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DNV·GL

# Net-to-gross Evaluation of 2013-14 Upstream HVAC Programs (HVAC1)

California Public Utilities Commission

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## 1 EXECUTIVE SUMMARY

The upstream HVAC distributor rebate energy efficiency program (HVAC1 program) encourages distributors to stock and sell high efficiency HVAC equipment. The California’s Investor Owned Utilities (IOU) San Diego Gas and Electric (SDG&E), Southern California Edison Company (SCE), and Pacific Gas and Electric Company (PG&E) managed these programs during the 2013–14 program cycle under the supervision of the California Public Utilities Commission.

Our primary goal for this research was to produce a reliable estimate of the net energy and demand savings achieved by rebated upstream HVAC measures during the 2013–2014 program cycle. To estimate net savings, we developed a net-to-gross (NTG) ratio that we applied to the gross savings estimates previously calculated by DNV GL. We derived the NTG ratio by estimating the influence various program activities had on distributor behavior, and how downstream buyers may have been influenced by this program as well. By quantifying this influence, we were able to estimate what percent of the gross savings was attributable to this upstream program, and what portion was freeridership.

### 1.1 NTG Evaluation

To establish program attribution, we considered the pathways distributors take when selling a high efficiency HVAC unit, and the related pathways buyers take when purchasing one. Our goal was to develop an approach that considered these pathways in the context of the HVAC1 program design and real-world complexity. We created the term “causal pathway” to identify how the program may cause behavior change along these paths. We then used this approach to integrate NTG survey responses between buyers and the distributors into an overall NTG score.

Our methodology assumed that there were three main causal pathways of influence which impacted both the HVAC equipment distributor and buyer. We derived these assumptions from the program logic model provided from the IOUs. Distributors and buyers are both important when evaluating program attribution of this nature, and both were taken into consideration to formulate an overarching attribution score. Table 1 shows the researchable questions which represent the three causal pathways across distributors and buyers.

**Table 1. Question themes across three causal pathways for distributors and buyers**

Causal Pathways	Distributor Questions	Buyer Questions
Stock	1. What was the program influence on distributor stock?	1. How did the mix of equipment in stock influence the buyer?
Promotion/Upsell	2. What was the program influence on encouraging the distributor to promote or upsell the units?	2. What was the influence that distributor upselling had on the buyer’s decision?
Price of Units	3. Did the distributor pass on some or all of the incentive to buyers?	3. What was the influence the price had on the buyer’s decision?

DNV GL used trained internal staff to complete the distributor in-depth interviews, and Pacific Market Research (PMR) to conduct buyer surveys. We completed 19 interviews with participating distributors,

and PMR completed 99 surveys with buyers. The full report below provides further detail on the sample design and response rates for these interviews and surveys.

After we received the original buyer data sets from the utilities, we discovered that 48% of total program kWh savings did not have distributor information listed. Therefore, we limited our buyer sample frame to those who had distributor contact information, and purchased equipment from distributors who responded to our distributor interview.

Only eight of the 19 completed distributor interviews had completed buyer surveys for the causal pathway analysis. All eight matched distributors were from the largest strata, representing 41% of program kWh savings, or 79% of the program kWh savings from the eligible buyer sample frame. All buyer survey responses for the equipment purchases were used with these eight distributors.

After the distributor and buyer surveys were completed, we calculated the individual buyer and distributor attribution scores, mapped them together, and expanded the scores to the whole population.

## 1.2 NTG Findings

The results of the data collection and NTG expansion analysis resulted in an overall attribution (**NTGR score of 64% (±6% at the 90% Confidence Interval)**) for the upstream program. Again, this NTGR started with individual buyers and their related distributors, and expanded these connected NTG scores to the whole population.

We used an overall NTGR instead of the measure category NTGR for two reasons. First, our sample for VRFs was so small that the NTGR could not be considered statistically significant for that measure. Second, the scores for each measure strata were not statistically different from the overall value.

Table 2 summarizes how each survey group responded to the individual questions contributing to each causal path. Note that these attribution scores cannot be multiplied together to calculate the overall NTGR since these scores group distributors and buyers separately. The overall NTGR is based on first matching the attribution scores of distributors with those of their equipment purchasers and then expanding these, which is different from what is displayed below. We present Table 2 broken out by each causal pathway to provide additional information on the results along each pathway, and to add context to our recommendations.

**Table 2. Grouped attribution scores for each causal pathway**

Causal Pathway	Distributor attribution	Buyer attribution
Stocking	35%	21%
Upsell	26%	81%
Price	54%	98%
Efficiency		4%
Sales	41%	

The evaluation results indicated that 35% of distributors' high efficiency stock was due to the program, and 21% of buyers were impacted by a distributor's stock during their purchase. The results also suggest that 26% of distributor upselling of high efficiency equipment was as influenced by the program, and buyers indicated that 81% of their purchases were influenced by distributor recommendation. Finally, the distributors reported that the program influenced them to pass-through 54% of the upstream incentives, and buyers indicated price was the largest influencer of their behavior when they made this purchase.

For the consistency checks, Table 2 shows that distributors indicated that over 40% of their sales of program-qualifying high efficiency equipment could be attributable to the program. It also shows that buyers were not considering lower efficiency options than what they purchased, as indicated by the 4% attribution score. While the low-efficiency attribution may be due to buyers already intending to buy high efficiency units, it also may indicate that many distributors are upselling and only presenting one option to buyers. One piece of evidence for this is that less than 30% of buyers indicated that distributors discussed more than one HVAC option with them. Since all the buyers surveyed bought the energy-efficient model, we can assume the majority of buyers were shown only one energy-efficient option. Our buyer survey results indicated that they take the recommendations of distributors seriously (80% attribution). Therefore, if a given distributor started off by recommending only one high efficiency model, it is possible that a buyer who might have otherwise considered a wider range of unit efficiencies instead deferred to their distributor's recommendation for the more efficient model.

Our distributor interviews revealed that only 26% of distributors indicated that their upselling practices were due to the program. This low attribution score could relate to the evidence described above regarding distributors only discussing one option with buyers. This attribution score could also be due to many distributors overvaluing their salesmanship abilities and consequently undervaluing program influence. This is akin to the "green retailer bias" –which has been recognized as a potential bias in past evaluations of California upstream lighting programs.<sup>1</sup>

### 1.3 Recommendations

DNV GL team recommends the following actions to increase distributor program participation and overall attribution. Since the upstream HVAC program implementation is focused on the upstream market, our recommendations are based around distributor interaction and behavior. We believe this will translate to upstream and downstream impact, as the causal paths above show.

- **Reduce uncertainty on how long the incentives will remain in place**

Reducing uncertainty regarding how long the incentives will remain in place at a given level would likely increase the trust which distributors have in the program, and, in turn, increase their willingness to change their stocking practices. Program practices which would increase participant certainty about how long the incentives will remain in place would include informing the distributors when the program is going to run out of money ahead of time, and honoring rebates for HVAC purchases that are already registered in the system.

- **Provide more marketing tools to distributors**

During our interviews, multiple distributors asked for additional sales tools and marketing materials to help them sell high efficiency units. We believe that the CPUC and IOUs should consider hosting trainings and providing online savings calculators to distributors in the program.

This recommendation may seem counterintuitive based on some of the evidence we provided which indicated that much upselling is already occurring, with or without the program's influence. This evidence includes the fact that only 26% of distributors said that their upselling was

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<sup>1</sup> See "Documentation for DEER Net to Gross Update," Prepared by DEER Consultant Team for the CPUC Energy Division, May 2, 2008. In that report the green retailer bias referred to the tendency of some retailers who participate in upstream lighting programs to overrate their ability to promote environmentally-friendly lighting products and thereby underrate the contribution of program discounts to their sales of energy-efficient lighting products. While that bias was occurring at the retail rather than the wholesale level, it is plausible that a similar bias might be present among some HVAC distributors.



attributable to the program, that less than 30% of buyers stated that the distributors discussed more than one efficiency option (this suggests that the upselling was already happening for the majority of buyers presented with only one option) and that only 4% of buyers were considering other efficiency types.

However, the fact that many distributors are still seeking additional marketing assistance indicates that some need exists. We believe it is important to point out that the buyer surveys only reflected the perspective of customers who bought energy-efficient units, whether due to previous disposition or due to distributor salesmanship (whether program-influenced or not). The comments from distributors may not be focused on those buyers, but rather on the customers who did not choose the energy-efficient units. It is likely for these “lost sales” that the distributors are seeking additional program marketing tools, and therefore we recommend providing them these tools.

- **Provide more clarity on program timing and changes**

Our interviews revealed that many distributors sought better communications on program timing and changes in general, in addition to their more specific demands for better information about rebate availability. Because the sales cycle for some of these high efficiency units can be several months, distributors want to keep their staff and buyers informed of any changes to the rebates. Since pass-through incentives had the highest attribution score for both distributors and buyers, clear communication on program changes can help distributors make better decisions on the incentives they pass on to buyers.

- **Solicit regular program feedback**

Our interviews allowed the distributors to provide useful suggestions on how the upstream HVAC program could be improved. Some of their suggestions, in addition to those mentioned above, included involving small municipalities in this program, offering different incentives and technologies based on climate zones, and including new technologies in the program such as pressure-independent valves and adiabatic cooling on air-cooled chillers. We recommend that the IOUs and CPUC set up a mechanism (if one does not exist) to solicit this feedback more regularly.

- **Expand research scope and improve data quality**

Nearly 50% of the buyer program tracking data we received was missing distributor names and buyer contact information. As a result, we could not match several completed distributor interviews to buyers, resulting in their omission from our NTG analysis. However, we believe that the data from these unmatched distributor interviews should be used for future analysis.

We recommend that a process evaluation be conducted for this HVAC upstream program to further analyze the distributor interview responses (from both “matched” and “unmatched”) distributors. Our evaluation, by necessity, focused on distributor responses most relevant to program attribution, but other interview responses could also be useful for identifying interesting market trends and for providing insights on how to improve upstream HVAC program design.

We also recommend that the programs strive to collect higher quality buyer tracking data, with special emphasis on collecting information relating buyers to the distributors that sold them their units. This will help increase the number of buyers matched to distributors that we can use for our NTG causal pathway analysis in future studies. For example, the program application form



should have the contact information for the distributor, contractor, and buyer, as well as indicate who was present at the time of purchase.

## 2 INTRODUCTION

The upstream HVAC distributor rebate energy efficiency program (HVAC1 program) encourages distributors to stock and sell higher efficiency HVAC equipment. The program was organized by the California Public Utilities Commission (CPUC), and conducted by California's Investor Owned Utilities (IOU) San Diego Gas and Electric (SDG&E), Southern California Edison Company (SCE), and Pacific Gas and Electric Company (PG&E) during the 2013–14 program cycle. The available rebate amounts are based on equipment performance tiers, and tiers vary based on equipment type, capacity, and efficiency. The underlying program theory is that the rebates encourage distributors to stock and sell higher efficiency equipment more than they would in the absence of the programs.

### 2.1 Objectives

Our primary goal for this research was to produce a reliable estimate of the net energy and demand savings achieved by rebated upstream HVAC measures during the 2013-2014 program cycle. To estimate net savings, we developed a net-to-gross (NTG) ratio that we applied to the gross savings estimates previously calculated. We derived the NTG ratio by estimating the influence various program activities had on distributor behavior, and how downstream buyers may have been influenced by this program as well. By quantifying this influence, we were able to estimate what percent of the gross savings was attributable to this upstream program and what portion was freeridership.

We have structured this report to first provide background on the program logic and structure, as well as the previously-estimated gross savings. Following this, we cover the NTG methodology we used to ascertain program influence, our data collection activities, and our analytical methods. Finally, the report concludes with findings from our NTG surveys, and overall recommendations for improving the upstream program.

### 2.2 Program logic

In determining the NTG estimation methodology, we started with the IOU Program Implementation Plan (PIP) that covered the activities taken by the programs, the target groups of the actions, and the expected outcomes.<sup>2</sup> Table 3 illustrates the program logic model of the upstream HVAC program based on the IOU PIPs and our interviews with Program Managers (PM).

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<sup>2</sup> <http://www.cpuc.ca.gov/NR/rdonlyres/2FB6AF0B-BBD2-4A73-A5B8-8B5305FAABDD/0/SWHVAC.zip>

**Table 3. PIP logic model**

Inputs	Activities	Outputs	Outcomes
<ul style="list-style-type: none"> <li>Incentive dollars to distributors that sell qualifying HVAC equipment</li> </ul>	<ul style="list-style-type: none"> <li>Identify and market program to distributors that ship equipment into CA market</li> <li>Educate sales personnel and contractors on program and high-efficiency equipment</li> <li>Annual awards banquet with contractors, utilities, high-performing distributors</li> </ul>	<ul style="list-style-type: none"> <li>Distributors promote high-efficiency equipment to contractors/ builders/ developers</li> <li>Cost-effective and competitive high-efficiency HVAC price points on lifecycle</li> <li># of units incentivized</li> </ul>	<ul style="list-style-type: none"> <li>Increased distributor stocking % of program-eligible equipment</li> <li>Increased sales of high-efficiency HVAC equipment from distributors to c/b/d</li> <li>contractors/ builders/ developers promote high-efficiency equipment to customers</li> <li>Increased installation of high-efficiency HVAC equipment (retrofit and NC)</li> <li>Measurable reduction in kW, kWh, therm usage</li> <li>Increased market penetration of high-efficiency HVAC equipment (shipments)</li> <li>Development of new minimum equipment efficiency standards</li> </ul>

The outputs and the outcomes from this logic model informed our team as to what aspects of the market the program intended to influence, and helped guide the initial discussion on how we could measure attribution.

### 2.3 Gross savings results

Previous DNV GL gross impact evaluation work identified *ex ante* and *ex post* gross savings for programs and measures in the HVAC1 program. The follow subsections briefly summarize these gross savings estimates for the key types of HVAC equipment which the programs support.

#### 2.3.1 Chillers

The overall realization rate for chiller energy (kWh) savings across all programs was 47%. The air-cooled chiller category had a very low realization rate of 18%, and this category accounted for 64% of all chiller upstream claims. For all of these upstream chiller measures, there have been no significant updates to the Database for Energy Efficient Resources (DEER)<sup>3</sup> since the 2013-14 *ex ante* values were developed; the only differences between *ex ante* and *ex post* estimates are the chiller efficiencies.

The HVAC1 program stipulated that chillers could meet each efficiency tier requirement by meeting the full load efficiency (kW/ton) or the integrated part-load value (IPLV) criteria. The IOU air-cooled chiller workpapers acknowledge that the full load efficiency of the DEER measure is higher than the majority of high efficiency models available. After further investigation, we found that the air-cooled chiller energy savings estimates developed in the workpapers were much higher than are feasible, representing approximately 85% of the cooling end use energy usage estimate from the DEER prototypes. In contrast, the *ex post* savings were about 10% of the cooling end use energy usage.

<sup>3</sup> "The Database for Energy Efficient Resources (DEER) is a California Energy Commission and California Public Utilities Commission (CPUC) sponsored database designed to provide well-documented estimates of energy and peak demand savings values, measure costs, and effective useful life (EUL) all with one data source." <http://www.energy.ca.gov/deer/>

For water-cooled chillers, many of the units met the efficiency assumptions, and realization rates were over 100% for two of the four categories. The total realization rate for water-cooled chillers was 98%. Table 4 shows the results.

**Table 4. Ex ante and ex post Gross kWh savings and realization rates for chillers**

Sample Group	Unit Size	Total Tonnage Claimed	Ex Ante Total (kWh)	Efficiency Adjusted Ex Post Total (kWh)	Efficiency Adjusted Realization Rate (kWh)	Building Type Adjusted (kWh)	Final Ex Post Savings Total (kWh)	Final Realization Rate (kWh)
Air-cooled Chillers	All	43,077	32,057,004	5,010,090	16%	115%	5,751,057	18%
Water-cooled Screw Chiller	<150 ton	463	133,531	62,580	47%	115%	71,835	54%
Water-cooled Screw Chiller	150 - 300 ton	8,992	3,416,405	2,282,340	67%	115%	2,619,887	77%
Water-cooled Screw Chiller	>300 ton	800	334,507	209,463	63%	115%	240,442	72%
Water-cooled Centrifugal Chiller	150 - 300 ton	1,132	249,859	440,809	176%	115%	506,002	203%
Water-cooled Centrifugal Chiller	>300 ton	42,497	14,250,960	12,765,019	90%	115%	14,652,901	103%
<b>Water -cooled Total</b>	<b>All</b>	<b>53,884</b>	<b>18,385,262</b>	<b>15,760,211</b>	<b>86%</b>	<b>115%</b>	<b>18,091,067</b>	<b>98%</b>
<b>All Chiller Total</b>	<b>All</b>	<b>96,961</b>	<b>50,442,266</b>	<b>20,770,301</b>	<b>41%</b>	<b>115%</b>	<b>23,842,124</b>	<b>47%</b>

In contrast to the energy savings, the demand (kW) reduction realization rate for all upstream chiller measures was 129% as shown in Table 5. The exact reason for the high realization rate is unknown since the *ex ante* models were unavailable to the evaluation team, but is likely due to differences in *ex ante* and *ex post* calculation methods.

