Lending for Energy Efficiency Upgrades in Low- to Moderate-Income Communities: Bank of America's Energy Efficiency Finance Program

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Executive Summary

In 2011, Bank of America launched its Energy Efficiency Finance Program (EEFP) to help families, businesses, and multifamily building owners in low- to moderate-income (LMI) communities increase their energy efficiency and reduce their energy bills. Through the program, Bank of America made $55 million in loans available to community development financial institutions (CDFIs), which are private financial institutions (including banks, credit unions, loan funds, and venture capital funds) that specialize in lending to these communities for a variety of purposes.[1] Participating CDFIs could borrow directly from Bank of America at 1% interest to relend to their customers for commercial, multifamily, and single-family efficiency projects. The Bank of America Charitable Foundation provided $5 million in grants to CDFIs to help offset their operating costs.

In all, 12 CDFIs participated in the program, together lending out over $34 million of the funding made available by Bank of America between 2011 and 2013. The CDFIs pooled EEFP funds with an additional $37 million in funds from other sources. In the aggregate, the CDFIs made over 700 loans, many of which were used to implement projects with multiple goals, combining energy efficiency upgrades with other efforts ranging from solar panel installations to complete building rehabilitations. Bank of America contracted with Bright Power, Inc. to monitor and analyze the energy and water use in a sample of the participating buildings to track changes in usage before and after the efficiency measures were put in place.

Under a contract with Bank of America to evaluate this program, we analyzed data supplied by the participating CDFIs and Bright Power to assess the performance of the loan portfolios as well as the efficiency investments themselves. In general, we found that the loans are performing well. At the time the CDFIs supplied us with data, 98.8% of the loan volume was current (payments were up to date or no more than 30 days overdue), 1.2% of the total loan volume was more than 30 days past due, and 0.7% of the loan volume was more than 90 days past due or in default.

Bright Power tracked energy consumption in a subset of the buildings, 106 of which had full data on energy consumption available. With complete data for only 106 buildings, it is difficult to draw broad conclusions about the performance of the efficiency investments themselves. However, from the data we have, it appears that it is possible to structure financial products and energy efficiency projects that are successful both at delivering substantial energy savings to LMI communities and creating a viable financial product to underwrite them.

At the same time, however, it is also clear that there are important issues along the project chain that must be handled appropriately for a program to be successful. Our analysis and conversations with CDFIs have led to valuable lessons learned from those trying to make these projects successful from both a financial and energy standpoint.

[1] ofn.org/what-cdfi

One overarching lesson we encountered was that homeowners, building owners, and managers typically do not have the expertise in energy efficiency or the bandwidth to identify viable upgrades or to design and implement projects to achieve them. Successful projects were not characterized by any particular financial or technological innovation, but rather the willingness to apply time and effort to figure out how to structure a project and a financing approach that worked for the specific markets and buildings in question. Effective partnerships between lenders, implementers, and others were a key part of most successful efforts.

In addition, several lenders found generating demand for energy efficiency loans challenging. Lenders also found that many potential customers, particularly in the multifamily sector, were reluctant to contemplate projects that might put their cash flow at risk by undertaking projects where the savings may not materialize or be enough to cover the costs of the energy conservation measure (ECM). Particularly in the multifamily and commercial sectors, lenders found it easier to initiate efficiency projects along with other nonenergy upgrades. This approach takes advantage of economies of scale, but can also introduce some new challenges.

Introduction

Energy efficiency is often one of the lowest cost options for delivering energy services to homes and businesses. In an examination of the costs of various electricity supply options, Molina (2014) found that of all the resources available to electric utilities to meet the energy needs of their customers, deploying energy efficiency cost utilities less on average than every other source of electricity. With costs ranging from about 2 to 5 cents per kilowatt-hour (kWh), utilities have been able to deliver energy efficiency to their customers at a lower cost than actual electricity, which has supply costs ranging from 5 to 15 cents per kWh. In addition to being inexpensive, investing in energy efficiency can also generate other substantial benefits, such as increasing overall productivity of businesses, increasing comfort inside homes, and reducing various types of pollution (Baatz 2015; Cluett and Amann 2015).

Despite these benefits and overall affordability, energy efficiency can be difficult to deploy as an energy resource. There are a number of reasons for this, several of which are discussed below. Among them is that, like other investments, efficiency requires a relatively large up-front expense to generate a stream of expected returns over time. The initial cost of efficiency investments can be a major hurdle, particularly for low-income communities and other income and credit constrained families and businesses.

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[2] CDFIs are licensed and supported by the federal government with mandates to support economically distressed communities. They also have the ability to use public and private capital, which can allow them to lend at below-market rates. This makes them well suited to engage in energy efficiency lending for LMI communities. For more information, see www.ofn.org/what-cdfi.

The American Council for an Energy-Efficient Economy (ACEEE) was contracted by Bank of America to do the ex-post analysis of the EEFP. ACEEE received cost and energy use data from Bright Power, as well as loan performance data and qualitative information from the CDFIs themselves. We conducted phone interviews with key staff from each of the participating CDFIs to get a better understanding of the challenges and successes of their efforts under the program. This paper discusses our analysis of the data provided and synthesizes the lessons learned from our conversations with CDFIs. While the success or failure of individual retrofit projects is important to the overall program results, we focus less on individual buildings or projects and more on buildings and loans as a portfolio. We are less concerned with how much energy any specific building saved and more with whether and how it is possible to design and implement a successful energy efficiency loan program.

Bank of America Energy Efficiency Finance Program

Bank of America's CDFI lending team began to develop the EEFP in 2010. In order to support Bank of America's growing environmental business commitment to address the issue of job creation in the post-recession economy, the CDFI team decided to focus on energy efficiency retrofits in LMI communities.[3] Bank of America hoped to use its capital to scale up successful CDFI programs and assist promising new pilots. At the time, Bank of America's CDFI program had a network of over 200 CDFIs to which they already had lent over $1 billion.

In November of 2010, Bank of America's CDFI team convened a session at the Opportunity Finance Network (OFN)[4] conference to learn from successful CDFI programs and created the EEFP soon after. Bank of America recognized that although low-cost capital would be key to success, it is only one component of a successful energy efficiency retrofit program. So, in addition to low-interest, long-term loans, the EEFP would provide grant support to cover administrative and servicing costs involved in scaling up programs. Bank of America would also provide data collection to assist property owners in real time and analyze that data ex-post for future best-practice approaches.

Bank of America lent to participating CDFIs at an interest rate of 1% over terms as long as 10 years. The loans were designed to be as flexible as possible so that the CDFIs could incorporate the funds into pre-existing loan programs. The loans to the CDFIs ranged from $2 million to $8 million, and each participating CDFI also received a $500,000 grant. The few conditions placed on the funding were aimed at ensuring that CDFIs addressed the LMI community and that they allowed energy savings to be tracked. The loans were restricted to targeted communities and came with a deployment deadline. Bank of America's intent in creating the EEFP was to catalyze already-successful programs as well as promising new pilot programs. With Bright Power collecting all the information and monitoring energy use

[3] At the outset of the project, the Bank of America environmental business commitment was $20 billion. That has since grown to $125 billion to be fulfilled by 2025.

[4] The Opportunity Finance Network is a membership organization of CDFIs that provides its members with financing, training, research, and other resources (OFN 2011).

before and after the retrofits, Bank of America was able to ensure the analyzed properties had complete and comparable data to be used in best-practices analysis.[5]

Bank of America formally announced the program in May 2011 with a July deadline for CDFIs to apply. A selection committee reviewed the applications and announced recipients in November of 2011. Nine individual CDFIs were chosen to receive funding directly, and EEFP made the remaining balance available to OFN to relend to its member network, resulting in four additional participants. The four CDFIs participating through OFN received loans at 3% interest and were held to the same restrictions as those receiving loans directly from Bank of America, although the time required for the funds to flow through OFN and to eventual participants left less time available for the OFN participants to issue loans.[6] This increased interest rate through OFN made it difficult for some CDFIs to lend funds at a below-market interest rate, particularly when factoring in servicing fees.

In addition, some of the CDFIs receiving funds through OFN did not receive any of Bank of America's grant dollars, thus inhibiting their ability to effectively staff and market the program in their individual markets. This made it particularly difficult for organizations that were launching new energy programs.

Bank of America contracted with Bright Power, Inc. to use their proprietary EnergyScoreCards to collect and evaluate data on energy use in a subset of buildings that used EEFP funds. Bright Power tracks usage and spending for different energy sources including electric, gas, oil, and renewable energy as well water consumption. At the time of this writing, Bright Power has provided this type of analysis for close to 20,000 buildings for a wide range of clients. For this project Bright Power also collected information on the types of retrofits done, the costs, and their projected annual savings.

