

# Multifamily Performance Program Refrigerator Measurement and Verification Plan

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Prepared for  
**The New York State**  
**Energy Research and Development Authority**

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## **NOTICE**

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## **TABLE OF CONTENTS**

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<b>NOTICE.....</b>	<b>I</b>
<b>ACKNOWLEDGEMENTS .....</b>	<b>III</b>
<b>TABLE OF CONTENTS .....</b>	<b>IV</b>
<b>REFRIGERATOR MEASUREMENT AND VERIFICATION PLAN SUMMARY .....</b>	<b>V</b>
<b>Section 1: INTRODUCTION .....</b>	<b>1-1</b>
1.1 Program Description .....	1-1
<b>Section 2: EVALUATION APPROACH AND SAMPLING PLAN.....</b>	<b>2-1</b>
2.1 Purpose of Evaluation .....	2-1
2.2 General Approach .....	2-2
2.3 Evaluation Steps and Issues .....	2-2
2.3.1 Data Sources and Issues .....	2-2
2.3.2 Surveys .....	2-2
2.3.3 Sampling .....	2-3
2.3.4 Baseline.....	2-4
2.3.5 Refrigerator Monitoring and Other On-Site Data Collection Activities .....	2-4
2.3.6 Other Issues.....	2-5
<b>Section 3: EVALUATION TASKS .....</b>	<b>3-1</b>
3.1 Task 1: M&V Plan and Sample Plan Development.....	3-1
3.2 Task 2: Instrument Design .....	3-1
3.3 Task 3: Data Collection .....	3-1
3.4 Task 4: Data Analysis .....	3-2
3.5 Task 5: Report Preparation and Presentation of Findings.....	3-3
<b>Section 4: ESTIMATED TIMELINES AND DELIVERABLES.....</b>	<b>4-1</b>
<b>Section 5: ESTIMATED BUDGET.....</b>	<b>4-1</b>

## **REFRIGERATOR MEASUREMENT AND VERIFICATION PLAN SUMMARY**

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This Refrigerator Measurement and Verification (M&V) Plan provides a detailed description of the refrigerator monitoring evaluation to be conducted on NYSERDA's Multifamily Performance Program and Low-Income Multifamily Performance Program during calendar years 2010 and 2011. It includes five sections: 1) an Introduction which provides a brief description of the program; 2) Evaluation Approach and Sampling Plan; 3) Evaluation Tasks; 4) Timelines and Deliverables; and 5) an Estimated Budget envisioned for successful completion of all tasks.





## Section 1:

# INTRODUCTION

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On June 23, 2008, the New York Public Service Commission created an Energy Efficiency Portfolio Standard (EEPS) program for New York State to develop and encourage cost-effective energy efficiency programs.<sup>1</sup> In their July 27, 2009 Order, the Commission approved, with modifications, NYSERDA's Multifamily Performance Program (MPP) and Low-Income MPP.<sup>2</sup> NYSERDA submitted a Petition for Rehearing in response to the Commission's July 27, 2009 Order. Subsequently, the Commission issued its December 23, 2009 Order on Rehearing Denying in Part and Granting in Part Petition for Rehearing which authorized NYSERDA to continue administering the MPP with modifications starting July 1, 2010 and required the development of this M&V plan.<sup>3</sup> Further, the Commission's June 24, 2010 Order approved enhancements to the MPP program and revised the unit eligibility threshold for two EEPS multifamily programs from 50 to 75 or fewer dwelling units.<sup>4</sup> NYSERDA will begin processing applications accepting new projects into the revised program in September 2010.

