PERFORMANCE-BASED INCENTIVE PROGRAM FOR NEW BUILDINGS:

REPORT FROM THE FIELD

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ABSTRACT

This paper discusses a large scale incentive program for new multifamily buildings in New York, funded by NYSERDA. The program followed a performance-based approach that involved energy modeling, was aligned with the EPA's ENERGY STAR® Multifamily High Rise Pilot, and had simulation requirements similar to LEED NC. The paper discusses the key aspects of program design and focuses on challenges associated with running a highly technical incentive program. It provides an overview of approaches used by the implementation team to ensure that model predictions translated into actual savings, and concludes with recommendations and lessons learned.

INTRODUCTION

The New York State Energy Research and Development Authority (NYSERDA) launched the Multifamily Performance Program (the Program, MPP) in early 2007, with the goal of offering a streamlined process for multifamily building developers, owners and management companies to access incentive funds available for improving the energy efficiency of their properties. The Program included New Construction and Existing Buildings components, each having distinct rules. This article focuses on the New Construction component, which was released in conjunction with the EPA pilot that provided a path for multifamily buildings to receive the ENERGY STAR label. The NYSERDA Program has led the nation in testing the protocol developed for this EPA pilot; NYSERDA's first rollout, prior to the release of MPP, served eight projects with a total of over 700 apartments. Four of these projects earned the ENERGY STAR label and were among the first five multifamily buildings in the nation to receive this honor.

In order to develop a successful program, many major stakeholders in the New York multifamily market and national and regional experts in energy efficiency were engaged at the early stages of program design, including Building Performance Institute; New York State Builders Association; U.S. Environmental Protection Agency; U.S. Department of Energy; American Society of Heating, Refrigeration, & Air Conditioning Engineers (ASHRAE); Residential Energy Services Network (RESNET); and U.S. Green Building Council.

The New Construction component of MPP was greeted with unprecedented enthusiasm from multifamily owners and developers. As of the spring of 2010, there were 180 active projects totaling over 10,500 apartments, with a total incentive pool of over $23M available to these projects. Over 75% of these projects were affordable housing, partially due to the strong support of state regulatory agencies. Five of these projects have earned the ENERGY STAR label, with dozens more expected in 2010.

PROGRAM DESIGN

Partner Network

In order to participate in the Program, the building owners were required to hire an energy efficiency professional approved by the Program, known as a Multifamily Performance Partner (Partner). The Partner acted as the owner's agent for the entire duration of the project, from design development to construction completion and beyond. NYSERDA and the program implementer (TRC) assumed a secondary role as project facilitators.

Partner fees were not set by the program but were negotiated between the building owner and the Partners. Partners could charge whatever the market would bear; conversely, owners had the ability to competitively select Partners and negotiate the price and the scope of services (beyond the minimum programmatic requirements).

The success of MPP was dependent on a strong network of Partners. Previous NYSERDA programs helped to establish this network; however, in previous programs the network was essentially closed following the initial selection process. MPP adopted an open Partner enrollment policy, with the goal to increase production capacity, offer statewide coverage and to introduce healthy competition.

Companies seeking to become Partners were required to submit applications demonstrating the firm's ability to successfully conduct business and experience with energy efficiency projects in the multifamily sector, including three relevant case studies that involved energy modeling. The applications were evaluated by Program staff at regularly scheduled Technical Evaluation Panels.

Process Overview

Each project was initiated with a preliminary meeting of the Partner, design team and developer to discuss the Program requirements and design options that could help achieve the Program performance goal. The Partner then created an energy model reflecting the current building design and compared its energy cost to the energy cost of the baseline model, as defined by ASHRAE Appendix G, to calculate the Performance Rating. The Partner then worked with the design team and owner to improve the design of the building to achieve the 20% performance target (20% lower energy cost for the proposed design compared to the baseline that minimally complies with ASHRAE 90.1 2004). Once the design was agreed upon by all parties, the design team incorporated the changes into the design and bid documents.

During construction, the Partner stayed involved to ensure that the building was constructed as specified, to assist with any energy-related challenges encountered, and to perform certain inspections to ensure that the Program requirements were met. Upon construction completion, the Partner updated the building model to reflect the as-built conditions and verify the achievement of a 20% energy cost savings relative to the baseline.

