The Great Migration: Moving Energy Efficiency Programs to Midstream

Rohit Vaidya, NMR Group, Inc., Somerville, MA
Ann Clarke, National Grid
James Fay, Commonwealth Edison
Jenna Bagnall-Reilly, NMR Group, Somerville, MA
Jared Powell, NMR Group, Somerville, MA
Sam Manning, NMR Group, Somerville, MA

ABSTRACT

Drawn by the prospect of increased adoption, higher savings, and more cost-efficient implementation, program administrators are seeking to gauge the potential for moving traditional, downstream energy efficiency programs to a midstream delivery model. Research conducted by NMR Group (NMR) assessed the potential opportunity for National Grid New York to move its downstream natural gas heating and water heating program to a midstream model. Drawing on primary research surveys of distributors and contractors, this study examined high efficiency equipment market shares and stocking practices and assessed the role and influence of the program and key market actors on contractors' and customers' decisions to purchase high efficiency equipment. As part of a study to characterize the HVAC market for Commonwealth Edison, NMR also recently conducted a secondary literature review of midstream programs nationwide to identify programs with upstream components, understand the benefits and challenges of moving HVAC programs upstream, and describe the lessons learned from implementing upstream programs or shifting to an upstream program design.

The National Grid study revealed that a midstream intervention would cast a broader net over the market by influencing supply house stocking practices and leveraging the relationships between supply houses and contractors to better promote the installation of high efficiency equipment. It also found that supply houses have strong and influential relationships with installers and contractors. Both studies resulted in the identification of opportunities, challenges, and program design considerations important to informing plans for migrating energy efficiency programs further upstream.

Background and Introduction

Historically, residential HVAC energy efficiency programs have typically focused on a downstream model whereby program administrators offered incentives to end use customers to reduce the cost to purchase and install high efficiency equipment. The downstream model often utilizes contractors as a key marketing channel. Adhering to this program delivery model, National Grid's current High Efficiency Heating Equipment (HEHE) program is implemented through a downstream intervention that offers incentives to customers to offset the incremental cost for purchase and installation of high efficiency heating and water heating equipment, with the goal of reducing overall energy consumption. National Grid sought to determine if its current downstream program was capturing all available savings opportunities in the upstate New York market or if savings were being left on the table. National Grid further sought to assess the market opportunity and dynamics of the supply chain. Specifically, it wished to determine how different market actors influence the end use customers' purchase decision.

As part of an HVAC market characterization study for Commonwealth Edison, NMR conducted a literature review in late 2018 that included a review of 16 HVAC upstream / midstream programs in over a dozen states. All of these were programs that targeted market actors further upstream from the end user. Though some called themselves *upstream* programs, they could all be considered "midstream" programs, as they were primarily focused on distributors and contractors. This literature review resulted

in the identification of opportunities and challenges as well as program design considerations for program administrators planning a midstream intervention. These findings are discussed in the concluding section of this paper on the implications of these studies for midstream program designs.

National Grid Study Findings

Study Objectives and Methods

NMR conducted a multi-phase research effort for National Grid that investigated the natural gas heating and water heating market in upstate New York. To assess available savings opportunities and understand the influence of market actors on customer purchase decisions, the research effort included the following key objectives.

- Estimate shares of sales in upstate New York of standard and high efficiency natural gas boilers, furnaces, and water heaters, and estimate the shares that are residential versus commercial.
- For high efficiency equipment, estimate the shares of sales that are sold either inside or outside the HEHE program (i.e., received incentives or did not receive incentives).
- Understand supply house stocking practices for high efficiency natural gas heating and water heating equipment.
- Assess the role and influence of key market actors on customers' and contractors' decisions to purchase high efficiency equipment.

To achieve these objectives, NMR conducted telephone surveys in August and September of 2017 with two key groups of supply chain market actors:

1. Representatives of supply houses in upstate New York
2. Heating and water heating contractors in upstate New York

The supply house telephone survey collected information on sales of residential and commercial natural gas heating and water heating equipment, practices regarding marketing and stocking of high efficiency equipment, interactions with contractors and customers, and experience with the existing downstream HEHE program. National Grid provided the sample frame for the supply house survey, which consisted of 60 supply houses representing the upstate New York region. The survey response rate (38%) surpassed expectations, resulting in the completion of 23 interviews, exceeding the target sample size of 20 interviews.