After significant discussion with Department of Public Service (DPS) Staff, and at their recommendation, NYSERDA will focus this M&V study on EEPS-funded, rather than System Benefits Charge (SBC)-funded MPP refrigerator replacements. This change in focus necessitated change to the original due date of the study to allow the time required to complete an energy reduction plan (ERP), and the subsequent project implementation steps, through unit installations, for a sufficient population of projects to be sampled in this study. On August 18, 2010 NYSERDA was granted an extension of the due date for the refrigerator M&V report from December 23, 2010 until December 31, 2011.<sup>5</sup>

## 1.1 PROGRAM DESCRIPTION

The multifamily housing market is a large market that represents approximately 50% of New York State's annual residential electric energy usage (6,000 GWh). There are approximately 50,000 multifamily buildings in New York, representing nearly 2.5 million multifamily units. These units are located in both small buildings and some of the nation's tallest and largest buildings. Some are high-priced luxury condominiums and some are large low-income housing complexes.

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<sup>1</sup> Case 07-M-0548, Energy Efficiency portfolio Standard (EEPS), *Order Establishing Energy Efficiency Portfolio Standard and Approving Programs*, issued June 23, 2008.

<sup>2</sup> Case 08-E-1127, et al., *Order Approving Multifamily Energy Efficiency Programs with Modifications*, issued July 27, 2009.

<sup>3</sup> Case 08-E-1132, Case 07-M-0548, *Order On Rehearing Denying In Part and Granting In Part Petition or Rehearing*, issued December 23, 2009.

<sup>4</sup> Case 07-M-0548, et al., *Order Approving Three New Energy Efficiency Portfolio Standard (EEPS) Programs and Enhancing Funding and Making Other Modifications for Other EEPS Programs*, issued June 24, 2010.

<sup>5</sup> Case 08-E-1132, *Petition of New York State Energy Research and Development Authority (NYSERDA) for Approval of an Energy Efficiency Portfolio Standard (EEPS) NYSERDA-Administered Electric Energy Efficiency Program, Extension Request*, granted August 18, 2010.

The MPP is an open enrollment program for building owners and service providers and serves all multifamily buildings (defined as buildings with 5 or more units) located in the NYSERDA-managed SBC territory. The new EEPS MPP program applies to buildings with greater than 75 units and consists of two tracks: 1) a New Construction track for new multifamily building construction and complete gut-rehabilitation projects, and 2) an Existing Buildings track. Both tracks have a low-income component and funding for each track comes from multiple sources and is monitored within NYSERDA by source.

The MPP uses energy-consulting firms to assist building owners in determining the most cost-effective measures that can be installed to help reduce energy use. These Program service providers (called “Partners”) help the building owners with each aspect of project implementation beginning with initial energy audits, through preparation of construction documents, construction and commissioning (for new construction), development of ERPs, measure installations (including ENERGY STAR® refrigerators in new buildings and replacement of old refrigerators in existing buildings, where appropriate), and through savings verification one year after the measures are installed.<sup>6</sup>

MPP Partners use the Program’s benchmarking tools, ERP templates and various auditing software packages to determine what measures are cost effective, expected energy savings and the costs to install the measures. To identify refrigerators that are eligible for replacement in the ERP, the current MPP requires Partners to collect nameplate data and to utilize manufacturer consumption data (as published in the Association of Home Appliance Manufacturers –AHAM catalog or equivalent) in a thermodynamic model of the building, which is reconciled to the building’s actual consumption. The ERPs identify the measures needed to reduce the energy use by at least 15% and develops a financing plan to identify sources of funding to pay for the measures. NYSERDA provides incentives (per unit for existing buildings and per square foot for new construction) to the building owner for measure installation. The incentive is paid in four installments,<sup>7</sup> with the final incentive paid when the Partner verifies the 20%energy reduction target has been reached. The MPP, both market-rate and low-income components, is implemented by a single, competitively selected contractor.

This M&V Plan solely addresses measurement and verification of energy use and savings associated the with the EEPS funded ENERGY STAR refrigerator replacement component of MPP., A more comprehensive detailed evaluation plan including impact, market and process evaluation for the MPP in its entirety is currently being developed in consultation with DPS staff.

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<sup>6</sup> NYSERDA EEPS Program Administrator Proposal, July 30, 2009. Section 2.