**Table 5. Ex ante and ex post Gross kW savings and realization rates for chillers**

Sample Group	Unit Size	Total Tonnage Claimed	Ex Ante Total (kW)	Efficiency Adjusted Ex Post Total (kW)	Efficiency Adjusted Realization Rate (kW)	Building Type Adjusted (kW)	Final Ex Post Savings Total (kW)	Final Realization Rate (kW)
Air-cooled Chillers	All	43,077	2,507	2,857	114%	95%	2,708	108%
Water-cooled Screw Chiller	<150 ton	463	35	39	111%	95%	37	106%
Water-cooled Screw Chiller	150 - 300 ton	8,992	928	1,369	148%	95%	1,298	140%
Water-cooled Screw Chiller	>300 ton	800	88	65	74%	95%	61	70%
Water-cooled Centrifugal Chiller	150 - 300 ton	1,132	75	213	285%	95%	202	270%
Water-cooled Centrifugal Chiller	>300 ton	42,497	3,801	5,545	146%	95%	5,256	138%
<b>Water -cooled Total</b>	<b>All</b>	<b>53,884</b>	<b>4,926</b>	<b>7,230</b>	<b>147%</b>	<b>95%</b>	<b>6,853</b>	<b>139%</b>
<b>All Chiller Total</b>	<b>All</b>	<b>96,961</b>	<b>7,433</b>	<b>10,087</b>	<b>136%</b>	<b>95%</b>	<b>9,561</b>	<b>129%</b>

## 2.3.2 Unitary systems

The overall realization rate for unitary systems across all programs and measures was 71%. The primary reason for this realization rate was lower-than-expected unit efficiencies (EERs). A contributing factor was that the DEER team had made significant updates to these measures since the 2013-14 *ex ante* values were developed. Some of these updates included code changes in 2014 to minimum efficiency, changes to fan speed requirements, and updated performance maps. Our *ex post* simulation baseline models incorporated these updates, which resulted in reduced savings when compared to the *ex ante* estimates appropriate to the fan speed and other code requirements in effect at the time of installation<sup>4</sup>. Aside from the code changes, we made the following modifications for the *ex post* estimates based on site observations:

- Adjustments to the building type assigned
- Adjustments to the assigned efficiency and fan control

For unitary systems less than 20 tons, we adjusted our estimates based on economizer functionality. The HVAC1 program stipulated that units could meet each efficiency tier requirement by meeting the full-load efficiency (EER) or the integrated energy efficiency ratio (IEER) criteria. This led to some units complying with IEER requirements that had full load efficiency at or close to code minimum. DEER 2016 updates have mapped IEER values to the performance curves to address this issue in the future. The tables below show the final savings for all large unitary systems, and then show the step-wise adjustments to small units (20 tons and under) to demonstrate the effect of each adjustment.

Table 6 summarizes the energy savings results for small and large unitary systems by unit size. It shows that low realization rates in large systems are partially offset by high realization rates for smaller systems leading to an overall realization rate of 71.2%.

**Table 6. Ex ante and ex post Gross kWh savings and realization rates for all unitary systems**

Unit Size	Total Tonnage Claimed	Ex Ante Total (kWh)	Final Ex Post Savings Total (kWh)	Final Realization Rate (kWh)
< 5 Ton	32,417	9,172,721	16,971,836	185.0%
5.5 - 11.5 Ton	43,485	8,158,817	12,297,743	150.7%
11.6 - 20 Ton	24,618	6,550,514	1,658,249	25.3%
20 - 63.3 Ton	51,595	17,223,839	3,210,509	18.6%
>63.3 Ton	15,784	8,069,909	851,418	10.6%
<b>All</b>	<b>167,899</b>	<b>49,175,800</b>	<b>34,989,755</b>	<b>71.2%</b>

<sup>4</sup> Code minimum was based on the installation date for all units. Exceeding earlier code requirements led to very high realization rates for units with two speed or variable speed fans. Categories with low savings/realization rates had two key factors: 1) equipment and 2) workpapers. The equipment factor caused low realization rates when units just met prior code minimum efficiency requirements and/or had a single-speed fan when a two-speed fan was the minimum allowed. The performance maps in the current DEER (updated 2015) represent the equipment installed in 2013 and 2014 better than the performance maps in DEER 2011 which best represent units from 2011-12.

Table 7 shows the peak demand reduction results for small and large unitary systems by unit size. The overall realization rate across all size categories was 128.9%.

**Table 7. Ex ante and ex post Gross kW savings and realization rates for all unitary systems**

Unit Size	Total Tonnage Claimed	Ex Ante Total (kW)	Final Ex Post Savings (kW)	Final Realization Rate (kW)
< 5 Ton	32,417	1,790	4,204	234.8%
5.5 - 11.5 Ton	43,485	4,011	3,765	93.9%
11.6 - 20 Ton	24,618	1,490	1,506	101.1%
20 - 63.3 Ton	51,595	2,189	2,625	119.9%
>63.3 Ton	15,784	358	583	162.7%
<b>All</b>	<b>167,899</b>	<b>9,838</b>	<b>12,682</b>	<b>128.9%</b>

### 2.3.3 Mini-split

In the 2013 Efficiency Savings and Performance Incentive (ESPI) memo, mini-split system savings were adjusted to account for what appeared to be an incorrect adjustment factor, which increased savings, by about 50%. In 2014, we had included this adjustment and determined through customer surveys that only 4% of units replaced existing ducted systems; in contrast, the workpaper assumption was 50%. Based on these findings we decided to pass-through mini-split *ex ante* savings.

## 3 NTG EVALUATION

The overall attribution, also known as the NTG ratio (NTGR), is the estimated proportion of gross savings that can be attributed to a program. This study used a phone survey with participating distributors and buyers to estimate NTGRs for the evaluated programs based on a methodology that we described in a memorandum submitted February 2016. This methodology asked concrete questions to calculate quantifiable, identifiable aspects of program effect on each causal pathway of the HVAC1 program.

### 3.1 NTG methodology

#### 3.1.1 Identifying causal pathways of influence

To establish program attribution, we considered the pathways distributors take when selling a high efficiency HVAC unit, and the related pathways buyers take when purchasing one. Our goal was to develop an approach that considered these pathways in the context of the HVAC1 program design and real-world complexity. We created the term “causal pathway” as a way to identify how the program may cause behavior change along these paths. We then used this approach to integrate NTG survey responses between buyers and the distributors into an overall NTG score.

Our methodology assumed that there were three main causal pathways of influence which impacted both the HVAC equipment distributor and buyer. We derived these assumptions from the program logic model provided from the IOUs. Distributors and buyers are both important when evaluating program attribution of this nature, and both were taken into consideration to formulate an overarching attribution score.

The three main causal pathways of program influence included:

1. The program influenced distributors to **stock** high efficiency units, and what was in stock influenced what buyers purchased when their unit failed. This causal pathway was driven by the assumption that when buyers replace existing equipment in an urgent situation (replace on failure in five days or less), the stocking habits of distributors would be most influential.
2. The program encouraged distributors to **upsell or promote** high efficiency units, and buyers were influenced by the upselling and promotional efforts to purchase high efficiency units rather than standard efficiency models.
3. The program encouraged distributors to reduce the **price** of high efficiency units or pass along the rebate to buyers, and buyers were influenced by the lower prices of these high efficiency units.

Table 8 shows the researchable question which represent the three causal pathways across distributors and buyers. The distributor and buyer survey instruments, which have the questions related to each pathway are in APPENDIX A and APPENDIX C:



**Table 8. Question themes across three causal pathways for distributors and buyers**

Causal Pathways	Distributor Questions	Buyer Questions
Stock	1. What was the program influence on distributor stock?	1. How did the mix of equipment in stock influence the buyer?
Promotion/Upsell	2. What was the program influence on encouraging the distributor to promote or upsell the units?	2. What was the influence that distributor/contractor upselling had on the buyer's decision?
Price of Units	3. Did the distributor pass on some or all of the incentive to buyers?	3. What was the influence the price had on the buyer's decision?

To better understand program attribution, our survey instruments also had questions which focused on the following topics:

- The distributors' perspectives on **sales** and how sales may have differed in the absence of the program.
- The buyers' perspectives on the factors that led them to select the specific **efficiency level** for the HVAC unit purchased.

We used the responses to these questions as consistency checks to the three main causal paths described above.

Each of the three causal pathways was contingent on the distributor changing their behavior in response to the program, and this change in behavior influencing the behavior of their buyers. We surveyed distributors involved in the program and a sample of buyers from those distributors. We believed that if the program failed to show attribution through the distributors or buyers, then the influence of this program had failed to affect the equipment sale on this casual path. This did not mean that the program had no influence on the sale, only that any influence it had was not through this path. If another causal path did show program influence, then we determined the sale to be at least partially program-attributable.

We evaluated each causal path at the level of the individual buyer and their associated distributor for attribution. We then subtracted from 1 to get a free-ridership score on that pathway. To calculate the total program attribution score, we multiplied these three free-ridership scores together. We explore this calculation further below, but the overall approach captures multiple paths of attribution, as well as partial attribution when it exists.

Table 9 lists the distributors questions related to each of the three paths and the basic scoring for each path. We began by asking distributors an open-ended question about how they think the program has impacted their business, and then asked questions related to the three causal pathways. Last, we asked distributors questions about how the program influenced their sales of high efficiency units. We used screening questions at the beginning of the survey to ensure that the respondent was the best person to speak to about program influence across all of these areas. For all these questions, we asked follow-up questions clarifying why the respondent gave certain answers. This allowed us to make sure that the respondent understood the question, and to collect additional information on how the program might have influenced their business practices.

**Table 9. Distributor attribution path questions and scoring**

Distributor Attribution Categories	Question Sequence	Scoring	Rationale
Influence on stock	<p><b>Has the program influenced your stocking patterns of High Efficiency(HE) units (Tier 1 and above)?</b></p> <p><b>Yes:</b> What % of the year do you have this unit in stock? What would this % be in the absence of the program?</p> <p><b>No</b></p>	<p><b>Yes:</b>  <math display="block">\frac{(program\% - without\%)}{program\%}</math></p> <p><b>No:</b> 0, no attribution for this category</p>	<p>This provided an estimate of whether the unit would have been stocked beyond what was already being stocked before the program.</p> <p>If no stocking, then this path of attribution equals 0.</p>
Influence on upselling	<p><b>Has the program influenced any upselling or promoting of HE units at your business?</b></p> <p><b>Yes:</b> What % of time are you recommending these HE units? What would this % be in the absence of the program?</p> <p><b>No</b></p>	<p><b>Yes:</b>  <math display="block">\frac{(program\% - without\%)}{program\%}</math></p> <p><b>No:</b> 0, no attribution for this category</p>	<p>This provides an estimate of whether the unit would have been upsold to the buyer beyond what was already being upsold before the program.</p> <p>The survey asked lead-in questions before this battery that discussed general business practices around sales and interaction with customers.</p>
Influence on price	<p><b>Do you pass any of the incentives onto the buyer?</b></p> <p><b>Yes:</b> What % of the incentive are you passing along to your buyers? Consistent across all unit types and sizes?</p> <p><b>No</b></p>	<p><b>Yes:</b> % of the incentive passed on to buyer.</p> <p><b>No:</b> 0, no attribution for this category</p>	<p>The % incentive passed on will be used as a proxy for the attribution score.</p>
Influence on sales (question outside causal paths)	<p><b>We would like to ask you some questions about your sales.</b></p> <p>Currently, what percent of the [size category] that you sell of [equipment type] is baseline, and what percent is HE units (Tier 1 and above)?</p> <p>Had there been no utility rebate program this year, what percent of the [size category] that you sell of [equipment type] would be baseline, and what percent would be HE units?</p> <p><b>Yes, there was an impact.</b></p> <p><b>No</b></p>	<p><b>Yes:</b>  <math display="block">\frac{(program\% - without\%)}{program\%}</math></p> <p><b>No:</b> 0, no attribution for this category</p>	<p>This score on the distributor side acted as a benchmarking to the other scores derived from the three paths above.</p> <p>As noted in the question, we asked for specific examples of unit types and sizes when ascertaining sales impact.</p>

For the buyer survey, we first asked buyers to list all of the factors that influenced their decision to purchase the unit. Then we asked them questions about the three causal pathways shown in Table 10. Finally, we asked them about the minimum energy efficiency they were considering before buying their HVAC equipment. Once again, for all these questions, we asked follow-up questions that allowed us to confirm the respondent’s understanding of the question, and to collect additional information on how the program might have influenced the equipment purchase.

**Table 10. Buyer attribution path questions and scoring**

Buyer Attribution Categories	Question Sequence	Scoring	Rationale
Influence of stock	<p><b>Had your existing unit failed, or was it failing?</b></p> <p><b>Yes:</b> How quickly did you need to replace your unit? (How many days did you wait/could you have waited?)</p> <p>Probe (not for scoring): If your normal/favorite distributor did not have what you wanted, would you have shopped around or gone with whatever was in stock?</p> <p><b>No</b></p>	<p><b>Yes:</b> 1, Considered fully influenced by what was in stock</p> <p><b>No:</b> 0, no attribution for this category</p>	<p>This causal pathway was driven by the assumption that when buyers replace existing equipment in an urgent situation (replace on failure in five days or less), the stocking habits of distributors would be most influential.</p> <p>We also compared the # of days the buyer said they could have waited to replace the unit. If it was less than five days, we considered the purchase an emergency replacement. Therefore, what the distributor had in stock during the buyer’s urgent need would open this pathway of influence.</p>
Influence of upselling	<p><b>Was your decision to buy influenced in any way by what the distributor told you about the efficiency level and pricing of available units?</b></p> <p><b>Yes:</b> On a scale of 1-10, how much influence did the distributor telling you about the unit have on your decision to purchase what you did?</p> <p><b>No</b></p>	<p><b>Yes:</b></p> <ul style="list-style-type: none"> <li>• 7-10, is 1</li> <li>• 3-6, is 0.5</li> <li>• 1-2, is 0</li> </ul> <p><b>No:</b> 0, no attribution for this category</p>	<p>The responses to these questions helped us to validate the influence the distributor’s upselling had on the buyer’s decision.</p>
Influence of price	<p><b>You purchased a unit of X efficiency, and you mentioned that price was an important factor in that decision during the first question.</b></p> <p><b>How much more would you have been willing to spend on the same unit or one with similar efficiency?</b></p>	<p><b>Between \$0 and incentive amount:</b> 1</p> <p><b>more than incentive:</b> 0, no attribution for this category</p>	<p>Comparing this amount to the incentive and the portion of the incentive that the distributor typically passes on allowed us to capture attribution from the program’s effect on price.</p>

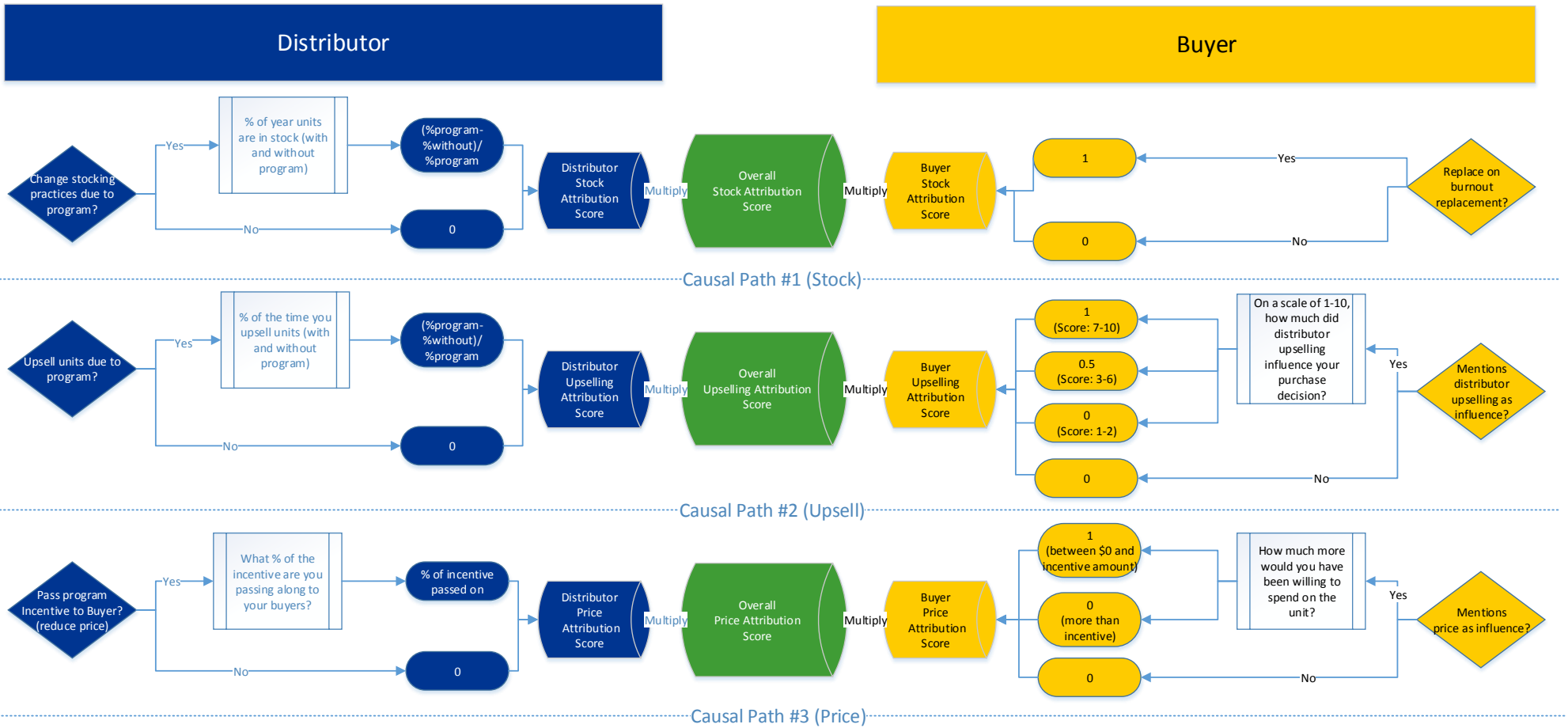
Buyer Attribution Categories	Question Sequence	Scoring	Rationale
Influence of efficiency (question outside causal paths)	<b>What was the minimum efficiency you were considering before buying this unit?</b>	<b>Baseline: 1</b> <b>Lower Tier, but still High Efficiency: 0.5</b> <b>Same as what they bought: 0</b>	This served as a consistency check on the buyer's mind set during their purchase. A low attribution score on efficiency could mean that the buyer was not considering any other options. It could also mean that the seller presented them with only high efficiency options. Overall, the question is intended to provide some insight on the buyer's decision making during their purchase.

