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CASE STUDY

Capturing the Value of Energy Upgrades in Affordable Multifamily Homes:

HOW POLICY MAKERS CAN PAVE THE WAY TO EFFICIENCY

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EXECUTIVE SUMMARY

The Natural Resources Defense Council's Center for Market Innovation worked closely with three affordable multifamily housing owners with properties located in New York City ("the City") to better understand the challenges facing them as they pursue energy upgrades and to identify the financial and social benefits that they and their tenants would realize through energy efficiency improvements. This study shows that there is huge potential to save money in the affordable multifamily housing (AMF) sector. Implementing packages of energy conservation measures in larger AMF buildings has the potential to make these properties more affordable and help preserve the City's AMF stock. The potential cost savings generated through energy efficiency (EE) improvements would reduce residents' total housing costs and help AMF owners increase their cash flow and reserves—monies that could be reinvested in their buildings.

POTENTIAL SAVINGS: The Center for Market Innovation (CMI) collaborated with these AMF owners to identify potential savings opportunities by conducting an ASHRAE Level II energy audit. The audit identified specific energy-related repairs and improvements that would result in cost-effective savings. CMI then rolled up these cost-effective measures into a package to evaluate financial impact of these measures and whether the costs were recoverable within a reasonable period. The table below shows that these investments do indeed make financial sense.

Financial Analysis Summary	Regina Pacis	Tower Gardens	River View Tower
Source Energy Reduction	28%	21%	29%
Annual Utility Savings	22%	22%	29%
Total Annual Savings	$80,600	$203,100	$514,500
Weighted Average Expected Useful Life (EUL)	16	17	17
Discount Rate	5.0%	5.0%	5.0%
Total Gross Savings over EUL	$1,289,000	$3,452,700	$8,746,500
Present Value of Cost Savings over EUL	$873,524	$2,289,763	$5,800,507
Net Implementation Costs	$558,300	$1,037,100	$1,634,400
Net Present Value of Investment	$315,224	$1,252,063	$4,166,107
Return on Investment over EUL	56%	121%	255%
Internal Rate of Return	12%	18%	31%
Simple Payback in Years	7	5	3

TECHNICAL AND FINANCING OPPORTUNITIES: The City offers programs that can help building owners achieve these outcomes.

- **NYC Retrofit Accelerator** is a technical and financing platform that was launched for buildings covered under the City's Local Law 84 (LL84) annual benchmarking requirements and Local Law 87 (LL87) audit and retro-commissioning requirements for all private buildings of more than 50,000 square feet. The Accelerator connects owners to technical service providers who can help guide them through the energy upgrade process. It also connects them to viable financing options.
- **The New York State Energy Research and Development Authority** (NYSERDA). In early 2016 the agency is expected to reopen its Multifamily Program, which is anticipated to provide technical and financial assistance to help AMF buildings achieve source energy savings of 25 percent or more and provide incentives for individual measures as well.
- **The New York City Energy Efficiency Corporation** (NYCEEC) offers a variety of financing and loan products that underwrite to cost savings to fund projects. In addition, NYCEEC recently developed a savings calculator, called efficienSEE, that helps building owners covered under LL84 understand their property's savings potential in advance of an audit just by entering their building's address.
- **Other lending institutions** include the New York City Department of Housing Preservation and Development (HPD), the New York City Housing Development Corporation (HDC), the Community Preservation Corporation (CPC), and Fannie Mae. These have all developed first mortgage and supplemental loan products that underwrite to a portion of savings to finance energy upgrades in the AMF sector.
- **Con Edison** offers incentives and rebates for energy efficiency upgrades for current electric and/or gas customers including multifamily customers. These may include incentives or rebates for building surveys, energy-efficient equipment upgrades, and other efficiency measures under one of their energy efficiency programs.
- **National Grid** offers rebates for high-efficiency heating and water heating equipment and other incentives for current multifamily customers.

With such renewed focus on the AMF sector, there is now more opportunity than ever for AMF owners to pursue energy efficiency upgrades at their properties. However, real barriers persist.

BARRIERS TO ADOPTION: While the savings potential is substantial, the CMI team saw firsthand the very real barriers inhibiting the adoption of energy upgrades in the AMF sector. These barriers, along with possible strategies for overcoming them, are discussed following.

Knowledge and capacity constraints are real barriers for AMF owners. Many AMF properties have lean staff with limited technical expertise in the area of energy efficiency. This hurdle can potentially be overcome through one-stop-shop platforms that provide owners with technical help throughout the energy upgrade process and connect them to viable financing options. New York City's Retrofit Accelerator is intended to address this issue in the five boroughs, but this remains an important barrier outside the City.

