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FINAL REPORT ON THE INITIAL THREE-YEAR SBC PROGRAM
JANUARY 2002

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INTRODUCTION

This Appendix presents a summary GDS Associates' review of the New York State Energy Research and Development Authority's (NYSERDA's) methodologies for calculating electric energy and peak demand savings associated with specific **New York Energy $mart[SM]** program interventions. The reviews assess appropriateness methodologies using several sources, including programs in other parts of the country. In addition, the reviews provide suggestions for changes to current estimating procedures.

OVERVIEW

A Savings Method and Peak Demand Review was developed for each program, assessing the reasonableness of NYSERDA's methods and providing recommendations for refining these methods. Each review includes the following sections:

- Program overview;
- Review of NYSERDA's methods used to determine energy savings (kWh), demand reduction (kW), and measure life; and
- Findings/Recommendations.

Table 1 presents a list of the programs that have been reviewed and summarizes the methods currently in use by NYSERDA for estimating savings (or renewable energy generation).

Table 1: Programs and Savings Methodologies

Program	Methodology	Comments
Premium-Efficiency Motors Program	Engineering estimates based on typical operating conditions.	Estimates are based on accepted engineering practices. Recommend that NYSERDA monitor ongoing research regarding "average" values for hours of use and loading factors.
Residential Appliances and Lighting Program and Energy Star® Public Awareness Program	Engineering estimates based on typical installations along with market effects from Energy Star® Campaigns.	Estimates are conservative. Major challenge to distinguish NYSERDA impacts vs. impacts from national campaign.
C/I New Construction Program	Engineering estimates based on site-specific data.	Estimates are reasonable and slightly conservative based on assumption that standard installation is 5% above NY state building code.
Wind power programs	Engineering estimates based on historical wind data.	Estimates are accurate. Contribution at time of peak will require further monitoring.
Technical assistance programs and Institutional Performance Contracting Assistance Program	Based on FlexTech evaluation findings that indicated 25 kWh in electric savings for every $1.00 of NYSERDA funding.	Estimates appear to be consistent with other programs. On-going evaluations should be used to refine methodology as data base of measures grows.
Peak Load Reduction Program: Permanent demand reduction efforts	Engineering estimates based on customer reported implementation plans.	Estimates are consistent with similar programs. Recommendation made to refine estimate of peak contribution.
Low Income Direct Installation Program	Engineering estimates based on customer reported usage data.	Estimates are based on accepted industry practices and are consistent with other Low Income programs reviewed.
Photovoltaic (PV) programs	Engineering estimates based on historical statewide insolation values.	Estimates are consistent with similar efforts nationwide. Capacity factor estimates should be refined through monitoring of installed systems.
C/I Performance Program ***(formerly Standard Performance Contracting)***	Engineering estimates based on data from participating ESCO.	Estimates appear to be more accurate than similar programs due to the requirement of ESCO involvement.
New York Energy $mart℠ Loan Fund	Engineering estimates for the various measures are based on typical operating conditions (*i.e.* hours of use, climate).	GDS recommendations for savings estimates are currently under NYSERDA review.

PROGRAM REVIEWS

Premium-Efficiency Motors Program

Overview. The Premium-Efficiency Motors Program was designed to induce lasting structural change in the motor market resulting in increased in the market share of Consortium of Energy Efficiency

(CEE)-qualified motors by 10%. The program provides monetary incentives and marketing materials to vendors.

For this review, data from the following regions/organizations were considered:

1. Northeast Energy Efficiency Partnership (NEEP);
2. Northwest Energy Efficiency Alliance (NEEA);
3. Southern California Edison, (SCE);
4. Pacific Gas & Electric (PG&E);
5. San Diego Gas & Electric (SDG&E) and;
6. National Grid.

Note: The corresponding numbers are used to reference the various sources within this summary.

Savings Estimation.

Table 2 provides a summary of findings.

Table 2

Program Component	NYSERDA's Method / Assumptions	Comments/Recommendation
Energy Savings (kWh)	75% Load DOE Hours	Consistent with all others
Demand Savings (kW)	75% Load	Consistent with all others
Measure Life	15 years	Consistent with Sources 1 and 6

A. Energy Savings (kWh)

The engineering algorithm for determining savings associated with the installation of premium-efficiency motors is universal for all programs reviewed in this report. The two calculation inputs are: (1) annual operating hours and (2) motor loading factor. NYSERDA's program targets motor vendors but determining application-specific information for each motor sold is not practical. In lieu of such data, NYSERDA uses the assumptions for annual operating hours and motor loading. These assumptions are derived from well-documented sources, primarily the 1998 DOE report "United States Industrial Motor Systems Market Opportunities Assessment."

Further investigation would be useful to determine the validity of assuming "average" annual operating hours and motor loadings based on horsepower ratings. Several projects addressing this issue are currently underway. These include: 1) Northwest Energy Efficiency Alliance (NEEA)'s study on over-sizing of motors; 2) research updating DOE's inventory data from the 1998 Report; 3) research from PG&E focusing on operating characteristics of motors in the field; and 4) Northeast Energy Efficiency Partnership's (NEEP) database of motors program information.

