Evaluation of the HVAC Right-Size Rebate Program

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Program Description and Introduction

In fiscal year 2013[1], Roseville's municipal electric utility, Roseville Electric (RE), offered the HVAC Right-Size Rebate Program, which is designed to help homeowners select the most energy-efficient and correctly sized heating, ventilation, and air conditioning (HVAC) system. This energy-efficiency program offers incentives—in the form of rebates—for qualifying residential HVAC retrofits. Program participation is driven by contractors with some RE marketing and outreach targeted toward homeowners.

To be eligible for this program, homeowners must meet the following requirements:

- Installation of a high-efficiency HVAC system[2]
- System sizing in accordance with ACCA Manual J & Manual D Installation of duct sealing
- Post-installation inspection by Roseville Electric

Additionally, homeowners must install all upgrades using a participating contractor who has attended a contractor training.

RE selected Cadmus to conduct an independent evaluation of the HVAC Right-Size Rebate Program, in accordance with the California Energy Commission EM&V Guidelines for Publicly Owned Utilities Energy Efficiency Programs (January 2011).

[1] FY 2013 was from July 1, 2012 through June 30, 2013.

[2] Qualifying systems include: 15 SEER / 12.5 EER / 8.5 HSPF Split System or 14 SEER / 12 EER / 8.2 HSPF Package System

Evaluation Objectives and Approach

Cadmus designed its evaluation of the HVAC Right-Size Rebate Program to meet these objectives for RE:

- Determine gross savings and net savings through an impact assessment;
- Verify the measures installed by participating contractors and assess the procedures followed;
- Evaluate the program process from the perspective of stakeholders; and
- Recommend actions for improving the program.

Methodology

To meet the evaluation objectives, Cadmus' approach entailed the activities shown in Table 1.

Table 1. Evaluation Activities

Evaluation Activities	Overview of Approach
Site-Visit Verification and Meter Installation	Verification of Manual J and D inputs, measure verification, and data logger installation.
Database and Engineering Review	Assessment of whether paper records are consistent with tracking data. Algorithm review and/or deemed savings assessment and verification of calculations. Analysis of primary data.
Stakeholder Interviews	Interviews with contractors and participating customers to understand program processes, net-to-gross factors, and opportunities for improvement.

Site-Visit Verification and Meter Installation

Cadmus selected a random sample of homes to visit for the purposes of measurement and verification.

Participant Recruitment

After Roseville sent letters regarding the evaluation to a census of measure-installation participants, Cadmus then called these customers to explain the study. During these calls, we scheduled a time for HVAC system inspection and meter installation with those customers who were willing to participate.

Site Visits

We conducted site visits at a statistically significant sample of program homes, based on targets of 90% confidence and 10% precision. Using the final 2012 tracking database provided by Roseville, we randomly selected 30 program participants for verification and metering and, ultimately, our field technician performed 29 site visits.

In August 2013 a Cadmus field technician performed the site visits, during which he installed a run-time meter on the HVAC condenser and a temperature sensor on the thermostat. Our technician also showed the homeowners how to remove the meters at the completion of the study.

By installing a run-time logger on the HVAC equipment (see Figure 1) in August, our field research was able to obtain data during peak temperature conditions, which provides some indication of whether equipment was properly sized.

Figure 1. Installation of run-time logger

To track indoor temperature setpoints, we installed thermostat loggers (Figure 2). It is important to monitor user behaviors when metering system run time, because an unexpected thermostat setpoint change will result in unexpected HVAC system run time. (We discuss system run-time coincidence factor during peak conditions in the section titled "Site Visit Findings.")

Figure 2. Installation of Thermostat Logger

In October, after the metering equipment had collected several weeks of data, we telephoned participants to remind them to mail the meters back to Cadmus. Upon receipt of the meters at the completion of the study, we advised RE, which provided each participant with a $50 check.

Database and Engineering Review

Cadmus performed a documents review of the program rebate applications and an engineering review of the reported database information and invoices for the census of HVAC system measure installations. Our goals were as follows:

- Check for errors in the database, including duplicate or erroneous records;
- Assess the reasonableness of the savings recorded in the database and ensure the savings values reported correctly matched the measure reported;
- Review invoices to determine whether measures were properly categorized;
- Assess the inputs used in estimating engineering savings values. These inputs included:
  - Address (to determine the heating and cooling zone location)
  - New equipment type and size
  - New equipment efficiency rating through the Air-Conditioning, Heating, and Refrigeration Institute (AHRI)
  - Existing heating and cooling equipment types and information
  - Type of home (manufactured or single-family)
  - Square footage of conditioned space
  - Duct location

Engineering Calculations

To estimate energy savings, Cadmus used engineering algorithms specific to the equipment type.

For central air conditioners (ACs):

$$(1) \quad \Delta kWh = EFLH_C \times \frac{BTU_c}{1000} \times \left(\frac{1}{SEER_{base}} - \frac{1}{SEER_{ee}}\right)$$

For central heat pumps (HPs):

$$(2) \Delta kWh = EFLH_C \times \frac{BTU_c}{1000} \times \left(\frac{1}{SEER_{base}} - \frac{1}{SEER_{ee}}\right) + EFLH_H \times \frac{BTU_h}{1000} \times \left(\frac{1}{HSPF_{base}} - \frac{1}{HSPF_{ee}}\right)$$

For central ACs and HPs:

$$(3) \Delta kW = \frac{BTU_c}{1000} \times \left(\frac{1}{EER_{base}} - \frac{1}{EER_{ee}}\right) \times mcf$$

Where:

$EFLH_c$= Equivalent full load cooling hours

$EFLH_H$= Equivalent full load heating hours

BTU_c= BTUs cooling

BTU_H= BTUs heating

$SEER_{base}$= Seasonal energy-efficiency rating of equipment replaced

$SEER_{ee}$= Seasonal energy-efficiency rating of new equipment (nameplate)

$HSPF_{base}$= Heating seasonal performance factor of equipment replaced

$HSPF_{ee}$= Heating seasonal performance factor of new equipment (nameplate)

mcf= metered coincidence factor

These are the standard algorithms used to estimate savings. Cadmus made the following adjustments as appropriate:

- Equivalent full load hours are adjusted for duct leakage before measure implementation
- A capacity adjustment is required if a system is not correctly sized
- SEER rating of baseline equipment is adjusted for age degradation

Engineering Adjustments: Equivalent Full-Load Hours

Cadmus reviewed research performed by KEMA and ConSol to determine an appropriate value to use for the equivalent full-load cooling hours. Based on this research, Cadmus determined that the value of 372 $EFLH_c$ is appropriate for compressor-based central AC and HP systems in Roseville's service territory[3]. Full-load hours are used to estimate energy consumption for an entire season by using the full-load capacity specified on the nameplate and the efficiency at ARI conditions[4]. While we accept the value of 372 hours as a reasonable value to estimate energy consumption of an HVAC system, we also consider the differences in operation before and after the measure installation.