Financial Outcomes

As mentioned above, participating CDFIs made loans into three different market categories: commercial, multifamily residential, and single-family residential buildings. The buildings in these three markets are distinct from one another both functionally and financially, so we consider their performance separately and as a whole. Tables 1 and 2 summarize key data on the loans issued by market segment. Table 1 summarizes all of the loans made by the CDFIs under the EEFP program, while table 2 deals only with those loans for which we also have energy usage data from the associated buildings. The subset of data presented in table 2 includes all of the ones for which we have a complete set of energy data and was not determined by building, loan, or performance characteristics.[7]

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[5] See Appendix A for sample images of Bright Power's EnergyScoreCards tool.

[6] While four CDFIs participated in the program through OFN, one was unable to issue any loans before the deadline. For the purposes of our analysis, we only consider the 12 CDFIs that made loans under the program as participants.

[7] One building characteristic that influenced the availability of data was the fact that buildings had to have been occupied for at least one full year prior to the upgrade. Buildings that were unoccupied prior to the upgrade are necessarily exclude from the sample in table 2.

Table 1. Loan summary data: total loan pool

Market segment	Number of loans	Total loan volume	Average interest rate	Average loan term (years)
Commercial	36	$36,155,844	4.11%	9.8
Multifamily	134	$26,125,905	3.50%	10.1
Single-family	545	$8,864,994	5.16%	19.1

Source: Data provided to ACEEE by participating CDFIs

Table 2. Loan summary data: loan pool with energy data

Market segment	Number of loans	Total loan volume	Average interest rate	Average loan term (years)
Commercial	13	$2,959,190	3.63%	6.3
Multifamily	38	$11,509,396	4.50%	14.0
Single-family	19	$249,947	4.22%	17.0

Source: Data provided to ACEEE by participating CDFIs

The subset of loans for which we have energy data is comparable to the overall loan pool, although the single-family market segment is significantly underrepresented. It is important not to attempt to draw strong conclusions from such a small sample of loans and buildings. This is true not only for the single-family segment, but for the other segments as well. We can infer some information from this data, but due to the sample size and other reasons mentioned below, it should not be used to draw overarching conclusions about efficiency loans in general.

LOAN PERFORMANCE

Tables 3 and 4 below present data on loan performance for the same two pools of loans. Participating CDFIs supplied the information in the fall of 2015, and the data reported below reflect the status of the loans at that time. As a snapshot in time, this means that loans that are current may have been past due in the past and may become past due before the end of the loan term. Only a full retrospective analysis of the loan portfolio will reveal the overall performance over the entire loan terms. Note that the past due values in tables 3 and 4 represent the entire original value of the energy-related portion of the loans, not the amount of the loans that is past due.[8] It is also important to note that the loans were all made between 2011 and 2014, during a slow recovery, which means that over the time period we examine, loan portfolios in general would be expected to perform better than they would during an economic downturn. However it should also be noted that in LMI neighborhoods in older urban areas (such as Chicago), the economic impact of the recession

[8] For many of the loans in this category, a significant amount of the outstanding loan had already been repaid at the time of reporting. We did receive a complete set of data on this, however, and the tables report the total amount of the loans in question that were intended for energy-related upgrades. The data therefore overestimate the value of the loan volume past due.

lingers, with recovery occurring at a much slower and lower rate than in more moderate-income communities.

At the portfolio level, the loans appear to be performing well. Only 0.7% of the loans (by value) were more than 90 days past due or in default at the time ACEEE received data from the lenders. Lending in the single-family sector is dominated by Craft3, a participating CDFI that operates in Oregon and Washington. Craft3 made 454 of the 545 loans in the single-family market, including the 20 loans that were between 30 and 59 days past due. In our interview with representatives of Craft3, they indicated that they were very satisfied with the performance of their loans and that the relatively large number of delinquent accounts was due largely to issues with the local utilities who collect payment on behalf of Craft3. This on-bill arrangement is discussed further below.

Of the 9 multifamily loans more than 90 days past due, all were also originated by a single CDFI, the Community Investment Corporation (CIC) operating in the greater Chicago area. These loans were made with a specific energy retrofit subordinate loan product (Energy Savers Loans in which the Bank of America investment resides) as part of a larger program aimed at preserving affordable multifamily housing. Energy efficiency and the preservation of affordable rental housing are among the several issues addressed by the larger CIC program. CIC's lending for energy efficiency totals more than $27 million in retrofit work on 11,000 units in more than 300 properties, with Energy Savers loan originations representing approximately $15.4 million of this loan volume.

CIC provided us with an update to its data and report that the nine loans that were past due at the original time of data collection (October of 2015) have been reduced to seven as of April 30, 2016. The principal balance of those loans was $175,324, or 1.1% of the Energy Savers loans originated. This is less than the $445,945 reported below because the tables show the entire original loan amount and not what is actually past due. It is also less because one of the loans, for $100,050, was in default, but that charge-off was covered by a loan loss reserve provided through the City of Chicago; therefore, CIC suffered no loss of principal. Of the $15.4 million of Energy Savers Loans originated, $7 million (45% of the originations) has been paid off in full with no losses.

In addition, of the 7 loans still more than 90 days past due, 6 of them were with a single borrower who encountered challenges in the overall portfolio of buildings in a very difficult low-income Chicago community. As CIC holds the first mortgages on these same properties, CIC is very actively involved with this owner and assisting in moving the loans out of delinquent status. CIC made special note that the delinquencies in the Energy Savers portfolio are not specific to loans for energy retrofits but rather reflect the overall challenges of owning and operating multifamily properties in low-income communities. A now-deceased borrower was the holder of the one other loan more than 90 days past due. CIC also holds the first mortgage on this property and is pursuing foreclosure on both loans. CIC reported that they were extremely pleased with the performance of the portfolio.

Over 98% of the loans in the multifamily sector examined in this paper were current at the time the data were reported. For comparison, the 30-day and greater delinquency rate on single-family mortgages in 2015 was 5.6%, and the default (or charge-off) rate was 0.21%

(Federal Reserve 2016a, 2016b). The total loan portfolio here has lower delinquency rates (1.2% more than 30 days past due) and higher default rates (0.69%).

As noted above, the delinquency and default data for the Bank of America loan portfolio include the entire original value of the energy-related portion of the loans in question; therefore, the data overstate the value of loans past due. This is not true for the Federal Reserve mortgage data presented here, which counts only the value of loans in delinquency or default still outstanding at the time of reporting. The unfavorable comparison, particularly for the default category, is unwarranted because of this overstatement of default values and because the Federal Reserve data cover mortgages issued in all customer categories. In contrast, the Bank of America loans were made explicitly to the LMI sector, in which we would expect to have somewhat higher delinquency and default rates than the market as a whole, all else equal. As a result, the Federal Reserve data are best taken as context for the Bank of America data, rather than as a point of comparison.

Table 3. Loan performance data: total loan pool

	Current		30–59 days past due		60–89 days past due		90+ days past due	
Segment	Value	Number	Value*	Number	Value*	Number	Value*	Number
Commercial	$36,155,844	36	$0	0	$0	0	$0	0
Multifamily	$25,647,960	134	$32,000	1	$0	0	$445,945	9
Single-family	$8,473,949	545	$304,176	20	$43,128	2	$43,741	2

*Values represent the entire original loan amount, not the amount that was past due. *Source:* Data provided to ACEEE by participating CDFIs.

Table 4. Loan performance data: loans with energy data

	Current		30–59 days past due		60–89 days past due		90+ days past due	
Segment	Value	Number	Value*	Number	Value*	Number	Value*	Number
Commercial	$2,959,190	13	$0	0	$0	0	$0	0
Multifamily	$11,409,346	38	$0	0	$0	0	$100,050	1
Single-family	$249,947	19	$0	0	$0	0	$0	0

*Values represent the entire original loan amount, not the amount that was past due. *Source:* Data provided to ACEEE by participating CDFIs.

BUILDING PERFORMANCE

As part of the project, Bank of America contracted with Bright Power, Inc. to track the energy performance of the buildings in which the upgrades were performed. Bright Power tracks consumption by analyzing energy and water bills for at least one full year before and one full year after an efficiency retrofit.

Bright Power supplied ACEEE with data on energy use before and after the retrofits. Bright Power adjusts the data to account for changes in the weather to normalize the data for swings in temperatures that might cause changes in energy consumption independent of the performance of the efficiency measures. These normalized data give an indication of what the changes in consumption will tend to be over the long run, and eliminate the impact of changes in the weather in the pre- and post-retrofit years.

