

**SECTION 7:****LOW-INCOME PROGRAMS**

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**7.1 LOW-INCOME SECTOR SUMMARY****7.1.1 Overview of the Low-Income Program Area**

The Low-Income programs are designed to reduce the energy burden of low-income households by improving energy efficiency and providing energy management and aggregated energy procurement services. Initiatives in this program area include: (1) providing support for and installing a broad range of energy-efficient electric end-use measures in low-income housing, (2) paying a portion of the incremental cost of energy efficiency measures and electric heat conversions in publicly-assisted housing, (3) helping low-income households aggregate energy purchasing power, (4) incorporating energy-efficient equipment and design specifications into State- and federally assisted housing, and (5) informing customers generally about the benefits of energy efficiency.

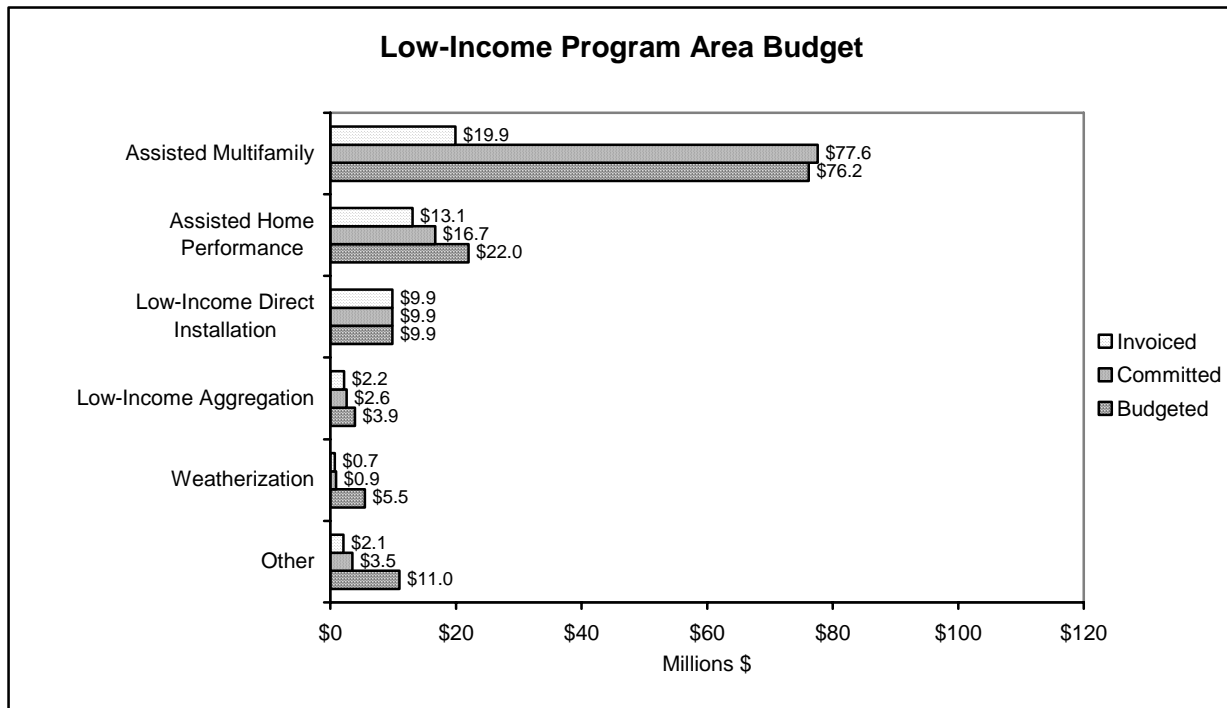
Specific Low-Income programs include:

- **Assisted Multifamily Program (AMP).** This program is designed to improve energy efficiency in eligible multifamily buildings, reduce energy bills for tenants and owners, and provide increased health and safety benefits to building occupants.
- **Assisted Home Performance with ENERGY STAR® (AHP).** This program is designed to reduce the energy burden on low-income New York residents by bringing a “building performance” approach to home improvement. The program follows a market transformation model first introduced by the Home Performance with ENERGY STAR® Program.
- **Low-Income Direct Installation (DI).** This program, now closed, was designed to improve energy efficiency for low-income households by installing electric reduction measures in homes receiving shell and heating system improvements through the federal Weatherization Assistance Program at a time when electric reduction measures were ineligible.
- **Weatherization Network Initiative (WNI).** This program is built on the lessons learned in the Low-Income Direct Installation Program. It returns to previously weatherized homes to implement electric measures in 1- to 4-family homes that did not receive electric reduction measures through the Weatherization Assistance Program and are currently ineligible for additional services.
- **Low-Income Oil Buying Strategies.** This program is designed to improve energy affordability for low-income customers through the bulk purchase of home heating fuel and other procurements that reduce the price of fuel oil.
- **Low-Income Energy Awareness.** This program is designed to implement a public awareness campaign to result in measurable improvements in the enrollment of low-income residents in energy efficiency and energy management programs.
- **Low-Income Aggregation.** This program is designed to improve energy affordability for low-income customers by grouping them together and increasing their buying power, to take advantage of reduced commodity prices through the bulk purchase of energy.
- **Low-Income Forum on Energy (LIFE).** This program provides one of the largest and most comprehensive public forums dedicated to discussing the issues facing the low-income population in the changing energy environment.

### 7.1.2 Low-Income Budget Status

The Low-Income program, funded at \$128.4 million represents 13.4% of the total **New York Energy Smart<sup>SM</sup>** Program budget. As of December 31, 2004, 86.5% (\$111.3 million) of the eight-year Low-Income program budget had been committed. Approximately \$47.9 million of the Low-Income budget has been invoiced. The balance of funds available is \$17.1 million. As of December 30, 2004, the Low-Income Program Area budget was distributed among the seven programs as shown in Figure 7-1.

**Figure 7-1. Low-Income Program Area Budget**



### 7.1.3 Low-Income Program Area Evaluation Activities

The Low-Income program evaluation activities conducted for this report are shown in Table 7-1; note that some of the work was conducted in 2003 and some in 2004. The Assisted Multifamily Program (AMP), as a relatively new and by far the largest Low-Income program, has received the most attention.

**Table 7-1. Low-Income Program Evaluation Activities**

	Theory & Logic	M&V	Market Characterization	Market Assessment	Causality/ Attribution	Process Evaluation
Assisted Multi-family (AMP)	Yes (2003)	Yes (2004)	Yes (2003) Update (2004)	Yes (2003) Update (2004)	Yes (2003) Update (2004)	Yes (2003)
Assisted Home Performance with ENERGY STAR (AHP)	Covered in the Residential Program Section under Home Performance with ENERGY STAR					
Weatherization Network Initiative (WNI)	No	Yes (2004)	No	No	No	No
LI Direct Installation (DI)	No	Yes (2004)	No	No	Secondary data (2003)	No
LI Oil Buying Strategies	No	No	No	No	No	No
LI Energy Awareness	No	No	No	No	No	No
LI Aggregation	No	No	No	No	No	No
LI Forum on Energy (LIFE)	No	No	No	No	No	No

**7.1.4 Summary of Low-Income Evaluation Findings**

The Assisted Multifamily Program (AMP), the largest program in the Low Income sector, has been the subject of the most evaluation in this sector. Despite its relative size, AMP has limited resources to address over 800,000 low-income multifamily housing units in the **New York Energy \$mart<sup>SM</sup>** area. To compensate, AMP seeks to leverage private and other public funds to maximize its reach and cost effectiveness. The evaluation documents the development of significant relationships between NYSERDA and public agencies, lending institutions, and building owners.

After only two years in existence, as of the end of 2004, 13% of eligible units had been addressed by the program, including 6.8% that installed energy efficiency measures, and 6.2% that received audits; many of those receiving audits are expected to install energy efficiency measures.

A number of key researchable issues identified as part of the logic modeling work were assessed during this past years’ market characterization, analysis, causality and process evaluation activities. These included general information on market barriers, freeridership and spillover, energy and non-energy benefits, awareness and knowledge, and changes in practices among targeted audiences. Highlights of these and other Market Characterization, Assessment and Causality/Attribution (MCAC) and process results are summarized below. More detailed information on key logic model-identified researchable issues and measurement indicators and associated MCAC, process and M&V evaluation results are then presented in applicable low income program sections. A logic model at the low-income sector level will be conducted in 2005 to help identify and prioritize key measurement indicators and evaluation activities for continued assessment of sector-level progress toward goals.

Approximately 40% of AMP participants responding to an MCAC survey stated that the AMP had greatly increased their understanding of the benefits of energy efficiency improvements. Only 8% said AMP had no impact on their understanding. Sixty-six percent of program participants say they are satisfied with the

program. Participants perceive non-energy benefits to be approximately equal in value to the energy benefits from the AMP.

The process evaluation of AMP was conducted in the first year of program implementation in order to provide early feedback on program operations. The process evaluation showed that the program had developed relationships with regulatory agencies, identified lending institutions, hired and trained Technical Service Providers (TSPs), refined technical audits, developed policies for working with subcontractors and Weatherization Assistance Program (WAP) agencies, and trained local case managers (LCMs). Program and subcontractor staff remained flexible to identified needs and often changed the program in response.

The Measurement and Verification (M&V) contractor assessed the energy and demand savings that NYSERDA reports for its residential programs. Methods used in this assessment included on-site verification of equipment installation and operation, billing analysis, and review of NYSERDA's files for reasonableness and accuracy. Based on this review, the M&V contractor adjusted the savings reported by NYSERDA. In turn, the MCAC contractor further adjusted these figures to account for freeridership and spillover. A summary of the energy and demand savings from the Low-Income programs is presented in Table 7-2, Table 7-3, and Table 7-4. These numbers show the savings both before and after adjustments by the M&V and MCAC evaluation contractors. Overall, the net energy savings estimated by the M&V and MCAC contractors are slightly lower than the savings originally reported by NYSERDA, and the estimated net demand savings are about the same.

**Table 7-2. Low-Income Programs Electricity Savings Summary**

<b>Program</b>	<b>Program-Reported Savings (GWh/year)</b>	<b>Realization Rate</b>	<b>Adjusted Gross Savings (GWh/year)</b>	<b>Net-to-Gross Ratio</b>	<b>Net Savings (GWh/year)</b>
Assisted Multifamily Program	3	0.97	3	0.84	2
Weatherization Network Initiative	2	1.00	2	1.00	2
Low-Income Direct Installation	11	1.00	11	1.00	11
<b>Total*</b>	<b>17</b>	<b>NA</b>	<b>16</b>	<b>NA</b>	<b>16</b>

NA = Not applicable.

\* Totals do not sum due to rounding.

**Table 7-3. Low-Income Programs Demand Savings Summary**

<b>Program</b>	<b>Program-Reported Savings (MW on Peak)</b>	<b>Realization Rate</b>	<b>Adjusted Gross Savings (MW on Peak)</b>	<b>Net-to-Gross Ratio</b>	<b>Net Savings (MW on Peak)</b>
Assisted Multifamily Program	<1	1.26	<1	0.84	<1
Weatherization Network Initiative	<1	1.00	<1	1.00	<1
Low-Income Direct Installation	2	1.00	2	1.00	2
<b>Total</b>	<b>2</b>	<b>NA</b>	<b>2</b>	<b>NA</b>	<b>2</b>

NA = Not applicable.