<sup>7</sup> The first installment is paid upon approval of the ERP; the second at 50% of completed construction; the third at 90% of construction; and the forth at one year post-installation upon verification that the 15% energy reduction goal has been reached.

## Section 2:

# EVALUATION APPROACH AND SAMPLING PLAN

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## 2.1 PURPOSE OF EVALUATION

The purpose of this measurement and verification effort is to compare the energy usage performance of a sample of refrigerators to that stated in the Association of Home Appliance Manufacturers (AHAM) catalog.<sup>8</sup> It is hypothesized that actual energy usage performance, particularly of old refrigerators, is a source of uncertainty and is generally understated.<sup>9</sup> Results from this effort will be used to: 1) validate or disprove this hypothesis, 2) provide data necessary to develop updated savings estimates based on an adjustment factor that can be applied to the AHAM estimated kWh usage values for the old and new refrigerators, and 3) inform the potential need for revising the MPP current refrigerator replacement guidelines, including screening processes and eligibility requirements. As stated in the Commission's December 23, 2009 Order, "NYSERDA shall report the results of this measurement and verification analysis including recommended modifications to its current estimation method."<sup>10</sup>

### Period Covered

All work will be conducted in late 2010 to mid 2011, to monitor both the kWh usage of refrigerators that have not yet been replaced and the kWh usage of the new replacement refrigerators.

### Expected Outcomes

1. Obtain baseline field-measured data on annual estimated energy (kWh) consumption and average demand (kW) of a sample of old refrigerators being replaced by the Program and of new replacement refrigerators, noting unit size, age, make, model, design and potentially other factors (e.g., condition, location/positioning, etc.).
2. Compare annual energy use estimates from field-measured data with manufacturer- or DOE-standard-based estimates as published in the AHAM catalog or other similar sources.
3. If actual energy use for old refrigerators being replaced and new replacement refrigerators varies from manufacturer- or DOE-standard-based estimates, provide an adjustment factor that can be used to appropriately account for energy use based on field measurements.
4. Review the EEPS MPP refrigerator screening processes and eligibility requirements, and based on findings from the M&V work recommend any changes that could improve the Program's ability to identify cost-effective refrigerator replacement opportunities.

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<sup>8</sup> ANSI/AHAM HRF-1-2007, Energy Performance and Capacity of Household Refrigerators, Refrigerator-Freezers and Freezers, Technical Standards, or other similar data sources where energy usage information associated with individual refrigerator model numbers has been published.

<sup>9</sup> The greatest savings uncertainty, it is believed, exists within the population of older refrigerators being targeted for replacement, due to increased potential for seals to break or deteriorate coils to become dirty, motor performance to degrade over time, etc. Although energy efficient replacement (new) refrigerators are also targeted for M&V within this current plan, it is anticipated that there will be less uncertainty of savings associated with these new refrigerators.

<sup>10</sup> Case 08-E-1132, *Order on Rehearing Denying in Part and Granting in Part Petition for Rehearing*, issued December 23, 2009.

## **2.2 GENERAL APPROACH**

The majority of data collection activities will be conducted on site, at buildings that are participating in the Program with refrigerators targeted to be replaced. The number and location of buildings, and associated old (to be replaced) and new (replacement) refrigerators will be identified following thoughtful development and approval of a statistically valid sampling plan. The resulting sample of refrigerators will be identified and monitored for a two-week period under normal operating conditions in the building units selected. Results will then be analyzed, summarized and compared against energy consumption estimates derived using the current NYSERDA program delivery approach. NYSERDA's current approach includes the use of measure nameplate data and manufacturer consumption data in a reconciled model of the building.