We confirmed duct leakage reduction and then adjusted the engineering algorithm to account for additional run time of the replaced systems. For example, when duct leakage is reduced by 25% due to measure installation, we assume the existing system would have operated 25% longer to provide equivalent cooling capacity to the home[5]. Thus, Equation 1 and Equation 2 are adjusted as follows:

$$(4) \qquad \Delta kWh = EFLH_C \times \frac{BTU_c}{1000} \times \left(\frac{1.25}{SEER_{base}} - \frac{1}{SEER_{ee}}\right)$$

[3] ConSol concluded the average cooling EFLH for the City of Roseville is 372 hours, which is 36% less than the hours RE estimated. ConSol argues that the RE method assumes units run constantly at high outdoor temperatures, but states that this is inconstant with empirical data. This is described in ConSol's 2011 report "Residential Cooling System Equivalent Full Load Run Hours Evaluation for the City of Roseville."

[4] ARI conditions are 95°F outdoor temperature, 67°F indoor wetbulb temperature, and 80°F indoor drybulb temperature.

[5] We use 25% as a probable duct loss prior to sealing based on Cadmus research and supported by information provided by Lawrence Berkeley National Laboratory (http://ducts.lbl.gov/calducts.htm, accessed January 3, 2014). If ducts are located in conditioned space, we assume 50% of the losses are recovered through regains of the system, which results in a lower EFLH adjustment of 12.5%.

Cadmus conducted secondary research to determine a reasonable equivalent full-load heating hours ($EFLH_H$) value. ConSol recommended 500 $EFLH_H$ based on its engineering judgment. We performed a literature search and engineering review to confirm this estimate. We did not find conclusive evidence to support use of any particular estimate for Roseville heat pump heating run time. In a study in which we metered heat pumps operating in the mid-Atlantic region, we found a value of approximately 900 $EFLH_H$. Adjusting for weather differences (using the ratio of heating degree-days from Baltimore to Roseville), we estimated a weather-adjusted value of 567 $EFLH_H$ for Roseville. We note that the heat pumps metered in Baltimore were different from those in Roseville in these ways:

- Duct systems were mostly in conditioned space and
- Some heat pumps metered in Baltimore had backup gas or oil furnaces, which reduced heat-pump run time.

Since ducts in Baltimore were usually in conditioned space, leakage to the outside is probably less than the ducts in RE's program meaning the 500 $EFLH_H$ value is conservative. In conclusion, Cadmus believes 500 $EFLH_H$ is a reasonable value for run time *after* ducts have been sealed through the Right-Size program.

We then applied a 25% increase to the 500 $EFLH_H$ value to account for pre-existing duct leakage and calculated the baseline energy consumption using 625 hours[6]. Thus, our adjusted equation for estimating heat pump savings is this:

$$(5)\Delta kWh = EFLH_C \times \frac{BTU_c}{1000} \times \left(\frac{1.25}{SEER_{base}} - \frac{1}{SEER_{ee}}\right) + EFLH_H \times \frac{BTU_h}{1000} \times \left(\frac{1.25}{HSPF_{base}} - \frac{1}{HSPF_{ee}}\right)$$

Engineering Adjustments: Nameplate Capacity Rating

The cooling EFLH value is based on several assumptions, including that the HVAC system is properly sized. Proper sizing is achieved using Manual J calculations, so through site visits and review of Manual J inputs and calculations, Cadmus identified those cases where the calculations were performed incorrectly and the systems were over-sized. Through reviewing metered data at peak-design conditions, we can determine how the system is operating (the metered peak coincidence factor). If the unit is over-sized based on the fact that it operates less at peak conditions than it would if right-sized, we can account for the effect on savings by adjusting the $EFLH_C$. An example is provided in the "Site Visit Findings" section.

Engineering Adjustments: Baseline Efficiency Values

Roseville requires the HVAC contractor to provide the nameplate efficiency rating of the system replaced through the Right-Size program. The actual operating efficiency degrades over time so Cadmus leveraged research performed for a utility in the Midwest to determine the baseline efficiency of the

[6] The leakage of the ducts of systems metered in Baltimore is not known. The average $EFLH_H$ of 500 hours after duct sealing and 625 hours before duct sealing is 562 hours – very close to the metered estimate from Baltimore adjusted for Roseville weather.

existing units replaced by the program. Trained HVAC contractors in the Midwest program received utility-funded incentives to service and tune-up HVAC systems to their optimal operating condition. Contractors reported nameplate efficiency rating (EER at ARI conditions), the tested EER after the tune-up normalized to ARI conditions, and the age of the unit.

Cadmus has researched installed HVAC systems of various ages in the Midwest extensively. Using a regression analysis of the reported efficiency degradation (ratio of tested EER to nameplate EER), we developed a model of efficiency decline relative to the age of the HVAC unit. We assumed the same degradation of EER applies to the SEER. Table 2 shows the results of the regression and applicable degradation factor.

Table 2. Baseline SEER Ratings

Vintage Year	Reported Baseline SEER	Degradation %	Year Used to Determine Degradation %	Adjusted Baseline SEER	Baseline HSPF
≤ 1977	8	27%	1977	5.8	5.8
1978-1983	8	24%	1981	6.1	6.0
1984-1991	8.9	19%	1988	7.2	6.4
1992-1998	9.7	14%	1995	8.4	6.8
1999-2000	9.7	11%	1999	8.7	6.9
2001-2003	9.7	8%	2002	8.9	7.0
2004-2005	9.7	6%	2005	9.1	7.0
2006-2013	13	0%		13.0	7.7

Using reported building vintage, we adjusted baseline SEER to determine the most reasonable baseline efficiency rating for the equipment replaced through Roseville's Right-Size program. To determine baseline HSPF ratings[7], we used a correlation value of SEER to HSPF, which we obtained` from an internal database of heat pump heating and cooling nameplate efficiency ratings from approximately 250 heat pumps.

Stakeholder Interviews

Cadmus conducted a telephone survey of approximately 75% of participating homeowners in our site visit sample (22 of 29) and 25% of participating contractors (8 of 32). We conducted these interviews to determine the following factors affecting program performance:

- Freeridership;
- Implementation details; and
- Program participation problems or issues.

[7] HSPF rating was not reported for existing heat pumps

Findings

This section presents Cadmus' major findings from our evaluation of the Roseville Right-Size Rebate Program.

Gross Savings

Through engineering review, database review, and on-site inspections, Cadmus found a 45.3% realization rate for energy savings and a 65.6% realization rate for demand savings. (The realization rate is defined as the total evaluated savings divided by the total reported savings.)

Table 3. Gross Savings

	Reported	Evaluated	Realization Rate
kWh	555,983	252,065	45.3%
kW	354.7	232.6	65.6%

Applying the measure verification rate we determined through site visits, engineering reviews, and meter data analysis to the entire population of measure savings, we estimated the savings for the entire program (Table 3). We report a realization rate, which is the ratio of *ex post* (evaluated participant or project) to *ex ante* (reported by participant or project by RE) savings. The average reported savings for the sites visited was 4,300 kWh/year, and we determined that the average evaluated savings for the sites visited was 1,968 kWh/year (or 45% of the reported value).

We determined that the following are the main reasons that the evaluated savings are only 45.3% of the reported savings based on analyses conducted by ConSol:

- The average assumed tonnage in the ConSol model is 4.0 tons. However, we calculated that the average tonnage of the replaced units was 3.3 tons and the tonnage of the new units was 3.1 tons.
- Manual J calculations were incorrect for two homes. One home appeared to have a significantly undersized AC unit. According to metered data the unit at the other home was sized appropriately, despite the calculation issues.
- The metered data indicated that several systems were over-sized, even though our review of Manual J calculations confirmed they were sized properly based on Manual J.