Timing is a particularly important factor in getting owners to say yes to an energy upgrade. The optimal time to pursue EE improvements is during a major refinancing/rehabilitation or recapitalization event. Since self-funding is not an option for most AMF properties, outside financing is needed. This is easiest to achieve during a major refinancing event, when all stakeholders are at the table and disruption to property operations has been planned for in advance.

First-cost hurdles and barriers to financing are particularly challenging in this sector since AMF properties tend to be constrained in terms of cash flow and capital. Even for improvements that pay back quickly, there remains the issue of how installation costs will be funded. There are a number of financing products that recognize a portion of the cost savings in their underwriting process, allowing the savings to be monetized. But since many AMF buildings are operating with thin margins, they are not necessarily sufficiently creditworthy to take advantage of these products. Even if a property is financially stable, obtaining the required consents from lenders and investors who are part of the capital stack can be challenging. More focus should be placed on developing financing products tailored to the unique risks of the AMF segment. This may mean developing credit-enhanced financing products or loan pools that shift the risk of first loss away from the primary lender or investor to a third-party credit enhancer who is arguably more comfortable with recognizing savings in AMF projects.

Timing and Certainty of Incentive Payments can also be problematic for many AMF owners pursuing an energy improvement project. There is a need for more certainty in connection with the payment of performance incentives by energy incentive providers like NYSERDA. Many lenders will not recognize these incentive payments as a source of funds since they are contingent upon successful completion of the scope of work and/or achievement of performance criteria. At

the very least, more bridge financing products to help cover contingent incentive program payments should be offered to help defray upfront costs. Also, modifying these types of programs so that at least a portion of these incentives are not contingent and can be released to pay for installation costs would help to streamline the construction and funding process.

Reliability of savings projections is a concern for AMF owners and lenders. More case studies documenting actual savings realized after implementation—organized in an accessible, centralized database—would help to better frame the business case for EE.

Soft-cost hurdles can deter AMF owners from pursuing more capital-intensive measures that require additional scoping studies and specialized consultants to assist with implementation. More grant funding and predevelopment loan financing would help AMF owners afford the studies, tests, and consultants necessary to get to "yes."

Complexities of advanced submetering present a challenge to cash-strapped AMF owners. Advanced submetering yields tremendous cost and energy savings but can be expensive and difficult to implement. Lenders, regulators, and investors all must buy in to the conversion to submetering, and the Public Service Commission (PSC) approval process can be complicated and lengthy. An incentive program akin to NYSERDA's now defunct advanced submetering program could be used to compensate AMF owners for the time, costs, and complexities related to this measure. Also, adopting statutory deadlines for PSC approval would help to create greater certainty and streamline the process.

INTRODUCTION

The Natural Resources Defense Council's Center for Market Innovation believes that a collaborative approach in which energy consultants and financial lenders partner to develop replicable energy upgrade solutions is essential to scaling owner demand for energy conservation measures in the affordable multifamily housing sector. The Center for Market Innovation (CMI), in partnership with Steven Winter Associates, Inc. (SWA), launched its Affordable Multifamily Housing Retrofit Demonstration Project in January 2015 to achieve three important objectives:

- To engage directly with owners and decision makers to identify the barriers impeding the adoption of energy upgrades.
- To quantify, document, and publish the potential economic benefits that can result from retrofitting AMF buildings.
- To identify financing solutions to address first-cost hurdles.

This case study looks at the business case for high-performance energy retrofits in affordable multifamily housing (AMF) properties in New York City. It describes cost-effective energy conservation measures (ECMs) suitable for this building typology. It further discusses theoretical financing strategies that can be used to address first-cost hurdles. Just as important, it identifies and validates the very real barriers faced by AMF building owners as they go through the process of undertaking an energy efficiency (EE) project. The case study is intended as a resource for policymakers and administrators trying to reach the AMF sector.

PROJECT BACKGROUND

The Buildings: All three buildings were originally financed under New York State's Mitchell-Lama moderate-income housing program, which was enacted in 1955. The buildings are located in Brooklyn, the Bronx, and Manhattan. Constructed between 1960 and 1975, they are high-rise masonry structures with two-pipe steam heating systems and are master-metered for electricity. All are regulated with respect to rent/assessment charges and occupant incomes by the New York State Homes and Community Renewal (HCR).