## **2.3 EVALUATION STEPS AND ISSUES**

### **2.3.1 Data Sources and Issues**

Program data will be used to identify participating buildings and tenant units that are targeting refrigerator replacements. Some of this information has already been provided to NYSERDA's evaluation contractors by MPP staff or is available through NYSERDA's CRIS database. Model numbers of refrigerators targeted for replacement may also be needed, but likely will not be available until on site, unless individual MPP Partners have collected that information and recorded it as part of field notes taken during their initial building site visits. The majority of data for this study will be collected on site through actual refrigerator metering, observations and formal customer survey activities as described in more detail below. In addition, NYSERDA's current refrigerator screening and eligibility process will be reviewed and documented through discussions with NYSERDA program staff, implementation and QA/QC contractors.

### **2.3.2 Surveys**

Onsite surveys will be conducted by NYSERDA's Impact Evaluation Team. Where possible, the Impact Evaluation Team will coordinate the collection of on-site data and installation of metering equipment with the MPP program staff and their MPP Quality Assurance (QA) / Quality Control (QC) contractor. The budget presented in Section 5 of this M&V Plan is based on complete utilization of the Impact Evaluation Team's local, New York field support staff to conduct the site visits, metering placements and removals, and associated data collection (metering, site observations and customer survey data). Where feasible, the Impact Evaluation Team will identify potential coordination opportunities for the MPP QA/QC contractor to install meters on the targeted refrigerators, observe and assess the physical condition of the units (seals, coils, placement, contents, etc.), and implement the brief customer survey. Under this coordinated approach, the cost for data collection might be reduced, since the QA/QC contractor would be on site anyway implementing their existing MPP support responsibilities.

While on site, in addition to refrigerator metering data, the following information will be collected for each refrigerator and tenant location:

- Brand, model number, size (cu ft), and serial number;
- Age and overall physical condition (e.g., door seals, refrigerator coils, etc.), placement within the room (installed within the cabinets with limited ventilation, positioned in the open against a wall, etc.), notes regarding additional features (e.g., ice maker, automatic defrost, coolness setting, freezer setting, and percent full), presence or absence of air conditioning in the apartment, and ambient temperature;
- Customer information including number and age of people living in the apartment, usage patterns (e.g., if someone is home all day, etc.) and perhaps income level, some of which may potentially be available in the program files; and

- Information on the building location including age, number of apartments, and number of floors in the building.

Through the course project level measurement and verification, the program screening process and eligibility requirements related to refrigerator replacement will also be reviewed and documented. This information will be gathered by discussing the MPP screening process and eligibility requirements with NYSERDA program staff, implementation and QA/QC contractors, and building owners.

### **2.3.3 Sampling**

The evaluation will be designed to investigate the relationship (ratio) between the estimated savings as calculated by MPP staff based on AHAM or other available data and the actual savings as determined through the metering of the old (to be replaced) and new (replacement) refrigerators. Thus, ratio estimation will be used to quantify this relationship. Ratio estimation typically requires smaller sample sizes since the variability of the ratio tends to be smaller than the variability of the refrigerator use (and related savings).

NYSERDA MPP will provide an initial list of participants who, according to proposed work scopes, are planning to replace old refrigerators in the near future. It is estimated that the list of participants will contain approximately 60 projects representing 220 buildings and 5,420 apartments. Given the nature of this Program, two-stage cluster sampling is the most feasible approach, with the project as the primary sampling unit and the apartments as the secondary sampling unit. Thus, a sample of projects will be randomly selected and then apartments will be randomly selected within the projects. While this approach tends to require a larger sample size to achieve a specified confidence/precision target, it will also reduce travel time and the overall costs of implementing the evaluation.

Many stratification variables have been suggested. In order to stratify the sample, the Impact Evaluation Team needs to have complete information on the population and the stratification variables. In addition, if the stratification variables are related to the apartments rather than projects, it may not be possible to both stratify and use cluster sampling, which would increase the sample size substantially. Stratifying by low income versus market rate projects would be simple to implement since projects are assigned to one category or another. Other potential stratification scenarios (discussed below) are likely to be costly and problematic to implement. In addition, the estimates of use provided by AHAM and other available sources already take into account numerous factors, such as the size and type of the unit. Since the goal of this M&V effort is to determine a ratio of estimated to actual savings (or consumption) it may not be necessary to stratify the sample using these factors. A more detailed compilation and review of MPP information and Program data will be required, along with an assessment regarding what value stratification would provide in terms of testing the hypothesis introduced in this M&V Plan, before final decisions regarding stratification can be made.