To compare our estimates, Cadmus reviewed the Measure Quantification report produced for the Northern California Power Authority and the Southern California Public Power Authority (KEMA, 2009). The values in this report are taken from the DEER database and utility work papers. In climate zone 11 (Roseville), the report lists the savings values per ton when a 10-SEER system is replaced by a more efficient system (such as those rated at from 14.5 SEER to 16 SEER). As shown in Table 4, we cross-checked our findings by applying these per-ton values to the average level of 3.1 tons (for the new units) and the capacity of 4.0 tons (for the replaced units) assumed by ConSol.

Table 4. Savings Comparison

Early Retirement (10 SEER)	DEER Savings per ton (kWh)	Annual Savings (kWh)	
		3.1 tons	4.0 tons
CEE Tier 1 / Split system 14.5 SEER	217	673	868
CEE Tier 2 / Split system 15 SEER	241	747	964
CEE Tier 3 / Split system 16 SEER	268	831	1072
CEE Tier 1 / Split system Heat Pump 14.5 SEER	492	1525	1968
CEE Tier 2 / Split system Heat Pump 15 SEER	515	1597	2060

The savings estimates in Table 4 are much less than the values assumed for the program. Even though less than the program values, our estimated average savings of 1,968 kWh per year for a group of mostly AC split systems is higher than the estimates derived from the KEMA report. One reason that our estimate is higher is because we increased the pre-treatment EFLH by 25% to reflect the benefit of the duct sealing measure in the program. Also, we adjusted the baseline SEER using a degradation factor that results in both higher assumed baseline energy consumption and higher savings.

Statistical Significance of Proper Application of Manual J

Cadmus determined that the Manual J calculation was done correctly for 27 of the 29 sites evaluated or in 93% of the cases. Statistically, this allows us to say with 90% confidence and 8% precision that the Manual J calculation is done correctly at this rate for the entire population.

Data-Tracking Findings

For all reported measures, Cadmus determined that the savings amounts are in agreement with the deemed savings estimates by measure type. We found one instance of a data-tracking error in the case where one site had installed two systems through the program. For this site, the record for each system included the combined savings for both systems resulting in an overstatement or double-count of savings for the site. Cadmus adjusted total savings to correct this error and the duplicate savings are not reflected in the final reported savings estimate. RE was aware that this type of double count error could occur through the data-tracking system.

Site Visit Findings

Cadmus' review of meter data revealed that six of the 29 units were over-sized. Our analysis to assess whether a system was properly sized is shown in Figure 3, Figure 4, and Figure 5.

Figure 3 shows an example of an under-sized system. There is no decrement for the calculated savings for an under-sized system because an under-sized system runs more and consumes (and saves) more energy per ton. Only one system was under-sized.

Figure 3. Under-Sized System Example

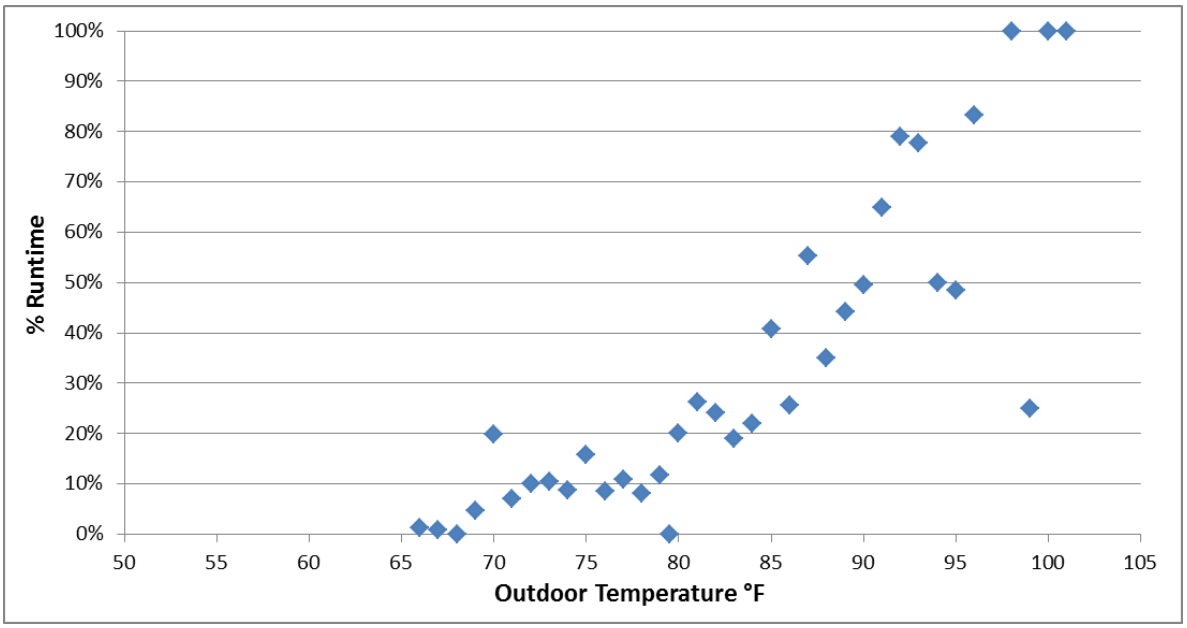


Figure 4 is an example of a system that was properly sized. During the hours that the outdoor temperature reached 100°F, the system operated approximately 80% of the time. Note we also looked at the indoor temperature to ensure the thermostat was set at a value that requires cooling. (For example, if the thermostat data showed the indoor temperature was 80°F, we would not be able to assess whether the system was properly sized because the expected indoor design temperature is 76°F.)