Building	Year Built	Type	Gross Square Feet	Fuel Type	Units	Stories	Location
Regina Pacis	1972	Low-Income Rental (Seniors)	132,209	Gas/Oil	167	18	Brooklyn, NY
Tower Gardens	1961	Moderate-Income Limited-Dividend Cooperative (Families)	242,700	#2 oil	209	14	Bronx, NY
River View Tower	1965	Moderate-Income Limited-Dividend Cooperative (Families)	400,800	#2 oil	386	24	Manhattan, NY

Building Owner/Decision Maker

Regina Pacis HDFC, Inc.	CB Emmanuel LLC (Developer)
Tower Gardens LLC	Cooperative Board Members and Prestige Management Inc.
River View Tower LLC	Cooperative Board Members and Prestige Management Inc.

Regulatory Overlay: All three buildings are subject to New York City's LL84 benchmarking regulations and LL87 audit and retro-commissioning regulations for commercial properties of more than 50,000 square feet. LL84 requires covered properties to submit benchmarking data to the City annually. LL87 requires covered buildings to conduct an ASHRAE Level II audit and retro-commissioning study every 10 years. Participating in this demonstration project allowed the three building owners to obtain free technical support to assess their energy performance and opportunities for improvement ahead of LL87 requirements. Benchmarking revealed all three buildings have above-average energy consumption relative to their peers, making them good candidates for an energy upgrade.

CMI Team

Facilitator/Project Manager	Center for Market Innovation (CMI)
Energy Consultant	Steven Winter Associates, Inc. (SWA)
Affordable Housing Lender	Enterprise Community Partners (ECP)
Energy Efficiency Lender	New York City Energy Efficiency Corporation (NYCEEC)

ASHRAE LEVEL II AUDIT AND ENERGY MODELING

SWA conducted an ASHRAE Level II energy audit for each property to identify packages of cost effective ECMs that would save energy and money. A description of the recommended measures can be found in Appendix A.

REGINA PACIS: Regina Pacis's energy costs are more than 40 percent of its total yearly operating budget of nearly $1 million. Eight cost-effective measures were identified. Because the building's domestic hot water usage is relatively low, CHP was not recommended for this building. Total direct installed costs for the package of eight measures are estimated at $558,000 million, after potential incentives and investment tax credits (for solar). The package of measures would reduce Regina's energy consumption by 28 percent, resulting in projected yearly cost savings of $80,600, a 22 percent reduction in its typical yearly utility costs.

Typical Annual Utility Cost:	**$360,700**				
Measure	Annual Savings	Savings as % of Typical Utility Costs	Cost	Rebates*	Simple Payback (Years)
1. Orifice Plates & Thermostatic Radiator Valves	$12,900	3.6%	$219,100	$0	17.0
2. Low-Flow Plumbing Fixtures	$14,400	4.0%	$8,800	$0	1.0
3. Linkageless Burner Upgrades	$8,600	2.4%	$71,400	$0	8.3
4. Common Area Lighting Upgrades	$9,000	2.5%	$43,900	$0	4.9
5. Apartment Lighting Upgrades	$7,900	2.2%	$80,800	$0	10.2
6. Community Room Thermostat	$200	0.1%	$1,500	$0	7.5
7. Advanced Submetering	$19,300	5.4%	$98,800	$0	5.1
8. Photovoltaics (Solar Panels)	$9,000	2.3%	$200,000	$166,300	4.1
TOTAL	**$80,600**	**22.3%**	**$724,300**	**$166,300**	**7.0**

* Con Edison and NYSERDA have recently expanded their rebate offerings, which may further improve the economics of these investments.

TOWER GARDENS: In 2014 Tower Gardens' utility costs were more than 50 percent of its total annual operating budget of $1.8 million. The audit recommended eight cost-effective ECMs. Total direct installed costs are estimated at $1,037,100, assuming no incentives. The building would realize total yearly energy cost savings of $203,100, equal to 22 percent of its typical yearly utility expenses. Source energy consumption would be reduced by approximately 21 percent annually. This does not include the potential savings that would be realized by converting from oil to natural gas. At the time of the case study, Tower Gardens was in the early stages of exploring such a conversion, which would likely substantially increase cost savings and shorten the payback period for the package of measures. However, it is important to note that if conversion to natural gas were implemented at Tower Gardens or River View Tower, the savings and paybacks for the other measures would change due to the interdependence of the measures.