**Table 7-4. Low-Income Programs Fuel Savings Summary**

<b>Program</b>	<b>Program-Reported Savings (MMBtu)</b>	<b>Realization Rate</b>	<b>Adjusted Gross Savings (MMBtu)</b>	<b>Net-to-Gross Ratio</b>	<b>Net Savings (MMBtu)</b>
Assisted Multifamily Program	29,465	1.00	29,465	0.84	24,736
Weatherization Network Initiative	NA	NA	NA	NA	NA
Low-Income Direct Installation	NA	NA	NA	NA	NA
<b>Total</b>	<b>29,465</b>	<b>1.00</b>	<b>29,465</b>	<b>0.84</b>	<b>24,736</b>

NA = Not applicable.

## 7.2 ASSISTED MULTIFAMILY PROGRAM

### *Program Synopsis*

The purpose of the Assisted Multifamily Program (AMP), begun in June 2002, is to improve energy resource efficiency in multifamily buildings, reduce energy bills for tenants and owners, and provide increased health and safety benefits to building occupants. The program is designed to change the market for energy efficiency investments in low-income multifamily buildings.

The program seeks to build cooperative relationships among private building owners, the Department of Housing and Community Renewal's (DHCR) Weatherization Assistance Program, and other market actors including the U.S. Department of Housing and Urban Development (HUD), DHCR's Housing Management Bureau, the U.S. Department of Agriculture (Rural Development), and the New York State Housing Finance Agency and Housing Preservation and Development (HPD) Agency.

AMP uses a two-pronged infrastructure development effort. The first effort targets private sector actors in order to increase adoption of energy efficiency into low-income multifamily capital projects. Activities to support the private sector include development of the audit industry through lowering of audit costs (to assist in increasing demand) and through continued short-term use of audits delivered as part of the program's current direct energy efficiency efforts. The program provides training to private building owners on financial packaging options that incorporate energy efficiency into their capital improvement projects. AMP also supports operations and maintenance projects and uses them as examples for other building owners to highlight the cost-effectiveness of such actions. These activities are designed to increase private building owner demand for audits and financial packaging for these properties.

The second prong of AMP's infrastructure development effort is focused on building relationships and expertise among key stakeholders in order to create a sustainable environment (free of many of the current institutional and related barriers) for increased investment in energy-efficient low-income multifamily buildings. Through partnerships and training activities with building operators, agencies and financial institutions, AMP is attempting to increase exposure to and experience with energy efficiency investments. In addition, the program is working, where possible, to change policies and procedures that currently impede adoption of these energy efficiency investments.

In 2004, AMP introduced a streamlined process for buildings with 30 or fewer units. The cost of implementing the full program in these buildings was found to be quite high, primarily due to the cost of the energy assessment process. The program developed a scaled-down audit process based on an average-of-measures analysis (rather than a measure-by-measure analysis) to reduce program implementation costs in these buildings by at least half.

Also in 2004, the program issued a Request for Proposals (RFP) from manufacturers to participate in bulk purchasing components for lighting, appliances, thermostatic valves, and carbon monoxide detectors. To participate, manufacturers must be willing to drop-ship anywhere in the State for a given price. This addition to the program was expected to reduce costs (and thus affect the savings-to-investment ratio in energy assessments) and to simplify program operations.

#### *Program Accomplishments*

The accomplishments of the Assisted Multifamily Program, as summarized in Table 7-5, include increasing awareness and understanding of energy efficiency among owners of low-income multifamily buildings, increasing their perceptions of value from the program, and increasing the efficiency of low-income multifamily units.

**Table 7-5. Assisted Multifamily Program Accomplishments**

Area	Accomplishment
Awareness and Understanding	Awareness of energy efficiency measures and equipment went from 29% in 2001 to 50% in 2003 among program participants, and from 20% to 40% among non-participants.
	66% of participants and 80% of non-participants (in 2003) said the program had increased their knowledge of the benefits of energy efficiency improvements
Perceived Value	66% of participants say they are very or somewhat satisfied with the program
	Participants perceive non-energy benefits to be approximately equal to the energy savings achieved on these projects
Market penetration	As of the end of 2004, 6.8% of eligible low-income multi-family housing units are covered by the program (i.e., are in participating buildings), and an additional 6.2% have received audits; thus 13.0% of eligible units have been addressed by the program.
Energy and demand savings	<p data-bbox="467 1507 1430 1591">NYSERDA program estimate of electric energy savings: 3,025 MWh/yr times Realization Rate of 0.97 times Net-to-Gross Ratio of 0.84 equals Cumulative Annual Electricity Savings through 2004: 2,453 MWh/yr</p> <p data-bbox="467 1619 1430 1703">NYSERDA program estimate of summer peak demand savings: 0.19 MW times Realization Rate of 1.26 times Net-to-Gross Ratio of 0.84 equals Cumulative Annual Demand Savings through 2004: 0.20 MW</p> <p data-bbox="467 1730 1430 1810">NYSERDA program estimate of fuel savings: 29,465 MMBtu/yr Times Realization Rate of 1.00 times Net-to-Gross Ratio of 0.84 equals Cumulative Annual Fuel Savings through 2004: 24,736 MMBtu/yr</p>

### *Program Recommendations*

Recommendations from the program evaluators have included the following:

- Program staff should complete and refine the policy manual, and clearly communicate program changes to affected contractors and customers.
- A clear program process should be presented to owners, especially those with small buildings.
- Efforts should be made to identify a primary contact for each project.
- AMP appears to be successful at leveraging funds. However, a number of audit-only project respondents specifically mentioned the dearth of gap financing as their reason for not signing a participation agreement. Identifying the proper amount of gap funding will remain one of the primary challenges that the AMP staff faces.
- Differences in housing stock, landlord practices, and regulation in New York City compared to the rest of the state could warrant examination of different approaches to the multifamily market there.
- Given the size, complexity, and barriers to energy efficiency in the multifamily market, the long-term shown in the current logic model should perhaps be extended from greater than five years to greater than ten years.

Program staff says efforts are underway to implement many of these recommendations.

#### **7.2.1 Assisted Multifamily Program Theory and Logic**

This section is based on the development of a full theory and logic model for the Assisted Multifamily Program (AMP). The logic model for the AMP is shown in Figure 7-2. This model first appeared in the May 2004 **New York Energy \$mart<sup>SM</sup>** Program Evaluation and Status Report. A review and update will be included in the May 2006 **New York Energy \$mart<sup>SM</sup>** Program Evaluation and Status Report.

#### AMP Barriers

The low-income sector faces significant barriers for adopting energy efficiency. The first and foremost barrier is a lack of resources to finance efficiency investments. In addition, many low-income customers live in rental property and have generally been found to be highly mobile (25% of the low-income population moves to a new residence each year<sup>1</sup>), thus making investments in energy efficiency measures by this sector of the low-income population less likely, and the design of programs targeting these customers difficult. AMP, therefore, is designed to target the multifamily building owners of low-income properties where many of this sector's low-income population live.

Multifamily building owners of low-income residential properties are not investing in energy efficiency options due to a number of market barriers. Key barriers are shown below and are grouped by those that have the potential to impact both the demand side and the supply side of the low-income housing market.

#### *Building Owners, Developers, and Building Operators (Demand Side)*

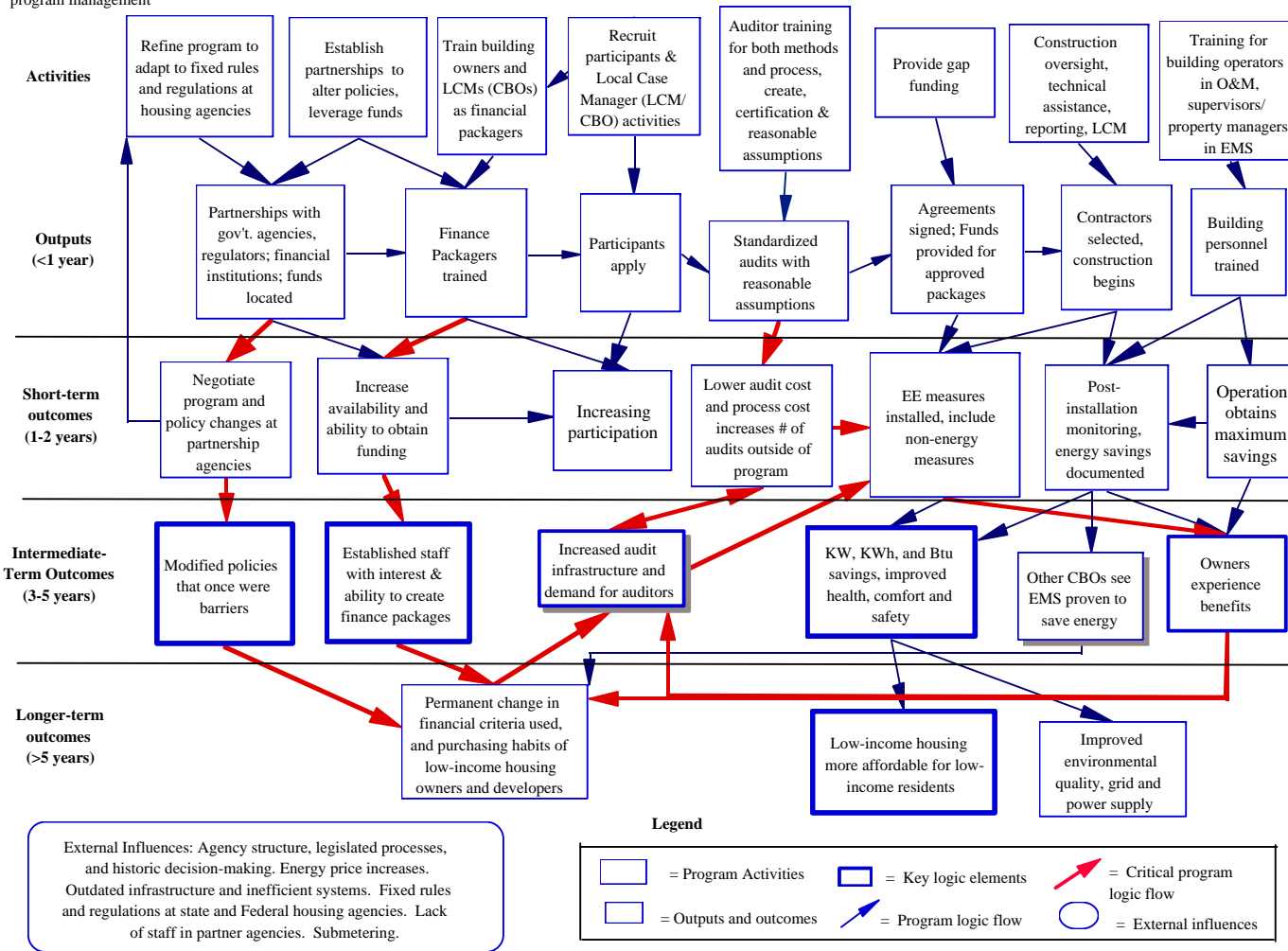
- Split incentives (the tenant pays the energy bills, and would benefit from lower energy costs, but is reluctant to make permanent investments in energy efficiency measures or improve the property in other ways)
- Resistance to new and/or innovative technologies

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<sup>1</sup> New York State Energy Plan: Volume II - Issue Reports. October 1994. Issue 5, Public Housing and Low-Income Energy Efficiency.

