Hard Work via Soft Costs: Achieving Ambitious Energy Efficiency Goals[1]

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ABSTRACT

To achieve ambitious energy efficiency (EE) goals, it is critical to understand and reduce cross-cutting market barriers. In clean energy, soft costs—including marketing and customer acquisition, project design, project installation, transaction costs, quality assurance, and recruiting/hiring—can often represent half or more of the total cost of a project. Hard costs represent everything else, namely the cost of manufacturing and distributing the equipment. Whereas hard costs are driven by national or international markets, reducing soft costs is addressable through state-level intervention and can result in a more robust and value-creating market for EE.

While there are tested approaches to assessing soft costs of certain clean energy measures like solar photovoltaic systems, soft costs of EE are much more heterogeneous and challenging to quantify. In fact, the authors believe this to be the first comprehensive study of EE soft costs. The work described in this paper confirmed that soft costs represent a significant portion of total costs on EE projects across all sectors. Several explanatory variables, such as a contractor's region or win rate, were associated with differences in estimated soft cost values. The paper will discuss cross-sector results, results specific to the Residential sector, study design and methods, and lessons learned for conducting this type of informative work in other jurisdictions. The paper will also discuss recommendations for program designs to effectively combat soft cost in New York's multi-billion dollar state EE portfolio.

Introduction

On April 26, 2018, the New York Department of Public Service (DPS) and the New York State Energy Research and Development Authority (NYSERDA) published the New Efficiency: New York report, outlining plans to accelerate the state's energy efficiency goal by 40%, and calling for achievement of 185 trillion British thermal units (TBTUs) of cumulative annual site energy savings by 2025. This goal represents fueling and powering over 1.8 million New York homes.

The 185 TBTU energy efficiency goal was later codified into law through New York's Community Leadership and Climate Protection Act (CLCPA) enacted on January 1, 2020. Further, achieving the broader goals included in the CLCPA make this 185 TBTU goal a first step, with additional order-of-magnitude scale-up of energy efficiency and building decarbonization necessary to meet New York's holistic and long term policy goals.

Achieving 185 TBTU energy efficiency goal requires savings in buildings and the industrial sector across fuel sources including electricity, natural gas, heating oil and propane. Goal attainment is also dependent on successfully addressing cross-cutting market barriers including key opportunities to impact

[1] Any opinions expressed, explicitly or implicitly, are those of the authors and do not necessarily represent those of the New York State Energy Research and Development Authority.

the soft costs associated with EE project development. If soft costs represent a large proportion of total costs, and contractors pass these soft costs onto end-users, the overall project economics will continue to be prohibitive to the market scale-up necessary to meet these large goals. As the cost of EE options gets closer to the cost of standard efficient options, the more likely end-users will be to choose EE option.

A key opportunity for leveraging state-level funding in support of clean energy is to focus on soft costs. Soft costs often represent a large portion of total project cost, as has been seen in distributed solar and now through this work in EE. Few, if any, states have the market power to meaningfully influence hard costs that are set by equipment manufacturers based on input costs, shipping costs, target profit margins, and customer demand/willingness to pay, but state governments can meaningfully reduce soft costs through various methods. (Kauffman and Sandalow) Further, reducing recurring soft costs in areas like customer acquisition or permitting, for example, can have far greater impact than one-time incentives or rebates that simply buy-down the cost of a single project.

In this study, soft costs are defined to encompass all project, marketing or staff development related costs, including those costs shown in Figure 1. The soft costs investigated are mainly through the contractor perspective, but are expected to be passed onto the end-user through each transaction. The study also investigated hard costs defined as materials and equipment, or essentially the cost to manufacture and distribute the equipment, in order to understand the proportion of soft costs to total costs. The study also covered supply chain/stocking costs and project financing/cash flow through a series of qualitative questions to understand some key facets of these costs that can impact soft costs.