Figure 4. Right-Sized System Example

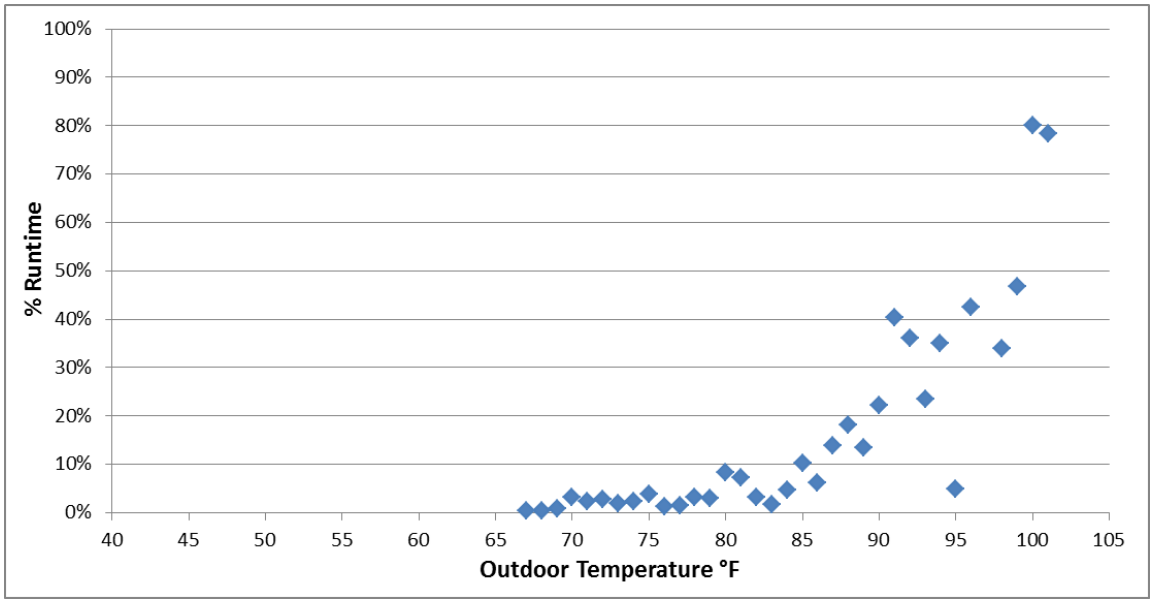
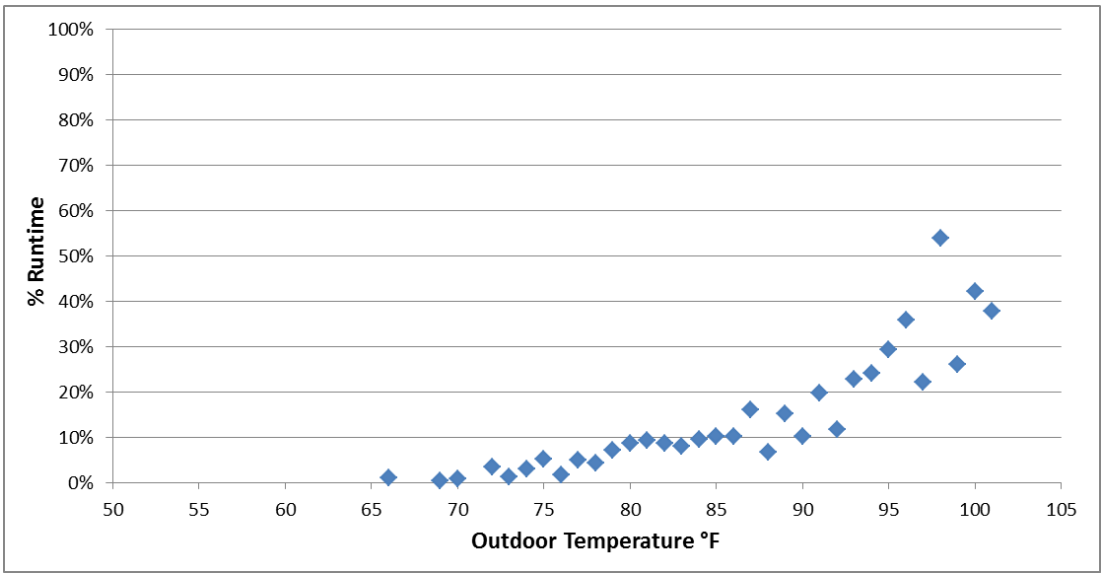


Figure 5 shows a system that we confirmed was over-sized. Through our review of the thermostat meter data, we confirmed there was a call for cooling during peak conditions. The system cycled on less than 60% of the time during this peak, while the indoor temperature held steady at 74°F.

Figure 5. Over-Sized System Example



We adjusted the savings for the six units that were over-sized. The result was a 20% decrement in calculated savings for these units, which resulted in a 4% average decrement of calculated savings for the sample of 29 sites we visited. We used engineering judgment to adjust capacity. The following example explains the rationale for the adjustments made.

At peak conditions metered data indicated a 3-ton AC operated 50% of the peak hour (average temperature was 101 degrees for one hour). A properly sized system would have run at least 90% of the time during peak conditions. Using 90% as a minimum, we adjusted the capacity of the 3-ton unit to 1.67 tons so that the savings were based on 1.67 tons, not 3 tons:

$$1.67\ tons = \frac{3\ tons}{\frac{90\%}{50\%}}$$

Manual J allows up to ½ton over-sizing so a 2-ton system would be appropriate for this particular home. Consequently, rather than using a 3-ton system in the savings calculation we use a 2-ton system. This is analogous to reducing the EFLH by the same proportion (50%/90%) because an over-sized system runs less than a properly sized system at peak conditions (full load).

During 2013, Cadmus metered AC and HP equipment for approximately 30% of the cooling season, based on cooling degree-days. When extrapolating to the entire season by a ratio of cooling degree-days metered to cooling degree-days for the season, we found an average of 321 runtime hours. Given the

level of uncertainty in the runtime measurement and extrapolation to the season, these data support the EFLH estimate of 372 hours.

One other adjustment we made to the engineering savings calculations was based on the location of ducts. Our site visits confirmed that two of the 29 sites had ducts located in conditioned space. As described in the impact methodology section, we assumed that the ducts located in conditioned space have 50% less energy savings due to duct sealing improvement, so we adjusted the savings accordingly as shown in Equation 6. The overall effect of this adjustment on energy savings and demand savings was less than 1%. The updated equation for ducts located in conditioned space is this:

$$(6) \qquad \Delta kWh = EFLH_C \times \frac{BTU_c}{1000} \times \left(\frac{1.125}{SEER_{base}} - \frac{1}{SEER_{ee}}\right)$$

System Size Findings

Cadmus found that there was a slight reduction in average installed AC and HP size due to the Manual J calculation required by the program.

- 0.20 average tonnage reduction for sampled group (5.77 tons / 29 sites).
- 0.18 average tonnage (21.5 tons / 120 sites) reduction for all program participants.

One objective of the Right-Size Program was to lead to right sizing of installed systems, and an underlying assumption was that this would generate energy savings in addition to those from replacing existing systems with more efficient ones. Our data showed, on the average, that units installed under the program were smaller capacity than those they replaced, but the size reduction was very modest. Whether this amount of down-sizing, or any magnitude of likely down-sizing, would increase energy savings is uncertain. Based on our experience, we would like to offer the following observations about the effect of system size.

Manual J provides a methodology to size a system correctly and should lead customers to avoid overpaying for a unit that is larger than required while maintaining comfort.

An over-sized system would likely short-cycle, for example, running 10 minutes instead of 20 minutes for a right-sized system. This can decrease overall efficiency and increase operating cost (although how much is not well known). But the average size reduction of the systems in Roseville that were down-sized from the replaced unit was only about a half-ton, which is equal to the tolerance indicated in Manual J.

The findings from our study suggest that over-sizing is not a significant problem in Roseville. Only 15 of 120 systems were reduced by more than a half ton. Overall operating efficiency may improve from down-sizing if, for example, a 2 ton unit replaces an oversized 4 ton unit and increases cycle time from 10 minutes to 20 minutes. But this is not happening in the RE program. In addition, our research on this topic has found that the literature is not conclusive that right sizing actually produces energy savings given the characteristics of the new air conditioner technologies. We found no information or specific

research about efficiency degradation due to short-cycle time of high efficiency units. High efficiency systems like those installed through the program can operate at variable cooling capacity. For this reason the effect of decreasing the system size to make a system effectively run a little bit longer has un unknown or negligible impact on average operating efficiency.

Rather than system size, the main savings-producing measures in our analysis are the improved system efficiency (SEER) and the duct sealing. Our savings analysis uses the nameplate efficiency SEER to calculate savings. We assume nameplate SEER is achieved when an HVAC system cycles normally (i.e., when a system is properly sized).

Stakeholder Interviews

Between September and November 2013, Cadmus interviewed 22 homeowners and eight contractors who participated in the Right-Size Rebate Program.