**Figure 7-2. Assisted Multifamily Program Logic Model**

**Inputs:** Funds, staff, allies, market knowledge, synergistic program management



- Lack of financing for making improvements to low-income properties
- Lack of consideration of operation and maintenance (O&M) costs compared to first-cost outlays

#### *Construction, Audits, Housing agencies (Supply Side)*

- Business practices and internal regulations that limit the use of life-cycle cost perspectives for multifamily low-income properties (to include DHCR, WAP, HUD, the DHCR Housing Management Bureau, and HPD).
- Many HUD regulations hinder prompt design and installation of improvements (HUD also pays energy bills; if energy costs are reduced in the building, HUD reduces its payments to the building. AMP is trying to have HUD take the money saved and use it to install energy efficiency measures).
- Policies of other low-income programs.

#### AMP Activities

As shown in the logic diagram, AMP activities include recruiting participants and local case managers (LCMs), training auditors, providing technical assistance, overseeing construction, training for building operators in O&M, training building owners and LCMs as financial packagers, providing gap financing, and adapting to and partnering to alter rules, regulations, and policies. These activities have been grouped into four areas and are summarized briefly below.

#### *Recruitment, Audits, Oversight, and Post-Work Energy Monitoring Activities*

The program's contractor, Hamilton, Rabinovitz and Alschuler (HR&A), held some early presentations and one-on-one meetings about the program as an early recruitment activity. Word-of-mouth from these initial efforts resulted in the recruitment of some participants over the short term without a significant marketing effort. However, the program is designed to have a longer-term recruitment and energy awareness effort driven by demand from private low-income multifamily building owners and assisted by LCMs.

LCMs are being recruited from community-based organizations (CBOs) throughout the state. LCM activities are expected to help even out workloads across the year, provide more timely and effective assistance for building owners (from LCMs that may already know specific owners and their unique circumstances), and provide systematic recruitment activities over time.

The network of LCMs is being developed to deliver program marketing and intake, and to provide case/client management services. In addition, the LCMs coordinate with technical assistance providers and conduct limited construction oversight and post-inspections. The LCMs being recruited may already have positive relationships with existing low-income multifamily building owners. This should allow easy access for recruitment into the AMP (given that trust is already established) and will increase the LCM's effectiveness while providing more timely interactions with individual building owners. LCMs can greatly assist owners' understanding of the AMP and should help to decrease cycle times for projects.

The AMP provides technical assistance, audits, and financial packaging. Audits are provided to develop a list of recommended measures including those that will benefit primarily the residents through reduced energy bills. One of the AMP targets is to develop audit certification, standardizing the audit process and the audits themselves. From this, AMP expects to significantly lower audit costs. One of the primary, NYSERDA-developed, tools promoted by the program is an audit software package called TREAT (Targeted Residential Energy Analysis Tools). This software has received United States Department of Energy (DOE) acceptance. A key activity of the AMP is to ensure consistent use of TREAT. The ideal audit will yield a cost-effective mix of measures that can provide energy savings and tenant benefits,

while increasing the value of the targeted building in a clear, measurable, and sustainable manner. Technical assistance includes developing a list of approved contractors and then providing construction oversight. One objective of the program is to develop an infrastructure of auditors to serve the expected demand created by the success of the program and potential energy efficiency improvements.

The program also requires energy data measurements prior to the project and monitoring for three years after installations are complete. These data are analyzed to ensure that expected energy savings are obtained, to provide feedback for building owners, and to verify program claims for new participating building owners. Additionally, these monitoring activities help to meet requirements of some of the AMP's federal agency partners.

#### *Financial Incentives*

Financial incentives are provided, when necessary, to increase the installation of energy efficient measures in public and publicly assisted housing. Before such incentives are authorized to cover the incremental cost of an efficient measure over a standard measure, building owners must provide financial reports and are required to provide their own funding. AMP funds are viewed as "last in" amounts - acting as gap financing. Building owners are not paid until the project is complete and the final amount of "gap financing" needed is identified.

#### *Partnership with Financial Institutions and Financial Packaging Services*

A primary service of the AMP is providing financial packaging. This financial packaging works side-by-side with financial institutions in an effort to develop effective partnerships. As these partnerships are developed, financial institutions are shown how energy efficiency investments can lower risks and accelerate payback. This means that, in some cases, greater debt can be allowed to support a financial package that includes energy efficiency building improvements. The program anticipates that resulting knowledge and experience from successful partnerships is a critical part of developing a financial infrastructure that would be more willing and able to support these types of investments in the future (developing the supply side of the financial packaging transaction).

Training on how to do financial packaging is provided through AMP to building owners and applicable agencies (developing the demand for financial packaging options). Finance packaging is the key to the AMP achieving its long-term market transformation goals, since it shows owners where to get the needed financing and accesses previously unknown sources of cash.

#### *Partnerships with State and Federal Agencies*

Another important part of the AMP is removing institutional barriers to energy efficiency. This is done through partnerships with state and federal agencies to identify potential issues and work toward removing applicable barriers. These partnerships are also used to help redefine program approaches and activities. Through cooperation on individual projects, NYSERDA is constantly reviewing and modifying AMP to maximize its effectiveness in working with other agencies, and to promote state and federal policy and procedure improvements that may result in more affordable low-income housing (through efficiency investments). To date, these activities have included: developing and gaining DOE acceptance of TREAT software, ensuring the software's consistent use, working with HPD on including energy efficiency requirements in low-income building specifications, and working with HUD on their payment policies for energy bill reimbursements and how such policies are affecting energy efficiency investments.

#### AMP Indicators

Shown in Table 7-6 are outputs and outcomes which can be used for program tracking and identification of key outcome variables and relationships. The outcomes are associated with the following time frames:

- Short-term - one to three years post program implementation
- Intermediate-term - three to five years post program implementation
- Long-term - more than five years

**Table 7-6. Assisted Multifamily Program Indicators**

Program Outputs	Short-Term Outcomes	Intermediate Outcomes	Long-Term Outcomes
<ul style="list-style-type: none"> <li>- Number of participation agreements</li> <li>- Number of energy efficiency measures installed</li> <li>- Number of units in buildings treated</li> <li>- Partnerships established</li> <li>- Trained agencies in financial packaging and number of financial packagers</li> <li>- Building operators, supervisors, and property managers trained</li> </ul>	<ul style="list-style-type: none"> <li>- Number of projects completed</li> <li>- Amount of funding of energy efficiency measures</li> <li>- Amount of funding leveraged</li> <li>- Number of energy efficient measures installed</li> <li>- Change in awareness of programs and energy efficiency</li> <li>- Partnering</li> <li>- kW, kWh, and Btu savings</li> </ul>	<ul style="list-style-type: none"> <li>- Increased purchase of energy-efficient equipment</li> <li>- Increased awareness of usage and energy efficiency options</li> <li>- Increased use of energy efficiency improvement loans within the HUD, DHCR and local housing authorities' portfolios</li> <li>- Financial institutions consider energy efficiency payback in debt coverage</li> <li>- Number of packages approved from the trained financial packagers</li> <li>- O&amp;M conducted to maintain efficiency where building operators trained</li> <li>- Consistent use of TREAT software</li> <li>- Lower audit costs</li> <li>- Owner recognizes benefits</li> <li>- Decreased energy burden and more affordable housing for low-income customers</li> <li>- Increased health, safety, and comfort for low-income tenants</li> <li>- kW, kWh, and Btu savings</li> </ul>	<ul style="list-style-type: none"> <li>- kW, kWh, and Btu savings</li> <li>- CBOs recognize benefit of EMS</li> <li>- Reduced institutional barriers to install energy-efficient equipment in low-income housing (financial institutions, HUD payments, HPD specifications)</li> <li>- Sustained change in market behavior, e.g. changed buying habits</li> </ul>

AMP Researchable Issues

Based on recognition of key underlying program hypotheses, the following relationships are proposed for potential testing. These relationships are grouped into short-, intermediate-, and long-term periods to represent when they are expected to become important or verifiable.

*Short-Term Researchable Issues (less than three years into program implementation)*

- Participation in the program by building owners and their staff increases the awareness of energy efficiency benefits.
- The program develops relationships with state and local agencies that change their planning and management of low-income properties with respect to energy efficiency investments.

*Many existing property management and agency rules/regulations and construction and purchasing requirements impact the ability to identify and pursue energy efficiency improvement opportunities. It will be important to track how effectively the program is*

*working with these agencies and market actors (in the short-term) so that problem policies can be identified now and potentially changed in the longer-term.*

- The program directly and indirectly increases the numbers of energy efficient measures installed and thereby creates kW, kWh, and Btu savings.

*Need to quantify and attribute energy benefits to program activities.*

- The energy saved due to the program translates into lower energy bills and/or rent and more affordable housing for low-income multifamily residents.

*Need to quantify and attribute certain non-energy benefits to program activities.*

#### *Intermediate-Term Researchable Issues (three to five years from initial program implementation)*

- Participation by building owners increases the inclusion and financing of energy efficiency improvement measures within HUD and the DHCR portfolios and of local housing entities.

*Targeting building owners is a key element of the AMP's logic (versus a program based on significant tenant outreach). It will be important to confirm that working with building owners is achieving measurable efficiency improvements and to determine the extent to which such activities are yielding greater efficiencies than could be achieved by working more directly with tenants.*

- The program-induced changes in efficiency within renovation and rehabilitation financing packages and associated gap financing increase the number of energy efficiency measures in low-income multifamily housing.

*It is an underlying expectation that the program will result in developing financial packages that recognize the benefits of including and funding energy efficiency improvements in renovation and rehabilitation projects. Evaluation should be conducted to test this logic and assess whether "gap financing" is increasing efficiency measure installations in a significant manner.*

- The program directly and indirectly increases the numbers of energy efficient measures installed and thereby creates kW, kWh, and Btu savings.

*Need to quantify and attribute energy benefits to program activities.*

- The energy saved due to the program translates into lower energy bills and/or rent and more affordable housing for low-income multifamily residents.

*Need to quantify and attribute certain non-energy benefits to program activities.*

#### *Long-Term Researchable Issues (more than five years following initial program implementation)*

- Partnerships with financial institutions and the training they receive, along with their program experiences, lead to increased available funding for energy efficiency measures as payback is included in risk assessment and allowable debt coverage.
- Financial packaging training from the program develops a capable, broad, and willing network of financial packagers within building owner agencies and organizations, allowing permanent change in financing and purchasing behavior.
- Education gained through training and positive program experiences lead financial institutions to change their policies and procedures to allow energy efficiency impacts on cash flow and/or risk (occupancy and rent payment stabilization) to be considered within the financing of capital improvements to low-income multifamily buildings.

- The program's standardization of the audit and its processes, plus the program's promotion of audits and thus the size of the multifamily audit market, cause a reduction in energy audit costs to the point that they are implemented without subsidy in the low-income multifamily housing sector.
- Participants' positive experiences (benefits seen) increasingly cause building owners to include energy efficiency investments in their capital improvement packages and develop financial packages that include these investments.
- All of the above are occurring as the program reduces the barriers to installation of energy efficiency measures in low-income housing units.

*The program has been designed and is being implemented to reduce many of the demand and supply barriers listed earlier in this write-up. Identifying reductions, if any, in key barriers is an important evaluation area and will be needed to assess program effectiveness in the long term.*

- The program directly and indirectly increases the numbers of energy efficient measures installed and thereby creates kW, kWh, and Btu savings.