Methodology

We took weather-normalized consumption data for each energy type for each building in the pre-retrofit year and multiplied it by state-level energy prices collected by the Energy Information Administration to establish a weather-normalized expected energy cost baseline for each building (EIA 2016a, 2016b, 2016c).[9] We then used the post-retrofit normalized consumption data multiplied by pre-retrofit energy prices to establish a weather-normalized expected first-year savings for each building.[10]

Unfortunately, because of anomalies in the data for water use, we were unable to include water savings in our analysis. Several of the projects included measures that were intended to reduce water use and costs, and some of the data appear to confirm that savings were realized in some buildings. Unfortunately, the water data contained a number of obvious recording errors so that we felt compelled to exclude it from the analysis to avoid overstating the positive impacts of the upgrades. The building performance results would likely have been significantly better had we been able to include accurate estimates of water savings in the benefits. A more detailed discussion of our methodology is included in the Appendix.

It is important to note that for this project, Bright Power did not undertake traditional evaluation, monitoring, and verification (EM&V). EM&V is critical for a complete and detailed understanding of how efficiency measures are performing over time. Utilities are often required to undertake EM&V of their efficiency programs to ensure that they achieve the results required or incentivized by regulators. EM&V as undertaken for utility programs requires the establishment of a counterfactual baseline of energy consumption, often estimating the nonenergy benefits of the investments, and other issues (ACEEE 2016). Bright Power's approach, on the other hand, is to monitor energy and water consumption in the buildings in question to monitor overall consumption and estimate energy use for various purposes such as space heating, air conditioning, and water heating. It is a less resource-intensive approach to assessing the results of efficiency upgrades and is distinct from the process generally referred to as EM&V in the efficiency industry.

Results

We assessed the performance of each building using two simple metrics. The first is the Savings to Investment Ratio (SIR), which is simply the ratio of the present value of the savings divided by the cost of the efficiency measures.

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[9] Bright Power's methodology imputes energy prices from total utility bills and weather-normalized consumption, which does not allow for direct observation of actual energy prices on a per-unit basis, necessitating our use of an alternate data source.

[10] Here, as in the other savings estimates, we assumed a 3% annual increase in energy prices.

$$SIR = \frac{PV(Savings)}{Costs}$$

This ratio gives a present-value-to-present-value comparison of the costs and benefits of the efficiency investments made in a given building. In simple terms, it indicates over the expected life of the project whether or not it was economically worth it. An SIR greater than 1 indicates that energy savings more than paid for the entire cost of the efficiency measures installed in the building.

The second measure, the debt coverage ratio, compares the first-year annual savings for each building to the annual loan payment required to cover the costs of the efficiency measures they financed. A debt coverage ratio greater than 1 indicates the energy savings are sufficient to cover the entire loan payment with some savings left over.

$$Debt\ Coverage\ Ratio = \frac{First\ Year\ Savings}{Annual\ Debt\ Service}$$

In both cases, we are considering a narrow definition of costs and savings. For costs, we only consider the costs of the upgrades to the building owners, including the cost of capital, net of any rebates, or other incentives. For savings, we only consider the projected energy cost savings, including those associated with efficiency, on-site solar generation, and fuel switching. This focus on financial costs and benefits ignores costs and benefits often considered in other evaluation metrics, such as the administrative costs of implementing an efficiency program, and nonenergy benefits to upgrades, including improvements in health and comfort.

Figures 1 and 2 show the performance of the buildings in our sample as measured by their SIR and debt-coverage ratio. An SIR of greater than 1 means that over the expected life of the efficiency measures, the savings are projected to be greater than the entire cost of the energy-related upgrades. A debt-coverage ratio of greater than 1 means that the efficiency measures generate at least enough savings to cover the entire annual debt service payment for the energy-related measures, increasing free cash flow for the building in question.

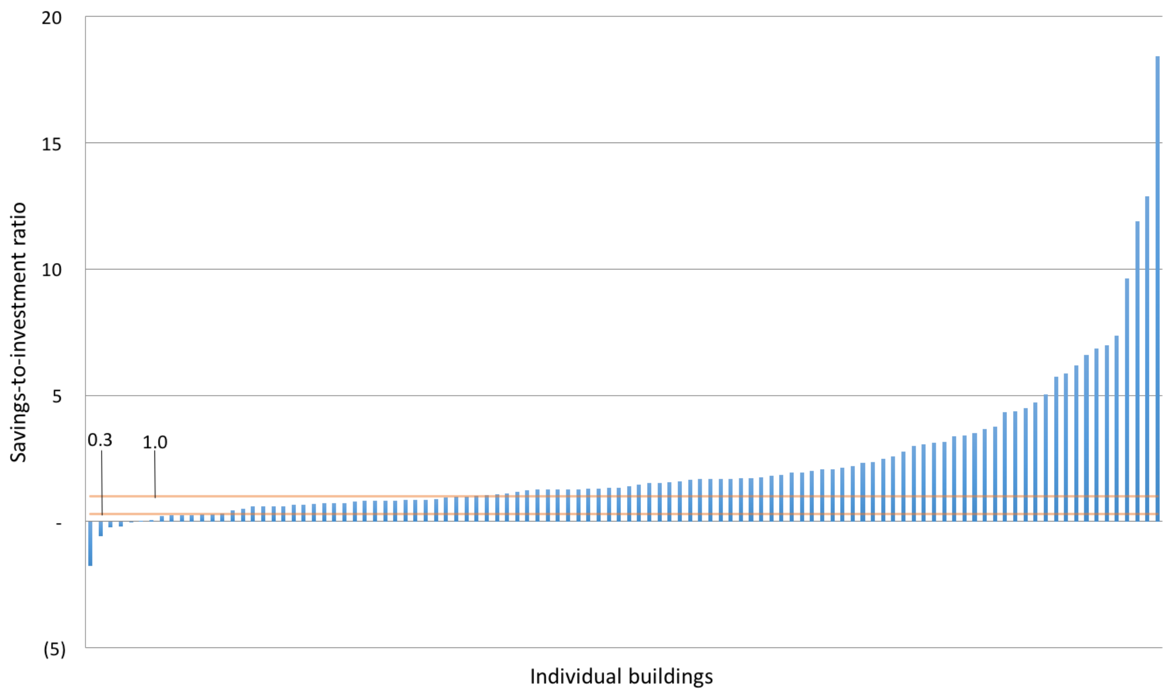

Figure 1. Savings-to-investment ratios for individual buildings. 0.3 is the efficiency premium threshold; 1.0 is the break-even threshold. *Source:* Project data provided to ACEEE by Bright Power and participating CDFIs.

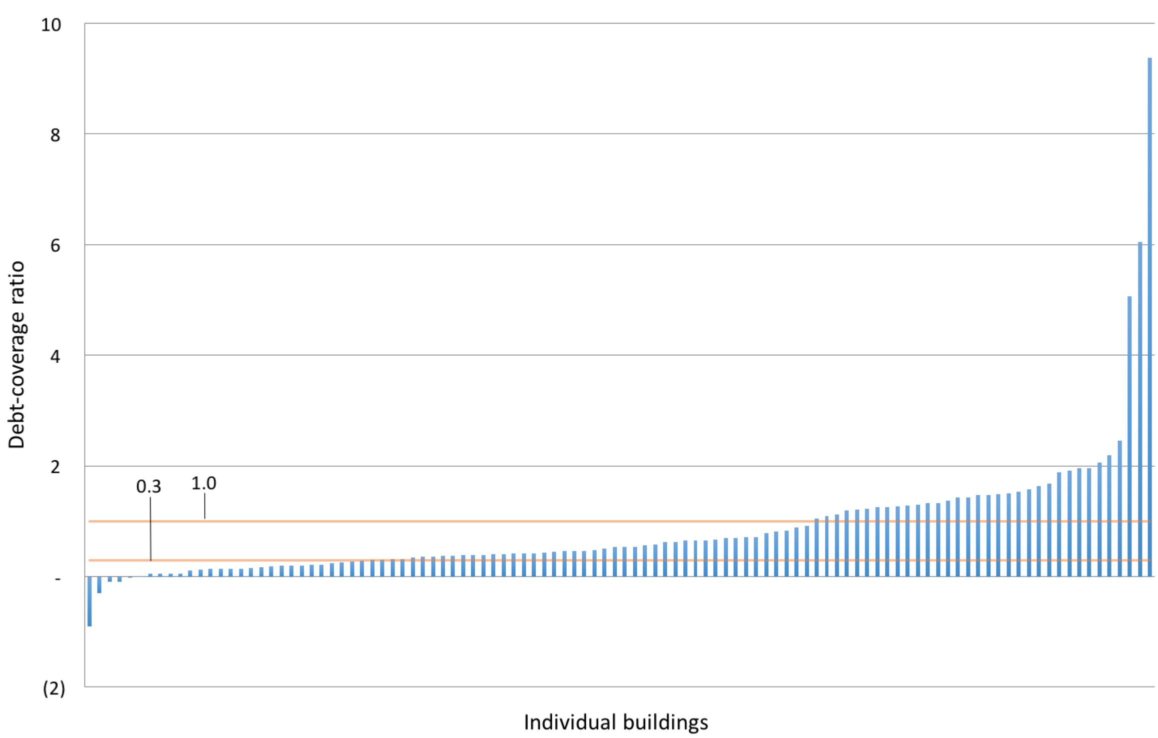

Figure 2. Debt-coverage ratios for individual buildings. 0.3 is the efficiency premium threshold; 1.0 is the break-even threshold. *Source:* Project data provided to ACEEE by Bright Power and participating CDFIs.