The contractor survey was originally fielded as a web-based survey, but was transitioned to a telephone survey to facilitate achieving the target number of completed interviews. The survey collected information on installations of residential and commercial natural gas heating and water heating equipment, as well as contractors' experience with the HEHE program. The contractor sample frame was developed from National Grid's HEHE program data and represented the same upstate New York regions as the suppy house survey. The overall survey response rate of 12% resulted in the completion of 43 contractor interviews, exceeding the target sample size of 30 interviews with this group. However, as noted earlier, this response rate was achieved only after switching to a telephone survey modality after a web-based survey approach experienced a poor response from the contractors.

Analytic Considerations

A key objective of this study was to estimate shares of sales of standard and high efficiency natural gas heating and water heating equipment and the shares that were residential versus commercial

equipment. The study also sought to estimate the shares of high efficiency equipment sales that were sold through the National Grid's existing downstream HEHE program. This information would help determine if the current downstream program was capturing all available savings opportunities from sales of high efficiency equipment or if some savings were being left on the table. If the data revealed that savings were being left on the table, that would be an indicator of an opportunity for a program intervention via a midstream market channel. The information about sales of high efficiency equipment would also be important for establishing a baseline against which to assess the impact of any future midstream intervention. Accordingly, this study collected information from both supply houses and contractors on sales and installations of residential and commercial natural gas heating and water heating equipment. After reviewing the results, NMR determined the supply house results provided more reliable estimates of natural gas heating and water heating sales in upstate New York. We arrived at this conclusion for the following reasons:

- Supply houses have a broader upstream perspective of the market.
- The supply house sample frame more completely represented the market than the contractor sample frame.
- The final sample of supply house respondents accounted for just over one-third (35%) of the sample frame; whereas, the final sample of contractor respondents only accounted for 10% of the sample frame.

Interestingly, this reasoning regarding the preferred analytic approach shares some similarities with the logic of a midstream intervention. The more upstream locus of supply houses would allow a midstream program intervention to take advantage of greater leverage and influence the market more broadly. A midstream program intervention would be able to more easily and efficiently work with a smaller set of supply houses to more completely address the market than a downstream program can through a larger set of contractors. Furthermore, the larger set of contractors that participate in a downstream program may not provide sufficient representation of all of the contractors operating in the market. Another study conducted by NMR in California found that up to one-quarter of HVAC technicians in the state may be unlicensed contractors and that the issue is not limited only to California but rather is rife nationwide. The California study also suggested that coupled with customer reluctance to pay, the presence of so many unlicensed technicians who do not pull building permits for HVAC installations and perform low-cost, sub-standard work likely places strong cost pressures on licensed contractors. All of this would only exacerbate the limitations of a downstream program's ability to achieve sufficient coverage of the market and implement a program design and incentive structure that effectively stimulates installations of high efficiency equipment. Findings from the California study were presented at the 2015 IEPEC and it is included in the references at the end of this paper.

Another key objective of the study for National Grid was to assess the role and influence of key market actors on customers' and contractors' decisions to purchase high efficiency equipment. To address this, we investigated three aspects of supply chain market actor actions and behaviors:

1. Influence of the HEHE program on stocking of high efficiency equipment
2. Influence of the supply house on the contractor's or customer's decision to purchase high efficiency equipment
3. Influence of the HEHE program on contractor's installation of high efficiency equipment

As part of this assessment of the role key market actors, it was important to develop an understanding of the factors influencing the supply chain market actor decision-making processes with regard to sales and installations of high efficiency equipment. Such an understanding would help National

Grid identify the point in the supply chain where and how a midstream program might best intervene to capture any untapped savings and have the most effective impact on the market.

Key Findings

Are savings being left on the table? To determine if National Grid's existing downstream HEHE program was leavings savings on the table, we analyzed the sales data collected from the survey of supply houses. As Figure 1 reveals, supply houses reported that sales of water heaters comprised nearly one-half (46%) of the total 2016 heating and water heating units sold in upstate New York, followed by furnaces (38%), and boilers (16%).