*Need to quantify and attribute energy benefits to program activities.*

- The energy saved due to the program translates into lower energy bills and/or rent and more affordable housing for low-income multifamily residents.

*Need to quantify and attribute certain non-energy benefits to program activities.*

- CBOs and agencies learn about positive benefits of energy management systems (EMS) through their experience with those installed through the program and/or what they hear about the benefits from other CBOs or building owners that adopted EMS through the program. CBOs and agencies then encourage the installation of EMS, and building owners incorporate EMS given the results they have seen elsewhere in New York.

*Good measure of long-term market transformation.*

- The program's work with policy makers causes policy makers to change policies and procedures in ways that decrease the institutional barriers to energy efficiency in low-income multifamily housing.

*Good measure of long-term market transformation.*

### **7.2.2 Assisted Multifamily Program Measurement and Verification**

Nexant, Inc., the Measurement and Verification (M&V) evaluation contractor for the **New York Energy \$mart<sup>SM</sup>** Program, has conducted an independent review of the savings impacts reported by NYSERDA for the Assisted Multifamily Program (AMP). The objective of the review is to verify the estimate of the program's cumulative savings. Based on Nexant's review, as of December 31, 2004, the program has resulted in the energy savings and demand reductions shown in Table 7-7.

Since beginning in 2002, the program has resulted in estimated cumulative program savings of 3,639 MWh and 46,022 MMBtu.<sup>2</sup> Program savings to date are based on installed energy efficiency measures in 2,541 units in 43 buildings grouped into twenty-four projects. Nexant's review of a random sample of completed projects found approximately 93% of individual measures installed and operating, and building

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<sup>2</sup> Cumulative program savings impacts are the sum of the savings realized across the life of the program. A measure that delivers 100 kWh/year cumulative annual savings, will have delivered 400 kWh cumulative program savings after four years.

owners typically expressed satisfaction with the measures and the resulting savings they have seen in their energy bills.

**Table 7-7. AMP Estimated Energy Savings and Demand Reduction (Through December 2004)**

	Cumulative Annual* Electric Energy Savings (MWh/year)	Summer On-Peak Coincident Demand Reduction (MW)	Cumulative Annual Non-Electric Savings (MMBtu/year)
Nexant <sub>mean</sub>	2,922	0.239	29,465
Nexant <sub>low</sub>	2,644	0.176	29,465
Nexant <sub>high</sub>	3,222	0.303	29,465
NYSERDA reported	3,025	0.189	29,465
Ratio (Nexant mean / NYSERDA reported)**	0.97	1.26	1.00
80% confidence interval	± 0.09	± 0.21	N/A

\* Cumulative annual savings impacts are the savings realized in a single calendar year from all measures installed to date.

\*\* This program ratio may vary slightly from a similar ratio, termed the realization rate, which is developed from the review sample.

Nexant's analysis used to develop the savings ratios in Table 7-7 is based on inspection findings, utility billing analysis, and review of the calculations used to develop NYSERDA's reported savings. The preferred verification method is utility billing analysis, which is based on actual energy use; however, historical billing data was not available for several projects in the sample. Therefore, for projects without billing data, calculation methodologies were reviewed and measure installation and equipment counts from Nexant's facility inspections were used to verify the calculated savings and to make adjustments if necessary. Nexant's analysis of non-electric savings resulted in an uncertainty that was too high for the realization rate to be applied to the NYSERDA-reported savings, therefore the realization rate was set to one. The high uncertainty was due primarily to one project that significantly underestimated the post-installation natural gas consumption resulting from an electric to gas heat conversion.

#### NYSERDA Savings Calculation

AMP provides technical assistance, auditing, inspection, energy monitoring and financial packaging to participants. NYSERDA reported savings are initially based on facility audits that identify energy savings opportunities. Savings estimates for each measure are developed through one of two methods: engineering calculations for individual efficiency measures or building simulation modeling. The program has used two different building simulation programs: EA-QUIP and TREAT, a NYSERDA-developed tool. After construction completion, NYSERDA representatives conduct a follow-up inspection and the measure savings calculations are adjusted to reflect the actual measures and equipment installed. Approximately one year after the construction completion date, the program conducts a billing analysis to determine the true, realized savings, and the program-tracking database is updated with this new information. Updates are performed for 3 years following construction completion. Program and individual project data and savings information are tracked with the CEM/REAP Information System (CRIS) database, which is maintained and updated by HR&A, Inc.

#### M&V Methodology

Nexant's 2004 M&V evaluation of the program consisted of the following tasks:

- Study the population of completed projects, stratify and draw a random sample.
- Review NYSERDA file records for each project in the sample.
- Conduct site visits to verify installation and operation of individual project measures.
- Develop energy, demand, and non-electric savings through billing analysis, verification of calculated measure savings, or review of building simulation model, and calculate realization rate.
- Apply realization rate to the kWh/kW/MMBtu savings reported by NYSERDA for the population of completed projects.

### M&V Review Findings

Applying the M&V methodology listed above, Nexant drew a random sample of thirteen projects from the population of twenty-two completed projects. The sample size was based on the goal of reporting results at the 80/20 confidence/precision level used across **New York Energy Smart<sup>SM</sup>** Programs. An additional two projects were completed by year end, following development of the sample. The sample was weighted to favor large projects, as twelve projects account for 90% of the savings for the population.

After developing the project sample, Nexant obtained available historical documentation for the projects in the sample, including: facility audits, contractor correspondence, change orders, facility billing data, and post-installation reports. The pre-existing projects from PAHP had different tracking and verification requirements and usually did not include historical billing data and all savings calculations. In addition, post-installation reports for some projects were still being developed and were not available for this review. Finally, at the time of this review, some building owners were still compiling and had not yet submitted post-installation billing data, a program requirement after project completion. However, Nexant was able to assemble sufficient data to develop savings results for all projects, either using historical billing data or by building up project savings based on the performance differences between baseline and installed measures.

Nexant conducted site inspections at all thirteen facilities to verify the installation and operation of individual project measures. During the site visits, Nexant inspected all measures in common areas, garages, rooftops, and boiler and electrical rooms. However, only a portion of apartments were inspected, based on the size of the facility due to time and cost constraints, as well as potential complications arising from building management entering individual apartments, and the requirement to provide sufficient prior notification to tenants. Significant findings include:

- Approximately 93% of financed measures were installed and operating.
- Some measures were not operating at the level proposed in the original audit.
- Screw-in compact fluorescent light bulbs were found only in a portion of the fixtures included in the measure inventory for some projects.
- Two of four energy management systems (EMS) in the sample were installed but not operating due to performance issues.
- Not all refrigerators installed through the program were ENERGY STAR<sup>®</sup> models. Program procedures were modified in 2004 to specify ENERGY STAR or equivalent refrigerators; the projects in the sample pre-dated this requirement.

To determine a realization rate for the program, Nexant developed energy savings for each project in the sample. The preferred method was to use baseline and post-installation facility billing data and calculate the actual savings that the facility has achieved. This approach was successful for only three projects. The following is a description of Nexant's billing analysis and the problems that were encountered.

The general approach was to incorporate local weather data as an independent variable to build a regression model that normalized baseline and post-installation billing data. Complete baseline and post-installation billing data were available for only seven projects in the sample. Technical problems encountered during the billing analysis include:

- Savings that were small relative to the overall facility energy consumption, making it difficult to distinguish between the effect of the retrofit and the natural variation in monthly energy use.
- No correlation between historical energy use and weather or other independent variable, thus making the model invalid.
- Uncertainty in the regression model that overwhelmed the predicted performance, making it difficult to distinguish between the model's results and its variance.

An alternative approach was developed to estimate savings for the projects for which billing regression analysis could not be applied. Individual measure savings, which were originally developed using engineering calculations or building simulation models, were analyzed. Most of the projects in the sample did not have complete measure calculations available to verify assumptions and calculation techniques. Therefore, based on Nexant's inspection results, individual measures were evaluated based on implementation and equipment counts. Savings were excluded for measures not installed and adjusted for equipment counts or energy consumption that varied from the original estimates. During Nexant's review of individual measures, several inconsistencies were observed in the calculations. Some project calculations included interactive effects while others calculated energy savings by simply summing up the individual contribution from each energy saving measure. An example of an interactive effect is the increase in heating energy (MMBtu) required to maintain room temperature due to the reduction in waste heat resulting from efficiency upgrades for refrigerators or lighting equipment, *i.e.* more efficient lighting adds less heat to the room, which must be made up by the heating system. In addition, the various calculation tools each used different estimates for baseline refrigerator energy use. And finally, the demand savings calculations were not consistent in determining on-peak demand use.

The final result of the billing analysis and measure calculations indicates that the program has successfully installed almost all financed measures and has achieved  $0.97 \pm 9\%$  of the electric energy savings tracked in the program records. The analysis of non-electric program savings resulted in an uncertainty that was too high for Nexant's realization rate to be applied to the NYSERDA reported savings, and therefore the realization rate was set to one. The high uncertainty for non-electric savings was due primarily to one project that underestimated the post-installation natural gas consumption resulting from an electric to gas heat conversion. Nexant used post-installation billing data to calculate the actual facility consumption, which was significantly higher than the estimated post-installation consumption in the facility audit, resulting in much larger negative non-electric savings than was reported by NYSERDA. Removing this project from the realization rate calculation resulted in a more acceptable uncertainty for non-electric savings, however, based on Nexant's review, this project was determined to be a representative project for the program and should be included in the realization rate calculation for the random sample.

### Recommendations

The following recommendations for the program are based on Nexant's M&V review of completed projects. Note that the projects included in the review consisted primarily of the first projects completed through the AMP program, including some that were inherited from other programs, and these older projects had less rigorous quality assurance procedures than more recent projects. Therefore, some of the recommendations may already be in place for more recent projects, and should be implemented or continue to be followed for all projects in the program:

- Improve reporting and recording of baseline and post-installation billing data.

- Standardize savings calculations, including calculation of interactive effects, baseline equipment energy consumption and efficiencies, and methodology for calculating on-peak demand savings. With the adoption of TREAT as the audit software tool and other changes, the program has already begun to implement this recommendation.
- Require complete tracking information for CFL distribution measures to enable the program to verify installations.

### **7.2.3 Assisted Multifamily Program Market Characterization, Market Assessment, and Causality (MCAC) Evaluation**

In 2003, the Market Characterization, Market Assessment, and Causality (MCAC) evaluation contractor team completed a comprehensive evaluation of the Assisted Multifamily Program (AMP). This comprehensive evaluation covered the period from program inception through year-end 2003. During 2004, the MCAC Team updated certain aspects of the earlier comprehensive evaluation effort. This section discusses findings cumulatively and presents last year's results for items not updated, and this year's results for items covered by the update. This year's update evaluation focused available resources on the following three tasks:

- Updating market penetration numbers by county and utility service area
- Gauging the market effects, or spillover, among 2004 "full" participants and "audit only" non-participants
- Summarizing qualitative impacts of the AMP

#### AMP MCAC Research Approach (2003)

As part of the 2003 research efforts, the MCAC team relied on both secondary data, including the 2000 Census, as well as primary research, including a telephone survey with 69 owners or managers of low-income multifamily properties. The survey examined a number of topics, including the type and quantity of efficiency measures, supply chain and procurement practices, awareness and understanding of energy efficiency, non-energy benefits, and estimated attribution of energy and demand savings to the Assisted Multifamily Program. The 69 survey respondents included a mix of full participants (each of whom received an audit and implemented measures through the program), audit-only participants (each of whom received an audit and, thus far, have gone no further with implementing measures through the program), and true non-participants. The MCAC team also conducted ten surveys with management and field staff at NYSERDA, HR&A (the program implementation contractor), and the audit contractor firms. Interviews were also conducted with a number of regulatory agencies involved in the low-income market. In addition, data from the 2003 process evaluation of the AMP was also included in the analysis where applicable.