CATEGORY	COMPONENT
Marketing and customer acquisition	**Marketing and/or customer education costs** (hours), including dedicated marketing staff
	Preparation for each bid, including time spent on building assessment and system sizing before the project has been contracted, which may include initial audits to gather necessary building information
	Project signing and contracting
	Other marketing or customer education costs (dollars), such as email marketing, advertising, or trade show visits
Project/system design and development	**Designing, scoping, and customizing the project** for an individual, including energy modeling (if needed), after the project has been contracted
Installation labor	**Installation labor** to install the system and manage the installation, including both the contractor's staff and any subcontractors
Transaction costs	**Obtaining permits** to complete the work compliant to local, state, and federal regulations
	Obtaining licenses necessary to execute [PROTOTYPICAL PROJECT] installations
	Acquiring and maintaining trainings and certifications necessary to execute [PROTOTYPICAL PROJECT] installations
QA/QC	**Quality assurance** and quality control activities to ensure the work has been completed per agreed-upon project design and standards
	Required callbacks to the customer to assist with equipment issues/servicing
Recruiting and hiring	**Recruiting and hiring employees** with the skills and expertise necessary to execute [PROTOTYPICAL PROJECT] installations

Figure 1. Soft Cost Categories Quantified

Study Design and Methods

The study involved robust primary data collection centered around surveys with nearly 500 decision makers and service providers and was underpinned by expert interviews, an advisor committee, and cognitive interviews to ensure sound research design.

To inform the research design, 13 experts with EE project experience across sectors in New York state were interviewed. These interviews helped the research team to refine working definitions of soft cost categories and prototypical projects, develop soft and hard cost estimates for prototypical projects, explore the largest soft cost categories and regional differences/drivers, and gather recommendations as to the sampling and data collection plan.

An advisor committee, consisting of three market experts, was convened to provide additional direction and input on the project. This group had an expanded role compared to the expert interviewees, in that the research team gathered input from the advisor committee throughout the project. A phased project fielding approach enabled a key check point with the advisor committee and a refinement step before conducting the full analysis. The committee also reviewed draft findings, conclusions and recommendations of the study to ensure market relevance.

Prior to conducting the full surveys, cognitive interviews were used to test the questions and gain feedback on any aspects of the questions that were confusing or inaccurate. This proved highly effective at enabling the research team to refine the survey instrument before engaging the larger sample of nearly 500 respondents. Several revisions were made to the survey, mainly to make sure question wording would be clear to all respondents. These cognitive interviews took approximately 30 minutes each, which is double the amount of time required for the surveys of the larger sample.

The main quantitative data collection consisted of nearly 500 surveys, roughly equally split between service providers and decision makers (i.e., end-users). Service providers across sectors include electrical contractors, insulation contractors, general contractors, HVAC contractors, controls contractors, plumbers and energy service companies. The research team used both online and telephone surveys to collect data from service providers. The research also included qualitative and quantitative surveys with decision makers across sectors to gather insights on soft cost impact on project decision making and associated points of friction.

Soft costs were quantified across nine EE “prototypical projects” in the residential, commercial and multifamily sectors. Prototypical projects included residential and commercial air source heat pumps, whole house weatherization, commercial building controls, commercial lighting, performance contracting, and multifamily building upgrades. All of the prototypical projects focused on retrofit measures, rather than new construction projects. The study approach balanced multiple factors, including selecting technologies and project types with which the market would have sufficient experience, selecting example building types found throughout the state, and identifying the proper level of detail to include in surveys. Each prototypical project was specified in detail to ensure consistency of data collection and survey responses. Figure 2 shows an example prototypical project spec for residential HVAC system replacement.

RESIDENTIAL SECTOR		
HVAC System Replacement	**Building Type**	Single-family home; family of 3 (2 adults, 1 child) living there year-round
	Building Size	2,000 sq. ft, 2-story home—living and kitchen downstairs with bedrooms upstairs Colonial, 50 years old
	Existing Conditions	Standard efficiency, gas-powered condensing boiler for heating; window AC units for cooling
	Equipment Installed	Ductless heat pump with 1 outdoor unit and 3 indoor heads. Indoor heads will be installed in the kitchen, the living room, and the bedroom (on the second floor). Existing gas boiler retained in place as backup heat.