Other possible stratification approaches examined in development of this work plan have included addressing factors that are specific to the apartment, such as number of occupants and condition of the seals on the refrigerator. To pursue this approach would require: 1) collecting the necessary data prior to the sampling, and 2) re-designing the sampling strategy to be based on stratification rather than cluster sampling. This latter outcome would be likely to increase travel time substantially and make it considerably more difficult to implement the evaluation within a reasonable budget. Already, it is likely that four site visits will be required at each tenant apartment, two to install the meter on the old refrigerator (to be replaced) and later on the replacement (new) refrigerator, and two to remove the meters. Stratification based on factors that would need to be observed in the field will only increase the number of site visits, particularly visits to sites that may turn out to be ineligible for sampling.

While stratification on many of the factors discussed above do not appear to be feasible, the Impact Evaluation Team is planning to collect detailed information on the potential contributors to refrigerator energy use, and will examine the possibility of conducting *post hoc* stratification to assess their impacts if there are sufficient numbers of refrigerators metered in specific categories. Such an analysis may be provided on an informational basis, and would most likely not be used to develop the final evaluation outcomes.

Sample size depends on the number of project completions under EEPS and the variability within the measured variable, in this case the ratio of the estimated savings to the metered savings. For cluster sampling, the variability includes both variation within the clusters (projects) and variation between the clusters. Often, estimates of the variability are made from other similar studies. As part of the initial planning, the Impact Evaluation Team will research the applicability of other refrigerator studies to the current evaluation task.

The budget included in this work plan is based on an initial sample size of 100 apartments (100 old refrigerators to be replaced and 100 new replacement refrigerators within these same apartments). This sample size is based on an error ratio of 0.60 and a target confidence/precision level of 90/10.

#### **2.3.4 Baseline**

Through review of current AHAM and other data sources being used by NYSERDA's MPP Partners<sup>11</sup>, baseline information on kWh and kW demand will be compiled and summarized for the same units on which the field monitoring is to be conducted. In addition, research will be performed to identify and review prior studies conducted by other entities and their findings to determine key variables, appropriate protocols and prior findings (including LBNL and Home Energy in mid-1990s).<sup>12</sup>

#### **2.3.5 Refrigerator Monitoring and Other On-Site Data Collection Activities**

Upon approval of this work plan, NYSERDA's Impact Evaluation Team will develop a detailed refrigerator monitoring protocol. Content will include: identification of equipment and materials needed for each site visit (current plans call for using simple Kill-A-Watt, or similar, meters to monitor refrigerator usage for a two-week period under normal operating conditions, and a separate device to measure current temperature and relative humidity levels); procedures to use for identifying refrigerators for monitoring, forms for collecting other information required while on site, scripts for recruiting and engaging building owners and tenants as needed, requirements for coordination with NYSERDA staff,

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<sup>11</sup> Per MPP Existing Buildings Component **New York Energy \$mart**<sup>SM</sup> Simulation Guidelines, Version 3.2, dated September 2009, page 35: "The usage of the existing refrigerators may be obtained from the manufacturer, the appliance Energy Guide label, the Association of Home Appliance Manufacturers (AHAM) directory, or from online databases such as <http://www.kouba-cavallo.com/refrig1.html> based on the actual models found in the building." "If the ERP includes installation of ENERGY STAR<sup>®</sup> refrigerators, the post-retrofit usage must be based on data from [http://www.energystar.gov/index.cfm?fuseaction=refrig.display\\_products.html](http://www.energystar.gov/index.cfm?fuseaction=refrig.display_products.html)."