Below is a diagram that illustrates how these causal paths come together to create attribution scores.

### 3.1.2 Causal pathway scoring

Figure 1 is an overview of the scoring methodology for each of the causal pathways. For detailed scoring by question, see APPENDIX B and APPENDIX D.

#### **Figure 1. Causal pathways scoring for distributors and buyers**

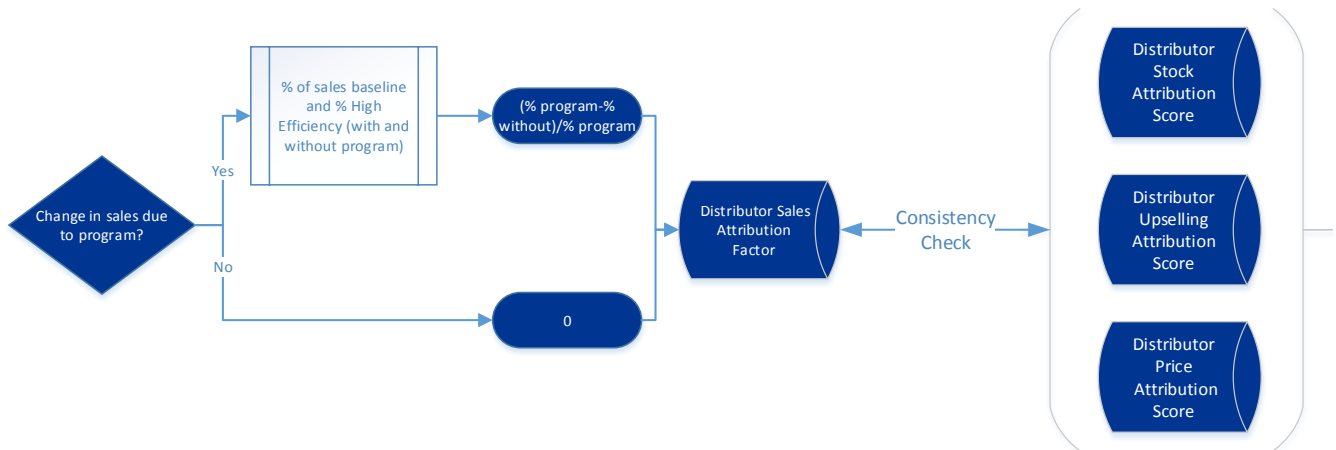


### 3.1.3 Consistency check scoring

The questions in Figure 1 focused on the scoring methodology within the causal paths. The questions outside the causal paths were used for validation and consistency checks.

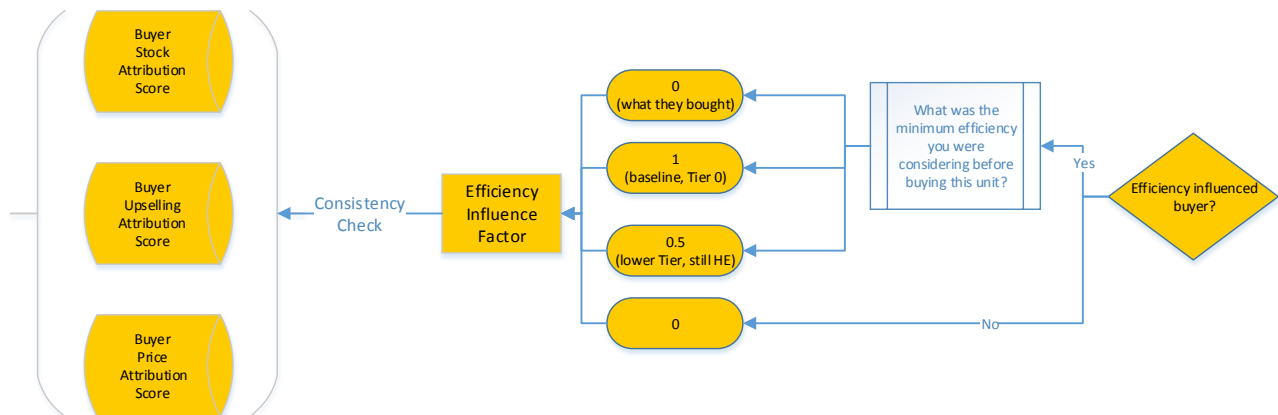
To check if sales were influenced by the program, we asked the distributors to describe the current % of their sales for baseline units, and % of their sales that are for high efficiency units, across different unit types and sizes. We then asked the distributors to estimate what baseline and high efficiency sales would have been without the upstream program. We used the change in these numbers to calculate a measurable impact the program had on distributors' sales. Figure 2 shows how we calculated sales attribution, and used the result to check consistency across the other attribution scores.

**Figure 2. Distributor attribution consistency check**



In the case of any three of the buyers' attribution scores, there was the possibility that in the absence of the program, buyers would have still purchased a high efficiency unit, but just at a lower tier than what they did. Therefore, we gathered additional information about buyers' decision-making to create a consistency check for the other causal pathways. Figure 3 shows the consistency check for buyers' attribution.

**Figure 3. Buyer attribution consistency check**





## 3.2 NTG data collection

DNV GL used trained internal staff to complete the distributor in-depth interviews, and Pacific Market Research (PMR) to conduct buyer surveys. We completed 19 interviews with participating distributors, and PMR completed 99 surveys with buyers. The sections below provide further detail on the sample design and response rates for these interviews and surveys.

### 3.2.1 Distributor sample design and interview response

We divided the distributor population into three strata: large, medium and small distributors. We based these strata on the total incentive dollars that were dispersed through the program. The large strata consisted of distributors who had over \$200,000 in incentives across all of the participating utilities. Medium distributors had between \$20,000 and \$200,000 in incentives. Finally, the small distributors had less than \$20,000 in incentives across all participating utilities.

We identified 20 large distributors in the tracking data, and we targeted the full population of these large distributors for interviews. For the medium and small distributors, we selected a random sample of ten distributors in each strata as our primary sample. When a sample point became dead or ineligible, we replaced it with a back-up sample point.

DNV GL staff conducted the in-depth distributor interviews. The interview guide can be found in APPENDIX A.

Table 11 below shows the final count of completed surveys across the distributor sample.

**Table 11. Distributor survey final disposition**

Distributor Strata	Completed Interviews
Large (>\$200k)	11
Medium (<\$200k, >\$20k)	1
Small (<\$20k)	7
<b>Overall</b>	<b>19</b>

### 3.2.2 Buyer sample design and survey response

After we received the original buyer data sets from the utilities, we discovered that 48% of total buyer program kWh savings did not have distributor information listed. Therefore, we did not sample from records that did not have traceable distributors. From there, we limited our buyer sample frame of buyers to those who purchased equipment from distributors who responded to our distributor interview.

Our sample design targeted 200 buyer sites with measure group for a specific buyer being the unit of analysis. We selected buyers within each equipment type to achieve 90/10 precision for the overall buyer population, for those buyers in the Rooftop/Split Systems and Chiller strata. For buyers in the VRF stratum we targeted a 90/20 level of precision.

Table 12 shows these precision goals along with sizes of the samples and populations by measure group. Additional criteria for stratification included utility, measure group, and size.

**Table 12. Initial Sample Design Precisions Goals**

Measure Group	Sample Buyer sites	Population Buyer sites	Expected Relative Precision at 90% Confidence	Percent Program Savings (kWh)
Chillers	53	402	10%	33%
Rooftop or Split System	128	4,880	10%	51%
Mini-Multi-VRF	19	711	20%	17%
<b>Overall</b>	<b>200</b>	<b>5,993</b>	<b>7%</b>	<b>100%</b>

We organized the final sample by unique contact numbers, which contained the measure group strata listed above. Of the total population of 5,993 sites, there were 2,048 unique contacts. We then identified 1,386 of these unique buyer contacts as having purchased their equipment from distributors with whom we had completed interviews. Of that sample, 1,117 were eligible numbers. Overall, we completed 99 surveys covering 479 equipment purchases. Table 13 shows the target sample sites for these measures, and actual completed sites.

**Table 13. Target and completed surveys based on # of equipment purchases**

Measure Group	Target surveys (# of equipment purchases)	Completed surveys (# of equipment purchases)
Chillers	53	21
Rooftop or Split System	128	445
Mini-Multi-VRF	19	13
<b>Overall</b>	<b>200</b>	<b>479</b>

Our data collection based on the sample resulted in 21 completed buyer sites for chillers, 13 for VRFs, and 445 Rooftop/Split System buyer sites (In total, 290 PGE sites and 189 SCE Sites). The fact that we had many Rooftop units, few other measures, and no completes on SDGE territory was due to the low number of sites associated with other measures and in the SDGE territory. In addition, there were multiple sites associated with many buyer contact phone numbers that got a higher priority to be completed.

This response rate was much lower than what DNV GL expected. Part of the reason for such a low response rate was the ineligible population. A total of 230 unique buyer contacts were deemed ineligible, meaning that they were not familiar with the program or claimed that no HVAC unit was recently installed. Our survey instrument attempted to address these ineligible respondents by asking for additional contacts or clarifying that no other HVAC equipment had been installed during 2013-2014 timeframe. However, this did not convert any of these ineligible to viable sample points.

Overall, this low buyer response rate meant that only eight of the 19 completed distributor interviews had matching buyer data for the full causal path analysis. Our eight matched distributors represent 41% of the

total buyer program kWh savings, and 79% of the of buyer program savings who had a distributor listed from the original buyer population frame. All 479 buyer responses for the equipment purchases were used with these eight distributors.

As for the 11 unmatched distributor interviews we completed, this data could not be used for our NTG methodology since the entire buyer causal pathway was missing. Additionally, only four of the unmatched distributors had buyer sales and kWh savings information available. The other seven unmatched distributors either did not appear in the buyer frame, or the buyer did not have contact information. Since the buyer frame was where we derived the kWh savings for each distributor (which was used for expansion), the only additional analysis we could do is include the four unmatched “good data” distributors with the eight matched distributors for a distributor-only question by question comparison.

However, this analysis would only be useful for process evaluation purposes, and is currently out of scope and budget. We therefore plan on excluding it from the analysis. We will make a recommendation to look at this data from that perspective in the future, as well as increase accuracy and completeness of tracking data from utilities.

All of the implications of this for weighting and population expansion are discussed in Section 3.3.2 below.

### 3.2.3 Non-participating distributor surveys

The updated research plan originally mentioned surveying non-participants during this cycle of program participant surveys, and including them in the NTG calculation. However, given that all of largest HVAC distributors in California are participating in this program, the non-participating distributors will be an unrepresentative control group for comparison. Additionally, self-selection effects would make this comparison problematic.

Conducting quasi-experimental study between participating and non-participating distributors to compare practices presents challenges to measuring program attribution. With such long-standing programs, there is always the risk of self-selection effects. There may be factors – e.g., smaller size, less sophistication, targeting the low-cost market – which make the HVAC companies which do not participate in the programs very different than those that do. If these differences are significant, then this would raise questions as to whether the nonparticipating HVAC companies were a valid comparison group for the participants. Since the HVAC1 program does have paperwork requirements which might be burdensome for smaller companies, this barrier to program entry might lead to self-selection effects based on company size and sophistication.

## 3.3 NTG analysis

After the distributor and buyer surveys were completed, we calculated the individual buyer and distributor attribution scores, mapped them together, and expanded to the whole population. This section will review the process of calculating the attribution scores individually, and then expanding them to the population.

### 3.3.1 Calculating attribution scores

We calculated the overall attribution scores at the buyer level, multiplying the buyer and their related distributor survey attribution scores on each causal path. We subtracted these scores from 1 to calculate a freeridership rate on each path. Next, we multiplied all three freeridership scores together, and subtracted the result from 1 to get the overall program attribution score at the buyer level.

We chose this approach because we wanted to give the program the maximum opportunity for attribution, and believe this provides the following benefits:

1. Ensures that attribution is capped at 100%
2. If multiple paths of partial attribution exist, they are fairly represented in the equation
3. If one of three paths is 100% attribution (0% freeridership), then the total program score gets 100% attribution
4. If one of three paths is 0% attribution (100% freeridership), then the path has no impact on the total score by turning into a 1, and it does not reduce the scores produced by the other two paths.

The equations below show the flow of these calculations. We calculated the buyer attribution scores from survey responses related to an individual purchase, and the distributor attribution scores based on the equipment type the buyer purchased. Note that the combined attribution scores come from an individual distributor (x) and an individual purchase from a buyer (y):

$$\text{Combined Attribution}_{\text{Stock}} = \text{Distributor}_X \text{Attribution}_{\text{Stock}} \times \text{Buyer}_Y \text{Attribution}_{\text{Stock}}$$

$$\text{Combined Attribution}_{\text{Upsell}} = \text{Distributor}_X \text{Attribution}_{\text{Upsell}} \times \text{Buyer}_Y \text{Attribution}_{\text{Upsell}}$$

$$\text{Combined Attribution}_{\text{Price}} = \text{Distributor}_X \text{Attribution}_{\text{Price}} \times \text{Buyer}_Y \text{Attribution}_{\text{Price}}$$

$$\text{Freeridership}_{\text{Stock}} = 1 - \text{Combined Attribution}_{\text{Stock}}$$

$$\text{Freeridership}_{\text{Upsell}} = 1 - \text{Combined Attribution}_{\text{Upsell}}$$

$$\text{Freeridership}_{\text{Price}} = 1 - \text{Combined Attribution}_{\text{Price}}$$

$$\text{Combined Program Attribution} = 1 - \left( (\text{Freeridership}_{\text{Stock}}) * (\text{Freeridership}_{\text{Upsell}}) * (\text{Freeridership}_{\text{Price}}) \right)$$

After we calculated this combined distributor/buyer attribution score for every single buyer, we needed to expand these estimates to the population. The next section describes how we reviewed all of the buyers for each distributor, as well as equipment type, to create a weighted overall attribution score for the program.

### 3.3.2 Expansion of sample results to the population

We applied sample weights in two stages: distributor level and buyer level. Each was developed proportional to the kWh savings by strata.

#### Distributor Weighting

As mentioned earlier, there were a total of eight distributors that had associated buyers sample completed. These eight distributors were all from the same stratum in the distributor sample, which accounted for 42 percent of total population savings. Each of the distributors for whom we completed buyer surveys was from the same strata, which resulted in the sample weights for each of our distributors being equal. The weight for each stratum was calculated as:

$$\frac{\sum kWh_{Frame}}{\sum kWh_{Complete}}$$

### Buyer Weighting

The buyers' weights were a function of the savings of the distributor from whom the equipment was purchased from. We calculated the weight for the buyer for each stratum within a distributor as:

$$\frac{\sum kWh_{distributor}}{\sum kWh_{completed buyers}}$$

We combined these weights with the specific measure savings to produce unbiased savings weighted results using the statistical technique of ratio estimation as described below.

We then used the calculation of the Net-to-Gross Ratio as appropriate case weights corresponding to the sampling rate as discussed above. The energy saving estimates (tracking savings) of the units of analysis (purchased measures) are present in both the numerator and the denominator of the ratio, when combined with the sample weights the ratio estimation method produces an unbiased, savings weighted ratio.

The process calculates NTG as a ratio estimator over the sample of interest (Cochran, 1977, p.165). The formula appears below.

**Notation:** The following terms are used in calculating the adjustment factors:

- $G_{Tj}$  = tracking estimate of gross savings for measure  $j$
- $N_{Tj}$  = Net estimate of tracking saving for measure  $j$ ,
- $W_{Nj}$  = weighting factor for measure  $j$  used to expand the NTG sample to the full population

### Net-to-Gross

The net-to-gross ratio  $R_A$  is calculated from the NTG sample as

$$R_A = \frac{\sum_{j \in N} N_{Tj} W_{Nj}}{\sum_{j \in N} G_{Tj} W_{Nj}}$$

### Standard errors

The procedure used for calculating ratio estimation by domains provided the correct standard error of the estimate for each domain and overall. The procedure also took into account the defined clusters of observations and stratification. Because we calculated the measure level attribution as a function of the distributor and buyer scores together, and buyers were selected within distributors, the distributor was the applicable cluster definition for the calculation.