Figure 2: Example Prototypical Project Specification

Cross-Sector Soft Cost Results

Evaluators found significant variability in the distribution of soft costs across prototypical projects as seen in Figure 3. Soft costs ranged from a low of 39% to a high of 68%, with the majority above 50% of total project costs. The residential sector is relatively consistent, with HVAC replacement and whole-home efficiency projects consisting of roughly 55% soft costs, while the insulation and air sealing project consists of roughly 65% soft costs.

As seen in Figure 4, installation labor represents approximately half of project soft cost across sectors. Marketing and customer acquisition account for about one-fourth of soft costs in the residential and commercial sectors. The spread of soft costs is substantially greater in the commercial and multifamily sectors (compared to the residential sector). For example, three commercial soft cost categories (marketing and customer acquisition, installation, transaction costs) have estimate spreads at or above 20 percentage points. The increased variability of soft cost estimates in the commercial and multifamily sectors reflects the diverse and complex nature of projects in those sectors.

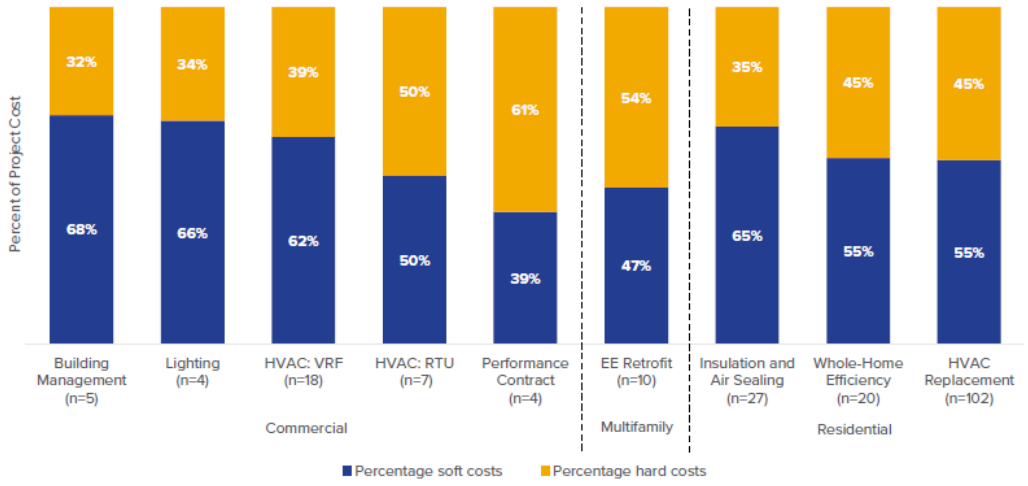

Figure 3: Hard vs Soft Costs Estimated Breakdown per Prototypical Project

SOFT COST CATEGORY	RESIDENTIAL (N=129-145)	COMMERCIAL (N=129-145)	MULTIFAMILY (N=129-145)
Marketing and Customer Acquisition	27% (26%-28%)	21% (12%-38%)	14%
Project Design	5% (4%-6%)	7% (6%-10%)	8%
Installation	51% (50%-54%)	53% (24%-69%)	48%
Transaction Costs (Training, Certifications, Permits)	11% (9%-12%)	13% (5%-25%)	20%
Quality Assurance	5% (3%-5%)	6% (3%-9%)	10%
Recruiting and Hiring	1% (0%-1%)	0% (0%-1%)	1%

Figure 4: Soft Cost Category Averages and Spread by Sector

Other trends became evident from the data on soft costs. Differences between upstate and downstate contractors for total cost of a residential HVAC installation were almost entirely due to soft costs. As seen in Figure 5, contractor soft costs were $1,640 higher downstate whereas hard costs were only $524 higher downstate. Key drivers of higher soft cost downstate are more expensive labor rates, as well as higher marketing and permitting costs. One market expert interviewed for this study hypothesized that commute times and a higher cost of living downstate contribute to differences in soft costs. There is also a greater spread of costs among downstate contractors, potentially indicating a more complex market to navigate.