The Partner submitted documentation to the Program at two milestones during design: one at 75% design completion and one at construction document completion, which corresponded to the incentive payments to the owner. In addition, the Partner also submitted documentation to the Program after the building was completed. Program staff reviewed each set of submittals for completeness and accuracy, and performed their own inspections during construction to verify compliance. All projects were inspected at the construction completion, and certain projects were also inspected at the open-wall stage. Any issues discovered during the reviews or inspections had to be addressed satisfactorily by the Partner and/or developer prior to receipt of any further incentives.

Key Program Documents

In order to ensure that the program rules were consistently followed and to expedite submittal reviews, the Program materials included specific guidelines for conducting energy modeling, site work, and reporting.

The *Energy Reduction Plan (ERP)* template was used to establish a single, standard format for reporting all aspects of the project. The template included a Word document with linked Excel tables, which helped streamline quality control. Given the number and variety of the Partners, the template was a necessity for providing timely reviews.

The *Simulation Guidelines* contained the Program's energy modeling methodology. The key goals of the document were to ensure that a consistent simulation methodology was used from building to building and from Partner to Partner, based on ASHRAE 90.1 2004 Appendix G, and to help establish a protocol for handling components that were not included in Appendix G, or were included without a sufficient level of detail. It also addressed areas left by Appendix G for the "rating authority" to decide, which for this Program was NYSERDA.

To achieve these goals, the Simulation Guidelines contained interpretations and explanations of Appendix G requirements, specifically focusing on areas that are frequently misunderstood, which were evident from the submitted models. The Guidelines included an Excel spreadsheet, the *Simulation Guidelines Appendix*, with templates for various supporting calculations, such as fan power, infiltration/ventilation inputs, lighting power density, and savings from low-flow fixtures.

Through its evolution, the Program modeling protocol reflected in the Simulation Guidelines remained closely connected to Appendix G. However, in several instances it became apparent that changes in guidance would benefit the program. For example, Appendix G suggests that the rates of the mechanical ventilation in the baseline must be the same as in the actual building (proposed design), which, in effect, eliminated the energy penalty for over-ventilation. It was discovered that designs of some of the new building in New York City called for continuous exhaust ventilation in kitchens and bathrooms in excess of 5 ACH relative to the *entire building area.* Clearly, it was important to adjust simulation rules to discourage this wasteful practice, and the Simulation Guidelines were modified so that the baseline is modeled with exhaust and supply ventilation rates that meet, but do not exceed, the requirements of applicable codes, without reliance on natural ventilation (opened windows).

Several versions of the Simulation Guidelines have been released to date, with each version going through a rigorous peer review process by Partners prior to its adoption as Program policy.

The Simulation Guidelines document developed by the Program also formed the foundation of the modeling protocols used by the EPA's ENERGY STAR Multifamily High-Rise pilot and by LEED for Midrise Multifamily program pilot.

Minimum Performance Standards (MPS) established the measure-by-measure parameters within which the Partner and developer could make performance trade-offs in the design. The specific components listed in the document were required to meet or exceed the indicated performance requirements. The MPS were intended to:

a) Ensure that buildings were built to the requirements of specific, applicable codes.
b) Require ENERGY STAR buildings to specify and install ENERGY STAR appliances, lighting, and equipment, where applicable.
c) Provide a reference for Partners to describe to developers the minimum required to participate in the program.

The MPS was not a prescriptive approach to achieving an ENERGY STAR label, and simply meeting MPS was not sufficient to achieve a 20% energy cost reduction compared to the ASHRAE baseline.

System Performance Testing Protocols outlined the inspection and verification requirements for all applicable measures and building systems. Each protocol included information on the type of testing; performance criteria to be included in bidding documentation; basic steps and documentation required; the timing within which the protocol must be performed; the person who must perform the protocol; and appropriate sampling methods. The information resulting from performing the required protocols was incorporated into the project's As-Built Energy Reduction Plan, and was used to confirm that the model's assumptions accurately reflected the installed measures and performance metrics.