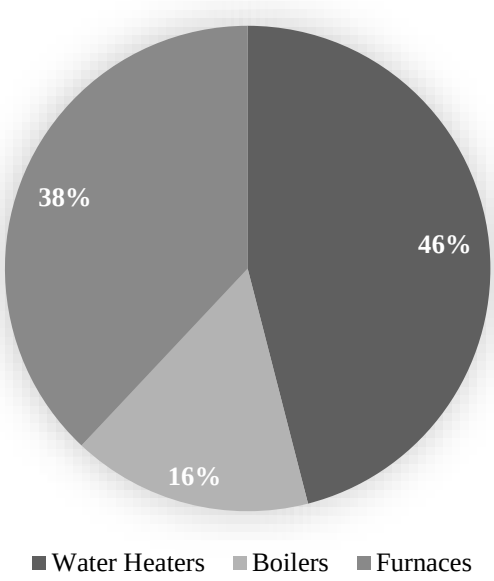

Figure 1: 2016 supply house sales of natural gas heating and water heating equipment in upstate New York (n=41,442 units)

Residential units represented the largest share of supply house sales. On average, 91% of sales of all three equipment types were sized for residential installations. Therefore, most of the opportunity for a midstream program intervention was determined to be in the residential sector. Further, these data indicated that high efficiency residential water heating equipment offered the most substantial opportunity for the HEHE program to reach untapped energy savings. That said, the sales data for residential furnaces and boilers also revealed some untapped opportunities. As Table 1 reveals, standard efficiency units represented, on average, about one-fifth (21%) of total furnace sales, and about two-fifths (41%) of total boiler sales. However, it is important to keep in mind that furnaces (38%) and especially boilers (16%) accounted for relatively smaller shares of the total sales of natural gas heating and water heating equipment.

Table 1: Efficiency level and HEHE program participation for 2016 supply house sales of heating and water heating equipment

Natural Gas Equipment Type	Boilers (22)	Furnaces (23)	Water Heaters (20)
Standard Efficiency	41%	21%	61%
High Efficiency	59%	79%	40%
Through HEHE Program	31%	37%	14%
Outside HEHE Program	28%	42%	26%

* Weighted by number of units sold by each supply house.

The survey additionally asked supply houses that reported sales of any high efficiency equipment outside the National Grid HEHE program, the reason that these sales did not go through the program. More than one-half (56%) of supply houses stated that high efficiency equipment sales occurred outside the HEHE program because either the homeowner, or the contractor, was not aware of the rebate, or because the contractor did not participate in the program. This bolstered the potential opportunity that a midstream program intervention would be able to capture this portion of equipment installations as well.

Can a midstream program capture untapped additional savings? To assess if a midstream market intervention by a National Grid program would be able to capture the identified untapped savings, we analyzed the survey responses of the supply houses regarding their stocking practices and the influence of the existing downstream HEHE program on those practices.

Nearly all the surveyed supply houses (96%) reported stocking all three equipment types of interest year-round. With regard to high efficiency equipment, as Figure 2 shows, about one-fifth (22%) of supply house respondents reported they would stock less high efficiency equipment if the HEHE program incentives were not available. The survey also asked these supply houses to rate the level of influence the HEHE program had on their stocking practices. Four out of five (80%) of them thought the HEHE program was either very or extremely influential on their stocking of high efficiency natural gas heating and water heating equipment. This indicated that most of the supply houses that were influenced by the HEHE program believe it strongly influenced their stocking practices. It also suggested that some of the HEHE program influence may be percolating up from the downstream incentives and inducing the stocking of high efficiency equipment. This further suggests that the level of influence on supply house stocking of high efficiency equipment would likely increase if National Grid were to implement a midstream intervention. Such direct engagement with supply houses would deepen the impact of the program by motivating their increased stocking of high efficiency equipment.