Anecdotal information from the motor experts contacted for this review indicated that the average annual operating hours, as published in the DOE Report, and used in the NYSERDA savings estimates, are conservative and likely to be higher in the field.

B. Demand Savings (kW)

The 75% loading factor estimate appears to be commonly accepted as a default value when actual loading information is not available. This value is considered to be optimistic by experts contacted for this review. It is difficult to estimate an "average" loading factor due the wide variety of possible motor applications. This is exemplified by the range of loading factor assumptions used in motors programs; from 62% in the National Grid program to 100% in the Southern California Edison (SCE) program. The estimates inherent in this program contain too many assumptions on key variables to form the basis for load planning decisions.

C. Measure Life

For determining lifetime kWh savings, NYSERDA assumes a measure life of fifteen years. Other programs assume measure lives which range from 10 to 20 years.

Findings / Recommendations. The savings estimates used in NYSERDA's Premium-Efficiency Motors Program appears to be reasonable and consistent with the body of knowledge available in this area. While this report has attempted to illustrate the potential kW peak demand reduction resulting from the premium efficiency motors, it is concluded that these estimates contain too many critical assumptions to be the basis for load planning decisions. Furthermore, it is concluded that the limited level of potential kW peak load reduction does not warrant the research necessary to refine these critical assumptions.

Residential Appliances and Lighting Program and ENERGY STAR® Public Awareness Program

Overview. The Residential Appliances and Lighting and ENERGY STAR® Public Awareness programs are designed to work together to increase awareness and understanding of the ENERGY STAR® logo and to increase the sale of ENERGY STAR® products. The program targets retailers, contractors, multifamily building owners, and manufactured home dealers. Program objectives include improved stocking, promotion, and sale of ENERGY STAR® products. ENERGY STAR® products promoted in the program include refrigerators, dishwashers, clothes washers, room air conditioners, televisions (TV), video cassette recorders (VCR), combination TV/VCR units, compact fluorescent lights (CFL), and lighting fixtures. The Keep Cool Program, which is a component of the Appliance and Lighting program, offers customers a $75 bounty for turning in their existing room air conditioners and purchasing an ENERGY STAR® model.

For this review, data from the following regions/organizations were considered:

1. Wisconsin Energy Conservation Corporation (WECC);
2. Northwest Energy Efficiency Alliance (NEEA);
3. Regional Consortium of Massachusetts Investor-Owned Electric Utilities;
4. National Grid Company;
5. Oregon Office of Energy;
6. Commonwealth Edison (IL); and
7. American Council for an Energy Efficient Economy (ACEEE).

Note: The corresponding numbers are used to reference the various sources within this summary.

Savings Estimation

A. Energy Savings (kWh)

Table 3 shows the per-unit savings values that NYSERDA uses for the Appliance & Lighting Program. Suggestions or revisions to NYSERDA values are indicated in the table. NYSERDA applies the incremental savings assumptions to their estimated share of the market for each product sold in New York. Estimates of market share are adjusted downward to account for the effects of the national ENERGY STAR® campaign.

Table 3

Measures		Annual kWh Savings per Unit Compared Conventional unit	Comments / Recommendation
Refrigerators		141	Consistent with Source 3.
Dishwasher		80	Consistent with Source 3.
Clothes Washer	Motor	59	Revised values based on NEEA Clothes Washer Program Evaluation and EIA report.
	Elec. DHW	404	
	Electric Dryer	64	
Room AC		57	Consistent with Source 3 and 7.
TV		30	Consistent with Source 7.
VCR		14	Consistent with Source 7.
Lighting Fixtures		164	Revised value based on Source 3.
CFLs		68	Revised value based on Source 3.
Keep Cool: Room AC		219	Calculated using actual program data.

B. Demand Savings (kW)

The kW demand values shown in Table 4 for each measure indicate the nominal demand savings. The total program demand savings can be estimated by multiplying the values shown in the table below by the number of ENERGY STAR® products attributable to the program. Demand reduction coincident with system peak requires additional factors that are currently being researched.

Table 4

Measures	Annual kW Savings per Unit	Comments / Recommendation
Refrigerators	.022	Suggested value based on Source 3.
Dishwasher	.008	Suggested value based on Source 3.
Clothes Washer	.337	Suggested value based on Source 2.
Room AC	.095	NYSERDA value based on NY cooling hours.
TV	.003	Suggested value based on Source 7.
VCR	.001	Suggested value based on Source 7.
Lighting Fixtures	.075	Suggested value based on Source 3, 7.
CFLs	.055	Suggested value based on Source 3, 7.
Keep Cool: Room AC	.300	NYSERDA value based on actual data

C. Measure Life

For determining lifetime kWh savings, NYSERDA assumes the measure life expectancies for applicable appliances, home electronics and lighting measures as shown below. A program level measure life of 15 years was estimated based on a measure savings weighting of 74% for appliances, 16% for electronics, and 9.5% for lighting (equally distributed between fixtures, torchieres, and CFLs).