Typical Annual Utility Cost: $927,400					
Measure	Annual Savings	Savings as % of Typical Utility Costs	Cost	Rebates*	Simple Payback (Years)
1. Orifice Plates & Thermostatic Radiator Valves	$50,900	5.5%	$315,000	$0	6.2
2. Closing of Elevator Smoke Vents	$900	0.2%	$3,000	$0	3.3
3. Advanced Submetering	$46,500	5.0%	$123,000	$0	2.6
4. Cogeneration (CHP)	$70,900	7.5%	$350,000	$0	3.6
5. Common Area Lighting Upgrades	$16,500	1.8%	$81,700	$0	5.0
6. Apartment Lighting Upgrades	$8,900	1.0%	$15,700	$0	1.8
7. Ground Floor Window Upgrade	$900	0.1%	$10,800	$0	12.0
8. Apartment Refrigerator Standards (EnergyStar®)	$7,600	0.8%	$137,900	$0	18.0
TOTAL	**$203,100**	**22.0%**	**$1,037,100**	**$0**	**5.0**

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RIVER VIEW TOWER: With utility costs representing close to 43 percent of River View Tower's total annual operating budget of nearly $4 million, board members and Prestige Management were very interested in exploring an energy upgrade. The audit identified 10 cost-effective measures. Total direct installed costs, assuming no incentives, are $1.634 million. Yearly projected energy cost savings are $514,500, equal to 29 percent of the building's typical yearly utility expenses. Source energy consumption would be reduced by approximately 29 percent. Conversion from No. 2 oil to natural gas for heating and domestic hot water is not included in these cost and savings totals because additional scoping studies are needed to determine installation costs and cost effectiveness of this measure. However, the cost savings generated by the difference in commodity pricing would be a striking $409,000 annually, or nearly 23 percent of River View Tower's yearly utility costs.

Typical Annual Utility Cost: $1,800,000					
Measure	Annual Savings	Savings as % of Typical Utility Costs	Cost	Rebates*	Simple Payback (Years)
1. Orifice Plates & Thermostatic Radiator Valves	$95,300	5.3%	$416,400	$0	4.4
2. Low-Flow Plumbing Fixtures	$67,400	18.7%	$24,000	$0	0.4
3. Advanced Submetering	$86,200	4.8%	$217,100	$0	2.5
4. Cogeneration (CHP)	$182,700	10.2%	$450,000	$0	1.9
5. Common Area Lighting Upgrades	$45,500	2.5%	$59,500	$0	1.3
6. Apartment Lighting Upgrades	$9,900	0.6%	$61,800	$0	6.2
7. Garage Fan Demand-Controlled Ventilation	$1,600	0.1%	$12,000	$0	7.5
8. Apartment Refrigerator Standards (EnergyStar®)	$17,000	0.9%	$218,600	$0	12.9
9. Photovoltaics (Solar Panels)	$9,000	0.5%	$175,000	$0	20
TOTAL	**$514,500**	**28.6%**	**$1,634,400**	**$0**	**3.0**
10. Conversion to Natural Gas Heating & Hot Water	$409,600	22.8%	TBD	$0	N/A

* Con Edison and NYSERDA have recently expanded their rebate offerings, which may further improve the economics of these investments.

FINANCIAL VALUE ANALYSIS

CMI believes there is a compelling business case for evaluating ECMs as a single investment, rather than analyzing each measure individually. Viewed in this way, owners can better assess the costs and benefits of implementing the proposed package of EPMs to determine whether the investment makes financial sense and is recoverable within a reasonable period of time.

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CMI developed a financial value analysis tool to analyze the financial returns associated with each investment or package of measures as shown in the table above. The analysis looks at each building's projected annual cost savings stream over the weighted average expected useful life (EUL) of each package of measures to calculate net present value (NPV) of the project investment and return on investment, assuming a 5 percent discount rate. We also calculated the investment's internal rate of return, which is the implicit discount rate that makes the NPV of all cash flows from a particular investment equal to zero. From an investment standpoint, all three packages of measures yield attractive returns when compared with other current market investment alternatives.

REVIEWING MEASURES AND THE DECISION-MAKING PROCESS

The owners' and management companies' receptiveness to the proposed measures varied according to ownership type and the unique circumstances of each property.

REGINA PACIS: CB Emmanuel controls all decisions regarding the scope of improvements at this rental property. The company was extremely receptive to folding the first six measures into the scope of its general rehabilitation work. However, advanced submetering and photovoltaics (PV) were perceived as overly complicated and risky.

CB Emmanuel was daunted by the process to convert to advanced submetering. The complexity involved in obtaining approval from the Public Service Commission (PSC), together with the potential political ramifications associated with converting a property for senior citizens, influenced the company's decision not to pursue that measure. CB Emmanuel was interested in photovoltaics for consumption and environmental reasons but wary of taking on the technology and maintenance risk. A power purchase agreement (PPA) structure in which the risk of ownership and maintenance is shifted to a third-party developer was seen as potentially more attractive, although this approach can reduce the total return to the building owner since the developer must be compensated for taking on the technology and maintenance risk. Indicative pricing for a theoretical PPA is discussed in the Financing Scenarios section, later in this report.