It is important to note that while both SIR and debt coverage ratios greater than 1 indicate that a project was a success from a cost-effectiveness standpoint, less than 1 does not necessarily indicate failure. Many of the efficiency upgrades undertaken under this program were replacements of existing energy-related equipment like water boilers and air conditioners. In cases like these, as discussed below, a significant number of the buildings were undergoing a major renovation or the equipment in question had failed. In either case, the existing equipment was going to be replaced, and the question is how efficient the replacement will be. In these cases, the appropriate metric should not be whether the savings are sufficient to cover the entire cost or debt service for the replacement, but rather whether the savings are sufficient to cover the incremental cost of the more efficient product. This situation is akin to expecting the gasoline savings from a fuel-efficient car to be large enough to cover the entire car payment. Instead, it is more appropriate to consider whether or not the savings are enough to cover the additional cost of the efficient version over the standard version of the same car. The same principle applies to efficient building equipment. If the choice is between a more efficient unit or a less efficient one, the relevant financial question is whether the savings from the more efficient unit will be enough to cover the difference in price between the two, not whether they will cover the entire cost of the more efficient unit.

More-efficient building energy equipment tends to be more expensive than less-efficient equipment. The price premium for efficient equipment varies depending on the type of equipment and how much more efficient it is. In general, we estimate that the efficiency premium is no more than 50% more expensive than average and is typically less. Using a 50% premium as a conservatively high threshold, the efficiency characteristics of efficiency equipment would constitute about one-third of the total equipment costs. If the energy savings are sufficient to cover one-third of the equipment costs, then in many cases, we would consider the investment successful. Even this is more conservative than it sounds, because our data do not distinguish between equipment and other costs, such as the labor required to install it. Since installing a more efficient piece of equipment typically carries a cost premium far less than 50% (if any at all), applying the 50% premium to the entire efficiency project (including both the purchase and the installation costs) sets our conservatively higher threshold even higher. Charts 1 and 2 show thresholds for SIR and debt-coverage ratios at 1 and 0.33 for reference (a 50% premium translates into 33% of total costs).

It is important to note that replacing old equipment with new equipment will likely result in some energy savings, even if the new equipment is of average efficiency. Our calculations implicitly attribute all energy savings to the efficiency characteristics of the upgrades, even though relatively inefficient new equipment will almost certainly be more efficient than the older equipment it replaces. This is less relevant for upgrades with SIR or debt-coverage ratios greater than 1. In these cases, we are comparing the entire cost of the upgrade (including both energy- and nonenergy-related characteristics) to the savings generated by the upgrade, whether they are due to the efficiency of the upgrades or simply by nature of their being new.

The danger of overstating benefits is more acute for the 0.33 thresholds, however. Here, we give an estimate of the upper bound of the costs of the efficiency characteristics and compare them to the savings generated by the upgrade, regardless of whether the savings are due to the efficiency or the newness of the equipment. Our data do not allow us to make an adjustment to the savings data to attribute only the share of savings due to the energy savings characteristics of the upgrades. To the extent that the analysis is concerned with the question of whether the savings from an upgrade are sufficient to pay one-third of the total cost of the upgrades, the 0.33 threshold may overstate the success of the projects since some of the savings we calculate would likely be achievable without any efficiency premium.

As figures 1 and 2 show, the cost effectiveness of the upgrades varies widely, with a significant minority of buildings returning lifetime savings of more than five times project costs, while others yield much more modest returns, and some in which energy expenditures actually increased.

Tables 5 and 6 show the same data, breaking each metric down into four categories (less than 0, between 0 and 0.32, between 0.33 and 1, and above 1), showing the number of buildings in each category and the share of the total loan volume in each.[11]

Table 5. Savings-to-investment ratios

	SIR<0		SIR 0–0.32		SIR 0.33–1.0		SIR >1.0	
Segment	Number	Volume	Number	Volume	Number	Volume	Number	Volume
All	**5**	**5%**	**9**	**13%**	**24**	**33%**	**68**	**49%**
Commercial	2	22%	1	21%	0	0%	10	57%
Multifamily	1	0.01%	3	11%	15	38%	55	51%
Single-family	2	12%	5	29%	6	26%	6	33%

Source: Project data provided to ACEEE by Bright Power and participating CDFIs

[11] Note that the number of buildings in the performance sample is significantly larger than the number of loans presented in the previous section (106 vs. 70). This is due to the presence of several multi-building apartment complexes in our sample. Each complex received a single loan covering all of the buildings in the complex, but we have performance data for each individual building. The efficiency measures installed differ, sometimes widely, among buildings in the same complex, and energy performance varies substantially between buildings in a single complex.

Table 6. Debt-coverage ratios

	Coverage <0		Coverage 0–0.32		Coverage 0.33–1.0		Coverage >1.0	
Segment	Number	Volume	Number	Volume	Number	Volume	Number	Volume
All	**5**	**5%**	**27**	**43%**	**40**	**27%**	**34**	**25%**
Commercial	2	22%	4	36%	5	37%	2	4%
Multifamily	1	0.01%	15	46%	26	23%	32	31%
Single-family	2	12%	8	53%	9	35%	0	0%

Source: Project data provided to ACEEE by Bright Power and participating CDFIs

The energy savings data indicate several results. First, a small number of buildings (5 out of 106 total) showed increased energy expenditures (i.e., they have SIR and debt-coverage ratios of less than zero). This may seem surprising for projects aimed explicitly at increasing energy efficiency and is somewhat counterintuitive. However portfolios of efficiency projects can show these types of anomalous results for a variety of reasons. For example, commercial buildings that undergo a major rehabilitation project (sometimes known as a gut rehab) of which efficiency measures are a part may change their use profile as a result of the project. Operating longer hours, adding additional lighting, or increasing square footage covered by heating or air-conditioning units, even if energy efficient, may increase overall energy use after the project. In residential buildings, there may be some event unrelated to the project that causes energy use to increase, such as the addition of a family member (a new child or an elderly parent moving in) that could cause energy use to increase. Faulty or incorrectly installed equipment may also be to blame. While we can only speculate on the causes, this is not an entirely uncommon result.

Looking at the SIR data, over 60% of buildings representing nearly half of the loan volume achieved an SIR of greater than 1, indicating that the energy savings were sufficient to cover all of the costs of the efficiency measures. An additional 22% of buildings representing 37% of loan volume achieved savings sufficient to cover a conservatively high estimate of the cost premium associated with high-efficiency equipment. For over 75% of the buildings and 85% of the loan volume in our sample, the efficiency investments were a success, and in some cases a resounding success, with over 10% of the buildings showing a return of over 500% over the life of the measures. A substantial minority of buildings showed at least some savings to partially defray the additional costs of energy-efficient equipment, but not enough to cover the entire premium.

As expected, the debt-coverage ratios are not as positive as the SIR data. Only 25% of the loan volume achieved debt-coverage ratios of greater than 1, as compared to almost half of the loan volume with an SIR greater than 1. However almost 70% of the buildings representing over half of the loan volume yielded debt-coverage ratios greater than 0.33, indicating that the savings are sufficient to cover the cost premium on more efficient equipment. The discrepancy between the SIR and debt-coverage ratios is attributable to the difference between the expected life of the measures and length of the loan term. Most of the efficiency measures installed in these buildings have expected lives of 15 years or more, with many having expected lives of 30 years or more. With a volume weighted average loan term of 12.5 years, the loans on the efficiency upgrades are being paid off much more quickly than the measures are returning savings, resulting in negative cash-flow impacts.

The data also show that the multifamily segment outperformed the commercial and single-family residential sectors. With only 106 buildings in the sample, of which 74 are multifamily residential, we need to be careful in drawing broad conclusions. Of the 13 commercial buildings in our sample, 4 account for nearly 75% of the loan value, 2 of which performed just above and just below 0 in both metrics. Without a broader, larger sample it is difficult to make clear comparisons between the market segments.

However we can identify a few key elements of successful projects in the multifamily space. First, some of the outliers on both ends of the spectrum are buildings with relatively low levels of investment, leaving both metrics highly sensitive to the amount saved. Both the most successful and least successful buildings had upgrade costs of less than $1,000. Interestingly, both buildings are a part of the same larger apartment complex, consisting of 13 buildings. As a whole, that complex undertook almost $300,000 in efficiency upgrades, and as a whole returned an SIR of 1.45 and a debt-coverage ratio of 0.61. As with many types of investment, diversifying by investing in a number of different buildings appears to help reduce the risk of failure for the portfolio as a whole.