## 4 NTG FINDINGS

The results of the data collection and NTG analysis expansion was an overall attribution (**NTGR**) score of **64% ( $\pm 6%$  at the 90% Confidence Interval)** for the upstream program. Again, this NTGR started with individual buyers and their related distributors, and expanded these connected NTG scores to the whole population.

We used an overall NTGR instead of the measure category NTGR for two reasons. First, our sample for VRFs was so small that the NTGR could not be considered statistically significant. Second, the scores for each measure strata were not statistically different from the overall value.

### 4.1 Causal pathway findings

Although we only use the overall NTGR for the net savings calculation, there is program design value in looking at the attribution across the causal paths within the distributor and buyer surveys. The survey results in Table 14 indicates how the pattern of responses from each of the two populations shows the potential for program influence on the sale for each causal pathway. Below we explore each of the three main casual pathways and highlight interesting findings from each of them. This way of breaking down the results provide additional context to the recommendations we provide below.

Note that these scores cannot be multiplied together to calculate the overall NTGR score, since these scores group distributors and buyers separately. The overall score connects the scores on an individual basis and then expands, which is different from what is displayed below.

**Table 14. Grouped attribution scores for each causal pathway**

Causal Pathway	Distributor attribution	Buyer attribution
Stocking	35%	21%
Upsell	26%	81%
Price	54%	98%
Efficiency		4%
Sales	41%	

#### 4.1.1 Stocking

The stocking causal pathway was intended to identify how distributors were influenced by the program to change their stocking habits, and in turn, whether what was available in stock influenced what the buyer purchased. The causal pathway was driven by the assumption that when buyers replace existing equipment in an urgent situation (five days or less), the stocking habits of distributors would be most influential.

On the buyer’s side, the survey results indicated that many buyers did not have a dire need to replace existing equipment. Only 21% of the buyers were in a situation where they needed to replace their existing HVAC equipment within 5 days. This pathway had the lowest attribution score among the three pathways for buyers.

The results from the distributor surveys were used to estimate that 35% of the distributor HVAC practices were due to the program. Therefore, the tactical goal of the program to update distributors’ stocking practice is succeeding to a certain degree. However, the same survey results indicate that 65% of distributors’ stocking patterns have not changed since joining the program.

### 4.1.2 Upselling

According to the program logic, another focal point of the upstream program was to encourage distributors to upsell high efficient HVAC equipment to buyers.

The buyer survey asked whether the distributor recommended an HVAC unit to the buyer, and how influential this recommendation was on a scale of (1-10). This score was a proxy for attribution this upselling had on the buyer. Overall, buyers found the recommendation of the distributor to be influential, giving it a weighted average score of 8 out of 10, which translates to an attribution score of 81%.

The evaluation used the interview responses of the distributors to estimate that 26% of upselling practices were due to the program. This low attribution score could relate to the evidence that less than 30% of buyers indicated that distributors discussed more than one HVAC option with them. Since all the buyers surveyed bought the energy-efficient model, we can assume the majority of buyers were shown only one energy-efficient option, which suggests upselling was already occurring. This attribution score could also be due to many distributors overvaluing their salesmanship abilities and consequently undervaluing program influence. This is akin to the “green retailer bias,” which has been recognized as a potential bias in past evaluations of California upstream lighting programs.<sup>5</sup>

### 4.1.3 Price

The surveys also explored the influence of price as a causal pathway. The upstream program provided incentives to distributors for participation, and we wanted to capture whether those program incentives were being passed on to buyers through lower unit prices. Furthermore, we wanted to estimate what amount of influence the price of the unit had on the buyer’s decision making, and see if these incentives were indirectly influencing buyer behavior.

As we expected, price was a big driver of buyer behavior. Buyers representing over 95% of the installed equipment indicated that they would not have paid more for their purchase. However, the buyer survey logic on price may have been too broad to provide an accurate picture of the influence of price. The pricing battery for buyers asked if they “Would you have been willing to spend more for the exact same measure?” (APPENDIX B, Question P3). If they answered “no”, then they were skipped out of the rest of the price battery and assigned 100% attribution for that causal path. It is our opinion that this was too broad of a question, as it does not dig deep enough into the layers of actual willingness to pay from a buyer. For example, would a buyer be willing to pay a penny more for their purchase? A dollar more? This granularity would have provided a more accurate depiction of the influence of price the distributor’s pass-through incentive had on the buyer’s decision making.

After identifying this situation on the buyer side of the causal path, we accepted that we were unable to adjust the buyer scoring methodology with the information we had collected. Therefore, we decided to look at the distributor side of the causal path and use the percent of money passed-through as a proxy for distributor price attribution. According to our original NTG methodology, if a distributor passed-through any amount of incentives to the buyer, they received 100% attribution on this pathway. We adjusted this scoring

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<sup>5</sup> See “Documentation for DEER Net to Gross Update,” Prepared by DEER Consultant Team for the CPUC Energy Division, May 2, 2008. In that report the green retailer bias referred to the tendency of some retailers who participate in upstream lighting programs to overrate their ability to promote environmentally-friendly lighting products and thereby underrate the contribution of program discounts to their sales of energy-efficient lighting products. While that bias was occurring at the retail rather than the wholesale level, it is plausible that a similar bias might be present among some HVAC distributors.



so that whatever percentage the distributor passed-through to the buyer, that percentage was considered the programs attribution on the distributor's price causal pathway. The resulting attribution was the highest of any other distributor causal path, as over 50% of the incentives are being passed-through by distributors.

There may be concern that this updated scoring approach overlooks the rest of the incentive money that may not be passed-through, but still used by the distributor to promote high efficiency units (such as incentivizing sales staff with bonuses if they sell these units). However, we believe that the two other causal paths of upselling and stocking adequately capture these other incentive impacts. Additionally, as we indicated in our original NTG methodology memo, our stated approach could change in light of actual data collection findings. Our update to this calculation is consistent with the language in that memo.

## 4.2 Consistency check findings

The buyer and the distributor surveys each had unique questions that acted as consistency checks for their respective attribution scores. The distributor survey asked a battery of questions focused on the programs influence on sales, and the buyer survey asked questions focused on the efficiency level desired during the purchase.

### 4.2.1 Sales

The results from this distributor consistency check indicates that about 40% of the high efficiency sales that distributors had in the past year were attributable to the program. This consistency check estimates the overall program impact on sales through its impact on distributors, and in turn buyers. In contrast, the distributor responses on each causal pathway focuses solely on effects of the program on distributor behavior. Therefore, the sales consistency check could indicate that our overall NTG methodology is a bit generous.

### 4.2.2 Efficiency

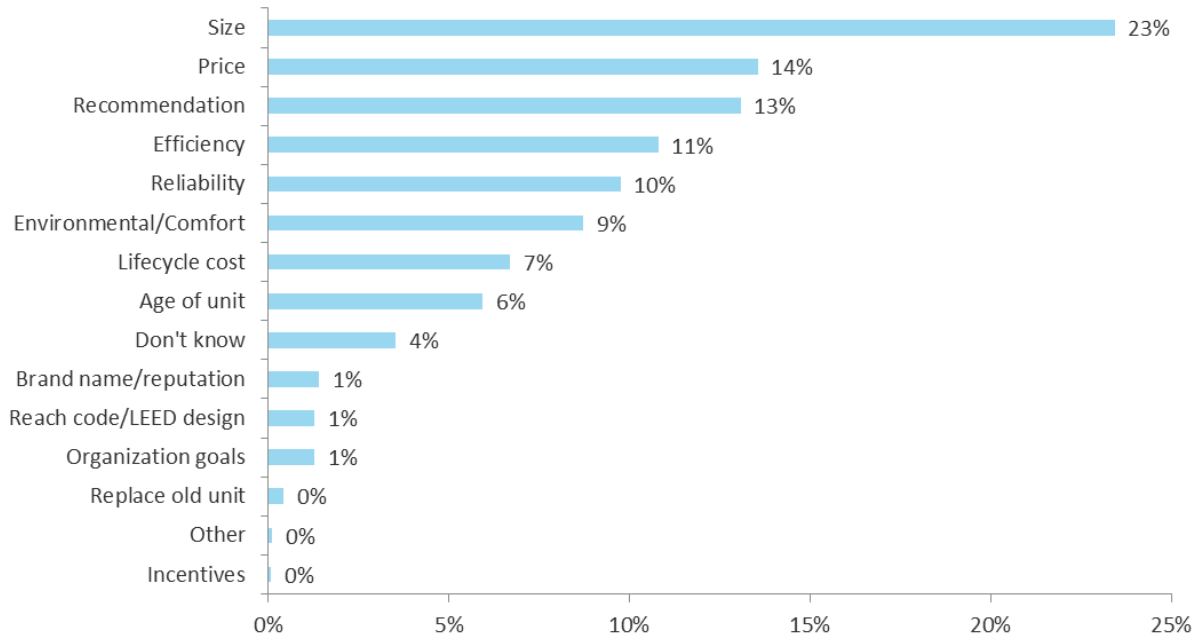
The buyer consistency check asked questions related to the efficiency level of HVAC equipment the buyer was considering. Our goal was to identify if buyers considered the efficiency of the HVAC unit when making their purchase.

Only 4% of buyers considered a different efficiency than what they bought from the distributor. While some of this may be due to buyers already intending to buy high efficiency units, it may also indicate that many distributors are upselling energy-efficient units from the start. Our survey results indicated that buyers take the recommendations of distributors seriously (80% attribution). Therefore, if a given distributor started off by recommending a high efficiency model, it is possible that a buyer who might have otherwise considered a wider range of unit efficiencies instead deferred to their distributor's recommendation of the more efficient model. One piece of evidence for this, as described in the Upselling section, is that less than 30% of buyers indicated that distributors discussed more than one HVAC option with them.

Figure 4 below shows the survey responses to another consistency question at the beginning of the buyer survey. Question G3 asked the buyers to identify the most important factor that influenced their HVAC equipment choice. If they provided more than one answer, they had to prioritize one that was the most important. The results of that question indicated that size, price and distributor/vendor recommendation were the most important factors. The efficiency of the unit is listed as the number four reason, it is not far

behind price and distributor recommendation. These results show that while efficiency was an important factor for buyers, it was not the most important factor.

**Figure 4. Buyer Survey Question G3: Most important factor that influenced equipment choice**



## 5 RECOMMENDATIONS

DNV GL team recommends the following actions to increase distributor program participation and overall attribution. Since the upstream HVAC program implementation is focused on the upstream market, our recommendations are based around distributor interaction and behavior. We believe these tangible recommendations could be used to adjust the program structure, and will translate into downstream impact, as shown in the causal pathways above.

### 5.1 Reduce uncertainty on how long the incentives will remain in place

Reducing uncertainty regarding how long the incentives will remain in place at a given level would likely increase the trust which distributors have in the program, and, in turn, increase their willingness to change their stocking practices. Program practices which would increase participant certainty about how long the incentives will remain in place would include informing the distributors when the program is going to run out of money ahead of time, and honoring rebates for HVAC purchases that are already registered in the system.

The 35% attribution on the distributor side of the causal path indicates that stocking habits are changing, although 65% of what is being stocked is the same as before the program. Distributors are responding to the program, just not with the majority of their stock.

One possible reason for this is that stocking these units becomes riskier when there is uncertainty around whether program rebates will be available in the near future. Below are a couple of thoughts distributors shared during their interviews:

- One distributor noted that if the rebate is available and they can count on it, they will stock the high efficiency equipment.
- Another distributor mentioned that if a given HVAC unit does not qualify for a rebate, they do not stock it.
- Several distributors mentioned the lack of clarity on rebate timing impeded their ability to sell the units.
- Another distributor described a situation where they bid and win a job two years before the work gets done, but by then the rebate is not available. This interviewee pointed out that this is difficult to explain that to customer because they have factored that rebate into the price paid by the customer.

### 5.2 Provide more marketing tools to distributors

During our interviews, multiple distributors asked for additional sales tools and marketing materials to help them sell high efficiency units. We believe that the CPUC and IOUs should consider hosting trainings and providing online savings calculators to distributors in the program.

This recommendation may seem counterintuitive based on some of the evidence we provided which indicated that much upselling is already occurring, with or without the program's influence. This evidence includes the fact that only 26% of distributors said that their upselling was attributable to the program, that less than 30% of buyers stated that the distributors discussed more than one efficiency option (this suggests

that the upselling was already happening for the majority of buyers presented with only one option) and that only 4% of buyers were considering other efficiency types.

However, the fact that many distributors are still seeking additional marketing assistance indicates that some need exists. We believe it is important to point out that the buyer surveys only reflected the perspective of customers who bought energy-efficient units, whether due to previous disposition or due to distributor salesmanship (whether program-influenced or not). The comments from distributors may not be focused on those buyers, but rather on the customers who did not choose the energy-efficient units. It is likely for these "lost sales" that the distributors are seeking additional program marketing tools, and therefore we recommend providing them these tools.

Several distributors mentioned in their interviews that they desire better tools and information for their marketing and selling tactics. The CPUC and IOUs should consider some tools to help distributors upsell these units more effectively:

- One distributor requested a simple calculator (from an unbiased third party such as the Department of Energy) that determines savings in dollars (with inputs like: tonnage, weather, county, utility rate) would be helpful. He thinks it should be a quick and simple rule of thumb calculator. Even if the calculator provides a comparison between a 10 EER vs 13 EER unit and shows the dollar savings associated with each unit that would be helpful ("\$ savings" is a better selling point than "XX% higher efficiency")
- A large distributor mentioned the trainings they hold for their staff to educate them on why high efficiency is better than the baseline equipment, and how to market these facts.

### 5.3 Provide more clarity on program timing and changes

Since pass-through incentives had the highest attribution score for both distributors and buyers, clear communication on program changes can help distributors make better decisions on the incentives they pass on to buyers.

Our interviews revealed that many distributors sought better communications on program timing and changes in general, in addition to their more specific demands for better information about rebate availability. Because the sales cycle for some of these high efficiency units can be several months, distributors want to keep their staff and buyers informed of any changes to the rebates. Below are some excerpts from the distributor surveys that highlight this sentiment, and the implications on their sales:

- One distributor interviewee said it would be helpful if someone could clarify process in terms of timing. For instance, they noted that if they sell a job, it would be good to tell the consumer that they can expect the process to happen in a certain time range. While the interviewee said that providing a window of rebate availability would be helpful, the interviewee also noted that the window cannot be too large because then it becomes pointless.
- One distributor requested that the program give them more lead time on changes. This interviewee claimed that sometimes there was only a week notice about upcoming changes to the program, which impacted what they were planning to stock.

## 5.4 Solicit regular program feedback

We recommend that the IOUs and CPUC set up a mechanism (if one does not exist) to solicit distributor feedback more regularly

Our interviews allowed the distributors to provide useful suggestions on how the upstream HVAC program could be improved. Some of their suggestions, in addition to those mentioned above, included involving small municipalities in this program, offering different incentives and technologies based on climate zones, and including new technologies in the program such as pressure-independent valves and adiabatic cooling on air-cooled chillers. Three comments in particular stuck out as interesting ideas to consider:

- One distributor noted that small municipalities are not involved in this program. He felt that the program should provide the same incentives for some of the “little guys,” and give them the same program access and rebate support.
- Another distributor noted that the program should get feedback from manufacturers about where the market is going. This interviewee claimed that the upstream HVAC program is too generic across the state. He noted that different climates (e.g., coast vs. valley) have different drivers for efficiency and operating conditions are dramatically different. He said that the current program does not take these differences into account and that the program should differ based on climate zone
- Several distributors discussed new technologies that the program should consider. One listed a few new technologies would help benefit in growing market including sensor-less pump control allow VFD to be integrated in pump itself, pressure-independent valves, adiabatic cooling on air-cooled chillers, hybrid cooling towers, and air handler fans.

## 5.5 Expand research scope and improve data quality

Nearly 50% of the buyer program tracking data we received was missing distributor names and buyer contact information. As a result, we could not match several completed distributor interviews to buyers, resulting in their omission from our NTG analysis. However, we believe that the data from these unmatched distributor interviews should be used for future analysis.

We recommend that a process evaluation be conducted for this HVAC upstream program to further analyze the distributor interview responses (from both “matched” and “unmatched”) distributors. Our evaluation, by necessity, focused on distributor responses most relevant to program attribution, but other interview responses could also be useful for identifying interesting market trends and for providing insights on how to improve upstream HVAC program design.

We also recommend that the programs strive to collect higher quality buyer tracking data, with special emphasis on collecting information relating buyers to the distributors that sold them their units. This will help increase the number of buyers matched to distributors that we can use for our NTG causal pathway analysis in future studies. For example, the program application form should have the contact information for the distributor, contractor, and buyer, as well as indicate who was present at the time of purchase.

## 6 CONCLUSIONS

Overall, the methodology in this report represents a unique approach to NTG estimation for an upstream program. The causal pathway analysis that linked buyer and distributor attribution questions provided insight on how various aspects of the HVAC1 program were functioning at upstream and downstream points of the market.