Differences in regional soft costs are especially clear when examining permitting cost. Figure 6 shows that downstate residential contractors spend an average of $224 more per project on permitting—and have a wider spread of permitting costs than their upstate counterparts—providing further evidence of the complexity of the downstate energy efficiency market. The same situation plays out for the commercial sector.

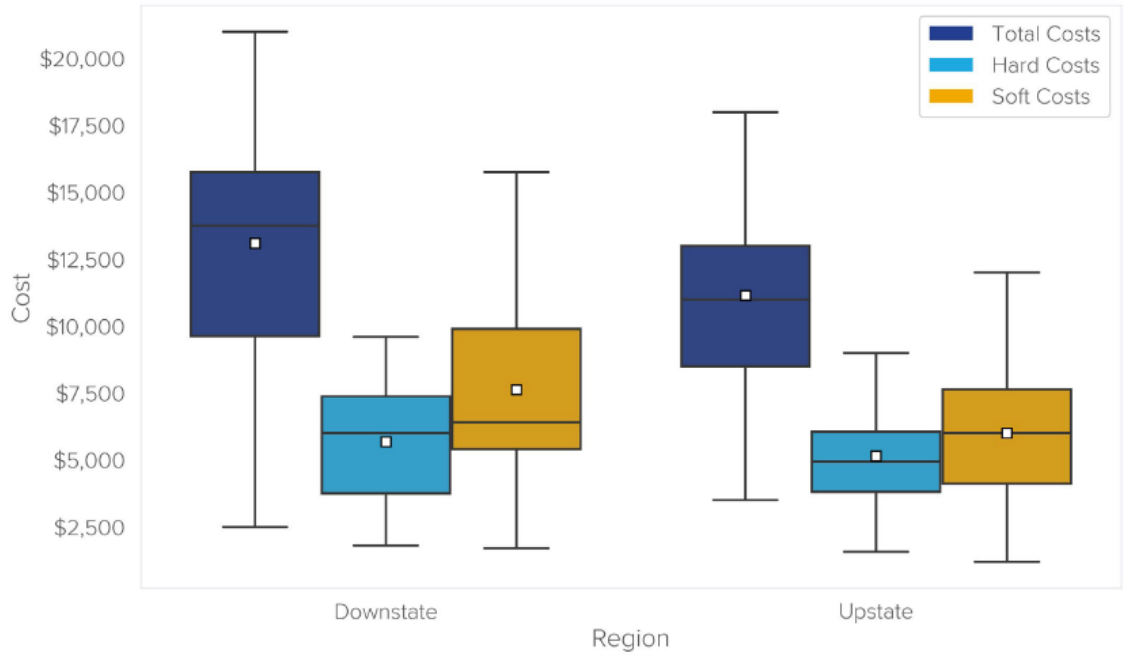

Figure 5: Residential HVAC Replacement Costs by Region

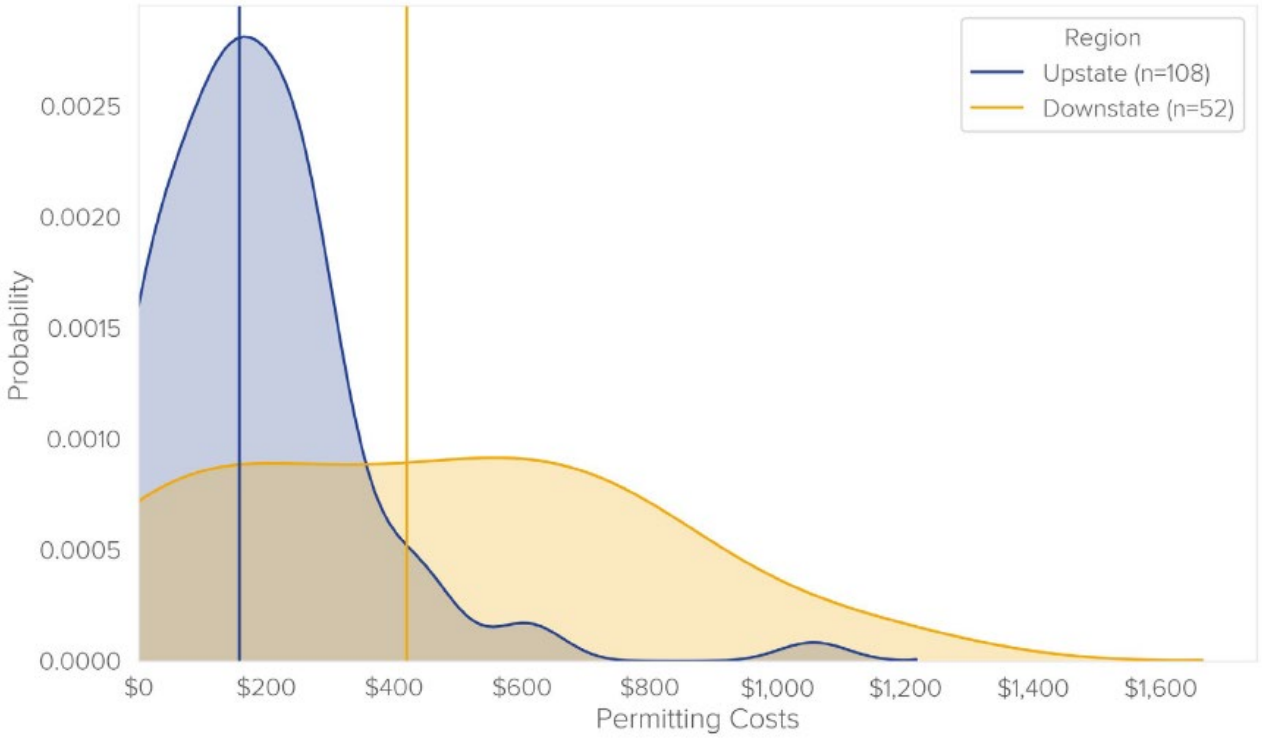

Figure 6: Residential Sector Permitting Costs by Region

Lastly, a specialization effect emerged for some prototypical projects; in other words, contractors earning a *higher* percentage of their revenue from one source tend to have *lower* installation costs. This was observed among residential insulation and whole-home contractors, though not among residential HVAC contractors. It stands to reason that contractors who specialize in one type of EE project can gain installation efficiencies compared to their peers who work on a larger variety of project types.

Notably, the evaluation did not find evidence of economies of scale in the residential sector, i.e., an increase in a company's size (based on number of employees or total installation count) did not lead to lower soft costs on a project level. This trend (or lack thereof) was most prevalent when reviewing data associated with bid preparation and marketing costs, which suggests that the additional overhead larger companies take on (i.e., dedicated marketing staff) does not translate into savings for customers.

Residential Sector-Specific Key Findings

Some selected findings for the residential sector related to the drivers of soft costs variation and highlights from the decision-maker surveys are detailed in this section. In most cases, residential sector-level findings are highly consistent with individual, prototypical project-level findings, as shown