Within the multifamily market, we find that many of the underperforming buildings took on projects that tend to be marginally economical from an efficiency standpoint, particularly window replacements. Replacing windows can save a substantial amount of energy and costs; however the expense of window replacement projects is often so high that the economics do not work well. We found that successful building upgrades often included boiler replacements, insulation upgrades, and in many cases a conversion from oil to gas, which increases general energy efficiency and uses a less expensive fuel.[12]

The single-family market seems to have underperformed compared with the other segments, with an aggregate SIR of 0.66 and debt coverage of 0.29. This outcome seems likely due to the fact that single-family homes do not enjoy the economies of scale associated with larger multifamily buildings. Among the more successful single-family projects, several included solar panel installations in addition to energy efficiency measures. The solar panels helped reduce energy bills and were often subsidized, helping to keep loan payments relatively low.

Program Lessons

LMI markets can be difficult to serve with energy efficiency. Many of the challenges associated with deploying energy efficiency are exacerbated in LMI markets, and designing programs to meet this market brings challenges specific to it, particularly when using loan-based financing as part of the deployment mechanism. In interviews with the CDFIs involved in the program, we were able to identify a range of challenges and lessons learned

[12] Fuel conversions, as well as solar panel installations, are not strictly energy efficiency measures, but they are both intended to save energy and reduce overall energy costs through a capital investment. From a financial standpoint, they are essentially similar to efficiency upgrades, and our analysis treats them as such.

from their experiences. One overarching message is that when working in these markets, it is critical to have a lender with experience in lending to customers in the LMI segment. The knowledge, experience, and flexibility the CDFIs brought to the program were essential to their success.[13]

Stewards of Affordable Housing for the Future (SAHF) and the Low Income Investment Fund, a participating CDFI, partnered on a project to use energy performance contracting to enable efficiency upgrades in subsidized housing through the Bank of America Program.[14] In a joint paper reviewing their experience, these two entities identify what they call the 3c's, challenges that must be overcome in deploying a successful efficiency program (Schaaf and Laitimer-Nelligan 2016):

- *Capacity.* The absence of building management staff with the responsibility and availability to manage energy and water projects
- *Competence.* The lack of expertise among building management required to identify potential savings
- *Capital.* Lack of access to affordable funds necessary to design and implement a program

While this analysis was conducted in the context of multifamily buildings, it encompasses a large number of the issues the CDFIs raised with us in our interviews. We would broaden the first category to include issues of driving awareness and demand among building owners and managers. Bringing potential projects into a pipeline is a challenge many of the CDFIs faced either before or in conjunction with questions of capacity.

Participating CDFIs experienced a range of challenges in all three categories, even in regard to accessing capital, an issue the EEFP specifically targeted. In retrospect, some of the issues seem obvious or predictable, while others are a little less so.

DEMAND AND CAPACITY ISSUES

Several of the participating CDFIs reported that homeowners and building managers were generally unaware of the potential for savings from energy and water upgrades. This appears to be due in part to the fact that there are relatively few energy efficiency companies serving the LMI market. While there may be a significant amount of latent demand for efficiency in the LMI market, unlocking it may require focused technical assistance, something that ESCOs, utilities, or other partners can potentially provide. The CDFIs that attempted to start a new efficiency program found it difficult to identify potential projects to which they could apply the EEFP capital. Those CDFIs that already had efficiency lending

[13] See Cluett, Amann, and Ou (2016) for a discussion of best practices in structuring utility-based energy efficiency programs for low- to moderate-income single-family homes.

[14] For SAHF, see www.sahfnet.org. Energy performance contracting is an arrangement with an ESCO to identify and perform efficiency upgrades that should save a sufficient amount of energy to pay for the upgrades and any related cost of capital. The ESCO typically provides the financing, guarantees the performance of the measures, and handles all of the project design and implementation.

programs in place had an easier time finding projects to finance. Similarly, CDFIs that worked with pre-existing borrowers also had more success in deploying capital.

Cash Flow and Risk Aversion

CDFIs working in the multifamily market found that even when they were able to identify potential participants in the program, building owners and managers were reluctant to participate out of a concern over their cash flow. Because many of these buildings operate on thin margins, any project that might put their cash flow at risk was met with skepticism. Even though the projects may have been specifically designed to increase cash flow by reducing energy expenditures by a greater amount than the associated loan payments, building owners and managers were hesitant to trust that the savings would be high enough. At least one participating CDFI, Boston Community Loan Fund, addressed this problem by guaranteeing the energy savings in terms of physical units (e.g., kWh). Even with this guarantee, something that most lenders are unlikely to give, borrowers were still hesitant because they could not get a guarantee for the projected dollar savings. They were able to come to an agreement because utility prices have not been declining and so the energy savings guarantee was a good enough proxy for a dollar savings guarantee. The properties that Boston Community worked with, two multibuilding apartment complexes, both had debt-coverage ratios of over 1, though some of the individual buildings within the complexes did not. The debt associated with the efficiency upgrades therefore did not negatively impact cash flow in either property, and the savings more than paid for the costs of the efficiency upgrade.

Pooling Projects

The question of cash flow raises another issue confronted by several CDFIs. In general, they found that coupling efficiency upgrades with other repair or rehabilitation projects made it easier to persuade business and multifamily building owners to participate. The ability to take advantage of a planned financing event allowed CDFIs and building owners to take advantage of economies of scale in dealing with legal and administrative costs. It also meant that it would minimize the additional impact on business activity or occupancy rates. In some cases, some nonenergy work was enabled because in the financial modeling, the savings from the efficiency project were projected to help cover some of the costs of the nonenergy work. One of the multifamily properties that Boston Community worked on was able to address multiple issues, including moisture problems, tenant amenities, and basic maintenance and repair issues. The energy savings covered about one-third of the total project, and the associated reductions in maintenance and repair costs also contributed to the financial success of the overall project. Similarly, Homewise, which made loans exclusively in the single-family market, found that their customers fell into one of two categories: those motivated to undertake solar installation projects explicitly for the purpose of saving energy and those who were undertaking necessary improvements to their homes and were willing to add efficiency measure to the projects. Homewise reported having no problems with sufficient demand. They found sufficient numbers of both types of customers to maintain steady demand.

Nonenergy-Related Challenges

At the same time, nonenergy issues with some buildings created challenges. Often, buildings with the worst energy performance, and thus with the greatest opportunities for savings, also had other problems that needed to be addressed either in conjunction with or before efficiency upgrades could be considered. In some cases, the contractors assessing buildings for efficiency upgrades found building code problems that had to take precedence over the upgrade. In at least one case, a significant efficiency upgrade would have cost a multifamily building its grandfathered status in compliance with accessibility codes. In all of these examples, the nonenergy issues are resolvable, but financing both the necessary repairs and the efficiency upgrades may be a challenge. Regardless, these experiences, both positive and negative, point to the need to consider the entire building status and operations when considering an efficiency upgrade. A project that minimizes negative impacts on occupancy or business operations and takes advantage of economies of scale associated with planned upgrade or repair projects is more likely to be successful and can facilitate addressing essential nonenergy issues. In dealing with affordable housing, it may be possible to bring in other public and private resources to put together a project that deals with all of the issues, but it is an additional layer of work that may need to go into developing a project.

Reactive Purchases

A related issue is the fact that many people don't think about their energy systems until something breaks. The point at which homeowners are forced to replace a broken air conditioner, for example, is the best opportunity to get them to install a more efficient unit. Unfortunately, this reactive market is by nature difficult to predict, and unless customers know about a program to provide financing for a more efficient unit, they may be more likely to replace their broken unit with something that is less expensive to buy even though its total lifecycle costs may be higher. This speaks to the need for programs to work midstream with experienced contractors who can offer customers more efficient units with associated financing options at the time of repair.

Effective Partnerships

Craft3, operating in Oregon and Washington exclusively on single-family homes, partnered with an existing program called Clean Energy Works (now called Enhabit)[15] that handled all of the marketing and managed contractor relations. Being able to participate with an existing program lowered the costs and other barriers to reaching potential customers. Craft3 predominantly uses an on-bill recovery mechanism by which homeowners made loan payments on their utility bill. Among the reasons for using a program structure like this is that lenders feel that collecting payments this way reduces the risk of nonpayment and that a successful project should show a net decline in the overall utility bill, allowing consumers to see and appreciate the savings more easily. In assessing applications, Craft3 was able to rely on both standard credit evaluations and utility bill repayment history, giving them added flexibility to reach a broader pool of customers. While the on-bill repayment system provided several benefits, it added a restriction that at least 75% of each loan must be devoted to energy upgrades, limiting customers' ability to couple efficiency with other projects. Craft3's partnerships with Clean Energy Works and the utilities allowed

[15] Enhabit is a nonprofit implementer of solar, efficiency, and health and safety upgrades. See www.enhabit.org.

it not only to reach prospective customers more easily but also to use a finance strategy that would otherwise be difficult or impossible to deploy.