#### AMP MCAC Research Approach (2004)

To gather data for this year's (2004) updated spillover calculation, the MCAC team conducted telephone interviews with a sample of building owners and managers from the program database. For "full" participants, building owners and managers who had completed the post-installation inspection in 2004 were contacted. In the future, these "full" participants will be surveyed through a program Integrated Data Collection (IDC) effort.<sup>3</sup> The "audit-only" non-participants included sites that had completed an

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<sup>3</sup> In an effort to collect timely, relevant data, NYSERDA is implementing an Integrated Data Collection effort for AMP. As part of this effort, sites undergoing the post-inspection report are asked a series of questions about within-project and outside-project spillover. Because no IDC surveys were returned at the time of this study, the MCAC Team conducted telephone interviews, but used questions identical to the IDC survey.

audit but had not signed a participation agreement and committed to installing recommended measures.<sup>4</sup> In total, fourteen participant and 23 audit-only surveys were completed.<sup>5</sup> Table 7-8 shows the sample dispositions for the latest round of surveys. These surveys are in addition to the ones discussed in the preceding paragraph.

**Table 7-8. Sample Disposition and Response Rates for Surveys Conducted in 2004-2005**

	<b>Total</b>	<b>“Full” Participant**</b>	<b>Audit-Only Non-Participant**</b>
Initial sample*	344	136	208
Number of 2004 properties	84	25	59
Wrong number	2	1	1
Contact not available/No contact	1	0	1
Adjusted Sample Size	81	24	57
Completions	37	14	23
Adjusted response rate	<b>46%</b>	<b>58%</b>	<b>40%</b>

\* Based on HR&A AMP Pipeline Database, 12/22/04. Counting all other non-participants, there were 523 properties represented in the pipeline at that time. Projects bound to receive services in AMP are referred to as being in the pipeline.

\*\* Participants include properties with an AMP Post-Installation Inspection in 2004. Audit-only non-participants could have a status of: “Audits Complete,” “AMP TA Alone Sufficient,” “Dropped from Pipeline,” “Technical and Financial Services Provided,” or “Technical Assistance Provided.”

### AMP Market Characterization Findings

The AMP market penetration estimate has been updated to reflect the addition of new participants in 2004. The estimate of the population of AMP eligible low-income multiple-family units remains similar to last year at just over 822,000 units.<sup>6</sup> Participation in terms of number of units remains highest in the Con Edison service area. The penetration rate, however, is highest in the Rochester Gas & Electric service area, where 21.6% of the eligible low-income multifamily units have either committed to installing measures or had an audit. Overall, a total of 13.0% of the eligible units in the **New York Energy \$mart**<sup>SM</sup> area have either committed to installing measures or have had an audit. This has increased from 10.5% in 2003. Table 7-9 shows the number of eligible and participating low-income buildings by utility service territory.

<sup>4</sup> Buildings categorized as ‘Audits Complete,’ ‘AMP TA Alone Sufficient,’ ‘Dropped from Pipeline,’ ‘Technical and Financial Services Provided,’ or ‘Technical Assistance Provided’ were classified as “Audit only” for our study.

<sup>5</sup> Based on a conservative estimate of 15% spillover (which is higher than what the 2003 report identified) a total of 12 full participant and 22 audit only participant surveys were required to achieve the benchmark of 90/10 confidence and precision for questions with a 50/50 proportion; the MCAC team exceeded this goal.

<sup>6</sup> Because no single reliable source for the number of low-income multifamily households in New York exists, these estimates were derived from three parameters in the 2000 Census: the total number of housing units, the share of total units that are multifamily households, and the number of low-income households.

**Table 7-9. Eligible Units and Penetration by Utility Service Territory through December 2004\***

Utility	Eligible Units	Participating Units**		Audit-Only Units		Total	
		No. Units	% of Eligible Units	No. Units	% of Eligible Units	No. Units	% of Eligible Units
CHG&E	14,796	747	5.0%	653	4.4%	1,400	9.5%
Con Edison	551,142	44,422	8.1%	37,919	6.9%	82,341	14.9%
O&R	10,610	0	0.0%	688	6.5%	688	6.5%
NMPC	150,631	4,808	3.2%	8,173	5.4%	12,981	8.6%
NYSEG	58,015	738	1.3%	1,656	2.9%	2,394	4.1%
RG&E	29,231	5,211	17.8%	1,104	3.8%	6,315	21.6%
Other/Dual	7,683	314	4.1%	514	6.7%	828	10.8%
<b>All Utilities***</b>	<b>822,108</b>	<b>56,240</b>	<b>6.8%</b>	<b>50,707</b>	<b>6.2%</b>	<b>106,947</b>	<b>13.0%</b>

\* Eligible units are based on Census data for New York State, participating and audit only units are based on the AMP database.

\*\* Includes properties where the participation agreement has been executed or the deal package has been approved but construction has not begun, the construction is in process/design, the construction is complete, and final inspection is complete with ongoing monitoring.

\*\*\* Totals may not sum due to rounding.

Note: Central Hudson Gas & Electric (CHG&E), Consolidated Edison Company of New York (Con Edison), Orange and Rockland Utilities (O&R), Niagara Mohawk Power Corporation (NMPC), New York State Electric and Gas (NYSEG), Rochester Gas & Electric (RG&E).

Other important market characterization findings from the 2003 evaluation include:

- AMP has successfully identified projects that are under the purview of many regulatory agencies; the New York State Division of Housing and Community Renewal (DHCR) Weatherization Assistance Program (WAP) (41% of Program units), DHCR Housing Management Bureau (HMB) (36%), and HUD (24%) are the most commonly represented.
- The majority of the buildings (56%) and units (76%) are master-metered, and the owner/management pays the electric bills in the majority of buildings (53% of all buildings) and units (71% of all units).
- Although owners most commonly approve the capital budget (48% of properties), the board of directors (29%), management companies/managers (23%), and regulatory agencies (15%) also play important roles in approving the capital budgets.<sup>7</sup>
- Low-income multifamily buildings in the AMP represent a wide range of ages. Half of the buildings, however, are between 20 and 39 years old, reflecting the growth in federal housing assistance during the 1960s and 1970s.
- Although 30% of the low-income multifamily buildings have gas heat, only 15% of the units are heated with gas (15%). Many of the units (31%) have dual heating fuels, including steam/oil, steam/gas, and electric/gas.

<sup>7</sup> The total adds to more than 100% because multiple responses were allowed.

- Non-participants surveyed by the MCAC team were also asked about when they last replaced different types of equipment. As shown in Table 7-10, many of the respondents (20%-40%, depending on the measure) were unable to answer the question. Based on those who could answer, refrigerators seemed to be the most recent replacements, while HVAC equipment and hard-wired lighting fixtures were among the oldest measures in multifamily buildings.
- The process evaluation found that 52% of the buildings have a regular schedule for capital improvements while 48% do not.

The supply chain for the low-income multifamily market differs markedly depending on the type of equipment being procured. Multifamily owners/managers tend to rely on contractors to purchase their HVAC equipment (50%) and shell measures (54%). Other measures, however, such as appliances (42%), hard-wired lighting fixtures (44%), and bulbs/CFLs (57%), are more commonly purchased directly from retailers. See Table 7-11.

**Table 7-10. Time When Equipment was Last Replaced (Base: True Non-participants Responding to MCAC Owner/Manager Survey)**

When last replaced	Majority of Windows	Insulation	Refrigerators	HVAC equipment	Hard Wired Lighting Fixtures
In the last year	5 (25%)	6 (30%)	9 (45%)	4 (20%)	4 (20%)
1-5 years ago	5 (25%)	3 (15%)	4 (20%)	3 (15%)	2 (10%)
6-10 years ago	2 (10%)	0 (0%)	1 (5%)	1 (5%)	0 (0%)
11-15 years ago	0 (0%)	1 (5%)	0 (0%)	2 (10%)	1 (5%)
More than 15 years ago	4 (20%)	4 (20%)	1 (5%)	5 (25%)	5 (25%)
Don't know	4 (20%)	6 (30%)	5 (25%)	5 (25%)	8 (40%)
<b>Total</b>	<b>20 (100%)</b>	<b>20 (100%)</b>	<b>20 (100%)</b>	<b>20 (100%)</b>	<b>20 (100%)</b>

**Table 7-11. Supply Chain for Equipment (Base: MCAC Owner/Managers Survey Respondents)**

	HVAC (n=69)	Shell Measures (n=68)	Appliances (n=67)	Hard-Wired Lighting (n=69)	Bulb and CFLs (n=68)
Contractors purchase	50%	54%	12%	33%	7%
Direct from manufacturers	7%	9%	15%	2%	0%
Direct from retailers	25%	24%	42%	44%	57%
Direct from wholesalers/distributors	17%	13%	27%	21%	34%
Other	0%	0%	5%	0%	1%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

### AMP Market Assessment Findings

The market assessment findings reported in this section are from last year's evaluation effort. These findings were not updated in the most recent year's work, but may be updated in the coming year, as appropriate.

### Awareness and Knowledge

Approximately 40% of respondents stated that the AMP had greatly increased their knowledge regarding the benefits of energy efficiency improvements. Anecdotally, some respondents mentioned that, although they were already knowledgeable regarding energy efficiency improvements, the program had helped increase the knowledge of other decision makers at their properties, and thus was extremely valuable. Table 7-12 shows the importance of the program in helping participants understand the benefits of energy-efficiency improvements.

**Table 7-12. Importance of the Program in Understanding Benefits of Efficiency Improvements (Base: Participant and Audit Only Respondents to MCAC Owner/Manager Survey)**

	Participant	Audit Only	Total
1. A great deal/very important	10 (42%)	10 (40%)	20 (41%)
2. Somewhat	8 (33%)	8 (32%)	16 (33%)
3. Slightly	5 (21%)	3 (12%)	8 (16%)
4. Not at all	1 (4%)	3 (12%)	4 (8%)
5. Don't know	0 (0%)	1 (4%)	1 (2%)
<b>Total</b>	<b>24 (100%)</b>	<b>25 (100%)</b>	<b>49 (100%)</b>

### Practices

Few respondents (13%) indicated that energy efficiency is a criterion used in capital improvement decisions. The owners/managers indicated that capital improvement decisions are made based primarily on necessity (63%), followed by number of years payback (23%) and available funding (23%).

Participants to the MCAC survey responded that they are very likely to replace both program equipment (67%) with the same or higher efficiency equipment and non-program equipment (50%) with higher efficiency equipment. Ten of the program participants (33%) stated that their practice of replacing equipment with energy efficient equipment had changed as a result of AMP.

### Other Indicators

AMP has used a high degree of leveraged funds: 79% of funds for the projects come from a source other than the gap financing. The percentage of AMP funding is highest for projects where the construction has already been completed (31%), and lowest for the audit-only projects (18%).

The regulatory agencies interviewed reported that AMP is clearly filling a gap that other programs (e.g., WAP) do not cover. While other programs offer funding and other assistance to the same population, the consensus was that AMP is complementing rather than duplicating the other program efforts.