Homeowner Survey

Of the 29 homeowners who participated in the site visits and metering, we were able to conduct a telephone survey with 22. We designed our homeowner survey to determine: (1) motivations for participating in the program; (2) whether there were process issues with regard to participating; and (3) the level of freeridership.

We first asked the responding homeowners if they recalled the value of the rebate they received from the program. Of the 17 who recalled the value, the average rebate was $4,729. We also determined that none of the homeowners were aware of the HVAC 400 Rebate Program, which provides incentives for energy-efficient HVAC units but does not including sizing requirements.

When we asked the respondents how they learned of the program, approximately half cited the printed material they received, as shown in Table 5.

Table 5. How Homeowners Learned About the Program

Response	Percentage (n=21)
Contractor	10%
Printed material	52%
Program participants	14%
Other word-of-mouth	14%
Other	10%

Table 6 lists the reasons the respondents gave for participating in the program. The two most-common motivators were to replace old equipment (43%) and to receive a rebate (38%).

Table 6. Motivations for Participation

Response	Percentage (n=21)
To replace old/broken equipment	43%
To receive a rebate	38%
To save money on utility bills	14%
Other	5%

Although the majority (57%) of homeowners had recently considered replacing their air conditioner, most had taken no action before they learned of the program. Specifically, only 15% of respondents had researched the possibility of replacing their air conditioner.

Responses Regarding Likely Actions in the Absence of the Program

When we asked homeowners how likely they would have been to replace their air conditioner without the program, 75% said they did not know. Among the other respondents, two homeowners said they would have replaced their old equipment in 2013 or 2014 and three said they would have made the replacement in 2015.

We also asked homeowners how likely they would have been—in the absence of a rebate—to replace their air conditioner system with a high-efficiency system rather than a standard-efficiency system. As shown in Table 7, approximately 65% indicated they were either "not very likely" or "not at all likely" to have purchased a high-efficiency unit without the program.

Table 7. Likelihood of Purchasing a High-Efficiency AC Without the Rebate

Response	Percentage (n=20)
Very Likely	25%
Somewhat Likely	5%
Not Very Likely	40%
Not at All Likely	25%
Don't Know	5%

We asked respondents how likely they were—without the program—to have undertaken all the various energy-saving measures regarding their air conditioner [specifically, ensuring they had a correctly sized unit; installing (or having installed) insulation; sealing (or having sealed) air ducts; and having their AC system tested or inspected]. Among these homeowners, 80% said they were either "not very likely" or "not at all likely" to have undertaken those measures (see Table 8.)

Table 8. Likelihood of Installing All Measures

Response	Percentage (n=20)
Very Likely	10%
Somewhat Likely	10%
Not Very Likely	55%
Not at All Likely	25%

Responses Regarding Program Influence and Program Satisfaction

Five of the 22 homeowners reported that since participating in the HVAC Right-Size Rebate Program, they had installed energy-efficiency measures for which they did not receive a rebate. These measures included insulation and air sealing as well as purchasing efficient lighting, water heaters, and appliances.

The responding homeowners tended to be satisfied with the equipment they received through the program, as shown in Table 9.

Table 9. Satisfaction with Equipment Installed

Response	Percentage (n=18)
Very Satisfied	72%
Somewhat Satisfied	22%
Not Very Satisfied	6%
Not at All Satisfied	0%

Table 10 shows about 70% of participants were very or somewhat satisfied with their contractor.

Table 10. Satisfaction with Contractor

Response	Percentage (n=21)
Very Satisfied	52%
Somewhat Satisfied	19%
Not Very Satisfied	24%
Not at All Satisfied	5%

Overall, the vast majority of participants indicated that they were very satisfied with the program, as shown in Table 11.

Table 11. Overall Satisfaction

Response	Percentage (n=21)
Very Satisfied	86%
Somewhat Satisfied	10%
Not Very Satisfied	5%
Not at All Satisfied	0%

When asked how the program could be improved, respondents offered these suggestions:

- More advertising (2 respondents)
- Including rebate information on bills (2 respondents)
- Additional rebates (2 respondents)
- Improving quality of contractors and units installed (1 respondent)
- To process rebates more quickly (1 respondent)
- More outreach (1 respondent)

Contractor Survey

Cadmus conducted a telephone survey of eight of the 32 contractors who participated in the HVAC Right-Size Rebate Program. Of these eight, four completed the retrofits for a large number of homes (between 7 and 19), while the other four contractors participated in the program at a single site. Overall, these eight contractors served 58% of participating homes.

We designed our survey to determine the following:

- Whether contractors faced process issues while participating in the program
- What issues were encountered (such as difficulties with the rebate process, compliance with program requirements, and communication with RE)
- Contractor freeridership for the program

When we asked contractors how they learned about the program, the two most-commonly cited sources were word-of-mouth and RE program staff, as shown in Table 12.

Table 12. How Contractors Learned of the Program

Response	Percentage (n=8)[8]
Contacted by a program representative	75%
Program sponsored workshop or training	25%
Printed material from the utility	50%
Word of mouth	88%

[8] Multiple responses were permitted so the sum of responses exceeds 100%.

All eight of the contractors surveyed reported that they participated in the program to offer rebates to their customers. Table 13 shows the reasons for contractor participation. (Note: Multiple responses were permitted so the sum of responses exceeds 100%.)

Table 13. Reasons for Contractor Participation

Response	Percentage (n=8)
To receive/offer rebates to customers	100%
Expand business by being on the qualified contractor list	13%
To expand service offerings	13%

Responses Regarding Program Influence and Program Satisfaction

We asked how important the program was—considering its incentives, services, and information—in influencing the decision to recommend that customers install all of the program measures. On a scale ranging from "0" (not important) to "10" (very important), more than half of the contractors rated the importance of the program as "9." (See Table 14.)

Table 14. Importance of Program

Response	Frequency
10	2
9	5
8.5	1

We asked contractors in what percentage of sales situations they recommended installing a properly-sized high-efficiency air conditioner and other measures incentivized by the program. Of the seven who responded to this question, three said that both before and after learning of the HVAC Right-Size Rebate Program, they recommended those measures to 100% of homeowners who would benefit from them. The remaining four contractors said that after learning of the program, they recommended the measures in 15% more sales situations (on average).

Approximately 45% of contractors also reported that they recommend right-sizing and efficiency measures equally in areas with and without incentives. These responses might suggest that many of the contractors were already recommending high-efficiency systems and taking steps to size them properly. However, when we asked contractors in what percentage of sales situations before participating in the program they used Manual J and Manual D procedures to size HVAC systems, five said they used these procedures only 25% (or less) of the time. Table 15 shows the percentage of projects that contractors used Manual J and Manual D procedures before the program.

Table 15. Projects Using Manual J and Manual D Before Program

Response	Frequency
0%	1
1%	1
5%	1
20%	1
25%	1
80%	1
100%	2

Regarding the importance of the program in the contractors' decision to use Manual J and Manual D procedures, six gave a rating of at least 6 (using the same 0-to-10 scale in which "10" is a rating of "very important"). The other two contractors, both of whom always use Manual J and D, said the program was "not at all important" (Table 16).

Table 16. Importance of Program in Using Manual J and Manual D

Response	Frequency
0	2
6	1
8	1
9	1
10	3

Four contractors reported being "very satisfied" and four reported being "satisfied" with the program overall. To obtain details, we asked about various elements of the program.