CORE COMPETENCY ISSUES

Homeowners and building managers are generally not experts in energy efficiency, and even in commercial or multifamily buildings in which energy is an important function and cost, it is unreasonable to expect that building managers will be able to keep abreast of efficiency technologies and deployment opportunities along with all of their other responsibilities. At the same time, CDFI lenders may be familiar with these issues, but it is still a relatively new area of work for most, and most are not experts in the field. For these reasons, many of the participating CDFIs noted the importance of partnering with experienced contractors or existing programs.

Logistical Challenges

CIC partnered with Elevate Energy[16] in Chicago, seven metro counties, and the City of Rockford to implement energy efficiency upgrades in naturally occurring affordable multifamily rental housing. Elevate Energy served as a one-stop shop to help building managers handle the rebates and other incentives that are available to purchasers of some types of efficient and other clean energy products. Elevate served as a kind of personal liaison for each building, managing the process from start to finish. It has significant experience in this role and was able to market effectively to potential buildings and manage the logistics of the upgrade projects. CIC has expertise in lending to this type of building (many of the projects were done with existing CIC borrowers). The partnership worked well, playing to the strengths of both partners.

The Low Income Investment Fund (LIIF), a participating CDFI that operates nationally, engaged with energy service companies (ESCOs) to perform upgrades on privately owned multifamily housing receiving assistance from the Department of Housing and Urban Development (HUD). This experience was less favorable than the partnership between CIC and Elevate Energy. ESCOs are generally private for-profit companies that provide efficiency and other clean energy services for buildings. They typically handle the logistics of identifying potential savings and implementing projects in buildings. They often guarantee energy (but not cost) savings. LIIF and its housing partner, Stewards of Affordable Housing for the Future (SAHF) hoped that ESCOs would bring significant expertise to bear on implementing projects in the LIIF/SAHF buildings. They found, however, that the ESCO engineers were in many ways overqualified for the task of upgrading the apartment buildings in their portfolio. At the same time, however, that expertise did not obviate the need for building owners to remain involved in the project to make key decisions (Schaaf and Latimer-Nelligan 2016). Since the launch of the EEFP program, a number of mission-oriented energy service companies have emerged to help address the LMI market space. These firms focusing in this market may bring specialized

[16] Elevate Energy is a mission-driven, for-profit efficiency program implementer. See www.elevateenergy.org.

knowledge of how to apply ESCO models to LMI buildings, thus easing some of these problems.

Accurate Savings Projections and Measurement

Participating CDFIs also reported having difficulties with assessing projected savings prior to a project and actual savings after a project was completed. The Connecticut Housing Investment Fund (CHIF) in particular noted that they struggled with the lack of standardized building assessments in the multifamily buildings they targeted. This absence made it difficult for them to judge the opportunities in their buildings and made it difficult to trust that the projects would generate sufficient savings. Ultimately, CHIF was able to move ahead by using conservative estimates of savings, using utility and other incentives to cover part of the project costs (especially for converting from oil to gas heat), and partnering with the Connecticut Green Bank[17], which provided a loan loss reserve. With these enhancements, CHIF was able to underwrite loans based entirely on projected savings, which must be considered a success. However the absence of consistent pre-project building assessments and post-project monitoring still present challenges in this market.

Implementer Incentives

Another issue raised by CDFIs also related to the question of the interface between project implementers and building owners and managers. Some noted that contractors tend to push low-cost measures that have a high return on investment but that do not address larger and often more expensive opportunities. This so-called cream-skimming can prevent buildings from achieving deep energy savings potential, even though they offer a good financial return. Owners and managers who are not well versed in building efficiency or who don't have an accurate picture of the full scale of the savings opportunities in their buildings might be inclined accept a less ambitious efficiency upgrade project. All of this points to the need to work with highly qualified contractors with good technical understanding of the buildings and systems in question and that will design an upgrade project to meet the specific goals of the building owners and managers.

CAPITAL ISSUES

The Bank of America Energy Efficiency Finance Program was specifically designed to enable homeowners, building owners, and managers in low-income communities access low-cost capital to finance efficiency upgrades. While affordable financing is critical for projects in these markets, it is not sufficient to ensure success.

Debt Stack

One common challenge in lending for projects in commercial or multifamily buildings is the problem of getting permission from multiple lenders. Taking on a loan to finance an energy upgrade in these markets often requires permission from pre-existing lenders. Many of the buildings in this market have multiple lenders that must give their approval, even if the building is not being used to secure the efficiency loan. Any project that might attach a claim to building revenues, thus potentially putting repayment of existing loans at risk, may

[17] See www.ctcleanenergy.com.

require consent of pre-existing lenders. While this situation can be difficult in itself, it becomes even more of a challenge when the building is being used as security on the energy loan and that security is subordinate to pre-existing obligations. In one case, Boston Community Loan Fund found that it would have been 13th in line behind other lenders in the event of default. The effort of obtaining consent from 12 lenders resulted in very little actual security on the loan, but was still necessary to move forward with the project. This is a common problem with commercial and multifamily buildings.

Assisted Housing

One issue specific to assisted housing (rental housing for which rents are subsidized by federal, state, or local governments, entities that generally regulate which costs can be passed on to tenants) is that owners can have a difficult time recouping the costs of upgrades. LIIF wanted to upgrade HUD-assisted, privately owned multifamily buildings owned by members of SAHF. The existing agreement with HUD specified the utility allowance that HUD provided to cover utility costs on behalf of renters. Cost savings from efficiency investments would lower the utility allowance so that owners would not be able to recoup the costs of the upgrades or share in any of the energy savings. LIIF and SAHF were able to negotiate a new agreement with HUD under which HUD would receive 5% of the savings; a minimum of 80% of the savings would be used to repay loans, and any remaining savings would accrue to the owners. While LIIF and SAHF eventually came to a satisfactory arrangement with HUD, it took 18 months, which delayed their program substantially.

The Connecticut Housing Investment Fund (CHIF) raised similar issues with housing supported through Section 8 of the Housing Act of 1937. Section 8 limits the rents that building owners can charge their tenants. Owners that undertake programs that reduce tenants' energy costs cannot pass the costs of the associated loan payments onto tenants without documented proof of savings. This situation represents a special case of the split incentive problem common to individually metered multifamily buildings. In this case, the building owner needs to convince HUD that the energy upgrades warrant an increase in rent. Providing verification of savings may present a barrier to undertaking upgrades.

Mismatched Loan Terms and Measure Lives

Another issue raised by participating CDFIs, which is also evident from the data presented in tables 3 and 4 above, is the importance of matching loan terms to measure lives. Comparing the SIR results in table 3 to the debt-coverage results in table 4 shows that a significant share of buildings received upgrades that were cost effective by the SIR measure but that still did not generate enough savings to cover the associated loan payments. This can occur in cases where the loan terms are substantially shorter than the measure lives they finance. Consider a simplistic example in which an upgrade costs $1,000 and generates $2,000 of savings over 30 years. If the loan is amortized over 10 years at 0% interest, the annual payment is $100, but the annual savings will only be $67. For the first 10 years, the savings are not sufficient to cover the debt payment, even at 0% interest. It is true that after the loan is completely paid the building owner receives the full benefit of the savings, but because of the short length of the loan term relative to the measure life, the cash-flow impact is negative for the first 10 years. While the project is still successful from an SIR standpoint with a ratio of 2, the 0.67 debt-coverage ratio means that the cash-flow impact is negative until the loan is paid off. This is a particular problem in the LMI market where homeowners and multifamily building owners are highly sensitive to cash flow, regardless of the long-term net benefits of a project.[18]

The Bank of America program restricted loans to a maximum of 10 years, which means that for an upgrade to be successful from a cash-flow standpoint, the savings would need to be sufficiently high over a short period of time relative to the loan term. Some participating CDFIs were able to issue loans to buildings in our sample with terms longer than 10 years. Boston Community in particular used a strategy, for at least one apartment complex, of issuing three-year loans under the Bank of America program, holding them until the projects proved to be successful, bearing the performance risk themselves, and then refinancing the project with a permanent lender over a 30 year term that matched the expected lives of the efficiency measures more closely. The project in question, a 12-building apartment complex that received $2.27 million in energy-related investments, had an aggregate SIR of 1.18 and a debt-coverage ratio of 1.00. Boston Community's strategy enabled a project that would have been more difficult to justify at shorter loan terms.