<sup>12</sup> LBNL's Energy Efficiency Standards (EES) group has performed technical and economic analyses of this product for the U.S. Department of Energy (DOE) since 1979. These analyses formed the bases of the efficiency standards established by DOE in 1989 and 1997 (which became effective in 1993 and 2001, respectively). Home Energy refrigerator database: <http://www.homeenergy.org/consumerinfo/refrigeration2/refmods.php>

other NYSERDA programs, or other evaluation contractor activities, etc.<sup>13</sup> While on site, other important data will also be collected, as specified in the Survey section above.

#### **2.3.6 Other Issues**

Assessment of interactive effects from HVAC equipment is not currently envisioned to be part of this Refrigerator Monitoring Project.

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<sup>13</sup> Security of the meters left within individual apartment units is always a concern. It is hoped that a \$20 participant incentive for each refrigerator being metered, will provide sufficient motivation for tenants to protect each metering device from being tampered with, lost or stolen.





## Section 3:

### **EVALUATION TASKS**

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#### **3.1 TASK 1: M&V PLAN AND SAMPLE PLAN DEVELOPMENT**

This task consists of developing two separate plans: (1) the MPP and Low-Income MPP Refrigerator M&V Plan, which is the subject of this document, and (2) a Sample Plan, which will be developed following approval of this M&V Plan. This Task includes time to develop the initial draft MPP Refrigerator M&V Plan in consultation with DPS Staff and subsequent activities leading to development of an approved Final M&V Plan. In addition, key activities to be conducted that will help inform and lead to final development of the Sample Plan include:

- Conducting more comprehensive review of MPP data and supplemental secondary research
- Using results from these data reviews and research to develop a draft Sample Plan memo for submittal to NYSERDA staff, DPS Staff and other interested stakeholders
- Participating in a meeting (via telephone) to provide opportunity for detailed discussion and to obtain feedback on the Sample Plan memo
- After receiving both verbal and written feedback on the draft Sample Plan memo, prepare final Sample Plan memo that will serve as the basis for Task 3 data collection activities

*Key Task 1 Deliverables Include: Draft and Final M&V Plan and a Draft and Final Sample Plan memo.*

#### **3.2 TASK 2: INSTRUMENT DESIGN**

This task includes development of a draft and then final on-site data collection and customer survey instrument. As detailed in Section 2.3.2, the on-site data collection instruments will call for consistent recording of critical refrigerator-specific model, condition and usage information along with important apartment and customer-specific demographic data. Key activities in this Task area include:

- Development of draft data collection instruments, including on-site refrigerator monitoring and data collection protocols for review by NYSERDA and DPS staffs and other relevant stakeholders
- Participating in a meeting (via telephone) to provide opportunity for detailed discussion and to obtain feedback from NYSERDA and DPS staff and other interested parties on draft data collection instruments and protocols
- Preparation of final on-site data collection instruments, based on verbal and written feedback received

*Key Task 2 Deliverables Include: Draft, then Final On-Site Data Collection Instruments and Protocols*

#### **3.3 TASK 3: DATA COLLECTION**

On-site data collection activities will include:

- Identifying and recruiting the owners of buildings and their tenants to participate in this refrigerator monitoring effort, in accordance with approved sample plan, data collection instruments and associated on-site refrigerator monitoring and data collection protocols. All such site identification and recruitment efforts will be conducted by NYSERDA's Impact Evaluation Team. To increase participation, a \$20 per refrigerator incentive (payable to the participating tenant) has been included in the estimated budget found in Section 5 of this M&V Plan.