INCENTIVE STRUCTURE

In addition to earning the ENERGY STAR label, projects meeting Program requirements were eligible to receive financial incentives from NYSERDA. The incentive structure was developed based on an analysis of the cost of services provided under former NYSERDA programs and on various national references, such as studies of the cost of energy modeling for LEED and of the incremental cost of design and construction of high performance buildings. Incentives were released at the completion of each of four distinct stages: early design, completed design, construction completion and lease-up.

NYSERDA's approval of the draft Energy Reduction Plan (ERP), submitted at 75% design completion, triggered the first incentive payment to the developer, set at \$30,000 for affordable housing projects and \$20,000 for market-rate projects. This incentive was meant to assist the developer with Partner's fees for developing the ERP and energy modeling.

NYSERDA's approval of the revised ERP, submitted once design was complete, triggered the second incentive payment to the developer. For market-rate projects, NYSERDA paid \$1.00 per gross heated square foot (ghsf) of residential and residential-associated spaces. For affordable housing developments, NYSERDA paid \$1.50 per ghsf. This incentive was intended to provide the developer with a significant portion of NYSERDA funding at closing, which was perceived as important, especially since the majority of the projects were affordable housing.

NYSERDA's approval of the As-Built ERP, submitted after construction completion, triggered the payment of the third incentive to the developer, and also triggered the award of the ENERGY STAR label if the program's performance target of 20% energy cost reduction was achieved and all Minimum Performance Standards were met. This performance-based payment varied depending upon the level of energy performance predicted by the as-built energy model, ranging from \$0.25 to \$0.50 per ghsf, with the maximum incentives available for projects performing more than 26% better than the baseline.

Finally, the receipt of the fuel bill release forms for the common areas and 10% of the tenants' meters triggered the payment of the fourth and final incentive – a 10% retainage withheld from the third payment. The fuel bill release forms granted NYSERDA permission to access fuel and electric accounts online, allowing NYSERDA to track these projects' electric and fuel use consumption data for a minimum of three years following lease-up.

Program designers decided not to tie incentive dollars to post-construction utility bills for several reasons, including the time it takes for billing data to become available as well as the difficulty in establishing a sound methodology for translating bills into incentive dollars. Billing data was collected, rather, to help evaluate and improve the program.

All requests for Program incentives had to be submitted by the Partner, with the incentives paid directly to the developer. This created a system of checks and balances, allowing the Partner to prevent the developer from getting paid by NYSERDA if the developer was withholding payment for the Partner's services.

CHALLENGES ENCOUNTERED

Insufficient energy modeling experience in the marketplace

In spite of the emphasis placed on experience with building energy simulation in the Partner enrollment process, many Partner companies went through a steep learning curve in mastering energy modeling to the degree required to pass Program review. The companies often had experienced modelers on staff, but personnel within the Partner company assigned to projects were often new to energy modeling, so it was not unusual for an energy analyst to learn how to use a modeling tool while working on their first MPP project. The problem was compounded by the lack of readily-available local trainings on applying the Appendix G method and using Appendix G compliant software, and weak or absent in-house quality control processes.

This issue has been somewhat alleviated by a recent increase in the popularity of energy modeling (substantially thanks to LEED's use of Appendix G modeling) and eQUEST Energy Modeling courses now offered regularly in the New York area. In addition, as Program staff identified common modeling mistakes, written guidance on those specific items were distributed to the Partners and included in the next release of the Simulation Guidelines.

Diverse expertise required of Partners

The performance approach required a comprehensive review of a building design, including aspects typically overlooked by prescriptive programs, such as equipment part load performance and equipment control. Therefore, in order to meaningfully comply with these requirements, Partners had to have an in-depth understanding of related building systems, code requirements, and modeling techniques. In addition, the skills needed to build an energy model were not the same skills needed during the construction stage, where an understanding of the construction process, as well as the confidence to interact with contractors, becomes key. As important as it is to develop skills using building simulation tools, it is also necessary to develop construction-phase skills among energy professionals.

To remedy this situation, the Program put significant emphasis on Partner education, covering 75% of the cost for approved trainings. Partners took advantage of these opportunity, with 176 staff members attending Multifamily Building Analyst training (131 became BPI certified), 360 attending Energy Modeling trainings, and 521 attending full day Program orientations. Attending the orientation was one of the required steps to become a Partner, and many firms relied on then to train new staff as well as to retrain existing staff. In addition, monthly Partner conference calls covered a range of technical topics and often included written "Technical Tips" focusing on specific problem areas.