- All eight of the contractors reported being satisfied with the program process. Regarding their experiences with RE staff, seven described themselves as "very satisfied," while one was "somewhat satisfied." Additionally, all contractors indicated that their questions were always answered by the program staff.
- Seven of the contractors reported that they were either "satisfied" or "very satisfied" with program trainings, and one contractor did not recall the trainings. Regarding the application process, five contractors were "very satisfied" and 3 were "satisfied." Only one contractor was not satisfied with the amount of time it took to process the application.

Five of the contractors have continued (or are planning to continue) with the program. One contractor will not continue, and the others were not sure if they would continue with the program.

We asked the contractors what went smoothly with the program, and these were their responses:

- "All went smoothly except for timing of launch of the 2013 program, which was a bit too late in the season"
- "Application was easy, the required documentation was clear, customer service from Roseville was great"
- "Easy and clear requirements"
- "Everything except that the program ran out of money really quickly. I don't want to invest in time and money for the program to run out of funding"
- "Good program"
- "It was very nice that older homes received higher rebates"
- "Opens up customers eyes that there's more than just replacing the unit"
- "Good rebate amounts"

When we asked for recommendations for improving the program, the contractors made the following suggestions:

- "Broadening the actual scope of work. I would like to see a more holistic approach such as whole house - more energy measures means that the HVAC unit could be sized smaller."
- "[The percentage of homes that participated in the program] dropped to 10% of [qualifying] homes … in 2013. This time there were too many extra requirements and less money for rebates."
- "I had a couple of projects where the requirements needed to be modified. Getting a hold of proper people to approve modified request was difficult. Eventually it was solved and customers participated. I recommend more flexibility in the program."
- "Increasing money for rebates"
- "I may not participate again. It's a big problem if we can't count on funding to be there."
- "More funding, have a secondary option that's more than the $400 rebate but less than the right size program. Rebate could still be based on square footage and age of home, but to add insulation to get more savings."
- "Program staff should have reached out to us for the 2013 program. Make sure that contractors know the deadlines/trainings/requirements."
- "Timing of launch of program needs to happen in the spring. It almost killed us that the launch happened so late this year."

Net Impacts

In any program that offers incentives to take action or change behavior, there is the possibility of freeridership. This is the percentage of savings that would have occurred in the absence of the program due to participants behaving the same (purchasing the same measures) without the influence of the

program. Cadmus calculated freeridership for the HVAC Right-Size Rebate Program to determine the program's net impacts.

Freeridership and Net-to-Gross

Our net-to-gross (NTG) analysis relied on responses (self-reports) to a series of questions that were in both our homeowner survey and our contractor survey. Our questions were designed to measure the influence of the program on the following: (1) the participating homeowner's decision to implement program-eligible energy-efficiency measures; and (2) the contractor's decision to offer and recommend such measures.

Proper sizing was a key component of the HVAC Right-Size Rebate Program, yet it is not a concept most homeowners are familiar with. Therefore, we discussed with contractors the program's impact on sizing and determine contractor freeridership based on their responses.

To determine the level of contractor freeridership, we calculated a maximum value (VMAX) NTG score for each contractor survey. The VMAX score (on a 0-to-10 scale) is the maximum value of the NTG scores calculated for responses to five survey questions. Our scoring matrix is shown in Table 17.

Table 17. Contractor NTG Scoring Matrix

Question	NTG Scoring
NTG1: Using this 0 to 10 scale where 0 is 'Not at all important" and 10 is "Very Important", how important was the Roseville Electric HVAC Right-Size Rebate Program, including incentives as well as program services and information, in influencing your decision to recommend that customers participating in the program install a premium efficiency HVAC system at this time?	Response (0 to 10)
NTG2: Using a 0 to 100 percent scale, in what percent of sales situations did you recommend premium efficiency HVAC systems BEFORE you learned about the Roseville Electric HVAC Right-Size Rebate Program?	(100 - %Response)/10
NTG3: Using a 0 to 100 percent scale, in what percent of sales situations did you recommend premium efficiency HVAC systems AFTER you learned about the Roseville Electric HVAC Right-Size Rebate Program?	%Response/10 - [score above]
NTG4: Now, using a 0 to 100 percent scale, in what percent of sales situations did you use Manual J and Manual D procedures to size HVAC systems BEFORE you learned about the Roseville Electric HVAC Right-Size Rebate Program?	(100 - %Response)/10
NTG5: Using this 0 to 10 scale where 0 is 'Not at all important" and 10 is "Very Important", how important was the Roseville Electric HVAC Right-Size Rebate Program, including incentives as well as program services and information, in influencing your decision to use Manual J and Manual D procedures?	Response (0 to 10)
Overall VMAX	**Maximum of Scores Above**

The program-wide contractor NTG score is based on the average VMAX score for each contractor weighted by the number of program projects that the contractor completed.

Table 18 presents the freeridership values we calculated based on the contractors' responses to the interviews.[9] For this study, the overall contractor VMAX is 9.64 and freeridership is 3.6%. This low freeridership is explained by the fact that the contractors rated the program influence as very high, and most would not have completed the sizing requirements in the absence of the program.

Table 18. Contractor VMAX

Contractor	NTG1	NTG2	NTG3	NTG4	NTG5	VMAX
Contractor 1	10	4	2.5	9.9	10	10
Contractor 2	9	0	0	10	10	10
Contractor 3	9	2	2	9.5	9	9.5
Contractor 4	10	0	0	8	10	10
Contractor 5	9	0	0	7.5	8	9
Contractor 6	9	10	0	2	6	10
Contractor 7	8.5	2.5	1.5	0	0	8.5
Contractor 8	9	6.5	0	0	0	9
Weighted Average VMAX*						9.64
Weighted Average freeridership*						3.6%

* Responses were weighted by contractor's volume as a percentage of the total volume for all respondents

Homeowner freeridership is also based on a VMAX approach. We asked three NTG questions and assigned a score for each question based on the answer. The overall VMAX score for each homeowner is the maximum NTG score as shown in Table 19.

The VMAX score ranged from 7 to 10 for homeowners, with an average score of 8.8. The overall contractor NTG score (9.6) was averaged with the individual homeowner scores for overall NTG and freeridership scores of 9.22 and 7.8%, respectively. The program NTG and level of freeridership is presented in Table 20.

Evaluated net savings for the program after applying the NTG values are shown in Table 21.

[9] The free ridership percentage is 100 minus ten times the VMAX score.

Table 19. Homeowner NTG Scoring Matrix

Question	Response (0 to 10)	NTG Scoring
NTG1: BEFORE you heard about the HVAC Right-Size Rebate Program, please indicate which of the following best describes what stage you were in regarding purchasing an air conditioner?	*I had not thought at all about getting a new air conditioner*	10
	I had thought about getting a new air conditioner, but had taken no action	7
	I had started doing research to purchase a new air conditioner	3
	I was already working with a contractor to install a new air conditioner	0
NTG2: If the Right Size rebate had not been available, how likely would you have been to replace your air conditioner system with a higher efficiency system instead of a standard efficiency one?	*Very likely*	0
	Somewhat likely	3
	Not very likely	7
	Not at all likely	10
NTG3: If the Right Size rebate had not been available, how likely would you have been to have your air conditioner sized properly, and have insulation installed, your ducts sealed, and additional system testing and inspections?	*Very likely*	0
	Somewhat likely	3
	Not very likely	7
	Not at all likely	10
	Overall Homeowner VMAX	**Maximum of Scores Above**

Table 20. Overall Program NTG and Freeridership

Score	Minimum	Maximum	Average
Program NTG	8.32	9.82	9.22
Program Freeridership	1.8%	16.8%	7.8%

Table 21. Net Savings

	Gross Savings			Net To Gross	Net Savings
	Reported	Realization Rate	Evaluated		
kWh	555,983	45.30%	252,065	92%	232,391
kW	354.7	65.60%	232.6	92%	214

Recommendations

To help Roseville increase participation in the Right-Size Rebate Program and to ensure improvement in the accuracy of savings estimates, Cadmus offers the following recommendations.