Creditworthiness

Another problem common in LMI income communities is the issue of creditworthiness. Loans for energy efficiency in single-family residential markets are often secured by the home but subordinated to mortgages and without recourse. Even with the security, potential borrowers often have credit scores too low to justify interest rates attractive enough to make the projects viable from either the borrower or lender's standpoint. In the vast majority of its loans, Craft3, which worked exclusively in the single-family residential market, used an on-bill repayment mechanism in which the loan payments were collected as part of the homeowners' utility bills. This helped make Craft3 comfortable enough to look beyond traditional credit scores to judge the creditworthiness of borrowers. Of the roughly 454 loans made by Craft3 in our sample, 95 went to owners with excellent credit scores (above 800), while an almost equal number, 92, went to owners with less than good credit scores of 699 or less at roughly equivalent interest rates. The lower credit score loans performed somewhat worse, with three loans in arrears and two in default as compared to the excellent credit group with three loans in arrears and none in default at the time Craft 3 reported the data. Craft3 indicated that it faced loss on less than 1% of its loans over more than five years and was happy with the performance of the overall portfolio. This experience highlights one lesson noted above: having lenders with experience working in these markets and with the flexibility to structure programs and financing to fit the market.

Conclusions

The Bank of America Energy Efficiency Finance Program was designed to help CDFIs further explore energy efficiency projects for the markets they serve. Its objectives included

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[18] At the same time, however, many borrowers may prefer shorter-term debt. This obviously impacts the debt-coverage ratios, but to the extent that it reflects borrowers' preferences, shorter loan terms may not be a hindrance, regardless of its impacts on debt service.

determining whether or not energy efficiency investments could generate a significant and steady enough revenue stream to serve as a stable source of underwriting for loans that finance the investments. If this were the case, it could potentially justify offering loans in this market at rates that are simultaneously low enough to attract borrowers and high enough to satisfy the lenders. This finding would address a number of barriers to efficiency investments in LMI communities, primary among them a lack of access to affordable capital.

Although ACEEE would need to conduct a more comprehensive comparison of this loan portfolio with others from the same time frame, our assessment of the loan data shows positive results. Looking at the entire loan pool at the time the data were reported, 98.8% of the loans were current, and 0.75% of the original loan volume was past due by more than 60 days. The loans issued through the program all initiated during a slow economic recovery, during which time we would expect loans to perform well overall. Also, the loans were made at below-market rates, which not only makes repayment easier, helping keep delinquencies and defaults down, but also alters the risk-adjusted return on the loan portfolio. Those caveats aside, there is little in the loan performance data to undermine the case for the program.

We had access to a limited set of energy data with which to assess the performance of the efficiency projects themselves. On its own, our analysis cannot support broad-based conclusions. With only 19 single-family homes in the sample, the results from the single-family residential sector in particular allow us to draw few broad-based conclusions. With that in mind, the buildings appear to be performing well on the whole. Of the loans (by original volume) made for buildings for which we have energy performance data, 85% are projected to save at least enough to cover the costs of any efficiency premiums attached to the upgrades, and almost half of the loan volume is likely to save enough to cover the costs of the entire energy-related expenses. In several cases, adding efficiency measures to a nonenergy upgrade project helped lower the overall net cost of the upgrade.

The multifamily residential market dominated our sample, with 74 of the 106 buildings in our sample, and it appears to have performed the best overall in both the savings to investment and debt coverage measures. This finding is a significant outcome in itself. The split-incentive problem often associated with multifamily has the potential to be a significant barrier in the LMI multifamily market (Hynek, Levy, and Smith 2012). Despite this, several lenders found success in the multifamily space. There are several potential reasons for this. One is that economies of scale, both in project administration and the efficiency upgrades themselves, made these projects viable. Additionally, many of the successful multifamily projects appear to have focused on building-wide systems with energy costs paid by the owner. Boiler upgrades were common in these buildings. They are generally large projects, taking advantage of economies of scale, and because they change how water is heated on its way to residents' faucets, radiators, and baseboards, residents might not even notice a difference in the energy performance of their units. In addition, many of the best performing buildings also included conversions from heating oil to natural gas boilers, which generally increased the energy efficiency of the systems and switched the system to a lower cost fuel at the same time.

Perhaps the most common characteristic of successful projects across all three segments of the LMI market is that they included effective partnerships between financiers, building owners and managers, and project implementers. These partnerships seem to be able to overcome gaps in expertise and capacity that might otherwise scuttle an upgrade project. In particular, it would be difficult to underestimate the value of the expertise and experience of the CDFIs in working with borrowers in economically challenged communities. At the same time, the flexibility of the EEFP allowed CDFIs to structure loans in ways that fit these communities. More than the below-market rates that EEFP offered the CDFIs, this flexibility may have been the single most important characteristic of the program.

One key question facing the efficiency finance world is whether it is possible to underwrite loans to energy savings. If the savings from efficiency projects are sufficient to cover the debt service on the loans, then the savings stream may be a sufficient asset to underwrite the loan. Lenders may not choose to rely on this metric and may prefer to base their decisions on standard criteria such as the creditworthiness of potential borrowers and the value of the underlying building asset. But the sufficiency of the savings can significantly reduce the risk of an efficiency loan portfolio and may open new markets for energy efficiency finance for willing lenders.

Our results show that on the one hand, it is clearly possible to design an efficiency upgrade that more than pays for itself, while on the other, it often requires more work and attention than more common types of loans such as mortgages. Even then, there is no guarantee of success. In each of the three market segments covered by the Bank of America program, there was at least one building in which energy costs actually rose after the upgrade. There are a number of reasons why this can happen, including the addition of a family member in a residential unit, a change in operating hours or use patterns for schools and commercial buildings, or a simple failure of the installed measures. These factors are difficult to control for when designing and implementing an efficiency program. More commonly, a significant minority (43%) of the buildings showed positive savings, but not enough to cover the debt service on the associated loan. In some cases, this was due to measures that simply did not produce enough savings, while in others the problem appeared to be that the loan term was too short relative to the measure lives so that the amortization schedule overwhelmed the energy savings stream. In many cases, this schedule may have been the direct result of an intentional strategy to finance a comprehensive whole-building project that was able to go beyond short-lived, high-return energy measures.

However in about one-third of the buildings in our sample (34 of 106) the efficiency improvements are projected to produce enough annual energy savings to cover the annual debt payment for the energy-related costs of the project. These buildings are almost exclusively in the multifamily sector and range from small projects spending a few hundred dollars upgrading lighting to multimillion-dollar projects converting from heating oil to natural gas, replacing boilers, and upgrading system controls. Almost every lender in the multifamily and commercial space had at least one such successful project, with a variety of different program designs. This variety of successful approaches is good news from a performance standpoint, and calls for further examination to identify common factors that contribute to success.

Looking at both the loan and building performance data available to us, it appears that the LMI market offers the possibility for successful efficiency loans. Lenders and project implementers need more experience to narrow down the key elements that maximize the likelihood of success. Continued refining of lending models, program approaches, and upgrade strategies, coupled with strategies for partnering between market actors, will hopefully produce the kind of information necessary to design consistently successful efficiency programs. Initiatives like Bank of America's EEFP play an important role in developing that experience.

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Appendix A. Examples of Bright Power EnergyScoreCards

Below are two images from Bright Power's online energy performance monitoring platform. The first shows the energy performance of a single property providing a year-to-year comparison of a pre- and post-upgrade overall energy use as well as information on the estimated impacts of individual energy conservation measures. The second image shows a pre- and post-upgrade energy use comparison for the entire portfolio of buildings in our sample.