Limitations of the modeling protocol and tools

The Appendix G modeling protocol is fairly comprehensive in its scope, addressing many key building systems and components. It is also quite terse, taking up just 10 pages at the end of ASHRAE Standard 90.1. Inevitably, many questions arise when modelers apply the protocol to actual projects, which required the Program to develop a knowledge-base to address the specific challenges of energy modeling that were frequently encountered by Partners.

In addition, the ASHRAE 90.1 Appendix G modeling protocol does not address some key aspects affecting building energy consumption, such as infiltration, distribution losses, and quality of construction. As a result, improvements in these areas could not be considered during the modeling process. An important obstacle to integrating these components into the analysis was the lack of an appropriate baseline, which would normally be established based on the minimal prescriptive requirements of ASHRAE 90.1 or another national code. For example, what should be used as the baseline infiltration rate for a new multifamily building? It was also difficult, in many cases, to verify achieved performance; for example, to determine leakage to the exterior of high-rise buildings under actual operating conditions.

Limitations of simulation tools were another important obstacle to capturing actual building performance. For example, it hindered quantifying the interactive effects between infiltration and mechanical ventilation or the impact of thermal bridging.

The Simulation Guidelines played an important role in mitigating the technical challenges outlined above, becoming an important depository of the collective knowledge accumulated by the Program. The scope of the Guidelines gradually expanded to cover some of the “unregulated” loads, with performance credit now allowed for ENERGY STAR lighting inside apartment units (which is not regulated by ASHRAE 90.1); air sealing of central exhaust ductwork; hot water savings due to low flow showerheads and faucet aerators; etc. However, some important areas still remain unaddressed.

As it grew in scope and became more detailed, the Simulation Guidelines and its companion spreadsheet underwent several version releases. Unfortunately, in the framework of an incentive program, this evolution was sometimes perceived as instability in the Program rules.

Learning curve disturbing the process

As discussed previously, most Partners encountered a very steep learning curve for their first few projects. Many of these projects required several, often extensive, submittal revisions prior to being approved by NYSERDA. One unfortunate outcome was that, due to the time required to complete these revisions, projects were sometimes under construction before the model was completed, disrupting the feedback cycle between modeling and design.

In even more problematic cases, Partners did not submit their first draft ERPs to the Program until after the building was under construction. While the Partners reportedly used their models to influence the design of the buildings, it was only when the buildings were already under construction that the models were discovered to be in error. In such cases, the Partner often prematurely assured the owner and design team that the design met the Program energy target, while in fact more changes were required in order for the project to qualify for incentives and the ENERGY STAR label.

Having experienced these issues, Program staff now works closely with new Partners and encourages more timely submissions of ERPs. The reporting format is undergoing revisions in an effort to simplify documentation requirements and eliminate redundancies that caused inconsistencies in submittals.

Difficulty of getting the buildings built to the level called for in the building model

The goal of energy modeling, is, of course, to help build more energy-efficient buildings. The process works when the energy modeler and the designer collaborate during the design phase so that the information developed by the modeler can be incorporated into the final design. Additionaly, it is necessary to ensure that the contrstruction is done to standards that will deliver the predicted energy savings.

Perhaps because so much of the Partners’ time and attention was taken up with energy modeling and submitting the required documentation at the design stage, many Partners were less involved in the other aspects of the design and construction process. Additionally, many of the Partners had different staff members developing the models and performing inspections, and many times there was insufficient communication between the two groups.

For smaller buildings, in particular, it was difficult to motivate Partner involvement in the construction phases, as the bulk of the incentives were received with the submission of the final proposed Energy Reduction Plan, before construction was even slated to begin.