in Figure 7. Some small differences do occur, directionally suggesting that transaction costs (permitting, training and certifications, and licensing) make up a smaller portion of soft costs for insulation contractors when compared to HVAC or whole-home efficiency contractors. Given the greater complexity involved with HVAC replacements and whole-home efficiency projects (both of these projects involve ASHP installations), this finding proved consistent with expectations.

SOFT COST CATEGORY	SOFT COST COMPONENT	HVAC REPLACEMENT (N =69-98)	INSULATION AND AIR SEALING (N=22-30)	WHOLE-HOME EFFICIENCY (N=18-30)	AVERAGE
Marketing & Customer Acquisition	• Marketing and/or customer education • Bid preparation • Project signing/ contracting	26%	27%	28%	27%
Project Design	• Designing, scoping, and customizing the project	5%	6%	4%	5%
Installation	• Installation labor	50%	54%	53%	51%
Transaction Costs	• Obtaining permits • Acquiring and maintaining trainings, certifications, and licenses	12%	9%	11%	11%
QA/QC	• QA/QC activities • Required callbacks to the customer to assist with equipment issues/ servicing	5%	4%	3%	5%

Figure 7. Residential Sector Soft Cost Component Estimates

Figure 8 shows the distribution of aggregated residential soft costs by category. The violin plot represents the spread of cost estimates (i.e., soft cost categories with a longer tail and wider body represent a wider dispersion of cost estimates, whereas soft cost categories with a shorter tail/body represent a tighter dispersion of cost estimates). For example, project design costs in the residential sector center closer to zero and have a short tail/body, while marketing and customer acquisition, installation, and transaction costs are dispersed more widely, with longer tails/bodies. Soft costs with a longer tail/body (such as marketing and customer acquisition, installation, and transaction costs) represent a reduction opportunity, as some contractors doing a similar job spend more than others.