### AMP Causality/Attribution Findings

#### *Freeridership*

This section analyzes the results of the 2003 MCAC owner/manager survey, program staff and implementer, and regulator surveys to assess the net energy and demand impacts that can be attributed to the AMP. Based on the self-reported intentions of the owners/managers and responses from program staff, implementers, and regulators the freeridership rate (combined for all measures and end-uses) was calculated at 27.1%. The net program impacts, before adjusting for market effects, are 72.9%, with a 95% confidence interval of 60.0% to 85.8%. However, this result should be viewed in the context of the high degree of leveraging that AMP delivers. AMP funding is the “last money in” on these projects, and

this might yield a higher reported freeridership rate because the many other funding sources, besides NYSERDA, also have an effect on what the owner is able to do in the building. There was an inverse relationship between gap funding and freeridership (*i.e.*, projects with the highest freeridership are generally those receiving the least amount of AMP funding), indicating that AMP is generally successful in offering a higher percentage of measure costs for projects in which the participant is least likely to install the measures on their own.

### *Spillover*

Although addressed to some extent in the 2003 evaluation, the effort in 2004 delved deeper with regard to assessing spillover. The latest results are described in this section.

Within-Project Spillover was addressed in the 2004 surveys. All full participant respondents (14) were asked if they had installed, or planned to install in the next year, additional energy efficiency measures at the participant site that were not listed on the audit report. Those that responded in the affirmative were then asked a series of follow-up questions regarding expected energy savings from these measures. None of the participants surveyed had installed additional energy efficiency measures at the project site other than those recommended by the AMP. One respondent did mention that, in the process of doing the recommended work, they identified other work that needed to be done – but it was not expected to provide energy savings.<sup>8</sup> The MCAC team, therefore, was unable to attribute any within-project spillover to the AMP at this time. One potential explanation is that the audits are extremely comprehensive and leave little additional opportunity for other energy savings at the site receiving the energy study. In fact, two of the 14 participants discussed, unprompted, the thoroughness of the audit.

Outside-Project Spillover was also addressed in the 2004 survey. Analogous to within-project spillover, all full participant respondents were also asked if they had installed, or planned to install in the next year, additional energy efficiency measures at other sites that they own or manage.<sup>9</sup> Those who responded in the affirmative were once again asked a series of follow-up questions regarding expected energy savings from these measures, plus how they planned to pay for the measures.

Four full participant respondents stated that they had taken, or planned to take, actions to save energy at other sites they own/manage as a result of participating in AMP. In fact, because of the AMP, one respondent said that they “saw the efficacy of installing heat recovery systems on vent systems.” This has already led to spillover in one project. Another respondent stated that, as a result of their participation in AMP, they have installed boilers, windows, and Energy Management Systems at three other facilities. A third respondent has plans to replace a boiler and windows at another site.<sup>10</sup> Total savings from these additional measures were then estimated based on respondent information regarding the measure type, quantity, and efficiency/size.

A fourth participant expects to renovate 41 other properties (totaling about 8,835 units) over the next three years. The range of measures implemented would vary by property, and the respondent could not provide details about expected savings. Furthermore, they will seek funding from several sources – possibly including AMP. Given a lack of specific information about the kind and number of measures, the additional savings for this participant was estimated based on the per-unit savings from the

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<sup>8</sup> They found that the laundry room vents were venting into the attic, instead of outside, which was causing some damage to the roof.

<sup>9</sup> This study only examines outside program spillover reported from owners and managers. It is possible that Program contractors have taken actions to save energy at additional, non-Program sites.

<sup>10</sup> This respondent is still contemplating applying for help through AMP, but is hesitant because he feels the process is too time-consuming, and is not sure if the property meets the program requirements. These measures are included in the spillover estimate under the assumption that the owner will not apply through AMP but will make the necessary investment.

participating property discounted to a one-year time horizon and further discounted for the savings that might actually be realized outside of AMP.

When asked why the work at these sites was not conducted through AMP, the respondents reported that they received funds through other sources, including the Weatherization Assistance Program (WAP) and the Association for Energy Affordability. AMP, by introducing many participants to these outside funding sources, is helping make the installation of many of these measures possible.

Outside project spillover savings was then calculated as the annual expected savings (converting all fuels to MMBtu) from the installations at the four projects (representing 46 additional sites), divided by the adjusted sum of the total savings from the respondent participating sites.<sup>11</sup> Total expected outside spillover savings was estimated at 5.59%. This is slightly higher than, and corroborates, the 2003 evaluation, in which outside spillover savings were 3.82%.

$$\begin{aligned}
 & \text{Outside Project Spillover=} \\
 & \quad \frac{\text{(Total annual expected outside spillover savings)}}{\text{(Total annual savings for participant survey respondents)* (Net savings factor from 2003)}} \\
 & \quad \frac{\text{(3,662 MMBtu)}}{\text{(89,876 MMBtu)*(0.729)}} \\
 & \quad = 5.59\%
 \end{aligned}$$

Non-Participant Spillover was also re-examined in the 2004 surveys. Audit-only respondents (23) were asked a series of questions regarding what recommended measures they installed or planned to install in the next year. These respondents were also asked questions about within-project and outside-project spillover. For each measure installed, the respondent was asked when the measures were installed, how they were paid for, the expected annual savings, and if they planned to participate in the AMP.

Of the 23 interviews, two respondents indicated they had installed recommended measures. These two respondents, however, indicated that they would have done so without the program, so they are in fact freeriders (*i.e.*, credit cannot be given to the program because of the audit). The majority of respondents (18) indicated that they are still actively pursuing AMP funding and do not know if they will install measures. For the most part, they still want and plan to install the audited measures; funding will determine whether or not it happens: 14 of the 18 specifically mentioned that they are waiting for final funding opportunities through the AMP.

The MCAC team, therefore, was unable to attribute any non-participant spillover from the audit-only sites based on the responses of the 2004 participants. In 2003, however, non-participant spillover was 11.2%. The primary difference was that the 2003 research included sites that had received audits from the beginning of the program, up to two years before the interviews took place. The 2004 research, only included sites that had received the audit during the calendar year 2004, in some cases just a few months before the interview. As mentioned above, many respondents were still hoping to sign participation agreements and install the measures through AMP.

An important finding from the analysis is that the time horizon on audit programs, such as AMP, is quite long. In fact, progressing from the audit to actual measure installation can take years.<sup>12</sup> In the case of AMP, many participants are waiting to commit to installing measures until NYSERDA can complete a full investigation into potential financing sources (one of the program benefits). In addition, although the

<sup>11</sup> The net savings factor was based on freeridership calculations from the 2003 evaluation of the Program. This update did not re-assess freeridership.

<sup>12</sup> Nexant, for example, found that the adoption rates for measure installation for the Technical Assistance Program increased from 40% in the first year after the audit to 81% four years or more after the audit.

program uses local case managers as “champions” to expedite the buildings through the participation process, building owners are often preoccupied with more urgent needs, such as repairs.

Based on the findings related to the re-examination of spillover, the MCAC team recommended that NYSERDA continue to use the net-to-gross ratio from the 2003 evaluation. Due to the shorter time horizon in this evaluation, the audit-only savings are probably being underestimated. In addition, the outside project spillover generally corroborated the findings from the 2003 evaluation.

### *Net Savings*

Incorporating both the net savings factor and the market effects leads to a total net-to-gross ratio of 83.8%. A summary of AMP installed savings is shown in Table 7-13.

**Table 7-13. AMP -- Installed Savings from Completed Projects (Cumulative through 2004)**

	Program-Reported Savings	Realization Rate	Adjusted Gross Savings	Free-Ridership Factor	Spillover Market Effects Factor	Net-To-Gross Ratio	Net Savings
MWh/year	3,025	0.97	2,922	0.73 (0.64 - 0.81)	1.15 (1.13-1.17)	0.84 (0.72 - 0.95)	2,453
MW On-Peak	0.2	1.26	0.2	0.73 (0.64 - 0.81)	1.15 (1.13-1.17)	0.84 (0.72 - 0.95)	0.2
MMBtu/year (Gas Savings)	17,625	1.00	17,625	0.73 (0.64 - 0.81)	1.15 (1.13-1.17)	0.84 (0.72 - 0.95)	14,805
MMBtu/year (Oil Savings)	11,839	1.00	11,839	0.73 (0.64 - 0.81)	1.15 (1.13-1.17)	0.84 (0.72 - 0.95)	9,945

### *Non-Energy Benefits*

The information presented in this section resulted from the 2003 evaluation. Non-energy benefits (NEBs) were not reexamined as part of the 2004 update, but may be evaluated again for AMP in the future.

Based on this first-time assessment, NEBs are important to respondents: three-quarters identified overall NEBs and environmental benefits as important. Highly rated benefits included equipment performance, tenant comfort, and ease of selling the building. NEBs appear to be more valuable to owners than the energy savings for average buildings. The results imply that total NEBs could contribute as much as 8% more value to owners above the value of the estimated energy savings (leading to a multiplier of up to 1.08 times the energy savings). Table 7-14 shows the distribution and estimated value of non-energy benefits as described by program respondents.

More than two-thirds of the value of the NEBs fall into four categories: building aesthetics, environmental benefits, equipment performance, and improved ability to sell the building. Maintenance related to the new energy efficient equipment is a concern. Owner/respondents gave negative valuation to the changes associated with equipment maintenance. Concerns about availability, and the greater knowledge needed to perform maintenance, may contribute to this result. The relative value statements made by owners in the NEBs analysis are strong indications of the types of factors they consider when making decisions regarding investments in energy efficiency.

The methods used to develop values for NEBs represent the current state-of-the-practice, but the MCAC study team has taken a conservative approach in applying these values to low-income sector energy efficiency investments and recommends a value on the order of one-half the estimated value for NEB values. This would add another 54% on to the net energy and peak demand savings attributable to the AMP.

**Table 7-14. Estimated Participant Non-Energy Benefits - Summary Results**

	Average valuation score (1=slightly valuable; 5=very valuable)	Percentage ranking 4 or 5 (5=very valuable)	Percentage of NEBs by category per participating building
Equipment maintenance costs (n=49)	2.1	46% <sup>c</sup>	-13%
Equipment performance <sup>a</sup> (n=57)	3.1	59%	14%
Equipment lifetimes (n=43)	1.8	32%	3%
Tenant satisfaction (n=48)	1.9	42%	1%
Tenant comfort (n=52)	2.8	56%	3%
Building aesthetics/appearance (n=41)	2.0	39%	17%
Lighting/quality of light (n=43)	2.4	25%	13%
Noise levels (n=29)	1.5	29%	8%
Building safety <sup>b</sup> (n=34)	1.8	35%	5%
Ease of selling the building (n=46)	2.7	49%	17%
Ability of tenants to stay in their units <sup>d</sup> (n=31)	1.7	29%	5%
Environmental benefits (n=65)	4.0	74%	27%
Overall NEB value (n=68)	3.9	76%	100%
Annual energy savings per participating building			Multiplier: 1.08

- a. Examples of equipment performance NEBs include improved ability of the equipment to push air through the building effectively, etc.
- b. Examples of “safety” NEBs include better lighting in common areas and stairwells leading to better tenant safety, newer equipment having lower potential for safety problems, etc.
- c. 11% rated -4 or -5
- d. For example, new equipment may lead to lower, more even bills across the year, which may help tenants avoid eviction for non-payment.