The Minimum Performance Standards were sometimes overlooked or misunderstood by owners, contractors and Partners. In many instances, the MPS simply required that basic energy code requirements be met; but in practice, some contractors were unfamiliar with or unwilling to meet these requirements. Contractors typically do not read the construction specifications, even though they are contractually obligated to meet them, unless someone points out where the specifications differ from industry standards. On some quality control inspections, it was discovered that requirements such as airsealing the envelope, sealing ductwork, and insulating piping were not met. Generally, when this occurred, the problem was that junior staff or staff unaccustomed to working in the field were given the responsibility of overseeing the construction phase. The Partners and building owners did not always understand the extent to which they had to intervene with the contractors to ensure that basic requirements were met. As one of the goals of the program was to bring about market transformation, working with contractors to understand and meet these requirements was an important piece of the puzzle.

Submittal Review Efforts

Energy Reduction Plans had to be thoroughly reviewed because the incentives were directly linked to the reduction in energy consumption projected by the energy model. Higher projected savings translated into higher incentives for the building owner, putting pressure on Partners to inflate the results.

The model review process initially focused on model inputs to ensure that they matched the building description and demonstrated understanding of the modeling protocol. However, this approach soon proved to be cost prohibitive, as models of even a simple building involved hundreds of inputs. To address that complexity, the review process was revised to instead focus on model outputs. The large pipeline of new multifamily buildings participating in the program offered a relatively homogenous sample for developing metrics that were then used for validating new submittals. The metrics included kBtu/SF consumption by end use (heating, cooling, DHW, lighting, appliances, and other) for both baseline and proposed models, and the improvement in consumption achieved in each end use. In addition, the reported energy savings were qualitatively compared to the building design to ensure that results were reasonable. For example, a significant projected reduction in lighting energy was questioned if the proposed design did not include significant improvements to lighting fixtures or controls. Review comments also routinely included questions targeting areas that were often overlooked in energy modeling, such as electric heaters in common spaces.

Aligning funding cycles with construction cycles

As is the case with many funding sources that put a deadline on the use of funds, the funding source for this program required that all funds be expended by specific date. Any unexpended funds would be forfeited.

The length of time required for projects to complete both the design and construction phases meant that the majority of funds had to be allocated to projects well before the funding deadline. This allowed projects to complete construction, be fully leased, and obtain fuel bill release forms before the deadline. If projects were unable to complete one or more of the later stages, thereby freeing up funding, it was difficult to admit new projects because there would be inadequate time to complete the design and construction process.

Ideally, a substantial incentive would be provided at least 12 months after occupancy for buildings demonstrating superior performance. However, the need to allocate those funds when projects were first accepted into the Program and the uncertainty over how many would ultimately receive the final incentive would have meant that a potentially large amount of money would be unexpended and returned to the funding agency, potentially limiting the funding received in future funding cycles. As a result, there was a need to allocate funds early in the design and construction process.

PROGRAM ADMINISTRATION AND PARTICIPATION COSTS

Administration Cost

Program implementation efforts involved a variety of activities, including program design, developing technical guidelines, overall program quality assurance, review of submittals, field inspections, and communications with Partners and building owners to address day-to-day questions. The program administration and implementation costs accounted for about 15% of the Program budget.

Participation Cost

As previously mentioned, the Program did not set restrictions on how much Partners could charge for their services. The Partner fees varied significantly from Partner to Partner, and also depending on the size of the building and the location of the project (New York City vs. Western New York). The average fee charged by Partners was $40,000. These fees were typically split such that 2/3 of the fees were for the work done during the design phase including energy modeling and related reporting, and 1/3 of the fees were for work done during the construction phase.

Based on the current pipeline of projects, the costs for installing energy efficiency measures averaged 2.1% of the construction budget. However, this value varied significantly depending on scope of work, ranging from less than 1% to over 8%. For example, projects that installed geothermal systems or photovoltaic systems cost significantly more than those which achieved the energy target using more traditional measures.

PERFORMANCE OF COMPLETED BUILDINGS

Analyzing utility bills holds the promise of substantiating projected energy savings with “hard data”. One popular approach to analyzing billing data, known as benchmarking, involves comparing billing data for a particular building to billing data for a group of similar buildings (peers). This approach provides several challenges. First, a proper set of buildings must be identified as peers., as it is not particularly meaningful to compare the energy usage of a multifamily building, to that of a school or a hospital. Even when limiting the focus to multifamily buildings, things are not clear cut. Should a market-rate multifamily building be compared to a low-income facility? Or a building occupied by seniors to one occupied primarily by families with kids? Additionally, once the subset of buildings has been properly identified, a statistically significant sample data set must be obtained. Because billing data is proprietary, this is generally done via surveys, a flawed but necessary approach.