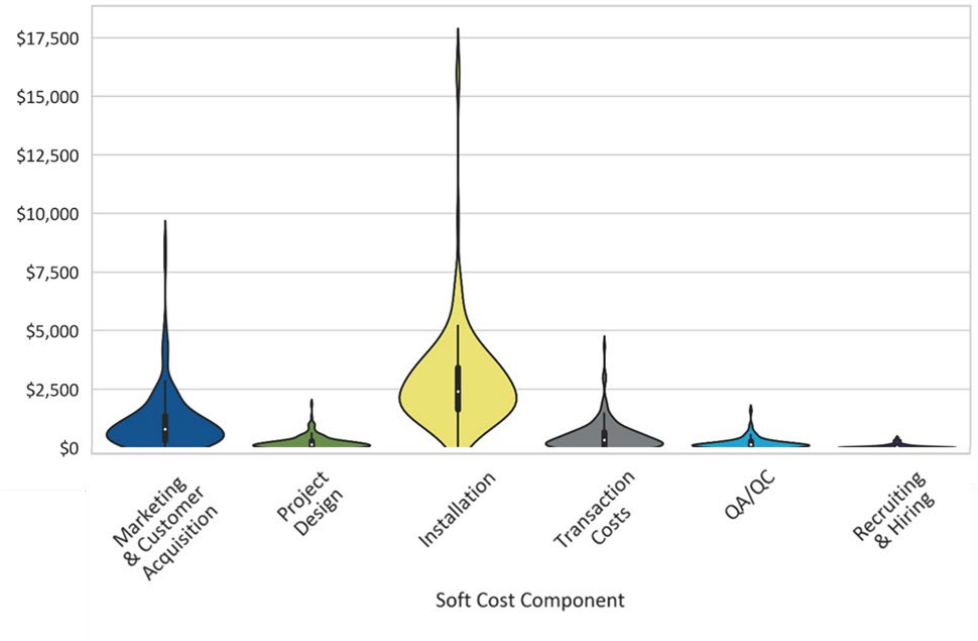

Figure 8. Residential Soft Costs Violin Plot

As noted earlier in the cross-sector findings section, win rate is a key explanatory variable on sector level soft costs. The residential sector follows this trend with residential contractors at the 75th percentile of win rates (67% win rate) reporting soft costs $1,250 lower than contractors at the 25th percentile of win rates (28% win rate). This finding suggests that improving a contractor's win rate (i.e., reducing the number of failed bids) is associated with a drastic reduction in soft costs.

Researchers analyzed the extent to which a company's design spending relates to the company's QA/QC spending, which exhibited a directionally positive relationship in the residential sector. Two reasonable hypotheses emerged regarding the character of this relationship:

- Companies that spend more on design costs may have more thoroughly planned projects and consequently spend *less* on QA/QC.
- Alternatively, companies that spend more time on design may be more thorough in nature and ultimately spend *more* on QA/QC after installation.

This relationship was most prominent for the whole-home efficiency prototypical project and least for the insulation prototypical project.

Evaluations collected survey responses from 207 residential decision-makers who completed residential sector prototypical projects. Through these surveys, evaluators found that decision-makers completing a whole-home efficiency project report spent nearly twice as much time finding and managing contractors as decision-makers completing an HVAC replacement or insulation and air sealing project, likely reflecting the more complex nature of the whole-home prototypical project.