The broad takeaways from this research indicate that the HVAC1 program is influencing distributor behavior, and these changes in behavior are impacting downstream buyer decisions. The degree in which this program changes distributor behavior ranges from 26% of upselling attribution, to 54% price attribution when selling these units. The overall program attribution of 64% indicates that the buyer causal paths lifted the attribution scoring for this program as a whole, mainly around distributor recommendations and pricing. Our consistency-checks on the distributor side indicate that our overall NTG methodology could be perceived as generous. While the buyer consistency check provides a "one option" theory that possibly explains why only 4% of buyers considered a different efficiency than what they bought, as less than 30% of buyers indicated that distributors discussed more than one HVAC option with them.

Our data collection efforts gathered valuable information on the influence the HVAC1 program is having on the high efficiency HVAC market in California. And we believe that our analysis and recommendations can positively impact the future program design to improve participation and attribution in this program.

## APPENDIX A. Distributor survey

### Introduction

Hello <Distributor Name>, this is <Interviewer name> the reason for my call is I'm conducting a state-wide evaluation of the utility-sponsored Commercial Upstream Distributor Rebate Program. I'd like to ask you about your companies past experience with this program. This call is sponsored by the CA Public Utilities Commission performed here at DNV GL. (PAUSE). I'd like to assure you that I'm not selling anything and the information you provide is treated confidentially.

[AGREES TO PARTICIPATE]	1	Intro4
[DOES NOT AGREE TO PARTICIPATE]	2	Thank & Terminate

[REPEAT IF NEEDED] All survey information collected including the results to this survey will be treated confidentially and reported in aggregate form.

[IF ASKED] If you would like to verify the legitimacy of this research our CPUC manager is Lola Odunlami at (415) 703-1893. If you have questions about this or the follow up survey you can reach our study manager by calling Jason Meyer at (707) 266-8332

### Screeners questions

SC1. The California Investor Owned Utilities, PG&E, SCE and SDG&E deliver incentives through a commercial Upstream HVAC Equipment Incentive Program that buys down the cost of high-efficiency HVAC equipment. The incentive records show your company received rebates. Are you familiar with your company's participation in this program?

Yes	1	G1
No	2	Terminate
Don't know	98	
Refused	99	

S1a. Who at your company could I speak with that would be familiar with this program?

Record and ask to speak with them.	1	G1
No one	2	Terminate
Don't know	98	
Refused	99	

### General distributor information

Next I'm going to ask a few general questions about your company.

G1. Which of the following distribution business models best describes your company's practice? Is this company a [Read list]

An Independent HVAC equipment distributor	1	G2
A manufacturer-owned or franchise distributor	2	
An Independent manufacturers' representative	3	
[Combination (list which ones)]	4/Record	
[Other (Self-report)]	50/Record	

G2. Does the company also offer HVAC installations?

Yes	1	G3
No	2	D1
Don't know	98	
Refused	99	

G3. Would you say the company is more of a distributor, installer or manufacturer?

Distributor	1	D1
Installer	2	
Manufacturer	3	
Don't know	98	
Refused	99	

G4. How many full time employees work at your company?

Record #	1	D1
Don't know	98	
Refused	99	



## Distribution area

D1. Which regions in California do you distribute your HVAC equipment? Do you sell in northern, central or southern California?

[Northern]	1	D2
[Central]	2	
[Southern]	3	
[All of the Above]	4	
[Don't know]	98	
[Refused]	99	

D2. Do you distribute anywhere else besides the state of California?

Yes	1	D2a.
No	2	D4
Don't know	98	
Refused	99	

D2a. Where else do you distribute? [record states or major metropolitan areas]

[Record verbatim]		D3
Don't know	98	D4
Refused	99	

D3. Do sales and/or stocking practices differ significantly in regions outside of California?

Yes	1	D3a
No	2	D4
Don't know	98	
Refused	99	

D3a. Why do you say that? [Probe: How are these markets different? How are they similar?]

[Record verbatim]		D3b
Don't know	98	
Refused	99	

D3b. Is there anyone else we should speak to at the company in those states?

[Record verbatim] <i>[If "Yes", ask for contact info at the end of the interview]</i>		D4
Don't know	98	
Refused	99	

## Equipment type and sizes distributed

Next I'd like to ask about a few equipment types distributed in California.

D4. Do you sell or distribute Unitary Air-Cooled or Water Cooled Equipment (a.k.a. Air Conditioners, Heat Pumps, Rooftop Units, Package Units)?

Yes	1	D5
No	2	D6
Don't know	98	
Refused	99	

D5. Do you sell the following sizes?

D5	Unitary Air-Cooled or Water Cooled Equipment Size Category	Response Code		Skip Logic
		Yes	1	
		No	2	
		Don't know	98	
		Refused	99	
D5a	≤ 20 ton			D6
D5b	>20 ton			

D6. Do you sell or distribute Chiller Systems?

Yes	1	D7
No	2	D8
Don't know	98	
Refused	99	

D7. Do you sell the following types and sizes?

D7	Size Category	Response Code		Skip logic
		Yes	1	
		No	2	
		Don't know	98	
		Refused	99	
D7a	Air-Cooled			D8
D7b	Water Cooled ≤300 ton			

D7c	Water Cooled >300 ton		
-----	-----------------------	--	--

D8. Do you sell or distribute Variable Refrigerant Flow (VRF) Systems?

Yes	1	ME1
No	2	
Don't know	98	
Refused	99	

## Market effects

### Sales

[Repeat for each equipment type and size that the respondent indicates their company sells]

ME1. In the past year, about what percentage of [equipment type] [size] that were sold in California would you estimate were high-efficiency, which is defined as Tier 1 and above?

ME1	Unitary Air-Cooled or Water Cooled Equipment Size Category	Response Code		Skip Logic
		[Record % in table]		
ME1a	≤ 20 ton	Don't know	98	ME2
ME1b	>20 ton	Refused	99	
		Not Applicable	NA	

ME1	Chillers Size Category	Response Code		Skip logic
		[Record % in table]		
ME1c	Air-Cooled	Don't know	98	ME2
ME1d	Water Cooled ≤300 ton	Refused	99	
ME1e	Water Cooled >300 ton	Not Applicable	NA	

M12	Variable Refrigerant Flow (VRF) Systems	Response Code		Skip Logic
		[Record % in table]		
ME1f	VRF	Don't know	98	ME2
		Refused	99	
		Not Applicable	NA	

ME2. What percent of all the high-efficiency [equipment type] [size] had a rebate claimed?

ME2	Unitary Air-Cooled or Water Cooled Equipment Size Category	Response Code		Skip Logic
		[Record % in table]		
		Don't know	98	
		Refused	99	
		Not Applicable	NA	

ME2	Chillers Size Category	Response Code		Skip logic
		[Record % in table]		
		Don't know	98	
		Refused	99	
		Not Applicable	NA	

ME2a	≤ 20 ton	ME2 <100%, then to go ME3, otherwise skip to ME4	ME2c	Air-Cooled	ME2 <100%, then to go ME3, otherwise skip to ME4													
ME2b	>20 ton		ME2d	Water Cooled ≤300 ton														
			ME2e	Water Cooled >300 ton														
			<table border="1"> <thead> <tr> <th rowspan="4">ME2</th> <th rowspan="4">Variable Refrigerant Flow (VRF) Systems</th> <th colspan="2">Response Code</th> <th rowspan="4">Skip Logic</th> </tr> <tr> <th>[Record % in table]</th> <th></th> </tr> </thead> <tbody> <tr> <td>Don't know</td> <td>98</td> </tr> <tr> <td>Refused</td> <td>99</td> </tr> <tr> <td>Not Applicable</td> <td>NA</td> </tr> </tbody> </table>			ME2	Variable Refrigerant Flow (VRF) Systems	Response Code		Skip Logic	[Record % in table]		Don't know	98	Refused	99	Not Applicable	NA
ME2	Variable Refrigerant Flow (VRF) Systems	Response Code		Skip Logic														
		[Record % in table]																
		Don't know	98															
		Refused	99															
Not Applicable	NA																	
			ME2f	VRF	ME2 <100%, then to go ME3, otherwise skip to ME4													

ME3. Why doesn't your company submit rebates for all the high-efficiency equipment types? [Reflect all that apply]

Not qualified	1	ME4
Missed opportunity	2	
Paid through down/mid-stream rebate	3	
Not in IOU service territory	4	
Other reason	50	
Don't know	98	
Refused	99	

ME4. What factors do you believe are the most influential in the sale of your company's high-efficiency equipment? [PROMPT AS NEEDED, RECORD ALL THAT APPLY]

Market demand or turns rate	1	ME5
Utility rebates	2	
Competitive comparisons/market competition	3	
Manufacturer rebates	4	
Energy costs	5	
Sales marketing/education	6	
Vendor promotions	7	
New product line offering	8	
Other (Record)	50	
Don't know	98	
Refused	99	

## Stocking

Next I would like to ask about stocking.

ME5. Does your company maintain a stock of high-efficiency [equipment type]? [Ask for each of the 3 equipment types sold.]

Yes	1	ME6
No	2	U1
Don't know	98	
Refused	99	

ME6. How are stocking decisions made for high-efficiency equipment?

[Record verbatim]		ME7
Don't know	98	ME7
Refused	99	U1

ME7. Are the inventories for high-efficiency equipment relatively constant, or are there seasonal fluctuations? [Reflect all that apply]

Constant	1	ME8
Seasonal variation	2	
[Varies by equipment type (record)]	3	
[Made to order]	4	
[Don't know]	98	
[Refused]	99	

ME8. What factors do you believe are the most influential in the stocking of your high-efficiency equipment? [PROMPT AS NEEDED, RECORD ALL THAT APPLY]

Utility rebates	1	ME11
Market demand or turns rate	2	ME9
Competitive comparisons/market competition	3	
Manufacturer rebates	4	
Energy costs	5	
Sales marketing/education	6	
Vendor promotions	7	
New product line offering	8	
Warehouse size limitations	9	
Other	50	
Don't know	98	

Refused	99	
---------	----	--

ME9. Does the rebate influence the selection of high-efficiency HVAC equipment the company keeps in stock?

Yes	1	ME10
No	2	ME10
Don't know	98	ME11
Refused	99	ME11

ME10. Why do you say that?

[Record verbatim]		ME11
Don't know	98	
Refused	99	

**[Question related to NTG calculations**

*Repeat for each equipment type and size confirmed as sold in questions D4-D7]*

ME11. For all [equipment type X] approximately how many [equipment type] [size] to do you normally keep available in stock? *[Probe: this includes regular and high-efficiency equipment? Emphasize a "soft estimate" is fine, and we're looking specifically at the CA market ]*

ME11	Unitary Air-Cooled or Water Cooled Equipment Size Category	Response Code		Skip Logic
		[Record # in table]		
ME11a	≤ 20 ton	Don't know	98	ME12
ME11b	>20 ton	Refused	99	
		Not Applicable	NA	

ME11	Chillers Size Category	Response Code		Skip logic
		[Record # in table]		
ME11c	Air-Cooled	Don't know	98	ME12
ME11d	Water Cooled ≤300 ton	Refused	99	
ME11e	Water Cooled >300 ton	Not Applicable	NA	

ME11	Variable Refrigerant Flow (VRF) Systems	Response Code		Skip Logic
		[Record % in table]		
ME11f	VRF	Don't know	98	ME12
		Refused	99	
		Not Applicable	NA	

**[Question related to NTG calculations**

Repeat for each equipment type and size confirmed as sold in questions D4-D7]

ME12. Of those, how many are high-efficiency?

ME12	Unitary Air-Cooled or Water Cooled Equipment Size Category	Response Code		Skip Logic
		[Record # in table]		
		Don't know	98	
		Refused	99	
		Not Applicable	NA	
ME12a	≤ 20 ton			ME13
ME12b	>20 ton			

ME12	Chillers Size Category	Response Code		Skip logic
		[Record # in table]		
		Don't know	98	
		Refused	99	
		Not Applicable	NA	
ME12c	Air-Cooled			ME13
ME12d	Water Cooled ≤300 ton			
ME12e	Water Cooled >300 ton			

ME12	Variable Refrigerant Flow (VRF) Systems	Response Code		Skip Logic
		[Record % in table]		
		Don't know	98	
		Refused	99	
		Not Applicable	NA	
ME12f	VRF			ME13

**[Question related to NTG calculations**

Repeat for each equipment type and size confirmed as sold in questions D4-D7]

ME13. If the program weren't available, how many of these high-efficiency [equipment type] [size] would you stock?

ME13	Unitary Air-Cooled or Water Cooled Equipment Size Category	Response Code		Skip Logic
		[Record # in table]		
		No change	97	
		Don't know	98	
		Refused	99	
		Not Applicable	NA	
ME13a	≤ 20 ton			ME14
ME13b	>20 ton			

ME13	Chillers Size Category	Response Code		Skip logic
		[Record # in table]		
		No change	97	
		Don't know	98	
		Refused	99	
		Not Applicable	NA	
ME13c	Air-Cooled			ME14
ME13d	Water Cooled ≤300 ton			
ME13e	Water Cooled >300 ton			

ME13	Variable Refrigerant Flow (VRF) Systems	Response Code		Skip Logic
		[Record % in table]		
		No Change	97	
		Don't know	98	
		Refused	99	
		Not Applicable	NA	
ME13f	VRF			ME14

[We are summing the values for ME12 for the ME15 QC question]

ME14. From your previous responses [in ME12] it appears that you have a total of [equipment type] in stock, across all sizes. Does that sound correct?

ME14	Unitary Air-Cooled or Water Cooled Equipment Size Category	Response Code		Skip Logic
		Yes	1	
		No	2	
		Don't know	98	
		Refused	99	
ME14a	Total			U1

ME14	Chillers Size Category	Response Code		Skip logic
		Yes	1	
		No	2	
		Don't know	98	
		Refused	99	
ME14b	Total			U1

ME14	Variable Refrigerant Flow (VRF) Systems	Response Code		Skip Logic
		Yes	1	
		No	2	
		Don't know	98	
		Refused	99	
ME14c	VRF			U1

## Upselling

U1. Can you describe what your company's marketing practices are? [Probe: By marketing, we mean any actions your company takes to promote and sell their products]

[Record verbatim]		U2
Don't know	98	
Refused	99	

U2. Does your company make HVAC equipment recommendations to contractors or other buyers?

Yes	1	U2a
No	2	P1
Don't know	98	
Refused	99	



U2a. What percent of the time does your company make any recommendation to buyers?

[Record %]		U3
Don't know	98	
Refused	99	

U3. Does the Upstream rebate influence the equipment efficiency level your company recommends to buyers?

Yes	1	U4
No	2	U3a
Don't know	98	U4
Refused	99	U4

U3a. Why do you say that? [Probes "why does it [rebate] influence/why is it not influential?"]

[Record verbatim]		P1
Don't know	98	
Refused	99	

**[Question related to NTG calculations**

*Repeat for each equipment type and size confirmed as sold in questions D4-D7]*

U4. In situations where you are selling [equipment type] [size], about what percent of the time are you recommending the high-efficiency equipment?

U4	Unitary Air-Cooled or Water Cooled Equipment Size Category	Response Code		Skip Logic
		[Record % in table]		
		Don't know	998	
		Refused	999	
U4a	≤ 20 ton			U5
U4b	>20 ton			

U4	Chillers Size Category	Response Code		Skip logic
		[Record % in table]		
		Don't know	98	
		Refused	99	
U4c	Air-Cooled			U5
U4d	Water Cooled ≤300 ton			
U4e	Water Cooled >300 ton			

U4	Variable Refrigerant Flow (VRF) Systems	Response Code		Skip Logic
		[Record % in table]		
		Don't know	98	
		Refused	99	
U4f	VRF			U5

**[Question related to NTG calculations**

*Repeat for each equipment type and size confirmed as sold in questions D4-D7]*

U5. For [equipment type] [size], what percent of the time would you recommend the high-efficiency equipment without the Program? *[Probe: and what we mean by "without the program" is supposing the program ran out of funding next month]*

U5	Unitary Air-Cooled or Water Cooled Equipment Size Category	Response Code		Skip Logic
		[Record % in table]		
		Don't know	998	
		Refused	999	
U5a	≤ 20 ton			P1
U5b	>20 ton			

U5	Chillers Size Category	Response Code		Skip logic
		[Record % in table]		
		Don't know	98	
		Refused	99	
U5c	Air-Cooled			P1
U5d	Water Cooled ≤300 ton			
U5e	Water Cooled >300 ton			

U5	Variable Refrigerant Flow (VRF) Systems	Response Code		Skip Logic
		[Record % in table]		
		Don't know	98	
		Refused	99	
U5f	VRF			P1

**Trickle down incentives**

P1. How does your company determine the price the buyer pays for the high-efficiency HVAC equipment we've been discussing?

[Record verbatim]		P2
Don't know	98	
Refused	99	

P2. Is the price ever negotiable?

Yes	1	P3
No	2	
Don't know	98	
Refused	99	

P3. Does the rebate impact the final price paid by the buyer?

Yes	1	P4
No	2	P3a

Don't know	98	S1
Refused	99	S1

P3a. Why do you say that?