Next, for the analysis to be meaningful, the independent variable of interest (energy efficiency) needs to be isolated from other variables that could influence the energy consumption. The most obvious variable affecting energy consumption, other than energy efficiency, is size, and it is common to account for this by expressing energy usage as energy intensity (e.g. kbtu/sqft). However, such a model assumes that usage is directly proportional to building area, and in reality this is not the case. A second variable to control is weather conditions, since available data will likely span different time periods and geographical locations, with possible approaches including normalization by cooling and heating degree days. However, beyond weather conditions and size, there are countless other variables impacting consumption. For example, a building that is 50% vacant will use less energy for in-unit lighting, plug loads, and possibly heating and cooling when compared to a building that is fully occupied; senior housing will likely consume more energy than average, as retirees will spend more time in their apartments with lights and appliances on and thermostats likely set higher in the winter and lower in the summer; the presence of in-unit or common laundry or elevators will increase energy consumption; the number and size of any common spaces in the building such as corridors, stairwells, and community rooms may have a large impact on consumption due to, among other things, ventilation requirements and lighting runtime. To compare one building's level of energy efficiency to that of another, it is necessary to normalize for these variables. This type of analysis is complex, requires many assumptions, and is difficult to incorporate into a sound statistical model. The most widely used benchmarking tool is the EPA ENERGY STAR Portfolio Manager; however, it does not support multifamily buildings.

In addition to benchmarking, utility bills can be compared to usage predicted by energy modeling (after normalization for weather). However, the outcome of this comparison would not be an indicator of a building's energy efficiency. Rather, it would show the degree to which the energy model predicted actual energy usage. The User Manual to ASHRAE Standard 90.1 states that the Appendix G modeling protocol "is not intended to provide an accurate prediction of actual energy consumption or costs for the building as it is actually built". Refining modeling assumptions and techniques based on analysis of billing data is valuable and can increase the utility of Appendix G energy modeling in assessing the energy efficiency; however, it does not appear possible to bring it to the point where a given set of assumptions fits any building. This is similar to how the cooling or heating equipment in a given installation would operate at efficiency levels that are different from the levels reported by manufacture for the AHRI rating conditions, or how EPA fuel economies put on the car sales stickers would be different from fuel consumption experienced by individual drivers.

Due to the length of new construction projects and the time needed to fully lease up buildings, and because the Program was relatively new, annual billing data was only available for a handful of buildings. An independent survey of energy consumption of twelve affordable housing buildings in New York City (Lehman, 2009) found that the two buildings that participated in NYSERDA Multifamily Program, and that were among the first multifamily buildings in the nation to receive the ENERGY STAR label, used 26% less energy than the control group average. The buildings in the study had floor areas between 42,500 SF and 130,000 SF and were constructed between 1997 and 2006. The two ENERGY STAR buildings reviewed in the study had an average annual energy use intensity of 75 kBtu/SF, compared to the control group average of 100.5 kBtu/SF, and a heating energy use intensity of 7.7 Btu/SF/HDD compared to the control group average of 11.2 Btu/SF/HDD. It is of note that while the usage of the two buildings was lower than that of other buildings in the referenced study, it was higher than the delivered energy consumption intensity of 71.5 kBtu/SF for public multifamily buildings in the Northeast reported in the DOE 2008 Building Energy Data Book. The reasons could involve the impact of occupancy and building characteristics discussed above and specifics of local building code. For example, the New York City building code that was in effect when the buildings were designed called for significantly higher mechanical exhaust from kitchens and bathrooms than ASHRAE 62.

Comparison of actual bills to model projections indicated that modeled consumption in early projects was typically below the actual usage. To overcome this pattern, potential causes were investigated and changes were made to the Program Simulation Guidelines, including an increase in modeled heating thermostat setpoints and an increased attention to pump and fan energy consumption. In addition, more emphasis was placed on construction-stage inspections to ensure adherence to Program requirements.

RECOMMENDATIONS

Based on the results observed during the first few years of this Program, the following recommendations can be made.