TOWER GARDENS AND RIVER VIEW TOWER: These properties are cooperatives, and physical upgrade decisions must be approved by the coop boards as well as by HCR, the regulating agency. The board members of both cooperatives and Prestige Management were interested in pursuing lighting upgrades, vent closures, boiler upgrades, and ground floor window upgrades. However, due to previous unsatisfactory experience with orifice plates and thermostatic radiator valves (TRVs), these were seen as less attractive despite the projected financial returns. In addition, CHP and photovoltaics were also seen as less attractive despite the significant potential for financial returns.

Not surprisingly, board members and management of both Tower Gardens and River View Tower were very interested in oil-to-gas conversion due to the tremendous potential cost savings from the difference in commodity pricing. Both cooperatives, along with Prestige Management, are currently investigating the feasibility of converting to natural gas.

Representatives of the two buildings were open in concept to advanced submetering but thought their shareholders would strongly resist paying for their own electricity usage. Again, the complexity involved in the PSC process and the challenge of garnering shareholder approval proved to be real barriers.

Of note, the audit recommended apartment ventilation upgrades as a health and tenant comfort measure for both cooperative buildings. Even though the energy and cost savings from this measure would be negligible, board members from both cooperatives indicated that improved ventilation was a high priority, because health and comfort were paramount issues. This finding suggests that ventilation and other health and safety upgrades should be incorporated as a requirement in incentive programs like the New York State Energy Research and Development Authority's (NYSERDA) Multifamily Program and green mortgage financing programs to incentivize AMF owners to undertake other EE measures.

TECHNICAL AND FINANCING OPPORTUNITIES: The City offers programs that can help building owners achieve these outcomes.

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FINANCING SCENARIOS

These Mitchell-Lama buildings face different sets of financing challenges due to their unique circumstances. Financing strategies available to each property are discussed below.

REGINA PACIS: CB Emmanuel is planning to recapitalize the property using HCR bonds and the federal low-income housing tax credit (LIHTC) program. As indicated earlier, it will likely fold the first six energy conservation measures into the general scope of its rehabilitation work. The company anticipates that its first mortgage refinancing, together with its LIHTC equity capital raise, will be sufficient to fund these costs. Should there be a funding gap, CB Emmanuel could consider obtaining an unsecured direct loan from NYCEEC to supplement its capital stack. However, obtaining the necessary mortgage lender and investor approvals could prove problematic since these stakeholders tend to be less comfortable with full recourse instruments that underwrite to savings.

CB Emmanuel also expressed interest in PV but was concerned about the maintenance and technology risk that accompanies ownership of such a system. To address these concerns, the CMI team evaluated the economics of a 15-year PPA, which is similar to an equipment lease. The PV developer would own and install the PV equipment at the property, and in exchange the property would purchase the electricity generated by the system at a known price over a specified term. Because the PV system proposed for Regina Pacis is fairly small, and the PV developer must be compensated for the ownership and maintenance risk it would take on, Regina Pacis would pay about what it is currently paying for electricity, $0.19 kilowatts per hour (kWh) in the first year under CMI's theoretical scenario. The analysis assumes a 2 percent escalation in the cost of electricity generated by the system over the 15-year term of the PPA. The PPA would eliminate price volatility over the term but would not necessarily generate meaningful cost savings. If instead the PV system was

owned and financed by CB Emmanuel and the project was able to realize 85 percent of the federal investment tax credits, accelerated depreciation, and NYSERDA incentives, the implicit cost of electricity generated by the PV system would be about $0.105 cents per kWh, resulting in yearly cost savings of $9,000 to $10,000.

TOWER GARDENS: Tower Gardens is currently operating with a negative cash flow. This makes financing difficult. The property is not sufficiently creditworthy for an energy services agreement (ESA) or an unsecured direct loan. An ESA is an operating contract in which a third-party energy company finances, installs, and oversees the operations of EE improvements, and in exchange the building owner pays it an agreed-upon amount for realized savings. ESAs require no money down, and frequently off-balance-sheet solutions are treated as operating expenses. An unsecured direct loan underwritten to savings would be full recourse to the borrower. As with any recourse instrument, the lender must feel comfortable that the borrower has the capacity to repay the loan.