### *Additional Impacts of the Program*

The AMP is having additional positive market impacts beyond spillover. For instance, several respondents indicated that their experience had caused them to enroll other properties in AMP. While the savings from these sites will eventually be directly attributable to the program, and are therefore not spillover, repeat participation is clearly a positive reinforcement of the program’s value and participant satisfaction.

In addition to the spillover cited in the previous section, the AMP is implementing a new strategy that could lead to substantial energy reduction in the low-income multifamily market: working with government agencies to adopt higher energy efficiency standards. For example, in September 2004, the Housing Preservation and Development Department (HPD) signed a memorandum of understanding with NYSERDA to re-write their building specifications to meet the AMP standards. These standards include building shell, heating system, and high efficiency appliance measures. Over the next three years, NYSERDA will help to rehabilitate 5,000 units under these standards, with expected energy cost savings (as calculated and reported by NYSERDA) amounting to \$418 per unit. HPD is the first agency to sign such an agreement, but NYSERDA is working toward agreements with other agencies, such as the state Division of Housing and Community Renewal (DHCR).

### AMP Programmatic and Evaluation Suggestions

Key suggestions from the MCAC work include:

- AMP participation has been modest, yet is beginning to accelerate. Therefore, this study should be seen in the context of a multi-year evaluation. In 2003, the MCAC Team recommended that additional program participants be surveyed next year as part of the assessment and causality/attribution components. This was done in 2004, and could be considered for annual updates.
- AMP appears to be successful at leveraging funds. However, a number of audit-only project respondents specifically mentioned the dearth of gap financing as their reason for not signing a participation agreement. Identifying the proper amount of gap funding will remain one of the primary challenges that the AMP staff faces.
- Audit-only sites should be counted as partial participants. This was a recommendation from the 2003 evaluation that is still relevant. Although the program database is now more clearly identifying those sites that had an audit, they are still counted as non-participants. The auditing process, however, can be costly and labor intensive. The results of a detailed energy study, especially when combined with the location of financing, are often enough to encourage owners and managers to install efficiency measures.

#### **7.2.4 Assisted Multifamily Program Process Evaluation**

The AMP process evaluation included interviews with program staff, contractors, and regulatory agencies, as well as surveys with a sample of participating building owners and a sample of nonparticipating owners (those who had dropped out of the program “pipeline”). Interviews were conducted in September 2003; they included three with NYSERDA staff, ten with contractors and subcontractors, and six with representatives of regulatory agencies. Surveys with 33 participants and 15 non-participants were conducted in November and December of 2003.

The research team cautions the reader that the results reported here reflect the earliest stages of program implementation and use data from very small survey samples, especially for non-participants. The evaluation offers an indication of the characteristics of eligible building owners, participating building owners, and of those who have not gone forward with implementation, as well as the reactions of early participants and non-participants. The data were collected when only seven projects were fully completed and policies regarding inspections and final payments were still being developed. Despite the early stage of implementation, the findings nonetheless provide insight into the process for customers and stakeholders who have participated thus far.

The process evaluation draws the following conclusions and related recommendations:

1. *Conclusion.* This evaluation was completed in the first year of program implementation and, as such, only a few owners had fully completed the process. Some of these projects had been in process for almost two years and original knowledgeable contacts were no longer available. Both of these factors limited the number of potential evaluation respondents and measurement of the program’s effects on equipment maintenance, energy costs, and tenants. Finally, a key program component, the Local Case Managers (LCMs), were just coming on-line and their contribution could not fully be assessed during this evaluation.

*Recommendation.* Another full process evaluation should be considered for the 2005-2006 evaluation cycle. Meanwhile, owner surveys should be conducted every six months to improve the chances of contacting the person most knowledgeable about program participation.

2. *Conclusion.* Significant accomplishments have been achieved during the first year of implementation. Examples include development of relationships with regulatory agencies,

identification of lending institutions, hiring and training of Technical Service Providers (TSPs), refinement of technical audits, development of policies for working with subcontractors and with WAP agencies, and training of LCMs. Program and subcontractor staff remained flexible to identified needs and often changed the program in response. Developing the program through implementation has, however, presented some confusion to building owners, regulatory agencies, and subcontractors. There have been definite growing pains, with learning among all actors. The development of weekly meetings among key actors has helped staff to more quickly identify and respond to issues.

*Recommendation.* Program staff should continue to monitor progress, complete and refine the policy manual, and clearly communicate program changes to affected staff and customers.

3. *Conclusion.* Some participating building owners/managers view the AMP as unclear, complex, stressful, and overly managed by too many actors. Adding another set of actors - the LCMs - may further confuse participants.

*Recommendation.* NYSERDA should continue to work with implementers to simplify the process. A clear program process should be presented to owners, especially those of small buildings. Efforts to identify the primary contact for each project could be considered, minimizing the number of parties with whom each owner must interact to complete a project. NYSERDA could also participate in the project review calls or clearly outline their criteria for the assessment in order to reduce delays when the assessments are not found acceptable. Finally, when delays occur, the Principal Designees should explore whether NYSERDA's requirements for installation subcontractors are contributing to the owner's difficulty in moving forward with construction.

4. *Conclusion.* Several program aspects - the variable nature of NYSERDA's gap funding, its "last money in" approach, a perceived "negative incentive" for reducing installation costs, and program complexity - are negatively viewed by some owners and several regulatory agencies. Non-participants clearly see funding-related issues as key to their decisions not to go forward with the recommended improvements. As a result, NYSERDA has, in 2004, begun to evaluate a minimum-contribution approach.

*Recommendation.* NYSERDA has begun to review how to maintain gap funding; this effort should continue. Maintenance of a base amount of gap funding would be very valuable to overall program success.

5. *Conclusion.* There have been some significant issues with the regulatory agencies leading, in the case of DHCR, to a negative view of AMP during the program's first year. Other agencies expressed cautious support. In early 2004, NYSERDA worked with DHCR to resolve issues and ensure that DHCR-regulated buildings move successfully through the pipeline. The full support of these agencies is essential if the program is to obtain the participation of owners and see them through project completion.

*Recommendation.* NYSERDA should continue to cultivate positive working relationships with the regulatory agencies, and quickly act to address any concerns.

### **7.3 ASSISTED HOME PERFORMANCE WITH ENERGY STAR®**

The Assisted Home Performance with ENERGY STAR® (AHP) complements the Home Performance with ENERGY STAR® Program (HPwES). The AHP program is fully contained within HPwES. AHP offers virtually all of the same services through the same players, but provides income-qualified households with subsidies to pay for the installation of recommended measures – for as much as 50% of project costs, up to \$5,000. AHP aims specifically to target those low-income households that are

between 60% and 80% of the State Median Income. This group is sometimes called the “working poor” – those who are too well-off to qualify for federal weatherization, but who do not make enough money to be able to afford needed energy efficiency improvements to their homes. (See Section 6.5 for more discussion of Assisted Home Performance.)

Community-Based Organizations (CBOs) augment the list of private HPwES contractors for delivery of program services. While NYSERDA recruited CBOs as the organizations best suited to serve the low-income market, CBOs have ended up serving both residential segments. Similarly, private market-based contractors have provided services to both HPwES and AHP customers since the subsidy program has been available. Thus, while NYSERDA’s initial intentions and expectations were that the two programs would attract different contractors, the business model allows both the CBO and private contractors to work in either markets. Thus, the AHP is fully incorporated into HPwES in terms of delivery, data management, and reporting and the AHP subsidy is simply considered an additional financing source for low-income participants.

Recent evaluation of AHP has been incorporated into HPwES evaluation efforts, including: the development of program theory and logic in 2004; measurement and verification conducted in 2003 and expanded in 2004; market characterization, assessment, and causality/attribution (MCAC) conducted in 2003 and updated in 2004; and process evaluation conducted in 2004. Therefore, please refer to Section 6.5 (HPwES) for key evaluation findings.

One recommendation from the HPwES evaluation is relevant here: to consider consolidating AHP and HPwES, since the vast majority of their services, features, delivery agents, and processes are virtually the same, and program staff talk about the two programs as if they are one.

## **7.4 WEATHERIZATION NETWORK INITIATIVE**

The Weatherization Network Initiative (WNI) works to reduce the energy burden and provide energy use and efficiency information and services to the low-income community. The program provides electric reduction measures that were not part of the scope allowed under the U.S. Department of Energy (DOE) Weatherization Assistance Program (WAP) and are currently ineligible for additional services through WAP. WNI measures include energy-efficient lighting and appliances, and strategies to reduce the use of electric-resistance space and water heating. The program targets New York households (one- to four-family residences) with incomes below 60% of State Median Income. The WNI target is to serve 5,500 previously weatherized homes by the end of 2006. As of the end of 2004, it had served 1,406 homes. The program estimates that these households are receiving an average energy cost savings of \$192 per year.

Recent evaluation of WNI has consisted solely of measurement and verification conducted in 2004, with minimal MCAC efforts to adjust the gross energy savings, along with benefit/cost analysis. The annual net energy savings for WNI (adjusted by the M&V contractor and the MCAC contractor) is 2,030 MWh and 0.3 MW.

### **7.4.1 Weatherization Network Initiative Measurement & Verification**

Nexant, Inc., the Measurement and Verification (M&V) evaluation contractor for the **New York Energy \$mart<sup>SM</sup>** Program, has conducted an independent review of the savings impacts reported by NYSERDA for the Weatherization Network Initiative (WNI). The objective of the review is to verify the estimate of the program’s cumulative savings. Based on Nexant’s review, as of December 31, 2004, the program has

resulted in the energy savings and demand reductions shown in Table 7-15. Since beginning in 2002, the program has resulted in estimated cumulative program savings<sup>13</sup> of 624 MWh.<sup>14</sup>

**Table 7-15. WNI Estimated Energy Savings & Demand Reduction (Through December 2004)**

Cumulative Annual* Electric Energy Savings (MWh/year)	Summer On-Peak Coincident Demand Reduction (MW)
2,030	0.31

\* Cumulative annual savings impacts are the savings realized in a single calendar year from all measures installed to date.

### NYSERDA Savings Calculations

WNI installs measures that have a savings-to-investment ratio (SIR) greater than or equal to one. Energy and demand savings values are determined for each piece of equipment targeted for replacement, see Table 7-16 for details on information collected. Replaced equipment is assumed to have a remaining useful life; therefore the baseline is the energy consumption and demand of the existing equipment. Baseline and replacement energy consumption data for refrigerators are based on 1) nameplate information, 2) an energy savings calculator developed by Conservation Services Group using Association of Home Appliance Manufacturer's (AHAM) data, and 3) measured data for a large sample of refrigerators<sup>15</sup> accounting for efficiency losses over time. Savings for lighting retrofits are based on tabulated fixture or lamp wattages and assumed operating hours. Savings are estimated as part of the SIR calculation and are the basis for the project and program savings.

All measure and project SIR calculations are performed by the implementation contractors using standard "WNI Threshold Calculator" spreadsheets. The spreadsheets are uploaded to the Internet-based Comprehensive Residential / Information System (CRIS) tracking database. Reports and forms built into CRIS show measure and program savings for all projects completed to date.