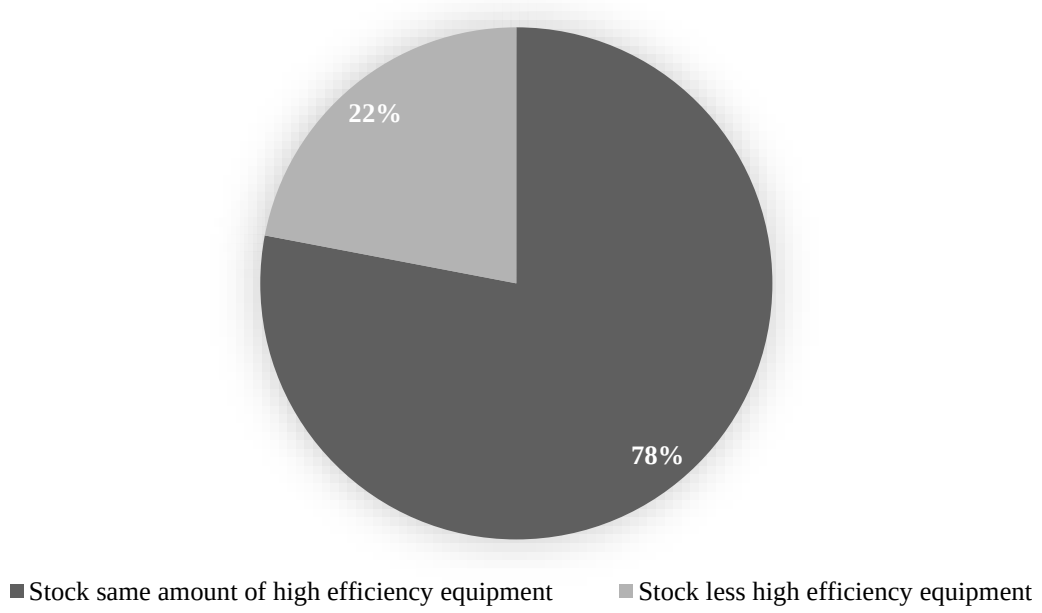

Figure 2: Supply house stocking of high efficiency equipment in absence of HEHE program incentives (n=23)

What are the market dynamics and market actor relationships that a midstream program could leverage? The contractor survey results generally supported the results from the survey of supply houses. NMR's analysis of the supply house and contractor surveys revealed that National Grid's HEHE program could cast a broader net over the natural gas heating and water heating market through a targeted midstream intervention. Figure 3**Error! Reference source not found.** outlines how a midstream program-design could deepen the influence on supply house stocking practices and leverage relationships between supply houses and contractors to better support the installation of high efficiency equipment.