- When on site, a Kill-A-Watt, or similar meter will be plugged in to the refrigerator targeted for monitoring. Observation regarding the refrigerator unit will be noted and a short customer survey will be conducted. Current temperature and relative humidity levels will also be recorded. Finally, a date and time for the two-week return visit to remove the meter will be scheduled. The \$20 per refrigerator incentive will be provided directly to the tenant by the Impact Evaluation team's field support staff while there on site, upon satisfactory removal of the refrigerator meter and taking of final temperature and humidity measurements.
- Once the new, replacement refrigerator has been installed in the same tenant apartment (which could be weeks later, unless extremely close coordination with the refrigerator replacement contractor can be managed), the above step (absent the need for another customer survey) will be implemented again including the payment of an additional \$20 incentive to the tenant upon completion.
- Data collection activities will be conducted by either an Impact Evaluation Team member already located in New York, or through coordination with the NYSERDA's MPP QA contractor. Where appropriate and cost-efficient, a combination of these two resources will be used.
- All data collected will be forwarded to the Impact Evaluation Team's refrigerator M&V project lead for compilation and analysis.

*Key Task 3 Deliverables include: Completed and compiled refrigerator monitoring data, observations and customer surveys to lead evaluation contractor for analysis.*

### **3.4 TASK 4: DATA ANALYSIS**

For this task, all energy usage data will be compiled and analyzed such that results can be presented consistent with the sample design and compared against baseline data. Analyses will include:

- Energy usage look-ups in AHAM catalog or other appropriate data sources based on model numbers and associated unit-specific characteristics identified for each refrigerator metered in Task 3
- Tabulation of metered data for these same refrigerators
- Comparison of usage between look-up and metered results

Additionally, data gathered through the M&V effort will be examined for its usefulness in informing whether the screening or eligibility process is meeting the goals of the program and whether there are ways to refine or enhance the efficacy of the screening/eligibility process in terms of identifying cost effective refrigerator replacements (*e.g.*, is the program collecting the right data to make a timely determination, using the right assumptions, collecting extraneous data, etc. based on what is observed in the field). Results from this assessment will include, to the extent possible, recommendations for improving the refrigerator screening or eligibility process. As more detailed work plans and data collection/analysis approaches are developed, other approaches to examining such process issues may also be considered.

Care will be taken to ensure data accuracy and to identify potential outliers. Other on-site observations and survey data will be compiled, analyzed, summarized and used to help inform analysis efforts and interpretation of results.

*Key Task 4 Deliverables include: Completed compilation and analysis of refrigerator monitoring data, observations and customer surveys with all data files labeled and stored for eventual data warehousing.*

### 3.5 TASK 5: REPORT PREPARATION AND PRESENTATION OF FINDINGS

For this task, a draft and final report will be developed summarizing results and detailing the methodologies used in administering and completing all tasks above. A presentation of preliminary findings will be made during an in-person meeting with NYSERDA and DPS staffs and other relevant stakeholders to provide opportunities for questions and feedback prior to development of the final report. As specified in the EEPs Evaluation Plan Guidance<sup>14</sup> document, in addition to an Executive Summary, the final report will include sections about:

- Methodology
  - Including discussion of M&V Plan, Sample Design, survey instruments, on-site data collection protocols and activities
- Key results
  - From secondary research, discussions with NYSERDA program staff and contractors, on-site data collection, and analysis
- Recommendations
- Summary and conclusions
- Appendices with detailed documentation of all of the above, including access to all data analysis and files, contacts and final survey documents, etc.

*Key Task 5 Deliverables include: Draft and Final Report including copies of all data files, contacts and survey documents for data warehousing, and a PowerPoint presentation of preliminary results.*

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<sup>14</sup> <http://www3.dps.state.ny.us/W/PSCWeb.nsf/All/83DF2A1A11C0D2BD85257696006D4A87?OpenDocument>, Evaluation Plan GuidanceA.doc, Appendix A – Checklist for an Evaluation Plan and Report, Reporting Section.