**Table 7-16. WNI Energy Savings Calculation Procedures**

End-Use	Data Collection	Energy Savings Calculations	Nexant's Remarks
CFLs	Existing wattage per fixture (based on lighting audit) and average usage (hours) in location	Pre minus post annual kWh usage per bulb.	Savings calculation methodology and M&V approach conform to standard practice.
Hardwired fluorescent fixtures	Existing wattage per fixture (audit) and average usage in location	Pre minus post annual kWh usage per fixture	Savings calculation methodology and M&V approach conform to standard practice.
Refrigerators	Existing annual kWh, based on metered data or stipulated usage from Association of Household Appliance Manufacturers (AHAM)	Pre minus post annual kWh usage.	Savings calculation methodology and M&V approach conform to standard practice. Savings are higher than standard because the program targets households with high energy using refrigerators for replacement.

<sup>13</sup> Cumulative program savings impacts are the sum of the savings realized across the life of the program. A measure that delivers 100 kWh/year cumulative annual savings, will have delivered 400 kWh cumulative program savings after four years.

<sup>14</sup> Most of the estimated annual savings shown in Table 7-15 are from projects installed in the second half of 2004. These projects have not had a whole year to deliver the expected energy savings, hence the much smaller cumulative program MWh estimate.

<sup>15</sup> See "M&V Evaluation, Low Income Direct Install," Table 2, Nexant, March 2004.

M&V Methodology

Nexant's evaluation of the WNI program involved a general review of current program procedures for calculating, tracking and reporting kWh and kW savings. The findings are based on interviews with NYSERDA program managers. The program is not currently reporting summer on-peak demand reductions. Nexant has calculated and reported these impacts for two measures as summarized in Table 7-17.

M&V Review Findings

Energy savings calculations for WNI projects are based on measure-specific protocols developed by the Association for Energy Affordability (AEA), in agreement with NYSERDA. These procedures were reviewed by Nexant as part of the 2003 M&V evaluation of the Low Income Direct Installation Program.<sup>16</sup> The program is not currently reporting summer on-peak demand reductions. Nexant has calculated and reported these impacts for two measures as summarized in Table 3, so that NYSERDA can begin counting kW demand reductions from WNI.

**Table 7-17. Demand Side Reduction Calculation**

Measures	No. of Units Installed	kW Savings / Unit	Peak kW Reduction (NYSERDA-reported)
Refrigerator	971	0.25	243
Compact Fluorescent	11,056	0.006	66
<b>Total</b>			<b>309</b>

Recommendation

Calculate and report summer on peak demand reduction for each measure installed through the program, as developed in this report.

**7.5 LOW-INCOME DIRECT INSTALLATION**

The Low-Income Direct Installation (DI) program was started in 1998 to reduce the energy burden and provide energy use and efficiency information and services to the low-income community. The program concluded in March 2002. The program worked with the New York State Division of Housing and Community Renewal (DHCR) Weatherization Assistance Program (WAP) to provide funding for additional energy efficiency measures that were not at the time supported by WAP rules and regulations. Targeted energy efficiency measures included:

- ENERGY STAR<sup>®</sup> refrigerators
- Hard-wired fluorescent fixtures
- Compact Fluorescent Lamps (CFLs)
- Fuel switching for electric hot-water heaters (primarily for single-family dwellings).

The program goal was to serve 9,400 units over three years. The program succeeded in installing measures in 10,236 units. In all, more than 3,900 refrigerators and 25,000 compact fluorescent lamps were installed. Recent evaluation of DI has consisted solely of measurement and verification conducted in 2004, with minimal MCAC efforts to adjust the gross energy savings, along with benefit/cost analysis. The annual net energy savings (adjusted by the M&V contractor) are 11,494 MWh and 1.6 MW.

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<sup>16</sup> Ibid.

**7.5.1 Low-Income Direct Installation Measurement and Verification**

In 2003, Nexant, Inc., the Measurement and Verification (M&V) evaluation contractor for the **New York Energy \$mart<sup>SM</sup>** Program, reviewed the basic savings calculations and data tracking tools for the Low-Income Direct Installation (DI) Program. The objective of the review was to verify that the algorithms and engineering assumptions used to report the program’s impacts were reasonable and conformed to accepted practices. No additional review was conducted in 2004. Based on NYSERDA’s quarterly savings estimates through March 2002 (program conclusion), the program has resulted in the cumulative annual<sup>17</sup> energy savings and summer on-peak demand reduction shown in Table 7-18.

**Table 7-18. Low Income Direct Installation Program Estimated MWh and MW Impacts**

Cumulative annual energy savings (MWh/year)	Summer on-peak MW reduction
11,494	1.6

Since October 17, 2001, the program has resulted in an estimated cumulative program savings<sup>18</sup> of 34,664 MWh. Although the program has concluded, measures installed by DI continue to accrue savings. Nexant’s cumulative program savings are calculated from October 17, 2001 through December 31, 2004, even though some projects may have been completed as early as 2000. This is due to insufficient information on dates for early project installation from the program tracking spreadsheets provided by NYSERDA. The calculated program impacts are extrapolated from NYSERDA’s annual savings reports, which have been found to be based on generally accepted M&V practices, assumptions and engineering calculations.

M&V Methodology

Nexant’s M&V evaluation of the DI program involved a general review of the program procedures for calculating, tracking and reporting energy and demand savings. Most of this work was completed in 2003, with information obtained from interviews with NYSERDA program managers and review of the final program report prepared by the Association of Energy Affordability (AEA) in June 2002.<sup>19</sup> As NYSERDA’s Direct Installation Program Implementer, AEA also maintained a multiyear database with project installation, audit and savings information.

*Review of AEA’s savings calculation methodology*

A summary of Nexant’s review of AEA’s energy savings is provided in Table 7-19. In general, the reported savings appear to be based on reasonable engineering assumptions and accepted M&V practices.

For lighting measures, AEA calculated kW reduction using Equation 7-1:

**Equation 7-1.**  $\Delta kW = Annual kWh Savings / (Average Daily Usage * 365 days)$

For refrigerators, AEA assumed an average of 0.25 kW reduction per refrigerator, but no documentation was found to support this stipulation. Without any knowledge of the size distribution of refrigerator units installed by the program, it is difficult to verify or adjust AEA’s stipulated savings.

<sup>17</sup> Cumulative annual savings impacts are the savings realized in a single calendar year from all measures installed to date.

<sup>18</sup> Cumulative program savings impacts are the sum of the savings realized across the life of the program. A measure completed in January of 2001 and that delivers 100 kWh/year annual savings, will have delivered 400 kWh cumulative program savings as of December 31, 2004.

<sup>19</sup> Integration of Electric Reduction Measures into the Weatherization Services Network, June 28, 2002.

The lighting kW calculation described in Equation 7-1 suggests that for some installed measures, AEA may be reporting the total change in connected load rather than summer on-peak coincident (SOPC) demand reduction. To estimate the SOPC portion of AEA's reported kW, the likelihood of an installed measure delivering kW savings within the defined system peak period<sup>20</sup> was taken into account. A summary of Nexant's approach for estimating the SOPC kW is provided in Table 7-20.

**Table 7-19. Review of NYSERDA's Energy Savings Calculation Methodologies**

End-Use	Data Collection	Energy Savings Calculations	Nexant's Remarks
CFLs	Existing wattage per fixture (based on lighting audit) and average usage in location (based on Residential Energy Consumption Survey)	Pre minus post annual kWh usage per bulb. Estimated savings used for 13% of installed CFLs for which audit contained missing or illegible information.	Savings calculation methodology and M&V approach are acceptable.
Hardwired fluorescent fixtures	Existing wattage per fixture (audit) and average usage in location (RECS)	Pre minus post annual kWh usage per fixture. Operating hours reduced due to installation of controls.	Savings calculation methodology and M&V approach are acceptable.
Outdoor, Common Area lighting	Existing wattage per fixture (audit) and average usage (RECS)	Pre minus post annual kWh usage per fixture. Operating hours reduced due to installation of controls.	Savings calculation methodology and M&V approach are acceptable.
Refrigeration	Annual kWh usage of existing model, based on 15% metered data and 85% stipulated usage from Association of Household Appliance Manufacturers	Pre minus post annual kWh usage. Estimated kWh savings assumed in cases where audit contained missing or illegible information.	Savings calculation methodology and M&V approach are acceptable.

<sup>20</sup> Monday - Friday, 12-6 P.M., June 1 to August 31, excluding holidays.

**Table 7-20. Demand Reduction Assessment**

Installed Measures	Nexant’s Assessment of Summer on-peak coincident demand reduction
In-Unit Compact Fluorescent Bulbs	For a residential building, the assumed average daily hours of operation (4) are more likely to occur outside of the defined peak window. Therefore, calculated kW reflects the connected load, not summer on-peak demand reduction. To estimate the summer on-peak kW reduction, a 10% summer coincidence and diversity factor was applied to the reported demand reduction.
In-Unit Hardwired Fluorescent Fixtures	See comments above.
Common Area Lighting	Since common area lighting stays on all day, calculated kW reflects the summer on-peak coincident demand reduction. No adjustments were made by Nexant.
Outdoor Lighting	Outdoor lighting is typically turned on outside of the defined peak window. Therefore, calculated kW reflects the change in connected load, not SOPC demand reduction. No summer on-peak kW was credited to outdoor lighting measures.
Refrigerators	The calculated kW for refrigerators represents the summer on-peak coincident demand reduction, since refrigerators typically operate throughout the day. No adjustments were made by Nexant.

M&V Review Findings

*Energy Savings*

Table 7-21 illustrates the total annual kWh savings by installed measure as reported by AEA in the final program report.

**Table 7-21. Total Annual kWh Savings by Measure, as of March 31, 2002 (End of Program)**

Installed Measures	Total Energy Savings (kWh)
In-Unit Compact Fluorescent Bulbs	1,555,414
In-Unit Hardwired Fluorescent Fixtures	2,817,775
Common Area Lighting	2,889,517
Outdoor Lighting	1,152,618
Refrigerators	3,076,994
Fuel Conversions	1,234
<b>Total</b>	<b>11,493,552</b>

*Summer on-peak coincident (SOPC) demand reduction*

An estimated 4.6 MW of demand reduction was attributed to the DI program in AEA’s final report. This estimate appears to represent the total change in both on-peak and off-peak connected load. Based on the information presented in AEA’s final report, Nexant’s estimated SOPC demand reduction is 1.6 MW. This represents the peak kW reduction from common area lighting, indoor lighting and refrigerator retrofits. For indoor lighting fixtures, a combined summer coincidence and diversity factor of 10% was applied to the average demand reduction calculated by AEA. The 10% factor is based on Nexant’s Deemed Savings<sup>21</sup> study, which was conducted as part of the overall M&V evaluation and presented in a separate report. Outdoor lighting measures would typically not be expected to deliver savings during the defined system peak window. Therefore, no on-peak kW reduction has been credited to outdoor lighting

<sup>21</sup> “M&V Evaluation Deemed Savings Final Report, March 2004,” prepared by Nexant for NYSERDA.

measures installed under the program. The reported and adjusted peak demand reductions are summarized in Table 7-22.

**Table 7-22. Low-Income Direct Installation Demand Reduction**

<b>Installed Measures</b>	<b>Average Daily Hours of Operation</b>	<b>Peak kW reduction reported by NYSERDA</b>	<b>Summer on-peak coincident kW reduction calculated by Nexant</b>
In-Unit Compact Fluorescent Bulbs	4	1,065	107
In-Unit Hardwired Fluorescent Fixtures	4	1,930	193
Common Area Lighting	24	330	330
Outdoor Lighting	12	263	-
Refrigerators	N/A	978	978
<b>Total</b>		<b>4,566</b>	<b>1,608</b>