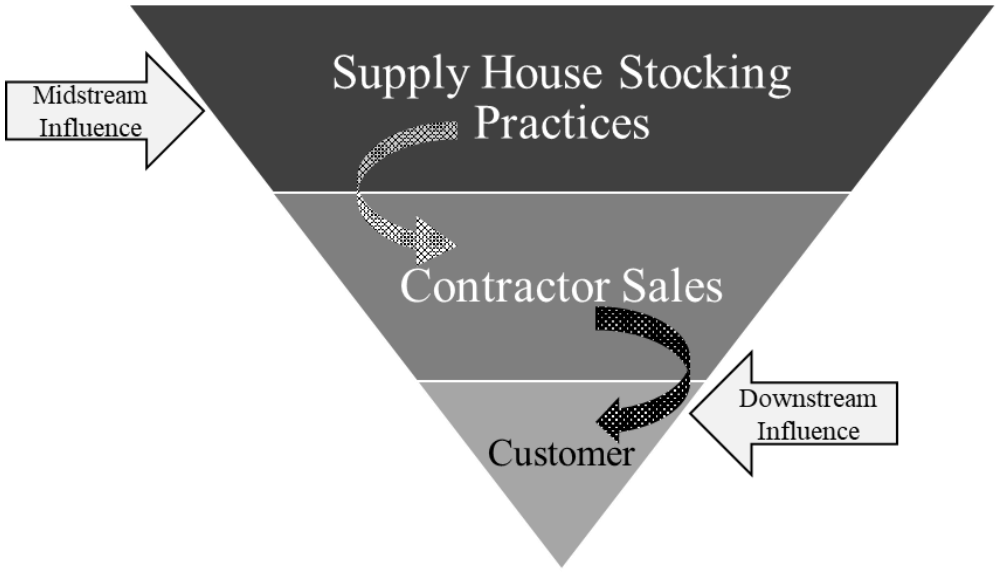

Figure 3: Program interventions and the supply chain

While National Grid's existing downstream HEHE program directly targets customers, as noted previously, our research showed that rebates for heating and water heating equipment have an indirect impact on supply house stocking practices. Direct engagement with supply houses through a midstream intervention could increase the influence of the HEHE program on stocking practices. Our study found that supply houses not only are the primary channel for distribution of residential heating and water heating equipment, they also are a key conduit for the flow of information further downstream to installers and contractors. Notably, the key results from the survey of supply houses provided evidence of the ways in which the supply houses maintain strong, influential relationships with installers and contractors. As shown in Figure 4, the large majority (92%) of supply house customers are installers and contractors.

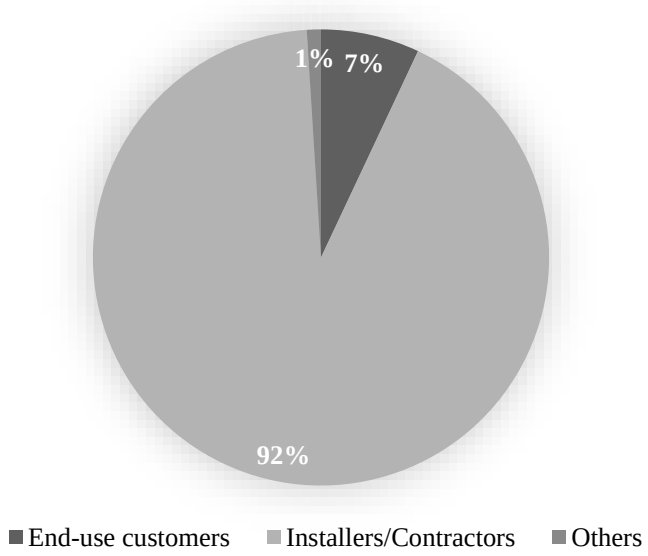

Figure 4: Primary customers of supply houses for heating and water heating equipment (n=23)

Figure 5 shows that supply houses very frequently provide advice to contractors on equipment energy efficiency (87%), second only to advice on equipment sizing (96%).

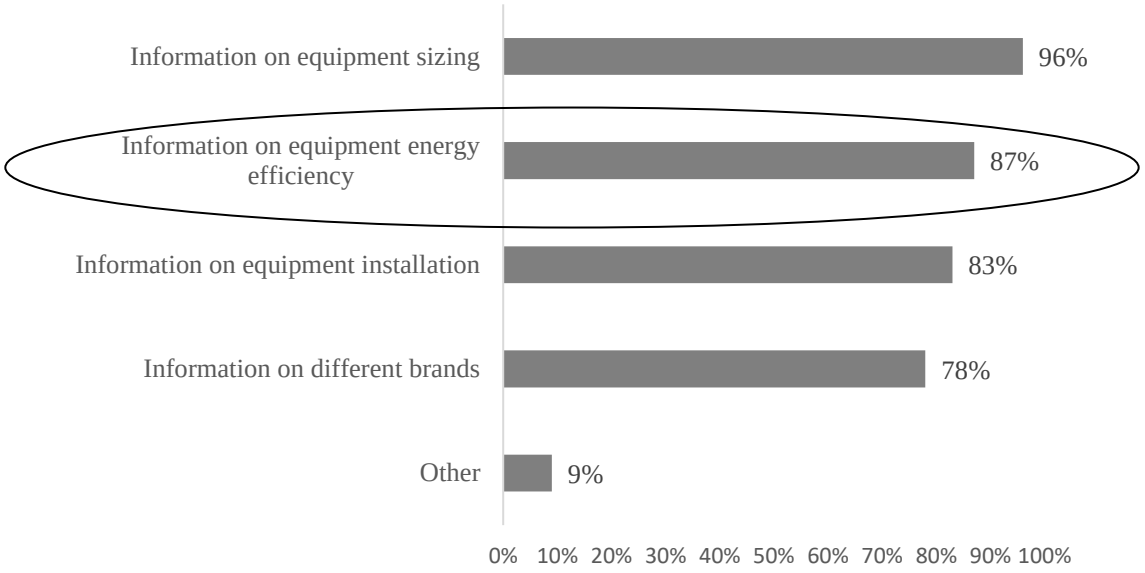

Figure 5: Types of advice given to contractors by supply houses (n=23)

