,313 | \$875 |
| Median | \$9,750 | \$5,600 | \$2,800 | \$770 |
| Min. | \$3,300 | \$1,950 | \$500 | \$0 |
| Max. | \$18,995 | \$18,738 | \$9,443 | \$3,450 |

Appendix - Scenario #2: Gas Furnace Like-for-Like Replacement

| 60,000 Btu/h Unit | Total Cost | Equipment Cost | Labor Cost | Misc. Cost |
|-------------------|------------|----------------|------------|------------|
| Mean | \$5,951 | \$3,301 | \$2,151 | \$599 |
| Median | \$5,375 | \$3,000 | \$1,800 | \$500 |
| Min. | \$2,100 | \$741 | \$250 | \$0 |
| Max. | \$13,406 | \$9,011 | \$9,406 | \$1,975 |

Appendix - Scenario #3: Central AC & Gas Furnace Like-for-Like Replacements

| 3-Ton Unit | Total Cost | Equipment Cost | Labor Cost | Misc. Cost |
|------------|------------|----------------|------------|------------|
| Mean | \$12,698 | \$7,856 | \$4,063 | \$969 |
| Median | \$12,000 | \$7,000 | \$3,350 | \$850 |
| Min. | \$7,250 | \$2,797 | \$620 | \$0 |
| Max. | \$22,995 | \$18,995 | \$10,281 | \$4,500 |

| 4-Ton Unit | Total Cost | Equipment Cost | Labor Cost | Misc. Cost |
|------------|------------|----------------|------------|------------|
| Mean | \$13,808 | \$8,770 | \$4,213 | \$1,022 |
| Median | \$13,322 | \$8,045 | \$3,500 | \$850 |
| Min. | \$7,932 | \$3,172 | \$620 | \$0 |
| Max. | \$23,995 | \$20,700 | \$11,548 | \$4,500 |

Appendix - Scenario #4: Central AC to Central, Ducted Heat Pump (Furnace Backup)

| 3-Ton Unit | Total Cost | Equipment Cost | Labor Cost | Misc. Cost |
|------------|------------|----------------|------------|------------|
| Mean | \$11,201 | \$6,767 | \$3,495 | \$1,103 |
| Median | \$10,950 | \$6,000 | \$3,000 | \$1,000 |
| Min. | \$5,650 | \$1,785 | \$800 | \$0 |
| Max. | \$21,000 | \$17,595 | \$9,683 | \$4,000 |

| 4-Ton Unit | Total Cost | Equipment Cost | Labor Cost | Misc. Cost |
|------------|------------|----------------|------------|------------|
| Mean | \$12,347 | \$7,795 | \$3,611 | \$1,110 |
| Median | \$11,925 | \$7,200 | \$3,100 | \$1,018 |
| Min. | \$4,655 | \$1,953 | \$800 | \$0 |
| Max. | \$22,345 | \$20,895 | \$9,681 | \$4,000 |

Appendix - Scenario #5: Central AC & Gas Furnace to Central, Ducted Heat Pump

| 3-Ton Unit | Total Cost | Equipment Cost | Labor Cost | Misc. Cost |
|------------|------------|----------------|------------|------------|
| Mean | \$13,281 | \$7,761 | \$4,284 | \$1,371 |
| Median | \$13,805 | \$7,000 | \$3,600 | \$1,000 |
| Min. | \$6,900 | \$3,070 | \$620 | \$0 |
| Max. | \$22,995 | \$20,000 | \$10,510 | \$5,500 |

| 4-Ton Unit | Total Cost | Equipment Cost | Labor Cost | Misc. Cost |
|------------|------------|----------------|------------|------------|
| Mean | \$14,529 | \$8,797 | \$4,456 | \$1,418 |
| Median | \$14,500 | \$8,146 | \$3,800 | \$1,050 |
| Min. | \$6,885 | \$3,524 | \$620 | \$0 |
| Max. | \$36,000 | \$27,000 | \$11,442 | \$5,500 |

Appendix - Scenario #6: Gas Furnace to Central, Ducted Heat Pump

| 3-Ton Unit | Total Cost | Equipment Cost | Labor Cost | Misc. Cost |
|------------|------------|----------------|------------|------------|
| Mean | \$14,909 | \$8,185 | \$5,029 | \$1,854 |
| Median | \$14,625 | \$7,000 | \$4,250 | \$1,643 |
| Min. | \$8,106 | \$3,070 | \$1,500 | \$0 |
| Max. | \$35,500 | \$27,000 | \$11,103 | \$6,500 |

| 4-Ton Unit | Total Cost | Equipment Cost | Labor Cost | Misc. Cost |
|------------|------------|----------------|------------|------------|
| Mean | \$15,555 | \$8,750 | \$5,176 | \$1,793 |
| Median | \$15,200 | \$8,000 | \$4,250 | \$1,500 |
| Min. | \$8,700 | \$3,524 | \$1,420 | \$0 |
| Max. | \$28,995 | \$25,000 | \$13,022 | \$6,500 |