Tower Gardens could pursue a conventional mortgage refinancing in conjunction with a modest (5 percent) increase in shareholder assessment charges to finance an energy upgrade. While not optimal, this option is fairly straightforward and would only require approval from the regulating agency (HCR). A more cost-effective alternative would be to participate in a green mortgage refinancing program that recognizes a portion of the savings in the mortgage underwriting. The CMI team evaluated this option for Tower Gardens, assuming a 5 percent refinancing rate, a 20-year term, and 50 percent of projected energy cost savings recognized in the underwriting. The resulting mortgage loan amount would be sufficient to repay Tower Gardens' existing debt and finance all eight recommended ECMs with cash flow of more than $75,000 per year to spare. Of course, this scenario is theoretical. There are only a limited number of mortgage lenders offering this type of product, including Fannie Mae, the Community Preservation Corporation (CPC), the New York City Department of Housing Preservation and Development (HPD), and the New York City Housing Development Corporation (HDC), whose Property Energy Retrofit Loan (PERL) program works only with properties regulated by HPD.

RIVER VIEW TOWER: In contrast to Tower Gardens, River View Tower has positive cash flow. It is a good candidate for an unsecured direct loan from NYCEEC or an ESA because it has sufficient cash flow to support additional debt to fund the recommended ECMs. The issue with an unsecured direct loan or ESA is that it would require consent from the first mortgage lender, as well as from HCR, which could potentially be challenging to obtain. Nonetheless, these are viable options for the building to consider.

River View Tower is in the enviable position of being able to pursue a conventional first mortgage refinancing based on historical operating expenses to fund its recommended package of ECMs. The CMI team evaluated a hypothetical refinancing, presuming no reduction in utility expenses, a 5 percent refinancing rate, and 30-year amortizing term. Theoretically, River View would be able to leverage a refinanced mortgage loan amount sufficient to repay its existing debt and fund all nine ECMs (excluding conversion from oil to natural gas). Moreover, if the mortgage lender were willing to underwrite to 50 percent of projected savings, the project could theoretically support a first mortgage loan of more than $12 million, providing more than sufficient proceeds to implement the same nine ECMs and have a surplus of more than $3.7 million to fund other improvements.

DEMONSTRATION PROJECT RESULTS AND LESSONS

Through this engagement, there were also important lessons on what it takes to get AMF owners to "yes."

COLLABORATION: This demonstration project clearly supports the need for one-stop-shop technical and financing assistance platforms to help owners and decision makers evaluate ECMs, secure financing, and implement their chosen scope of work in a manner that will ensure savings are realized. Constraints on time, knowledge, and capacity are real barriers. The cooperatives in particular required strategic guidance throughout the process. The City's Retrofit Accelerator is precisely what these buildings need. However, this resource is available only to a certain subset of New York City buildings, those of more than 50,000 square feet. More Retrofit Accelerator–type platforms should be sponsored by other cities and jurisdictions to fully tap the potential of the AMF sector.

TIMING: The demonstration project supports the tenet that combining an energy upgrade with a major refinancing/rehabilitation or recapitalization event is the optimal way to pursue EE improvements. At issue is capital. Since self-funding is not an option for any of these three properties, outside sources of financing are needed. This is easiest to achieve during a major refinancing event, when all stakeholders are at the table and disruption to property operations has been planned for in advance.

FIRST-COST HURDLES: In the AMF sector perhaps more than any other building sector, financing first costs can be a very real barrier. While any number of theoretical financing scenarios can be developed, it is important to recognize the real-life challenges facing AMF properties. Like Tower Gardens, many AMF properties are not financially healthy enough to take advantage of ESAs or financing products like unsecured direct loans. Other AMF properties may be financially stable but have complicated capital stacks, making it challenging to obtain the lender, investor, and regulator consents needed to

execute these types of transactions. More emphasis should be placed on developing EE financing and mortgage products that mitigate the distinct credit risks inherent in the AMF segment to get more lenders and investors comfortable with financing products that underwrite to savings. One solution might be to develop credit-enhanced loan pools in which the risk of first loss is absorbed by a credit enhancer who is presumably knowledgeable and willing to underwrite to energy cost savings.

SOFT-COST HURDLES: Many of the more capital-intensive ECMs require additional scoping studies and/or the hiring of specialized consultants to assist with the siting and implementation aspects of these measures. These costs can inhibit AMF owners from exploring these measures. One option is for programs such as NYSERDA's to provide these services at no cost or low cost. Another option would be to capitalize a predevelopment revolving loan fund that could be used to provide financing or grants to AMF owners to perform these more expensive studies and tests to ensure that high-performance measures are considered instead of disregarded out of hand.