Figure 6 shows that over two-thirds (70%) of supply houses reported that they thought they were very or extremely influential on the contractor's decision to purchase high efficiency equipment.

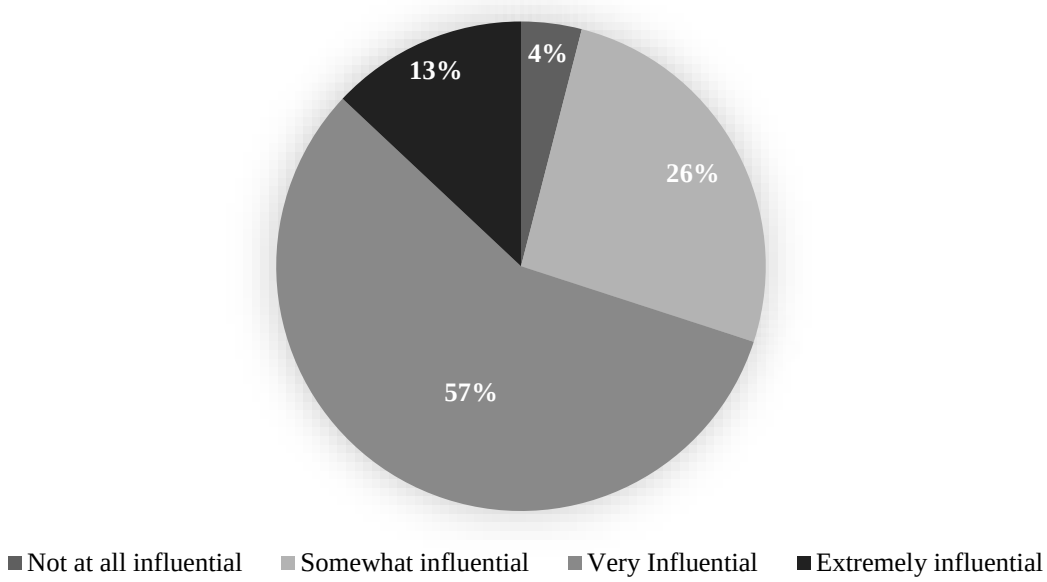

Figure 6: Supply house self-reported influence of equipment energy efficiency advice to contractors (n=23)

This supply house self-assessment of their influence on contractor purchase decisions, is substantially supported by contractor survey responses. Figure 7 shows that about half (49%) of the survey contractors indicated that the distributors, suppliers, manufacturers, or retailers who sold them energy efficient equipment were at least somewhat influential on their decision to purchase it.