Recommended Program Designs

New York's EE market is complex and diverse, with multiple factors impacting EE soft costs. While standard incentive/rebate programs do have their place, they tend to be focused on reducing the cost of one project at a time, and do not have the broad or longer-lasting impact that soft-cost interventions can achieve. Improving the economics for contractors and end-users on all projects will help increase adoption. The research conducted for this study illuminates that a multi-faceted solution, including tools already in the EE program toolkit, is needed for achieving soft cost reductions in New York's EE market. Some study recommendations for future EE programs include continuing to develop resources to assist contractors with customer acquisition and educating contractors on standardized project design and installation procedures. In many cases, the recommendations summarized herein represent continuing or enhancing elements of existing programs.

- Continue to develop resources and leverage existing relationships to assist contractors with customer acquisition. Research shows contractors have to make a significant investment of time and energy—typically around one-quarter of project total soft cost—in customer acquisition. Building on work already started in the areas of renewable heating and cooling and solarize campaigns could help reduce barriers to generating new business. Maps to identify potential customers based on building characteristics are a top opportunity. Building and leveraging relationships with communities that could be prime targets for EE work is another opportunity. Lastly, identifying customers for possible aggregation, like large portfolio owners, could also bring down soft cost for contractors.
- Provide technical engineering assistance and project development support. Substantially increased customer acquisition, design and installation costs arise from inclusion of newer technologies (e.g., VRF in commercial settings where installation cost made up nearly 70% of total soft costs). In these situations, programs that provide technical and engineering assistance and project development support could be especially helpful at lowering soft cost. This support could include things like feasibility studies, remote audits, standardized technical analysis approaches, design support, and M&V assistance.
- Create standardized design and installation procedures and educate contractors on them. Nearly 60% of total soft costs across all sectors comes from project design and installation work, with these costs being relatively dispersed indicating possible process inefficiency. There is some evidence of a specialization effect, in which contractors with a higher percentage of their overall revenue coming from one specific prototypical project tend to have lower installation costs. Creating or expanding facilitation of standardized installation, design and quality control approaches could help in this regard. Solutions could include partnering with manufacturers to offer standardized approaches and contractor training or encouraging more contractor specialization in other ways to help the market gain experience and reduce soft cost of key EE measures.

- Encourage development of a unified and streamlined permitting process. Permitting can be a driver of variation in project costs across sectors and geography, especially in New York with downstate and upstate differences. A unified, streamlined permitting process for key technologies could encourage adoption across municipalities. Continuing efforts like creating and disseminating model stretch codes, training and education for building inspectors, and other similar efforts will be key.

Lessons Learned for Future Studies

This trailblazing study validated methods for quantifying EE soft costs and provided a model that can be replicated in other jurisdictions that wish to harness such information to take their programs to the next level. NYSERDA is in the process of completing a second round follow up study currently and is applying these lessons learned. Key lessons include:

1) Focus on a limited and well-defined list of prototypical projects that service providers can easily envision and report typical costs for. In an attempt to increase sample sizes for the prototypical projects in the follow-up study, a full quantification of some prototypical projects will be conducted while other projects will be investigated through a more qualitative analysis with a small number of focused interviews. Such an approach will lead to a larger eligible population of service providers that could participate in the full review.
2) Choose prototypical projects carefully. While it is tempting to include newer, novel types of technologies and projects, it is likely that not many contractors will have had enough experience on those projects on which to base a response. This study confronted this issue with the Commercial VRF and Multifamily ASHP projects. In response, the team split one prototypical project into two branches to capture information from a larger population.
3) Ask questions in a way that service providers can most easily respond to, i.e., don't require respondents to perform their own math or extrapolation, which will introduce inconsistency and error. Utilize market experts to test the wording and understanding of questions and to help interpret results. Additionally, balance the desire to perfect the survey approach and questions in follow-up waves with the ability to observe trends in the data over time
4) Accept that results will include data with a mix of statistical and practical significance. In other words, not all results will be robust enough to draw firm conclusions, but they can provide insight for decision making and serve as the beginning of understanding trends over time.
5) Additional enhancements made in the follow-up study include expanding the role of the strategic advisory committee, increasing the number and type of sources for sample generation, lengthening the fielding timeline, and using study ambassadors to increase response rate through their assistance with fielding the survey to their network.

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