SUBMETERING APPROVALS: Studies by NYSERDA and others have demonstrated that submetering master-metered buildings results in substantial electricity savings, in the range of 18 to 26 percent. Contrary to popular opinion, most residents will actually see a decrease in their electricity costs. However, submetering is fraught with complexity. In the case of the two cooperatives in this study, the first step is to convince shareholders that submetering benefits them directly. One strategy might be to have a sample of residents test submeters to determine their monthly electricity costs and usage in advance of implementation. However, purchasing submeters can be a costly endeavor. Additionally, the Public Service Commission (PSC) approval process is complicated and lengthy. For many AMF owners, the complexity of obtaining PSC approval requires engaging a specialized consultant whose services can cost upwards of $40,000. Submetering also raises the issues of utility allowance determinations for subsidized housing and rent decreases for market-rate housing to ensure that residents' overall housing costs do not increase. These rent adjustments can require approvals from numerous parties, including lenders, the regulating agency where applicable, and the PSC. There is, too, the issue of split incentives: While the building owner pays for the submetering, the savings accrue to the tenants. Three potential strategies to address some of these barriers would be to streamline the PSC process by creating statutory deadlines for approval to create more certainty, to undertake pilots and demonstration projects that show the benefits of submetering to both owners and residents, and to reinstate incentive programs, like the one that was previously offered by NYSERDA, to assist AMF owners with the costs and complexities involved in submetering a master-metered property.

TIMING OF INCENTIVE Payments can also be problematic for many AMF owners pursuing an energy improvement project. There is a need for more certainty in connection with the payment of performance incentives by energy incentive providers like NYSERDA. Many lenders will not recognize these incentive payments as a source of funds since they are contingent upon successful completion of the scope of work and/or achievement of performance criteria. At the very least, more bridge financing products to help cover contingent incentive program payments should be offered to help defray upfront costs. Also, modifying these types of programs so that at least a portion of these incentives are not contingent and can be released to pay for installation costs would help to streamline the construction and funding process.

RELIABILITY OF SAVINGS: Prestige Management was resistant to embracing orifice plates and TRVs due to the limited availability of case studies showing verified savings in comparable buildings. There is a need for more post-implementation case studies that demonstrate actual performance of the measures installed. An accessible database of such post-implementation case studies would make the argument to adopt capital-intensive measures more compelling to AMF owners and lenders alike.

OPERATING AND MAINTENANCE COSTS: Another perceived barrier is the ongoing cost of maintaining new technologies. Prestige Management was concerned that investing in new computer/communication systems and engaging service contractors to maintain and repair high-efficiency smart systems would increase the building's operating costs. More studies should be made available to AMF owners showing that ECMs tend to be more durable than their conventional counterparts and actually reduce operating and maintenance costs. Additionally, more programs and documentation should be made available to building owners to train these operators on new equipment maintenance and the correct sequence of operations.

APPENDIX A: ENERGY CONSERVATION MEASURES

Orifice Plates and Thermostatic Radiator Valves (TRVs). Orifice plates and TRVs are a more efficient alternative to replacing broken steam traps in two-pipe steam heating systems like the ones in the three Mitchel-Lama properties in this study. Two-pipe steam systems typically have issues with unbalanced and uncontrollable heating, with large portions of the buildings being overheated and small portions being underheated. Overall, this results in higher-than-necessary energy consumption. To address the problem, steam traps must be replaced every three years, though this is rarely done.

Orifice plates in combination with TRVs offer a more permanent and efficient solution to balancing and regulating space heating. Their installation allows occupants to easily adjust the amount of heat in each room, as needed. TRVs sense room air temperature and open or close to maintain comfort. This serves to eliminate overheating, increase efficiency, and conserve fuel.

Closing of Elevator Smoke Vents (Glass). In high-rise buildings, some of the largest commonly found openings where energy can escape are vents at the top of elevator shafts and stairwells. These openings are intended to vent smoke in the event of a fire. However, there are two other code-compliant options that allow the partial or full closure of vent openings: installing annealed glass to partially cover the vent opening, or using motorized dampers that fully cover the opening and open mechanically. The latter saves more energy, but at a substantially higher installation cost.

Submetering. All three buildings are master-metered for electricity, with resident and common area electricity use billed to one central account. Tenants are not directly charged for their electricity use. Instead, apartment electricity use is included in residents' maintenance charges, the amount based on apartment size.

With submetering, residents become financially responsible for their electricity usage. Each apartment unit receives an advanced (digital) meter so tenants can view their electricity consumption and control their behavior to reduce utility costs. Residents are often resistant to the idea of submetering because they see it as an additional financial burden, but in reality it can empower them to lower their overall housing costs. Studies conducted by NYSERDA and HCR have shown significant electricity savings of 18 to 26 percent when advanced meters individually monitor each apartment unit's electricity consumption.