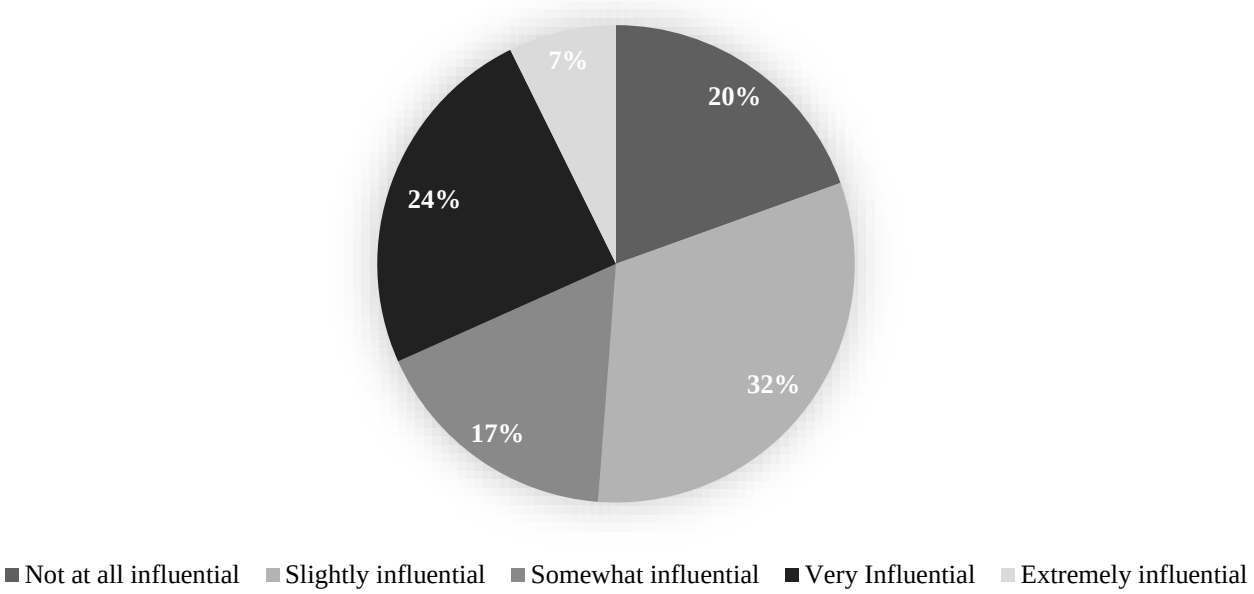

Figure 7: Contractor reported influence of recommendations from distributors, suppliers, manufacturers, and retailers on energy efficient equipment purchase decision (n=41)

Taken together, these data suggest that by leveraging these influential relationships between supply houses and contractors, the program administrators could productively implement a midstream intervention targeted at supply houses to both increase the overall availability of high efficiency options and promote high efficiency installations.

Literature Review of Midstream Programs

Background

As part of a study to characterize the HVAC market for Commonwealth Edison, NMR conducted a comprehensive literature review to understand the benefits and challenges of moving HVAC programs upstream, identify programs with upstream components, and describe the lessons learned from implementing upstream programs or shifting to an upstream program design. Covering 16 HVAC programs in over 11 states, all of these programs target market actors further upstream from the end user. Though some call themselves “upstream” programs, they can all be considered “midstream” programs, as they are focused on distributors and contractors. The available program literature was limited in some cases with mature, established programs often having more information (e.g., program materials, evaluations, etc.) available for review. This literature review utilized industry practice of classifying HVAC equipment of less than 5 tons as residential, equipment between 5 and 25 tons as small commercial, and equipment greater than 25 tons as large commercial. Table 2 shows the HVAC programs identified in this literature review.

Table 2: Midstream HVAC Programs

Program Administrator	State	Residential	C&I
PG&E	CA		✓

SCE	CA		✓
SDG&E	CA		✓
SMUD	CA		✓
NV Energy	NV		✓
Efficiency Vermont	VT	✓	✓
Efficiency Maine Trust	ME	✓ (HPWH only)	✓
National Grid	MA		✓
National Grid	RI		✓
Eversource, United Illuminating	CT	✓	✓
Xcel Colorado	CO		✓
PNM	NM		✓
Georgia Power	GA		✓
NYSERDA	NY		✓
Duke Energy	N/A*		N/A
CenterPoint Energy	N/A*		N/A

* Indeterminate due to operation in multiple states and limited program information

Key Findings

Key findings from this literature review include the following:

- Midstream HVAC programs can operate successfully in the residential or C&I sectors, and in some cases operate in both. Programs that incentivize residential and C&I equipment tend to focus their commercial efforts on small and medium-sized systems, rather than large commercial equipment.
- When implemented with focused and thoughtful planning, programs that have shifted upstream often tend to increase their savings and drive the market toward higher efficiency HVAC equipment.
- Industry organizations such as Midwest Energy Efficiency Alliance (MEEA), Southwest Energy Efficiency Project (SWEEP), Northwest Energy Efficiency Alliance (NEEA), Northeast Energy Efficiency Partnerships (NEEP) and Association of Energy Services Professionals (AESP) support moving HVAC programs to midstream or upstream channels. Our review of the results of HVAC midstream programs often corroborated this recommendation.