#### Section 4:

### **ESTIMATED TIMELINES AND DELIVERABLES**

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By December 31, 2011 NYSERDA will file a report indicating the results of these MPP refrigerator monitoring activities including a comparison of those results to the results of its current method of estimating replaced refrigerator energy usage. To accommodate this schedule, the following key milestones and time lines have been defined:

- Draft M&V Plan filed with the Commission by August 27, 2010.
- Final M&V Plan and Sample Plan memo, including incorporation of feedback received on drafts, developed by October 31, 2010.
- Field data collection will commence during the 4<sup>th</sup> Quarter 2010, or at the latest by early in the 1<sup>st</sup> Quarter of 2011. Field data collection will be completed by end of the 3<sup>rd</sup> Quarter 2011.<sup>15</sup>
- Draft report distributed to NYSERDA and DPS staffs on or before November 21, 2011 for internal review and to allow time for feedback, revisions and consultation with the DPS Director of the Office of Energy Efficiency and Environment prior to report finalization.
- Final report submitted to NYSERDA prior to filing requirement with the Commission by December 31, 2011.

The exact start and end dates of some deliverables or activities may be subject to change depending on the time line for approval of this compliance filing, commencement of work and progression of the study once field data collection begins. As long as the key milestones in the bulleted list above are met, some modification of this initial time line is expected and will not present a problem in terms of completing the final report by the Commission's extended deadline of December 31, 2011.

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<sup>15</sup> Based on planned staggering of meter installations on old refrigerators (targeted for replacement) at building and apartment sites identified and recruited in accordance with Sample Plan, that have ERPs in place that have not yet been acted on. These sites represent the M&V Plan's ideal targets, and opportunities may be missed, based on timing or delays which could result in a need for repeat data requests, increased coordination efforts, and delays in proposed timelines.



## Section 5:

### ESTIMATED BUDGET

The initial budget estimate for the Refrigerator M&V Plan described herein is approximately \$185,000.<sup>16</sup> This estimated budget does not include any leveraging or coordination opportunities with the MPP QA/QC contractors; nor does it include the potential for additional site visits to gain access to apartments where tenants were not at home at the scheduled times. Should further investigation indicate that coordination is possible for meter placement, retrieval, and on-site data collection, the estimated total project costs will be modified accordingly. Further, once a detailed sampling plan is developed and finalized, the budget will be adjusted as needed to accommodate any changes to the initial sample size estimates or determination regarding stratification.

Approximately 90 percent of the estimated budget will be allocated to the tasks associated with metering old refrigerator units. The remaining 10 percent represents incremental costs for metering, analysis and reporting tasks related to the new refrigerator units. Should cost reductions be desired or necessary, metering of new refrigerators could be eliminated from this project without sacrificing a great deal of uncertainty of overall savings estimates used by the program.

Additional modest cost savings could accrue from not offering the tenant incentives proposed in this M&V Plan.<sup>17</sup> The Impact Evaluation Team believes the incentive is a relatively small additional cost that will aid in successful completion of the on-site metering (including helping to maintain the security of required metering equipment). However, the Team is willing to forgo the incentive or consider other incentive options that may be less costly.

Total estimated hours and associated costs, by project task area, are summarized in table 5-1 below. Initial estimates of other expenses are also presented in this table.

**Table 5-1. Budget Estimate By Project Task**

<b>Budget Estimate by Project Task</b>	<b>Estimated Hours</b>	<b>Estimated \$ Costs</b>
Task 1 – Work Plan and Sample Plan Development	100	\$16,600
Task 2 – Instrument Design and Protocols Development	130	20,500
Task 3 – Data Collection	910	56,200
Task 4 – Data Analysis	460	47,700
Task 5 – Presentation of Findings and Report Preparation	240	32,500
<b>Subtotal Labor Hours and Costs</b>	<b>1,840</b>	<b>173,500</b>
<b>Other Project Expenses<sup>1</sup></b>		<b>11,500</b>
<b>Grand Total Estimated Project Budget</b>		<b>\$185,000</b>
NOTE: Includes site visit travel costs, recruitment incentives, and other overhead costs.		

<sup>16</sup> Should the final budget exceed 5% of the additional EEPS 90-day electric funding currently being considered for the MPP (including low-income), NYSERDA will draw on evaluation resources from the original SBC-funded Multifamily Performance Program.

<sup>17</sup> Approximately \$4,000 will be needed to fund the tenant incentives for metering both the old and new refrigerators.