[Record verbatim]		S1
Don't know	98	
Refused	99	

**[Question related to NTG calculations]**

Repeat for each equipment type and size confirmed as sold in questions D4-D7]

P4. On average, what percent of the rebate is passed on to the buyer for [equipment type] [size], either directly or indirectly?

P4	Unitary Air-Cooled or Water Cooled Equipment Size Category	Response Code		Skip Logic
		[Record % in table]		
		Don't know	99	
		Refused	8	
		Not Applicable	99	
P4a	≤ 20 ton			S1
P4b	>20 ton			
P4	Chillers Size Category	Response Code		Skip logic
		[Record % in table]		
		Don't know	98	
		Refused	99	
		Not Applicable	NA	
P4c	Air-Cooled			S1
P4d	Water Cooled ≤300 ton			
P4e	Water Cooled >300 ton			
P4	Variable Refrigerant Flow (VRF) Systems	Response Code		Skip Logic
		[Record % in table]		
		Don't know	98	
		Refused	99	
		Not Applicable	NA	
P4f	VRF			S1

## Program influence on sales

[You will be using previous response from ME1 Table for question S1]

**[Question related to NTG calculations]**

Repeat for each equipment type and size confirmed as sold in questions D4-D7]

S1. Earlier you described the percent of high-efficiency sales across the different equipment types in California [Question ME1]. Had there been no Upstream rebates 2015, what percent of high-efficiency sales do you think these [equipment type] [size] sales would be?

S1	Unitary Air-Cooled or Water Cooled Equipment Size Category	Response Code		Skip Logic
		[Record % in table]		
S1a	≤ 20 ton	Don't know	98	PE1
S1b	>20 ton	Refused	99	
		Not Applicable	NA	

S1	Chillers Size Category	Response Code		Skip logic
		[Record % in table]		
S1c	Air-Cooled	Don't know	98	PE11
S1d	Water Cooled ≤300 ton	Refused	99	
S1e	Water Cooled >300 ton	Not Applicable	NA	

S1	Variable Refrigerant Flow (VRF) Systems	Response Code		Skip Logic
		[Record % in table]		
S1f	VRF	Don't know	98	PE11
		Refused	99	
		Not Applicable	NA	

### Process questions

[Go through this section if you have time, and participant doesn't seem anxious to get off the phone. These questions are "nice to haves", not "must haves".]

PE1. Do you have any suggestions on how the program can be improved?

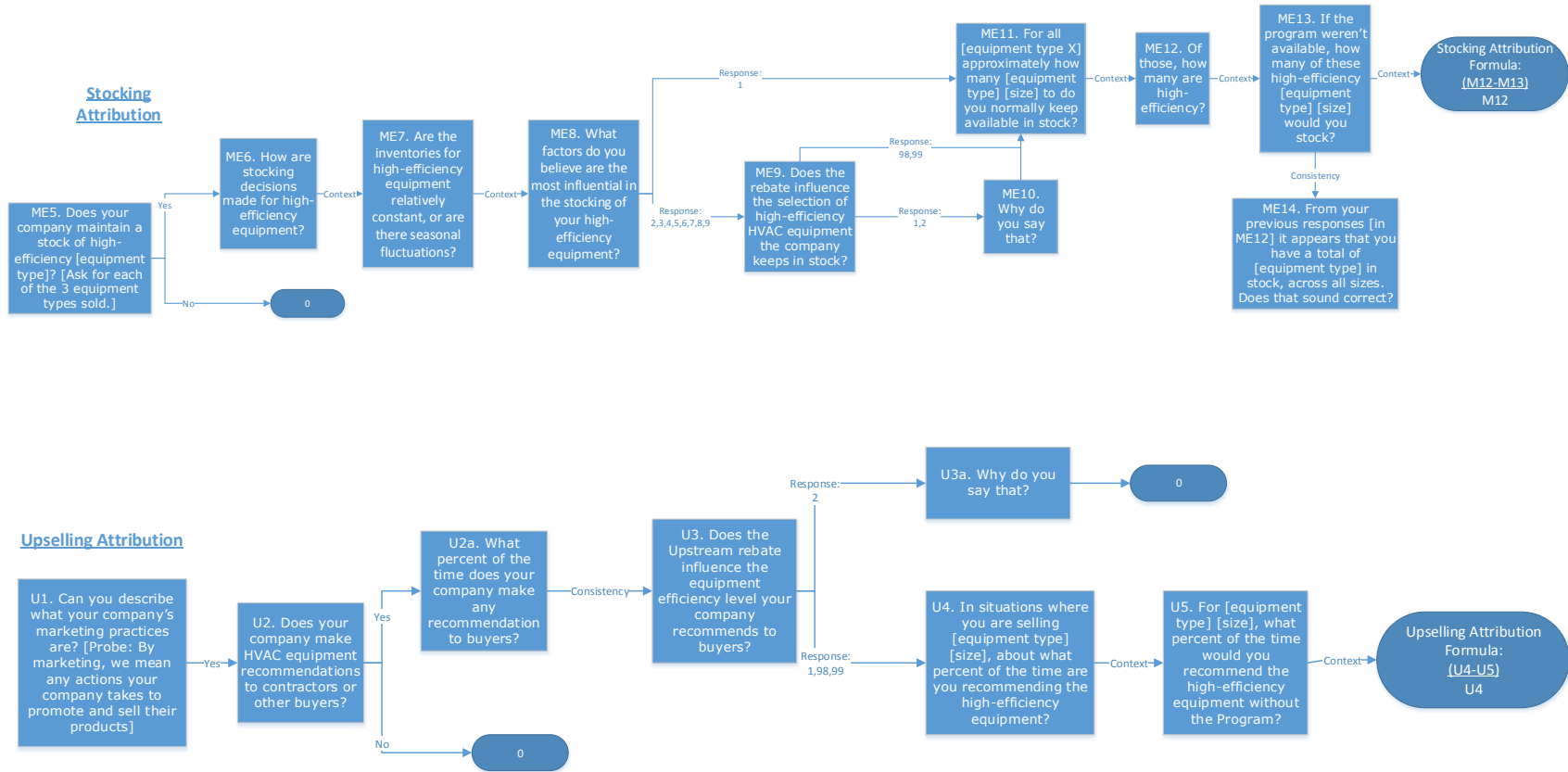
[Record verbatim]		PE2
Don't know	98	
Refused	99	

PE2. Is there anything else you would like to tell us regarding your experience with this program?

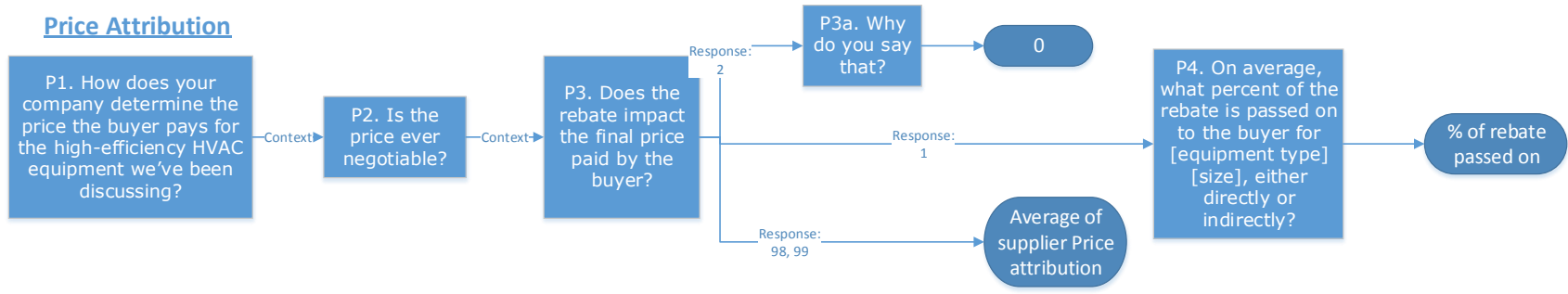
[Record verbatim]		End
Don't know	98	
Refused	99	

End. Those are all the questions I have for you today. Unless you have any questions for me, we are finished. Thank you for your time and cooperation.

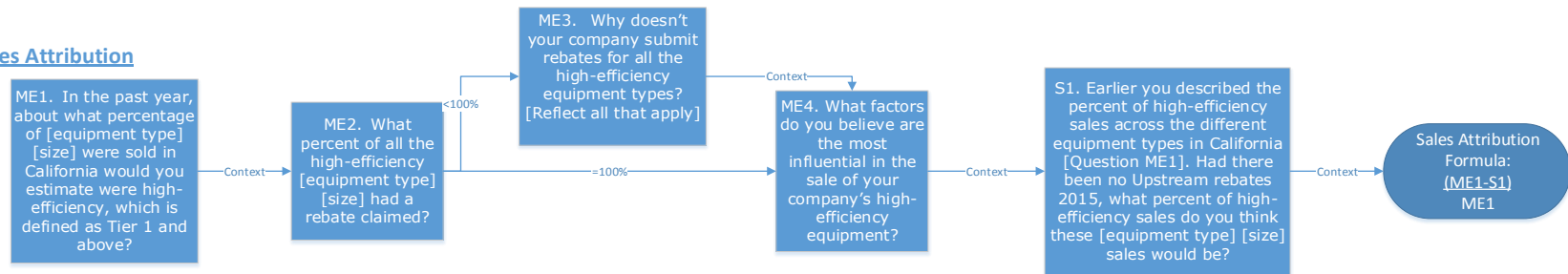
## APPENDIX B. Detailed distributor causal pathway scoring



Price Attribution



Sales Attribution



## APPENDIX C. Buyer survey

### Introduction

Hello , my name is [Interviewer\_name] and my company, Pacific Market Research, is calling on behalf of the California Public Utilities Commission and electric utility, [Utility]. Our records show that your company installed high efficiency air conditioning equipment around [Months] in [Year]. The reason for my call is we are conducting research to learn more about the decision to purchase this equipment. Is the person most familiar with this purchase available?

[DO NOT READ. ADDITIONAL INFORMATION AS NEEDED]

[Measure1\_Type] at [Measure1\_SiteAddress1], [Measure1\_SiteAddress2] , [Measure1\_SiteAddress3] , [Measure1\_SiteAddress4] , [Measure1\_SiteAddress5]

[Measure2\_Type] at [Measure2\_SiteAddress1], [Measure2\_SiteAddress2] , [Measure2\_SiteAddress3] , [Measure2\_SiteAddress4] , [Measure2\_SiteAddress5]

[Measure3\_Type] at [Measure3\_SiteAddress1], [Measure3\_SiteAddress2] , [Measure3\_SiteAddress3] , [Measure3\_SiteAddress4] , [Measure3\_SiteAddress5]

Business name: [ContactName\_string] IF INCORRECT BUSINESS NAME, ASK IF FAMILIAR WITH ADDRESSES, IF YES CONTINUE – IF NO TERMINATE – NOT FAMILIAR WITH ADDRESSES

[AGREES TO PARTICIPATE]	1	S1
[DOES NOT AGREE TO PARTICIPATE]	2	Thank & Terminate
[DOES NOT KNOW WHO MADE PURCHASE]	3	S1.1

S1.1. Do you own or lease your business space?

Own	1	Thank & Terminate
Rent/lease	2	S1.2
Don't know/Refused	2	Thank & Terminate

S1.2. Do you have a name and phone number for your property manager you can share with me for HVAC installation purchase decisions?

Yes - Record Name and Contact Info	1	Call and go back to Intro
No	2	Thank & Terminate
Don't know	98	
Refused	99	

[REPEAT IF NEEDED] All survey information collected including the results to this survey will be treated confidentially and reported in aggregate form.

I'd like to assure you that I'm not selling anything and the information you provide is treated confidentially.

[IF ASKED] If you would like to verify the legitimacy of this research our CPUC manager is Lola Odunlami at (415) 703-1893. If you have questions about this or the follow up survey you can reach our study manager by calling Jason Meyer at (707) 266-8332

### Screener questions

S1. Are you familiar with the company's decision to install [MeasureGroup\_string] sometime around [Month] in [Year]?

Yes	1	G1
No	2	S2
Don't know	98	
Refused	99	

S2. Who do you suggest I speak with that would be familiar with this purchase decision?

Record Name and Contact Info		S3
No	2	Terminate
Don't know	98	
Refused	99	

S3. Is this person an HVAC contractor?

Yes	1	Terminate
No	2	Continue
Don't know	98	

Thank you for your time.

### General buyer information

I have a few general questions about your company's purchase decisions for newly installed HVAC equipment.

[DO NOT READ: The intent of G1 is to confirm purchase of program equipment]

**INSTRUCTIONS TO PMR: START LOOPING HERE**



G1. Our records show that around [Month] of [Year], your company installed [Measure1\_Type] that was/were installed at sites, such as [Measure1\_SiteAddress1], [Measure1\_SiteAddress2] , [Measure1\_SiteAddress3] , [Measure1\_SiteAddress4] , [Measure1\_SiteAddress5] .

. Does that sound correct?

Yes	1	G3
No, the equipment type is wrong	2	G2.1
No, the site addresses are wrong	3	G2.2
No, both the equipment type and site addresses are wrong	4	G2.1 then G2.2  Next Loop or F1
No equipment was installed at these sites	5	
Don't know	98	
Refused	99	

G2.1 Can you describe the correct equipment type that was installed at these sites?

[Measure1_TypeUpdate]		If G2=4 go to G2.2 otherwise G3
[Measure2_TypeUpdate]		
[Measure3_TypeUpdate]		
Verbatim		
No	2	
Don't know	98	
Refused	99	

G2.2 Can you describe the correct addresses where this equipment type was installed?

[Measure1_SiteAddress1]		G3
[Measure1_SiteAddress2]		
[Measure1_SiteAddress3]		
[Measure1_SiteAddress4]		
[Measure1_SiteAddress5]		
Verbatim		
No	2	
Don't know	98	
Refused	99	

G3. When you purchased the [MeasureGroup\_string], what factors influenced your equipment choice?*[DO NOT READ LIST. MARK ALL THAT APPLY]*

Energy savings/ROI	1	IF THEY NAME MORE THAN ONE REASON,
Lifecycle cost	2	
Equipment price	3	

Organization goals/requirements	4	GO TO G4,OTHERWISE SKIP TO ST1
Physical size/space limitations	5	
Reach code/LEED design	6	
Incentives/promotions	7	
Brand name/reputation	8	
Reliability	9	
Other reasons (describe)	50	
Don't Know	98	
Refused	99	

G4. You cited multiple factors which influenced your decision to purchase this equipment. These included [response to G2]. Which of these reasons would be your most important?

Verbatim		Go to ST1
Don't know	98	
Refused	99	

For these next set of questions, I would like you to think specifically about the [Measure1\_Type] that was/were installed at around [Month] of [Year].

### Influence of stock

ST1. Were all these [Measure1\_Type] replacing existing equipment at the sites we just mentioned?

Yes	1	ST2
At some of these sites	2	ST1.1
No	3	ST4
Don't know	98	ST4
Refused	99	ST4

ST1.1. Which specific sites from those we just mentioned had at least one existing equipment replaced with these [Measure1\_Type] **[READ and MARK ALL THAT APPLY]**

[Measure1_SiteAddress1]	1	ST2
[Measure1_SiteAddress2]	2	
[Measure1_SiteAddress3]	3	
[Measure1_SiteAddress4]	4	
[Measure1_SiteAddress5]	5	
Don't know	98	ST3

Refused	99	ST3
---------	----	-----

ST2. Why did you have your existing equipment replaced at these sites? [DONT READ RESPONSES BUT ALLOW MULTIPLE REASONS]

It was not functioning at all	1	ST4
It was still functioning but with significant performance or maintenance problems	2	ST3
It was too expensive to operate/Not energy efficient	3	
Our HVAC contractor/plumber recommended it	4	
We were doing a major renovation in our house	5	
Older unit was undersized	6	
Older unit was oversized	7	
Other RECORD RESPONSE	50	
Don't know	98	
Refused	99	

ST3. How quickly did you need to replace your existing equipment? (How many days did you wait?)

Record # of days		ST4
Don't know	98	
Refused	99	

ST4. Where did you look for information before buying these [Measure1\_Type] (PROBE: this includes internet research, going to more than one vendor, or calling multiple vendors)

Record Verbatim		ST5
Don't know	98	
Refused	99	

ST5. If the model and size of [Measure1\_Type] you purchased was not available from your preferred HVAC vendor, would you have ....[READ ALL ANSWER OPTIONS]

Waited until the unit was in-stock	1	U1
Selected the next best available alternative	2	ST6
Contacted an alternate vendor to get the same equipment you wanted	3	U1
[Something else (record)]	50	

[Don't know ]	98		
[Refused]	99		

ST6. You indicated you would have selected the next best alternative that was available. Thinking back, would that unit have been....[READ ALL ANSWER OPTIONS]

The same efficiency as what you purchased	1	U1
Standard efficiency on the market at the time	2	
Between standard efficiency and what you purchased	3	
Don't know	98	
Refused	99	

### Influence of upselling

For these next couple questions, I would like to know more about your interaction with the HVAC vendor when you purchased the [Measure1\_Type] for sites, such as [Measure1\_SiteAddress1], [Measure1\_SiteAddress2] , [Measure1\_SiteAddress3] , [Measure1\_SiteAddress4] , [Measure1\_SiteAddress5] .