Opportunities and Challenges

This literature review also identified notable opportunities and challenges that programs face in shifting away from a downstream intervention approach. The opportunities were associated with midstream program influence on high efficiency equipment stocking practices and on equipment purchase choices and decision-making.

- **Improving distributor stocking practices**. Midstream programs incentivize distributors to stock efficient equipment, making these systems readily available to installers.

- **Addressing the emergency replacement market**. When efficient equipment is readily available, it can be installed in emergency situations.
- **Influencing the new construction market**. These programs can make it easier for large purchasers such as builders and commercial system designers to install efficient systems in their projects.

The challenges for a midstream program were varied, ranging from its impact on customers and market actors to implications for program evaluation.

- **Reduced focus on end users.** Program administrators risk becoming more disconnected from end users (customers) who are no longer active and engaged program participants.
- **Restrictions on incentives**. If midstream programs include requirements that midstream market actors pass discounts along to their customers, they risk discouraging or even alienating them.
- **HVAC installation quality**. Programs without a contractor focus may have limited leverage to require contractors to adhere to sound installation practices.
- **Lack of end-user data**. Midstream market actors may not be willing to share sales data with program sponsors, and they may have limited information about end users.
- **Double-counting program savings**. Programs risk double-counting savings if they incentivize the same products via upstream and downstream channels.

Midstream Program Design and Implementation Considerations

NMR's secondary literature review for Commonwealth Edison resulted in the following general findings and considerations for the design and implementation of a midstream program. Many of these findings also find support and validation from the previously described results of the primary research study that NMR conducted for National Grid New York.

- **Conduct sufficient market intelligence**. By understanding how their market operates, programs are best positioned to intervene effectively.
  - The National Grid study effectively sought to accomplish this through its surveys of supply houses and contractors.
- **Engage with distributors**. Programs will need to develop and invest in relationships with their distributors, who are key drivers of midstream programs.
  - The National Grid study also determined that the program administrators could productively implement a midstream intervention by working with supply houses to leverage their strong relationships with contractors.
- **Strategize about getting sales data from distributors**. Programs benefit from detailed sales data, but distributors may be averse to responding to burdensome requests for sensitive data.
  - The survey of supply houses for National Grid study collected sales data to assess the opportunities for savings that were being left untapped by the downstream intervention of the existing HEHE program.
- **Choose the best equipment to shift upstream**. Programs will need to identify which technologies to shift upstream based on program goals, savings potential, and market potential; recognize the challenges associated with operating simultaneous midstream and downstream programs.

    - The National Grid study found that high efficiency residential water heating equipment offered the most substantial opportunity for the HEHE program to reach untapped energy savings.
- **Communicate the midstream value proposition**. Programs need to understand and be able to explain how these incentives will affect distributors' business outcomes.
- **Set the proper incentive structure and amount**. Programs should work with distributors to set incentive levels and structures that encourage participation by key market actors.
- **Keep abreast of local economic conditions**. Challenging local economic conditions can reduce program outcomes, without concerted program efforts.
- **Non-program equipment may catch up to efficiency of program equipment**. To stay ahead of baseline performance, programs may need to be flexible and adjust their offerings in terms of both equipment efficiency levels and technology improvements.
- **Market transformation programs must track indicators of market progress**. Without tracking indicators or market progress, programs may not be able to measure their impacts on the market, limiting their ability to claim market effects or market transformation.
- **Participating distributors can become inactive**. Continual engagement with distributors is needed to keep low-interest distributors from failing to actively engage with the program.

References

1. Vaidya, R. 2015. "Swimming Against the Tide—Gauging HVAC Quality Installation and Quality Maintenance Program Efforts to Establish a Foothold in the Market." Proceedings of *International Energy Program Evaluation Conference*, August 11, 2015.
2. Vaidya, R., Bagnall-Reilly, J. 2018. "Market Surveys of Upstate New York Supply Houses and Installers." Study for National Grid New York.
3. Vaidya, R., Powell, J., Manning, S. 2019"Characterization of HVAC Supply Chains in Northern Illinois. Literature Review." Study for Commonwealth Edison.