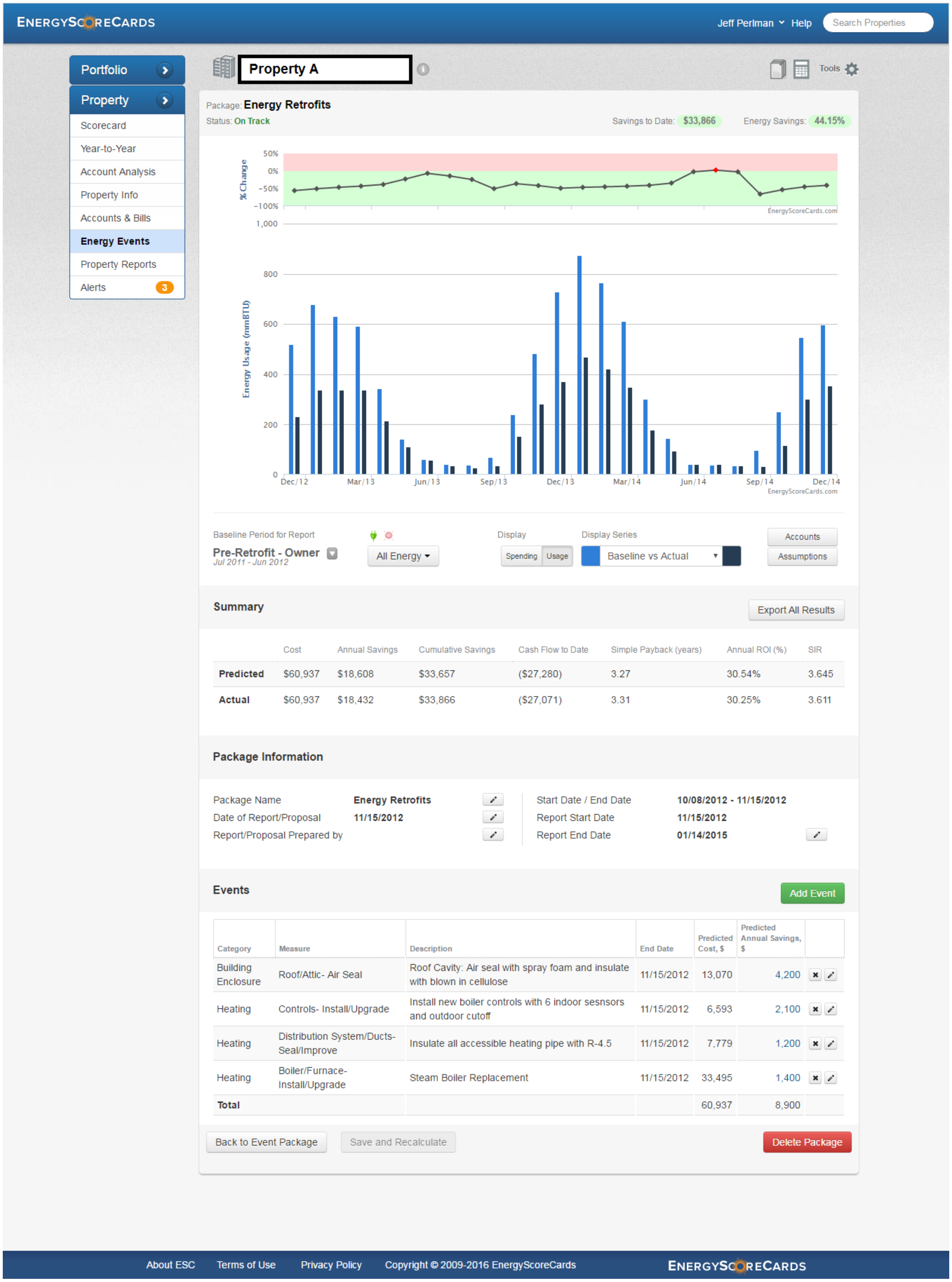

Figure A1. Individual building performance dashboard. *Source:* Bright Power, Inc.

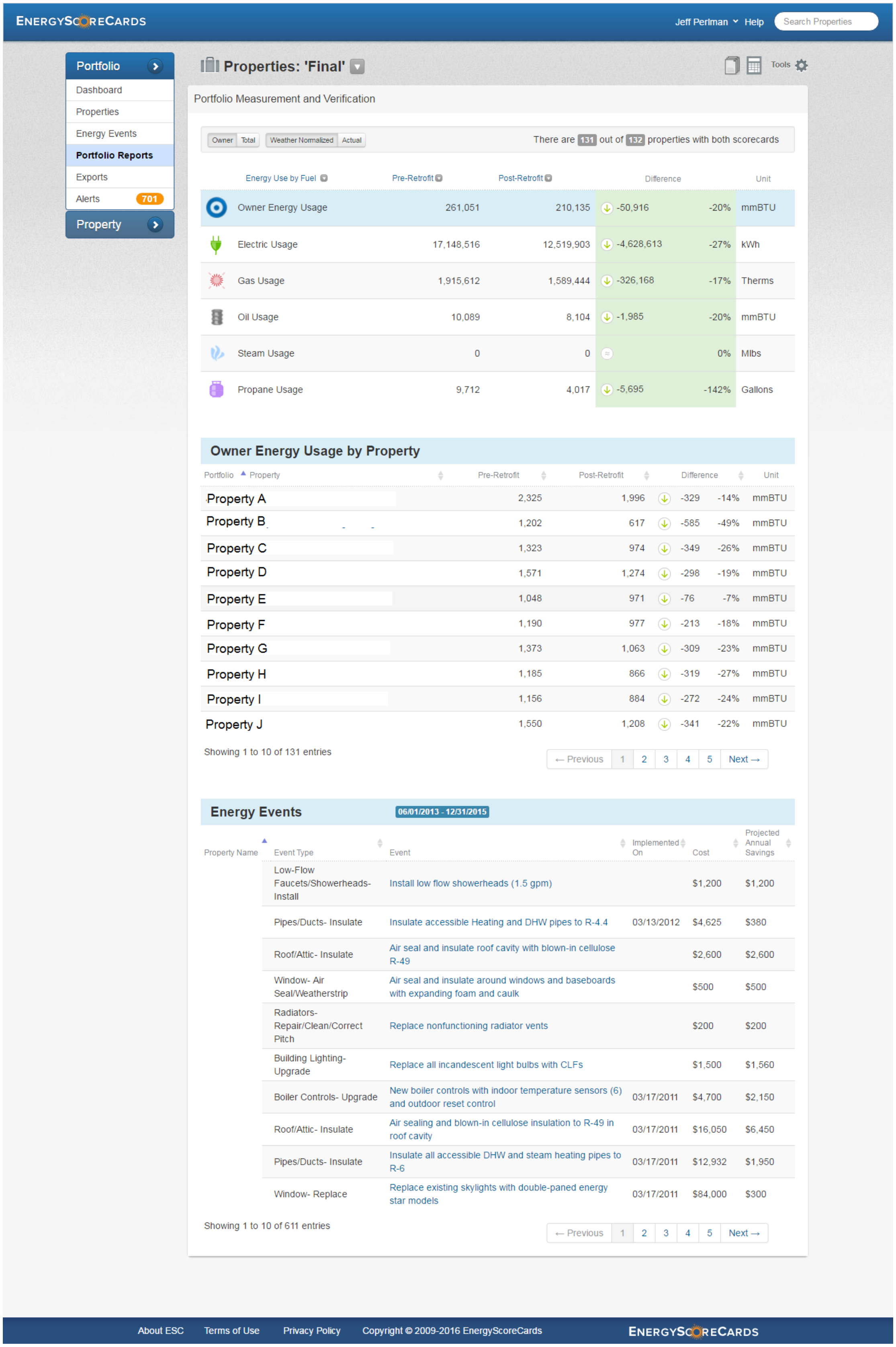

Figure A2. Portfolio dashboard. *Source*: Bright Power, Inc.

Appendix B. Methodology for Calculating Lifetime Savings

To assess the energy performance of each building, we calculated the present value of the expected energy savings and compared it with the cost of the measures and with the cost of servicing the debt that financed the investments in each building. We estimated lifetime savings based on expected savings in the first year after the efficiency upgrades, projected over the lifetime of the measures. To estimate the lifetime energy savings associated with each building, we first determined the average maximum useful life of the efficiency measures installed in each building. Because the data reported to the CDFIs did not identify the cost of each individual efficiency measure, we had to treat each building as though it received a single measure and assumed that the useful life of the measure was equal to the simple average of the individual measures installed. It would have been more accurate to weight the useful life of each individual measure either by its cost or by the amount of savings it generated, but neither of those data were available on a per-measure basis (the former because of how cost data were collected and the latter because it is difficult to assign savings to individual measures after the fact). With neither of these data available, using the simple average was the best method available to us to estimate useful life of the energy measures.

The average expected life of efficiency measures can be 15 years for lighting conversions, 30 years for a water boiler in a multifamily building, or essentially permanently for the conversion from heating oil to natural gas. We assumed that the savings from the efficiency upgrades in each building would decay over time as the equipment ages. We used a simple straight-line decay rate and assumed that permanent upgrades like oil-to-gas conversions had a maximum life of 50 years. Under this methodology, a building with a set of measures that together have a maximum useful life of 20 years, we assumed that the energy savings experienced in the first year would fall by 50% after 10 years and fall to 0 in the 21st year after the upgrade. Applying this decay factor for each year over the estimated measure life yields an estimated energy savings for each building over the life of the efficiency measures.

To calculate lifetime savings in dollar terms, we multiplied this annual energy savings stream by energy prices in the year the upgrades were performed, with an annual escalation factor of 3% to account for inflation and long-term energy price trends. Finally, we calculated the present value of the savings for each building by discounting the annual energy savings at a rate equal to the interest rate applied to the loan for each individual building. The result is an indication of what the lifetime energy savings for each building would be worth today, or equivalently, how much a building owner should be willing to borrow today to implement the upgrade.