U1. Did the vendor discuss multiple models of [Measure1\_Type] to choose from at these sites?

Yes	1	U2
At some of these sites	2	U1.1
No	3	U3
Don't know	98	U3
Refused	99	U3

U1.1. Which specific sites from those we just mentioned did the vendor discuss multiple models of [Measure1\_Type] ?**[READ and MARK ALL THAT APPLY]**

[Measure1_SiteAddress1]	1	UT2
[Measure1_SiteAddress2]	2	
[Measure1_SiteAddress3]	3	
[Measure1_SiteAddress4]	4	
[Measure1_SiteAddress5]	5	
Don't know	98	U3
Refused	99	U3

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U2. How many models did the vendor discuss with you for these sites?

Record #		U3
Don't know	98	
Refused	99	

U3. Did the vendor recommend the equipment you eventually purchased?

Yes	1	U4
No	2	
Don't know	98	
Refused	99	

U4. On a scale of 1 to 10 where 1 is "not at all influential" and 10 is "extremely influential", how influential was the information that you received from the HVAC vendor for the [Measure1\_Type] you purchased?

Record Level of Influence (1-10)		U5
Don't know	98	
Refused	99	

U5. How did the HVAC vendor influence your purchase decision?

Record Verbatim		P1
Don't know	98	
Refused	99	

**Influence of price**

P1. Do you remember approximately how much typical [Measure1\_Type] we have been discussing cost at these sites?

Yes	1	P2
No	3	P3
Don't know	98	P3
Refused	99	P3

P2. Approximately how much did it cost?

Record cost (\$)		P3
Don't know	98	
Refused	99	

P3. Would you have been willing to spend more for the exact same [Measure1\_Type] you purchased?

		If P2= \$Value, go to P4, otherwise got to P5
Yes	1	E1
No	2	
Don't know	98	
Refused	99	

P4. In terms of dollars, how much more would you be willing to pay?

Record \$ amount		E1
Don't know	98	P5
Refused	99	

P5. In percentage terms, how much more would you be willing to pay?

__%		E1
Don't know	98	
Refused	99	

## Influence of efficiency

E1. The [Measure1\_Type] you purchased at these sites were more efficient than what is required by building code. Had you considered purchasing a less efficient unit at any of these sites?

Yes	1	E2
At some of these sites	2	E1.1
No	3	F1
Don't know	98	F1
Refused	99	F1

E1.1. Which of these sites that we've been discussing had you considered purchasing a less efficient [Measure1\_Type]? **[READ and MARK ALL THAT APPLY]**

[Measure1_SiteAddress1]	1	E2
[Measure1_SiteAddress2]	2	
[Measure1_SiteAddress3]	3	
[Measure1_SiteAddress4]	4	
[Measure1_SiteAddress5]	5	

Don't know	98
Refused	99

E2. What was the minimum efficiency you considered purchasing at these sites?

The same efficiency as what you purchased	1	F1
Standard efficiency on the market at time	2	
Between standard efficiency and what you purchased	3	
[Don't know]	98	
[Refused]	99	

*(If [Measure2\_SiteCount] or [Measure3\_SiteCount] is greater than 0, loop for that Measure)*

## Firmographic Information

Thank you for your patience. We're almost finished. These final questions are about your company.

F1. Does your company have more than one location?

Yes	1	F2
No	2	F3
Don't know	98	
Refused	99	

F2. Do you work out of the main office or is this a satellite or local branch?

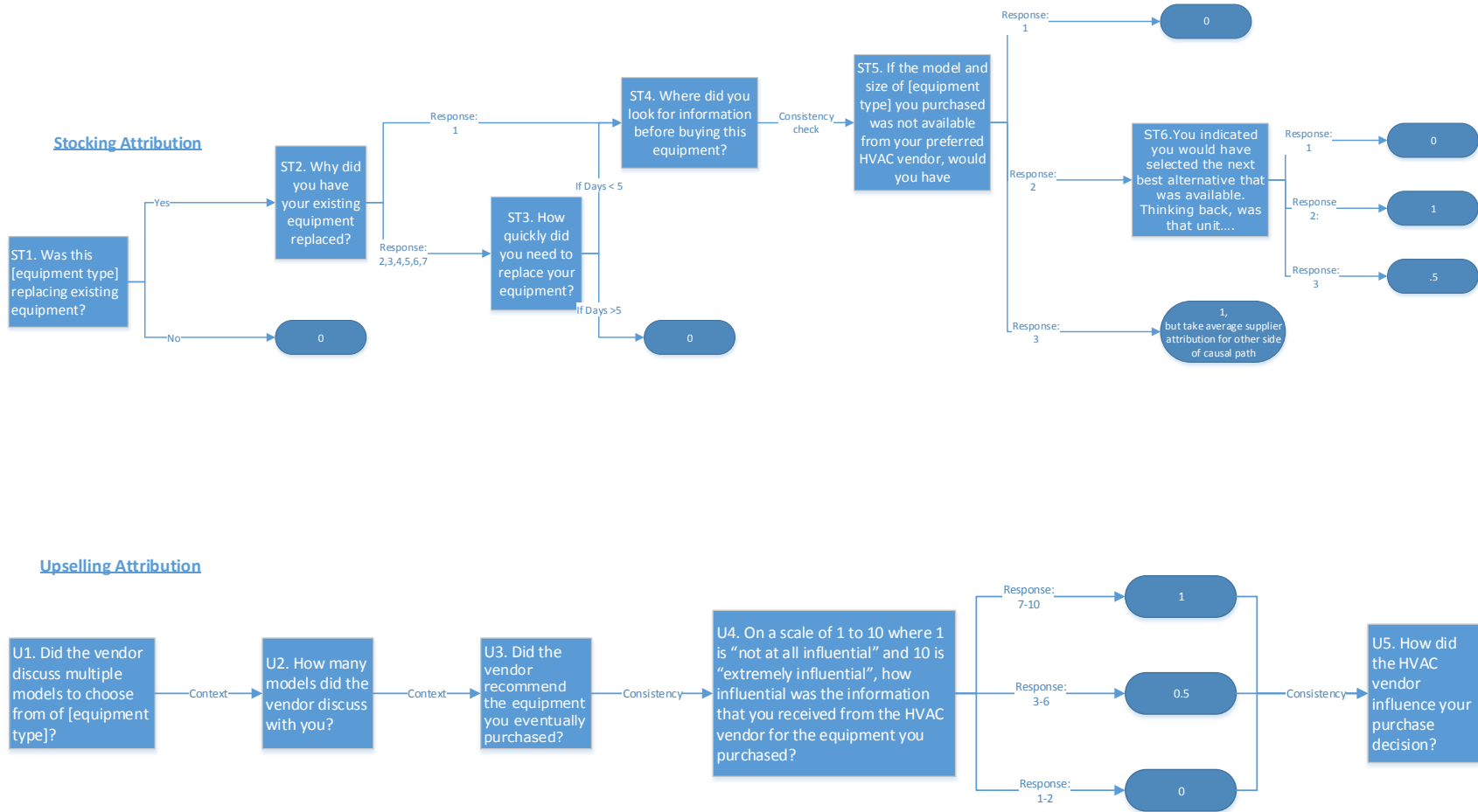
Main office	1	F3
Satellite	2	
Local branch	3	
Don't know	98	
Refused	99	

F3. About how many full time employees work at this location? [IF THEIR COMPANY HAS MORE THAN ONE LOCATION, ADDITIONALLY ASK ABOUT HOW MANY EMPLOYEES AT ALL LOCATIONS]

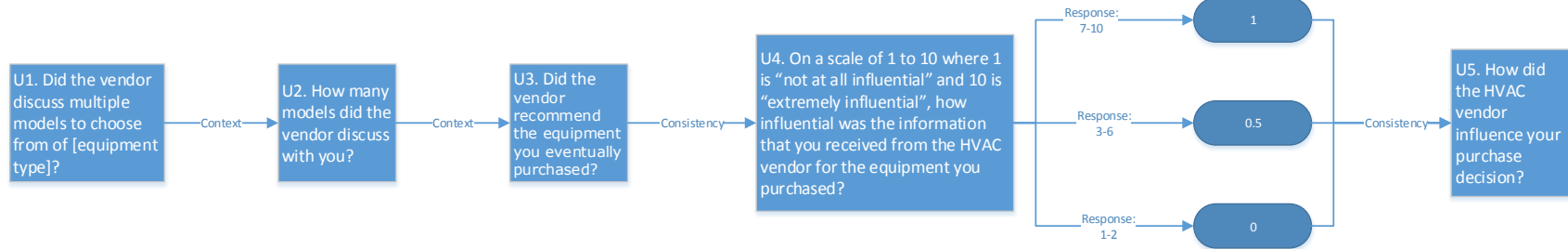
Record Employee #		End
Don't know	98	
Refused	99	

End. This concludes all the questions I have for you today. Unless you have any questions for me, the survey is complete. Thank you for your time.

## APPENDIX D. Detailed buyer causal pathway scoring

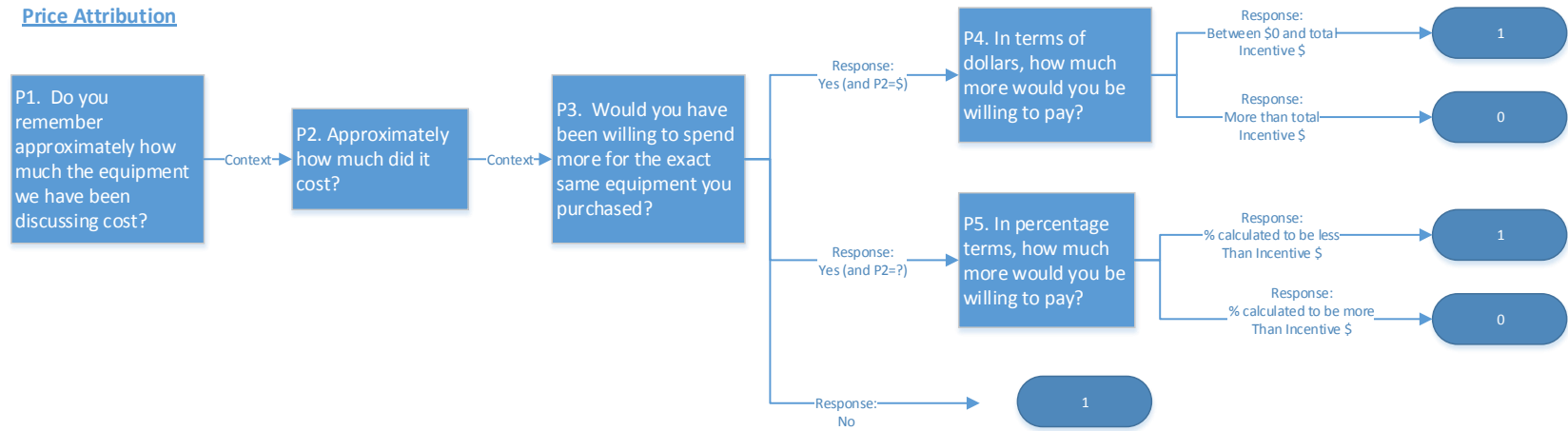


### Upselling Attribution

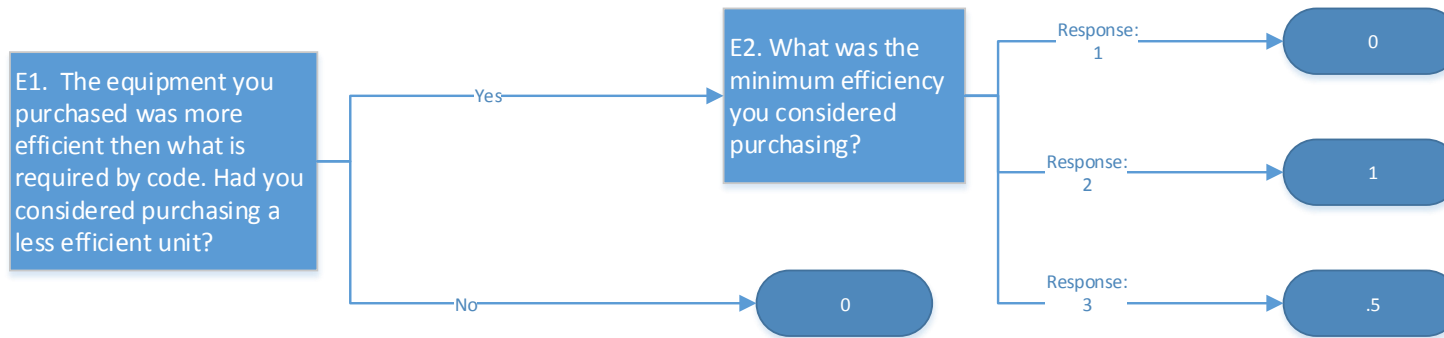




Price Attribution



Efficiency Attribution





## **ABOUT DNV GL**

Driven by our purpose of safeguarding life, property and the environment, DNV GL enables organizations to advance the safety and sustainability of their business. We provide classification and technical assurance along with software and independent expert advisory services to the maritime, oil and gas, and energy industries. We also provide certification services to customers across a wide range of industries. Operating in more than 100 countries, our 16,000 professionals are dedicated to helping our customers make the world safer, smarter and greener.

Comment	Page	Commenter	Comment	DNV GL Response
1	3	Alex MacCurdy	Are there EM&V Policy studies that validate this new "approach" and methodology? Was there a justification for change? The PIP and Program Policy directs Program Impacts at distributors-to stock and upsell. Buyers (especially customers) have no contact with the Program or with distributors).	<p>The CPUC EM&amp;V Research Roadmap indicated that they wanted a more sophisticated NTG approach compared to the previous one used. There are standard NTG methodologies use for large commercial and residential downstream rebate programs, but the HVAC1 upstream program was not a standard program. DNV GL created a more sophisticated NTG methodology to respond to these needs, and received feedback and input from both the CPUC and IOU teams.</p> <p>We included a buyer component for this methodology to capture the total influence of the program on the market of high-efficiency HVAC purchases. There was a distributor-only approach applied in previous program cycle, and in that report, there were limitations on knowing what the true customer needs were and trusting participating distributors for scoring.</p> <p>Our methodology was designed to not only understand how upstream components of this program were influencing distributors, but also how the program was translating into downstream impacts. The overall intent of this program was focused on upstream stocking and upselling of distributors, but in the context of increase purchases of high efficiency units downstream. If the upstream program was highly influencing stocking and upselling behavior of distributors, but large numbers of buyers were already intending on buying these high efficiency units, we would want to capture that reality in our assessment. To this end, we chose to incorporate both distributor and buyer inputs into our NTG methodology.</p>
2	4	Alex MacCurdy	This statement suggests that upselling was occurring during the Program, but does not suggests that upselling was "already occurring" before the Program was in place or to what degree upselling was occurring.	We agree that this statement is meant to infer that upselling was occurring during the program, in the form of the distributor presenting one option to the buyer. Distributors are showing efficient models as the first model they show, which is a form of upselling. We will clarify the language in the report.
3	6	Alex MacCurdy	The stocking and sale of a unit takes time and distributor need to be able to count on the program being in place at the time the invoice is written in order to fully commit to stocking and upselling through the Program. Energy Solutions has heard from distributors that they are more willing to participate and change stocking practices if they know the incentives will be in place in the future. Participation levels as well as stocking %'s change quarter to quarter based on Program announcements, incentives, and the presence of future rebates. Recommendation: It is assumed that these interviews were conducted in 2016, during which the SCE Upstream Program was been suspended, and there has been greater uncertainty with all the Upstream Programs. The Program is evaluating the 2013-2014 Program which had much greater stability. Therefore, these distributors concerns are likely negatively influencing the impacts of the 2013-2014 evaluation. These factors do not seem to be considered in the current evaluation, but as pointed out by this study, the distributors recollections are influential. The team should consider these factors in the final calculation.	<p>Uncertainty around the program is something that we wanted to capture in our methodology if it was influencing stocking and sales decisions.</p> <p>In relation to time frame, DNV GL decided to focus on a reliability of responses approach instead of an exact timeframe approach. The distributor interviewers did set the stage of the interview by discussing that this was an evaluation of the 2013-2014 program. Our approach was focused on "now vs. then" instead of "then vs. before then." The participating distributors knew about the program we were discussing, and we wanted them to think about "now vs. then" to provide the most accurate answers of the programs influence across their current sales and stocking practices.</p> <p>There are limitations to this approach in regards to bias and uncertainty that the commenter identifies, but there is also bias of remembering sales and stocking patterns in 2013 or earlier. We therefore decided to ask questions where reliability would be priority over time frame. Our approach was reviewed and approved by the CPUC and IOUs, and we will use this feedback to improve future evaluations.</p>
4	9	Alex MacCurdy	Disagreement with Statement: The ex ante savings estimates use a scaling of DEER based on the difference in the equipment IPLV and code IPLV. The ex post savings estimates do not use any scaling and appear only to rely on DEER savings values for chillers.	Clarification made to the report. DEER estimates apply performance curves and the IPLV using those curves was consistent with the units found in the onsite sample.
5	9	Alex MacCurdy	Disagreement with Statement: It is not known what is feasible because the study did not look at the energy usage on actual installed equipment. The energy savings may be unlikely because of the comparison to DEER prototypes, but DEER is an estimate and does not indicate actual energy usage for a site.	The statement is purely referencing the ex ante values and the scale-up approach. The recommendation in the gross savings report was to check these issues when scaling from DEER values. To support the high savings would require efficiencies not available or much higher building use on average for the program (on the order or two to three times higher). An effort to find evidence that the actual buildings have higher EUIs than the DEER prototypes was not within the scope of the evaluation, but will be considered as future research recommendations toward the gross evaluation.