Savings and Analysis

1. ***Continue to record complete tracking data for each project.*** To estimate program savings, we used the collected data with the algorithms provided in this report. The completeness of the dataset collected by contractors allowed us to use a savings estimate based on the actual systems installed.
2. ***Consider using revised values for reported savings***. As described below, we propose using either a simple deemed value based on the average found by the current evaluation or an estimate based on the parameters of each site instead of the savings estimates used previously.
    a. ***Adopt ex post savings for all measures*.** The results of this evaluation could be used to create deemed savings estimates for different categories of systems replaced, for example, air conditioners with ducts in unconditioned spaces. These values should be more accurate than the values initially assumed, but less accurate than the second method described next.
    b. ***Use engineering algorithms to estimate savings.*** We reviewed equivalent full-load hour (EFLH) values to determine whether they reasonably represented equipment run time and savings for HVAC replacement. To estimate the savings from the participants, we recommend using EFLH values with nameplate information of the equipment installed through the program. To estimate baseline system efficiency and energy consumption, we also recommend that contractors continue collecting specific details such as duct system location and the age of the home. Equation 3 estimates demand savings and Equations 4 and 5 provide the energy savings estimates.
3. ***Conduct billing analyses to determine program impact.*** When sufficient post-program energy consumption (billing) data is available, we recommend that a pre- / post-treatment analysis be done to determine the savings impact of the program. Typically, nine months of post-treatment data that includes one full cooling season is sufficient to support billing analysis. For heat pumps we recommend 12 months of post-treatment data to capture heating season impacts too. We note that this approach can be applied to all program participants rather than a sample.
4. ***Conduct billing analyses to perform targeted marketing.*** According to our review of detailed invoices and documentation, the rebate covers a significant portion of the total HVAC system installation cost. To maximize energy savings, we recommend that Roseville conduct an HVAC disaggregation billing analysis to identify the highest HVAC energy users, especially among those customers who have high electric-heat costs and then market to these customers.

5. ***Conduct additional research to determine appropriate EFLH heating value for heat pumps.*** The engineering analysis we performed to estimate savings assumed these factors: 625 EFLH for heat-pump heating run time *before* duct improvement, and 500 EFLH *after* duct improvement. The latter value is supported by meter data obtained from a study Cadmus conducted in the mid-Atlantic region, which was then adjusted for weather differences. However, because heat-pump operation may be different in Roseville's service territory, we recommend—at a minimum—that contractors collect information regarding sources of backup heat (such as gas furnace and electric strip heat), as this information can be used to improve the EFLH estimate.

Process

1. ***Continue to offer excellent customer service to homeowners and contractors.*** Overall, both homeowners and contractors were satisfied with the program. Nearly everyone we interviewed reported that they had a very good experience with the program staff and that all of their questions were answered. Only one contractor and one homeowner said that the rebate application process took too long.
2. ***Consider maintaining consistent rebate values and requirements across program years.*** Some of the contractors interviewed had participated in the current year of the program as well as the previous year. Several of the contractors expressed disappointment that the rebate values had declined, yet there were some additional program requirements. One contractor indicated that business was severely affected by the late launch of the 2013 program. The program should be launched well before the start of the cooling season. Another contractor was frustrated that funding had run out before many customers were able to participate in the program. This contractor will not spend time and resources to be a participating contractor in future years unless there is a large overall program budget.
3. ***Continue to include Manual J, Manual D, and the additional measure requirements in the program design.*** Many of the contractors and homeowners said that in the absence of the program, they might have installed high-efficiency air conditioners. However, most of the contractors said they would not have used Manual J and Manual D procedures to make sure the system was sized properly, nor would they have included some of the additional measures. This explains the high net-to-gross value for the program. Program staff may want to include additional weatherization and insulation requirements, perhaps as options for additional incentives, to take further advantage of proper HVAC sizing.

Appendix A: Homeowner Questionnaire

Roseville Electric Homeowner Participant Questionnaire

Awareness

F1. Do you recall participating in the Roseville Electric HVAC Right-Size Rebate Program?

1. Yes [GO TO F3]
2. No
99. Refused [THANK AND TERMINATE]

F2. This program provides a rebate and would have required you and your contractor to sign a one-page form when you had your new air conditioner installed. Do you recall signing a form like that when you had your air conditioner installed?

1. Yes
2. No [THANK AND TERMINATE]
99. Refused [THANK AND TERMINATE]

F3. Do you recall the value of the rebate you or your contractor received?

1. Yes. Specify amount _____
2. No
99. Refused

F4. Are you aware of the HVAC 400 Rebate Program [$400 rebate for upgrading to energy-efficient air conditioner only]?

1. Yes
2. No
99. Refused

Influence

F5. How did you learn about the Roseville Electric HVAC Right-Size Rebate Program?
[DO NOT READ RESPONSES, MARK ALL THAT APPLY]

1. Through my contractor
2. Printed material from the utility
3. Utility website / internet research
4. Word of mouth
5. Other program participants
6. Other. Specify _____

F6. Why did you decide to participate in the Roseville Electric HVAC Right-Size Rebate Program? [DO NOT READ RESPONSES, MARK ALL THAT APPLY]

1. To receive a rebate
2. To learn about which energy-efficient equipment to install
3. To save money on utility bills
4. To reduce maintenance costs
5. To replace old/broken equipment
6. To help protect the environment
7. Because it was recommended to me.
8. Part of a broader remodeling or renovation.
9. Other. Specify _____

F7. BEFORE you heard about the HVAC Right-Size Rebate Program, please indicate which of the following best describes what stage you were in regarding purchasing an air conditioner?

1. I had not thought at all about getting a new air conditioner [GO TO F12]
2. I had thought about getting a new air conditioner, but had taken no action [GO TO F8]
3. I had started doing research to purchase a new air conditioner [GO TO F8]
4. I was already working with a contractor to install a new air conditioner [GO TO F9]
98. Don't know [GO TO F12]

F8. When would you have been most likely to purchase the new air conditioner?

1. 2012
2. 2013
3. 2014
4. 2015 or later
98. Don't know

F9. If the Right Size rebate had not been available, how likely would you have been to replace your air conditioner system with a higher efficiency system instead of a standard efficiency one?

1. Very likely
2. Somewhat likely
3. Not very likely
4. Not at all likely
98. Don't know
99. Refused

F10. If the Right Size rebate had not been available, how likely would you have been to have your air conditioner sized properly, and have insulation installed, your ducts sealed, and additional system testing, and inspections.

5. Very likely
6. Somewhat likely
7. Not very likely
8. Not at all likely
98. Don't know

99. Refused

Spillover Questions

F11. Since participating in the HVAC Right Program, have you made any energy-efficiency improvements or installed any other energy-efficient products in your home that you did NOT receive an incentive for? By energy-efficient products, I mean appliances such as ENERGY STAR clothes washers or refrigerators; high-efficiency water heaters, insulation or windows, CFL light bulbs, etc.