Cogeneration. Combined heat and power (CHP), also known as cogeneration, is the simultaneous production of electricity and thermal energy (heat) on-site. Larger buildings with high domestic hot water usage are typically good candidates for CHP. CHP systems are combustion appliances that require sufficient gas service and venting. They also require thermal storage (i.e., water tanks) to act as a heat battery. Despite these space and siting challenges and an involved construction process, CHP's energy and cost benefits frequently outweigh these challenges, especially in buildings the size of Tower Gardens or River View Tower.

Because CHP consumes more energy on-site, it generally causes an increase in site energy usage. But the carbon footprint reduction and source energy savings are still significant, since CHP brings generation to the site, meaning less reliance on the grid. This results in significant savings at the power plant level. It also provides important sustainability, resiliency, and cost savings benefits. To more accurately determine the financial benefits of CHP, Tower Gardens would need to undertake a feasibility study to determine the best location for the units and the costs associated with installation. That study is beyond the scope of this demonstration project.

Linkageless Burner Retrofit. Compared with a standard modulating burner, a linkageless burner system delivers a more precise mixture of air and fuel during the combustion process. This results in higher efficiency. Standard burners with mechanical linkages have components that can fall out of calibration. Linkageless systems use sensors and microprocessors to deliver the most efficient fuel-to-air ratio. System components like the fuel valve and combustion damper are powered by separate actuators, which can be calibrated for optimal positioning at a range of firing rates. Additionally, these systems have the capability to communicate with building automation systems, resulting in reduced fuel costs.

Photovolataics (PV or Solar Panels). Solar panels can offer great savings by allowing users to harvest energy from sunlight rather than purchasing it from the grid. In order for this measure to be cost-effective, a building must have sufficient roof area and a high electricity cost. The cost-effectiveness of this measure also depends, of course, on the initial installation cost of the system. Recognizing that PV systems can be expensive, the federal government, along with state and city entities, offers a variety of incentives to defray the initial outlay. If an owner can take advantage of these incentives, including NYSERDA or utility incentives, federal investment tax credits (ITC), and accelerated depreciation losses, a PV system can produce attractive returns and meaningful savings. Up-front costs can be eliminated through lease or PPA financing programs, but that means the tax credits and other benefits are monetized by the financier.

Common Area Lighting Upgrade. In older properties, hallways, stairwells, community rooms, and rear building spaces are often illuminated by conventional and inefficient lighting fixtures. Upgrading these fixtures to high-efficiency LED equivalents will improve lighting efficiency (lumens/watt), reducing energy consumption. Additionally, LEDs typically have a more appropriate color-rendering index for clarity and visual recognition under low-light conditions. These qualitative benefits offer improved vehicular and resident safety.

LEDs last longer than regular incandescent or fluorescent lamps and do not require any more maintenance than existing fixtures. To further optimize energy use and cost savings, occupancy sensors can be installed on stairwell LED fixtures to reduce light levels when the space is unoccupied. This again reduces electricity consumption and results in greater cost savings.

Apartment Lighting Upgrade. The in-unit inspections of all three properties revealed that residents use traditional incandescent light bulbs and that some hard-wired fixtures would need to be replaced to accommodate LED bulbs. When residents do not pay directly for their electric usage, they do not have a financial incentive to upgrade fixtures and purchase the pricier, but more efficient bulbs. To address this, building management could purchase LED lighting in bulk to sell to the residents at cost. This type of program could be used to offset first costs and increase resident awareness.

Window Upgrade. Replacing all single-pane windows with double-glazed, argon-filled, low-E thermally broken windows will minimize energy loss by reducing heat transfer. This produces cost savings in the form of reduced fuel consumption for heat.

Apartment Refrigerator Standards. Many of the buildings' apartments have older, inefficient refrigerators instead of newer Energy Star–rated units. On average, new Energy Star–rated units would use 30 percent less energy than currently installed models. The audit recommends that the cooperatives' policies be revised to require residents replacing their units to purchase an Energy Star–rated model and that the property buy Energy Star–rated units in bulk. This approach would offset the slightly higher first costs of purchasing a higher-efficiency refrigerator and would result in electric cost savings for the building (or for residents if submetering is implemented).

Low-Flow Plumbing Fixtures. Installing low-flow plumbing fixtures can reduce flow rates, which in turn can help decrease water bills and domestic hot water energy costs. This measure is generally highly cost-effective, with a payback of less than one year.

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