Changes to the Incentive Structure

a) The ERP and supporting documents are currently submitted to NYSERDA at three distinct stages (draft proposed, final proposed and as-built), which requires a significant time commitment from both the Partners, who prepare the submittals, and Program staff, who review the submittals. While the intent of providing funding to the developer early during the design process with the submittal of a draft proposed ERP made sense in theory, it proved to increase the number of administrative hours considerably. It is recommended that the design-based ERP be submitted only after the design is completed, in order to decrease the administrative cost for both the developer and the Program.

b) It was discovered that Program requirements were often forgotten or ignored during the construction phase, even when these requirements were explicitly included in the design documents and specifications. If a higher percentage of the incentives were shifted from the design stage to construction stage, it would be less likely that these requirements would be overlooked.

c) Currently, there is only one construction phase incentive given at the As-Built stage, and for the first two years of the Program, the one inspection performed by Program staff occurred at the As-Built phase. Based on the number of issues that were discovered during these inspections, it was determined that there should also be an early inspection, performed at the open-wall phase, though Partners did not always notify the Program before the walls were closed up. It is recommended that open-wall inspections be made an integral part of the Program. Linking these inspections to the shift in incentives, suggested above, would help ensure timely notification by the Partners of when the buildings were ready for inspection.

d) We recommend placing added emphasis on achieved performance by evaluating post-construction utility bills through benchmarking, or other billing-based metrics, with an additional level of incentives offered based on the results of billing analysis. This would help address areas of design, construction, and operation that may not currently be incentivized sufficiently, such as air sealing, construction quality, and building maintenance.

Allow a prescriptive path

It takes a significant amount of time to learn the ASHRAE Appendix G method and to develop, revise and review the energy models. For standard building designs that have been proven to achieve required level of performance, and for states that do not have a NYSERDA-type entity to administer a Program such as MPP, a prescriptive path that does not require energy modeling would be beneficial. Designing such a path presents a challenge due to the diversity of the multifamily building sector. However, the EPA is working on developing prescriptive approach for its ENERGY STAR Multifamily High-Rise Program, which is expected to be included in their national rollout.

CONCLUSION

In spite of some bumps and bruises that were encountered during the Program's first few years, the Program has been a success, and was recognized by the prestigious ACEEE Exemplary Program award.

The program *helped improve housing stock* in New York State, incentivizing the construction of over 8,000 energy-efficient apartments in affordable housing projects alone. And as the affordable housing programs in the state of New York have embraced the principles of this Program and are now requiring all projects to incorporate these goals, the Program will influence the development of thousands of more energy efficient apartments in the future.

At a time when the economy is hurting and unemployment in New York State is at a 26-year high, the Program has resulted in a significant number of *green jobs* across the State. Based on a survey of Partners, the Program has created and/or retained 343 jobs within the Partner network alone. In addition, it is estimated that this Program has resulted in over 3,000 construction jobs in New York State.

The Program helped increase awareness among developers, design professionals, and contractors of building energy code requirements and best practices for energy efficiency. The knowledge gained during one project will be applied in subsequent projects, even if incentives are not provided. For example, the requirement to calculate the designed lighting power density helped educate the marketplace about appropriate lighting levels and the need to avoid over-illumination. Rather than simply installing the same number of higher-efficiency light fixtures, designers will optimize their future lighting designs to also decrease the number of fixtures, reducing both energy consumption and construction costs.

The ability to evaluate various design alternatives using energy simulation helped demonstrate to developers and design teams that upgrading insulation or windows might save more energy at a much lower cost than a new solar photovoltaic array, or that increasing insulation might not be cost effective because of the high efficiency of heating and cooling systems. Modeling has also emphasized the possibly dramatic impact of some frequently overlooked design details on energy efficiency. These factors include electric resistance heaters in common areas, unjustifiably high exhaust rates, un-insulated rim joists and over-lit common areas.

These lessons learned are affecting a larger number of buildings than just those participating in the Program. The developers, design teams and Partners have used what they learned to influence the way they build within and outside of the multifamily sector.

ACKNOWLEDGMENT

This document includes information from various guidelines and studies developed for NYSERDA Multifamily Performance Program.

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