6	11	Alex MacCurdy	The HVAC1 Evaluation was based on DEER2016, which has since been updated. DEER2017 was recently released, which lower IEER requirements associated with EER values. The same building simulations and savings impacts are used in both DEER2016 and DEER2017, the only change is DEER2017 has lower IEERs. This update was performed after PG&E provided data that helped show that the DEER 2016 evaluation was inflating IEER requirements because of the limited data set used to create the IEER tiers.	This recommendation will be used toward the gross evaluation. The NTG report simply applies the NTG estimate to the published gross savings. The report tries to clarify and define that the net attribution does not get into the gross baseline and measure case efficiencies, it focuses on program influence to get the claimed units installed.
7	14	Alex MacCurdy	It is unclear who at the distributors was contacted? Was it the sales engineer listed on the application? The financial contact? Or the Sales Manager? This will have a large impact on the evaluation. Historical evaluations have shown that many times evaluators have contacted people that do not understand the entire upselling and stocking practices of the business or weren't part of the sale.	As part of our interview screening process, we had experienced interviewers confirm that the respondent was not only familiar with the program, but could also speak about the various stocking and upselling practices at the company.
8	14	Alex MacCurdy	It is unclear how the stocking and upselling was calculated for different types of units. These units vary greatly in how they are sold, if they are stocked, etc... and there is not enough information provided to determine how these positively or negatively affected the NTGR.	The same NTG methodology was used to calculate a score for three types of units: unitary ACs, chillers, and VRFs. The program theory is the same for each unit type, so NTG was assessed in the same manner. We did ask distributors NTG questions about separate unit types and sizes. However, we did not have enough sample from each of these bins to report on these unit types individually.
9	15	Alex MacCurdy	What % of those surveyed responded to this question? What is the sample size and how did it change across different categories?	A total of 13 of the 19 distributors who took our survey responded to this question. Of those 13 who responded, 12 did not describe changes across different categories and one gave different percentage amounts for different categories. Of the eight distributors used for the final NTG calculation, six responded to this question.
10	16	Alex MacCurdy	How does this account for the interaction of the contractor? The distributor and buyer usually do not have any contact. The contractor buys the equipment from the distributor and the customer buys the equipment from the contractor. This survey does not make it clear who the buyer is that was contacted. Although the survey questions ask to speak to someone involved with the unit, it does not mean they know the details of the transaction.	<p>DNV GL used the tracking data available to contact who was listed as the end-user/buyer for the high-efficiency sale. Screener questions S1 through S3 for the buyer survey were specifically designed to identify if the HVAC contractor would be the best person to speak with about the purchase decision. None of the buyers we contacted indicated that this was the case. We acknowledge that several buyers had interactions with contractors during the purchasing decision. However, our studies of HVAC markets have also shown that many distributors also do installations for commercial sites, and so in these cases, the distributor and contractors are one and the same.</p> <p>Additionally, we would have could have interviewed more contractors if we had better tracking data that records the contractor contact info. We contacted the buyers who we had information for. It should also be noted that the motivation of the end-use buyer is what we are trying to quantify. It is the buyer who eventually decides to purchase high-efficiency equipment or not, and the better the contact data, the better we can evaluate all the influences on that decision. As it was, we did not know whose name was in the "buyer" field, and did the best we could to screen them or have them provide their contractor's information if the purchase decision relied heavily with them.</p> <p>Recommendation: We have added language to our fifth recommendation that urges program administrators to have better data quality tracking to better characterize the market. Their application form should have distributor, contractor, and buyer information, and who was present at the time of purchase.</p>

11	16	Alex MacCurdy	<p>Disagreement with calculation and Recommendation: This question is not the only indication of the influence of stocking. Stocking practices help reduce the barrier for installing a high efficiency unit during an emergency replacement, but it also motivates distributors to sell high efficiency units. Distributors sell what they have in stock, its not just quicker, its more efficient, less paperwork is involved and the whole reason that they are stocking it to begin with. Without improved stocking percent, it would be less likely that the buyer would have been given options for buying high efficiency units, regardless of whether the replacement was planned or not. The study indicates that less than 30% of buyers indicated that distributors discussed more than on HVAC option with them. Since all buyers bought energy efficient models it is assumed that they were only shown an energy efficient model. The % of time buyers were given one high efficiency option to purchase seems like a much better indication of both the stocking and upselling attribution on the buyer than what % were emergency replacements or whether or not the distributor telling you about the unit had an influence. We recommend using this factor (&gt;70%) or a combination of the factors to calculate the buyer attribution for both stocking and upselling. No data is provided to back up the use of five days as the number being used to calculate if the purchase was an emergency replacement.</p>	<p>It is our opinion that increasing the upselling causal pathway based on the stocking would be double counting the stocking effect. The stocking effect on recommendations is "baked in" to the change in upselling due to the program. We considered several options for our NTG methodology, and our approach was reviewed and approved by the CPUC and IOUs. We will use this feedback to improve future evaluations.</p>
12	17	Alex MacCurdy	<p>Disagreement with approach: This survey assumes that the customer is aware of all equipment options, efficiencies, and prices available and is making an informed decision. Most buyers are not aware of what the baseline efficiency is, what qualifies for the program, and definitely does not know their tiers for the program. This questions appears biased, and is not a good indicator of the program influence, even for a consistency check.</p>	<p>These HVAC equipment purchases represent a significant investment where it would be worth the buyer's time to make an informed decision. C&amp;I purchasers generally have more technical knowledge than residential purchasers. While it is likely that there are different levels of knowledge and sophistication in the buyer population, there is not enough evidence to assume that most buyers are ignorant of technical EE considerations.</p> <p>Furthermore, our approach only asked people about different efficiencies if they indicated they were considering less energy efficient units. If they did not consider them, then the more detailed questions were not asked. Therefore, bias is further addressed through the survey logic that only asks buyers who had considered other efficiencies the more detailed questions.</p>
13	21	Alex MacCurdy	<p>Recommendation: These strata are not evenly distributed since there were multiple distributor receiving &gt;\$2 M in incentives. The actual NTG calculation only includes 8 distributors from 1 strata (page 24) that represent 42% of kWh saving. This indicates that these 8 distributors are all in the &gt;\$200k strata. A better weighting needs to be implemented to differentiate between distributors receiving Millions of dollars vs those only receiving hundreds of thousands. Larger distributors are able to more fully invest in program stocking and upselling practices and therefore we would expect different attribution factors for larger distributors compared to medium sized distributors that may only participate in certain measures and cannot fully commit to the program objectives of stocking and upselling.</p>	<p>It is true that distributors receiving millions of dollars in incentives and those receiving hundreds of thousands in incentives were placed in the same "Large" strata. The original cut points for these strata were based on the breakout of the 60 distributors who were part of the population frame, and the natural breaks in size distribution the team observed. However, although the case weights are equal, the final weight for each distributor is different within the strata. This is because the results are savings weighted by distributor and buyer. Therefore, the weighting does account for these different-sized distributors even though they were placed in the same strata.</p>
14	24	Alex MacCurdy	<p>Recommendation: As mentioned before, the strata do not seem to accurately represent the range in the market since most kWh is from distributors &gt;\$200k and there are multiple distributors receiving &gt;\$2 M in incentives. The document uses these strata to weight responses and assigns equal weights to distributors that could be as small as \$200k in incentives or those as large as &gt;\$3 M in incentives. It is recommended to create different strata to more accurately capture the variety in distributors participating in the Program.</p>	<p>Please see response to Comment 13.</p>

15	26	James Hanna	This question and the 5 days or less omits the condition that stocking significantly influence other sales including 'normal replacement' (as defined by Policy: "Some program administrators include NR as a subset in the ROB category"). Also, can the consultant source how the 5 days or less was determined and how it relates to actual timeframe for ROB/NR distributor/buyer transactions in the market place.	We chose five days based on the expert opinion of our engineering staff, who said a five-day wait (or more) for an HVAC replacement should not be considered an emergency replacement. Only about 3% of buyers said they waited slightly over five days. All other respondents that answered this question indicated that they could have waited weeks, sometimes months, before they purchased the new equipment. There's no direct causal linkage between stocking and projects that could wait and we wanted to capture that reality in our methodology.
16	26	Alex MacCurdy	Incorrect Language: Distributors did not "indicate that about 35% of their high efficiency HVAC stocking practices were due to the program." Instead the results from the distributor surveys were used to calculate that 35% of the distributor HVAC practices were due to the Program. This is an important distinction. The evaluators should not claim the distributors said something they did not.	We agree that language should be tightened up. This sentence will read: "the results from the distributor surveys were used to estimate that 35% of the distributor HVAC practices were due to the Program."
17	27	Alex MacCurdy	Incorrect Language: This is not phrased correctly. 26% of distributors did not indicate that their upselling practices were due to the program. Instead, the evaluation calculated that 26% of upselling practices among distributors interviewed were due to the Program. Again this is an important distinction. The current statement seems to imply that 74% or 3 in 4 distributors did not change upselling practices because of the program.	We agree that language should be tightened up. This sentence will read: "the evaluation used the interview responses of the distributors to estimate that 26% of upselling practices were due to the Program."
18	27	Alex MacCurdy	The survey assigns 100% attribution for this question as long as the buyer indicated that the additional money they would have paid is less than the incentive amount. Incentives are often in the hundreds or thousands of dollars per equipment. Therefore, asking a more granular questions of whether or not they would spend \$0.01, \$1, or even \$100 more does not appear that it would affect this attribution factor at all.	We agree that asking whether a buyer would have paid a penny more for their unit would probably not produce measurable results. However, by not asking more specific questions, we got survey responses that seemed overly extreme. Therefore, when we consider future changes to this methodology, we plan on asking questions about appropriate spending increments in relation to the incentive level for the unit type and size.
19	27	Alex MacCurdy	This statement implies that evaluators decided to change the methodology for this pathways because they couldn't "adjust the buyer scoring methodology with the information we had collected" (Since the buyer attribution was 98%, this means the team could not lower the buyer attribution for pricing). As stated above, asking a more granular question would not likely change the results of the price attribution. Therefore, changing the distributor pricing attribution does not seem justified.	We respectfully disagree with this commenter's statement. If the buyer question was asked in the proper increment (tens, hundreds or thousands of dollars), there would have been a measurable threshold in which the buyer would not have purchased the equipment. Since the survey questions were not designed to address this, a more accurate way to measure price attribution was the percent of the incentive that was being passed through to the buyer. This was an explicit indicator of how much the price was being influenced by the program, which was one of the causal pathways we wanted to explore.
20	31	James Hanna	Energy Solutions experience with distributors indicate that distributor stocking decisions are based on the program and if there is not stability in the program, participation as well as stocking and upselling decisions are affected. If a distributor may or may not receive an incentive for selling a high efficiency unit in the future, then they will not stock as much high efficiency equipment. If they are not stocking as much high efficiency less high efficiency equipment will be sold.	We set up our NTG methodology to capture the program impacts on distributor stocking, upselling, and pricing. If this lack of consistency influenced distributor behavior across these three causal pathways, we captured that in our NTG methodology.
21	35	James Hanna	The Stocking and Upselling goals are implemented by the CEO, General Manager, or occasionally the Sales Manager. Other staff, such as sales engineers, implement upselling strategies, but are not be conversant with the extent of these practices. The identity and title of the person answerig questions needs to be known to ensure accuracy of these responses.	We're obligated to protect confidentiality of interviewees, so we cannot provide this information. However, part of our interview guide protocol included a battery of questions to identify key decision makers.
22	39	James Hanna	The program has 5 size categories for unitary AC equipment. Tier 1 efficiency is different for each of the 5 size categories. Tier efficiencies are not defined in this document.	Due to the length of the survey and time constraints for how long we estimated distributors would be willing to speak on the phone with our interviewers, we were not able to ask about different tiered efficiency levels for each size category. Our survey instrument combined high-efficiency units by defining them as Tier 1 or above. Interviewers had a program rebate sheet with tier levels and efficiencies so that they could clarify what these tier levels meant for each unit type and size if asked by distributors.

23	40	James Hanna	<p>Per a comment made in the 11/28 workshop: "We tried to get them to agree to one reply". This question has 10 possible answers. Multiple answers are possible and still proves 'program influence'. All real work transactions include multiple factors, and therefore getting them to agree does not capture the complete answer, and leads to bias by directing respondents to one reply.</p>	<p>Upon further review of the distributor survey responses, it is evident that the interviewers did not direct the respondents to choose only one answer. A total of 11 of the 19 distributors gave more than one answer to this question, and they were not pressed to narrow down their selection. We used this framing question to help distributors think about the possible influences on their sales of high-efficiency equipment before they answered NTG questions. This question was not used for any NTG calculations. We regret any confusion we may have caused during the workshop on 11/28/16.</p>
24	40	Alex MacCurdy	<p>In general the stocking questions appear to be very simplified. Many of these questions cannot be answered with a yes or no. The answers are dependent on numerous variables including: equipment size and type, economy, project type (some of which calls for custom orders) consistency of IOU incentive programs, end use, bonds, legislation, etc. Upselling is the goal when units are not stock, especially for custom orders, orders at certain times of year, orders for large quantities, unique installations and larger size units. The absence of stocking doesn't mean not mean that there is no Program Influence. Some distributors only sell custom units and do not stock equipment.</p>	<p>We appreciate the feedback on the survey questions. The stocking questions were asked by equipment type and size for distributors. We also agree that the lack of stocking does not mean there is no program influence. That is why the causal pathway analysis explored three different areas that the program intended to influence. If one of the causal pathways showed zero influence (or lack of relevance, such as a distributor that did not stock), there were two other pathways that would still allow the distributor to demonstrate program influence, and even rate 100% attribution if one of the pathways indicated as such.</p> <p>Again, we considered several options for our NTG methodology, and our approach was reviewed and approved by the CPUC and IOUs. We will use this feedback to improve future evaluations.</p>
25	42	James Hanna	<p>High Efficiency doesn't appear to be defined in the survey. Stocking is highly dependent on size, transaction type (e.g. design bid, design spec, design build, direct to customer/contractor, contractor pick up, drop ship, etc., market sector, and end use customer. The Program has 5 size categories and equipment stocking varies by these size categories. This question is broad to capture program influence.</p>	<p>Please see response to Comment 22.</p>
26	42	Alex MacCurdy	<p>This question does not provide a time frame for distributors. The evaluation is for a 2013-2014 Program. The SCE Upstream HVAC Program was suspended in 2016 and there has been an increase in uncertainty for future incentives in 2015 and 2016 Programs. Depending on the timeframe these surveys were conducted, they are likely showing lower results because of the recent Program uncertainty.</p>	<p>Please see response to Comment 3.</p>
27	46	Alex MacCurdy	<p>The Program's goal is supposed to create market transformation. If the program ran out of funds, then distributors would still have high efficiency stock that they specifically upsold for the program. They would also be influenced by the program because of the market transformation effects of the program.</p>	<p>Market effects happen outside of the program, such as the program influencing non-participating distributors to sell these units without rebates, or participating distributors selling these units without rebates. While we did not interview non-participants, we did ask participating distributors what percentage of their sales do not receive rebates. Most answered that the sales that did not receive rebates were non-qualified equipment or sales outside the IOU's territory. Such sales may or may not have happened without the program. However, further research and analysis would be needed for us to make a reasonable conclusion, and this was outside the scope and budget of the original NTG evaluation.</p> <p>Regarding market transformation, our methodology captures calculating the stocking and upselling effects on customers. We are getting an effective attribution score on distributor sales. Therefore, we are capturing the attributable market transformations through sales from participating distributors in our NTGR.</p> <p>Finally, it was understanding that there was a portfolio-level study of spillover effects being done by another consultant team for the entire CA portfolio. If not, we would encourage the CPUC to pursue a full market effects study.</p>

28	C-5	Alex MacCurdy	<p>The NTG calculation was influenced by this questions, which assumes an influence in stocking if the replacement window was under 5 days. If the buyer could wait more than 5 days no buyer stocking influence was credited. There is no explanation on why a 5 days timeline was used instead of 4 days, 6 days, or any other time frame. Depending on the size of the job, specifications, and time of year, equipment not in stock can take much longer than 5 days to be ordered, arrive at site, and be installed. This question only works to identify replace on burnout jobs and does not determine the influence of stocking on sales. The question ignores all stocking attribution for normal replacement jobs. The document states that "less than 30% of buyers indicated that distributors discussed more than one HVAC option with them." Equipment stocking influences options presented to customers and is a is more accurate indication of the influences of stocking than whether or not the unit was an ROB job. Additionally, this question which was asked in 2016 was asked about a timeframe (within a day) about equipment sold in 2013 and 2014. Setting the required time frame within a day instead of a week or larger factor does not account errors in information that could have occurred.</p>	Please see response to Comment 15.
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