1. Yes [GO TO F13]
2. No [GO TO F14]
98. Don't know
99. Refused

F12. What energy-efficiency improvements have you made or energy-efficient products have you installed?

1. [RECORD VERBATIM]_____
98. Don't know
99. Refused

Satisfaction Questions

F13. How satisfied are you with the equipment that you installed under the Roseville Electric HVAC Right-Size Rebate Program?

1. Very satisfied
2. Somewhat satisfied
3. Not very satisfied
4. Not at all satisfied
98. Don't know
99. Refused

F14. How satisfied are you with your experience working with your contractor under the Roseville Electric HVAC Right-Size Rebate Program?

1. Very satisfied
2. Somewhat satisfied
3. Not very satisfied
4. Not at all satisfied
98. Don't know
99. Refused

F15. How satisfied overall are you with your participation in the Roseville Electric HVAC Right-Size Rebate Program?

1. Very satisfied
2. Somewhat satisfied
3. Not very satisfied
4. Not at all satisfied
98. Don't know
99. Refused

F16. Do you have any suggestions for improving the Roseville Electric HVAC Right-Size Rebate Program?

1. Yes [RECORD VERBATIM]_____
2. No
98. Don't know
99. Refused

Appendix B: Contractor Questionnaire

Roseville Electric Contractor Participant Questionnaire

Screening

F1. **First, please confirm you participated in the** Roseville Electric **HVAC Right-Size Rebate Program.**

1. Yes
3. No **[DETERMINE IF THERE IS ANOTHER CONTACT AT ORGANIZATION; IF NOT THANK AND TERMINATE]**
99. Refused **[THANK AND TERMINATE]**

Awareness and Participation

F2. How did you learn about the Roseville Electric **HVAC Right-Size Rebate Program? [DO NOT READ RESPONSES, MARK ALL THAT APPLY]**

1. Contacted by a program representative
2. Program sponsored workshop or training
3. Through a trade or professional organization
4. Printed material from the utility
5. Utility website / internet research
6. Word of mouth
7. Program participants
8. Other. Specify _____

F3. Why did you decide to participate in the Roseville Electric **HVAC Right-Size Rebate Program? [DO NOT READ RESPONSES, MARK ALL THAT APPLY]**

1. To receive/offer rebates to customers
2. The program incentive helps meet financial goals
3. Expand business by being on the qualified contractor list
4. Customer requesting/asking about the program
5. To expand service offerings
6. To differentiate my business
7. To learn about energy-efficient equipment/proper sizing
8. Because it was recommended to me
9. Relationship with Roseville Staff
10. Other. Specify _____

Freeridership

F4. In how many homes in the Roseville territory did you install new air conditioning units in 2012? How many of these participated in the Roseville **HVAC Right-Size Rebate?**

1. Total homes _____

2. Right-Size homes _____
98. Don't know
99. Refused

F5. Using this 0 to 10 scale where 0 is 'Not at all important" and 10 is "Very Important", how important was the Roseville Electric **HVAC Right-Size Rebate Program**, including incentives as well as program services and information, in influencing your decision to recommend that customers participating in the program *install a high efficiency air conditioner, have their air conditioner sized properly, have insulation installed, ducts sealed, and additional system testing, and inspections* at this time?

1. [Record score] _____
98. Don't know
99. Refused

F6. Now, using a 0 to 100 percent scale, in what percent of sales situations did you recommend *installation of a properly-sized high efficiency air conditioner, additional insulation, ducts sealed, and additional system testing, and inspections* BEFORE you learned about the Roseville Electric **HVAC Right-Size Rebate Program**?

1. [Record percentage] _____
98. Don't know
99. Refused

F7. Using the same 0 to 100 percent scale, in what percent of sales situations do you recommend *installation of a properly-sized high efficiency air conditioner, additional insulation, ducts sealed, and additional system testing, and inspections* NOW that you have worked with the Roseville Electric **HVAC Right-Size Rebate Program?**

1. [Record percentage] _____
98. Don't know
99. Refused

F8. **I**n what other ways have your recommendations regarding *installation of a properly-sized high efficiency air conditioner, additional insulation, ducts sealed, and additional system testing, and inspections* been influenced by your participation in the Roseville Electric **HVAC Right-Size Rebate Program?**

1. [Record Verbatim] _____
98. Don't know
99. Refused

F9. Do you promote *installation of a properly-sized high efficiency air conditioner, additional insulation, ducts sealed, and additional system testing, and inspections* equally in areas with and without incentives?

1. Yes
2. No

98. Don't know
99. Refused

F10. Now, using a 0 to 100 percent scale, in what percent of sales situations did you use Manual J and Manual D procedures to size HVAC systems BEFORE you learned about the Roseville Electric **HVAC Right-Size Rebate Program**?

1. [Record percentage] _____
98. Don't know
99. Refused

F11. Using this 0 to 10 scale where 0 is 'Not at all important" and 10 is "Very Important", how important was the Roseville Electric **HVAC Right-Size Rebate Program**, including incentives as well as program services and information, in influencing your decision to use Manual J and Manual D procedures?

1. [Record score] _____
98. Don't know
99. Refused

Satisfaction & Process Questions

F12. How satisfied are you with your experience working with the Roseville Electric staff under the HVAC Right-Size Rebate Program?

1. Very satisfied
2. Somewhat satisfied
3. Not very satisfied
4. Not at all satisfied
98. Don't know
99. Refused

F13. Was Roseville Electric able to answer all your questions about the Program to your satisfaction?

1. Yes
2. No
98. Don't know
99. Refused

F14. How helpful was your participation in the Roseville Electric HVAC Right-Size Rebate Program trainings?

1. Very helpful
2. Somewhat helpful
3. Not very helpful
4. Not at all helpful

98. Don't know
99. Refused

F15. How satisfied are you with the application process?

1. Very satisfied
2. Somewhat satisfied
3. Not very satisfied
4. Not at all satisfied
98. Don't know
99. Refused

F16. About how much time typically passed between when you filed the completed application and all required paperwork and the rebate was issued (i.e., participation in the program was completed)? [READ LIST AS NEEDED]

1. Less than 2 weeks
2. 2 to 4 weeks
3. 4 to 6 weeks
4. More than 6 weeks
98. Don't know
99. Refused

F17. Are you satisfied with that amount of time?

1. Yes
2. No
98. Don't know
99. Refused

F18. Have you continued (or are you planning to continue) as a participating contractor in the Roseville Electric HVAC Right-Size Rebate Program?

1. Yes
2. No
98. Don't know
99. Refused

F19. Overall how satisfied are you with your participation in the Roseville Electric HVAC Right-Size Rebate Program?

1. Very satisfied
2. Somewhat satisfied
3. Not very satisfied
4. Not at all satisfied
98. Don't know
99. Refused

F20. What worked well under the Roseville Electric HVAC Right-Size Rebate Program?

1. [RECORD VERBATIM]_____
98. Don't know
99. Refused

F21. Do you have any suggestions for improving the Roseville Electric HVAC Right-Size Rebate Program? Materials, guidelines, application process, etc…

1. Yes [RECORD VERBATIM]_____
2. No
98. Don't know
99. Refused