Table 5

Measure	Measure Lifetime	Comment/Recommendations
Refrigerators	19	Consistent with Source 3, 5 and 7.
Dishwasher	15	Consistent with Source 3, 5 and 7.
Clothes Washer	14	Consistent with Source 2, 3, 5 and 7.
Room AC	12	Consistent with Source 3 and 7.
TV/VCR	11.5	Revised value based on Source .
Lighting Fixtures	20	Consistent with Source 3 and 7.
Torchiere	7.2	Based on ECOS estimate from Torchiere Trade-In.
CFLs	5.5	Consistent with Source 2, 3 and 7.

Findings / Recommendations. NYSERDA's **New York Energy $mart℠** ENERGY STAR® Lighting and Appliances Program, including Keep Cool, is estimating the energy savings associated with the sale of ENERGY STAR® products in a manner that is consistent with similar efforts nationwide. NYSERDA's approach to determining the change in market share of ENERGY STAR® product sales as a result of the program is slightly more conservative than that of other ENERGY STAR® programs throughout the U.S. NYSERDA may be the first to distinguish the national EPA/DOE ENERGY STAR® campaign impact on

market share from state or regional program impacts. For the Keep Cool Program, the savings algorithm used to determine energy and demand savings is valid and based on generally-accepted engineering principles.

New Construction Program

Overview. The New Construction Program fosters the use of energy-efficient measures during the planning, design and construction phases of commercial, industrial, institutional and multi-family buildings. A primary objective of the program is to transform the market so that the inclusion of energy efficient measures in building design becomes standard practice for architects and engineers. This program combines technical assistance and financial incentives to reduce perceived risks to the designers, developers and managers of commercial, industrial, and multi-family buildings.

For this review, data from the following programs and/or studies were considered:

1. Design2000Plus (National Grid-MA);
2. Boston Edison (1995);
3. Energy Conscious Construction (NU: CT-MA);
4. Savings by Design (CA utilities) and;
5. Energy Assets (NSP-MN).

Savings Estimation

A. Energy Savings (kWh)

Table 6 shows NYSERDA's methods for estimating energy savings for the New Construction Program. Savings are based on the incremental savings between the baseline building practice and the proposed higher-efficiency measure. Whereas similar programs in other states uses the minimum state code as the baseline, NYSERDA's uses a baseline that exceeds the minimum state energy code. A study conducted for New York State indicated that standard building practices commonly exceed minimum energy codes. Customer-reported operating hours are used to obtain project-specific savings. The estimated savings for each project are reviewed by NYSERDA's technical consultants.

Table 6

Measures	Energy Savings Methodology	Comments / Recommendation
Baseline	105% of minimum NY Energy Code. Publish "Standard Practice" listing for all measures.	Based on NY State energy code.
Whole Building	Computer Simulation Model (*e.g.* TRACE, DOE-2)	Consistent with all other sources.
Custom Measures	Custom Analysis (Building Energy-use Simulation)	Consistent with sources 1, 4, 5.
Pre-Qualified	Predetermined savings by measure	Consistent with source 1.

B. Demand Savings (kW)

NYSERDA estimated peak demand savings by applying a factor that represents the typical load profile for each end use. The lower the factor, the higher the impact on peak demand. The following table presents the factors used by NYSERDA and other organization to estimate demand savings.

Table 7: Demand Factors (kWh/kW)

Measure	NYSERDA	NU 1994	BECo 1995	National Grid 1999
Lighting	3,085	9,158	3,100	6,192
Motors	6,216	—	6,401	7,385
HVAC	1,826	—	2,879	1,861
Cooling	—	3,503	—	—
VSDs	—	—	—	4,628
Custom / Other	3,710	8,333	3,436	4,573
All Measures	2,405	7,813	3,479	4,716

Sources: NYSERDA staff and DSM Annual Reports from respective utilities.

New construction projects' demand reductions are highly contingent upon the mix and quantity of measures installed. Comparing the ratios that represent the relationship between savings and demand reduction to other programs' values indicates that NYSERDA's proportionate demand reductions on average, attribute more kW savings per kWh than the other programs reviewed. Because the other programs' values are based on post-installation evaluations, NYSERDA should use these values as benchmarks as they refine the demand reduction estimates on a measure by measure basis.

C. Measure Life

The assumptions made for measure lives for NYSERDA's New Construction Program are consistent with assumptions used by the other programs reviewed and are shown in the table below. A program level measure life of 19.9 years was estimated using an average measure life weighted by proportion of savings associated with each measure.

Table 8

Measure	NYSERDA'S Measure Lifetime	% of Savings (12/12/01)
Lighting Systems	20	6.8%
Lighting Controls / Occ Sens	15 / 10	6.8%
Building Shell / Glazing	20	11.8%
Motors / VSDs	15	11.8%
HVAC Systems / Controls	20 / 10	0.5%
Chillers	23	21.1%
Heating	20	1.7%
Geothermal Heat Pumps	25	16.0%
Other HVAC	15	0.5%
Weighted Measure Life	**19.9**	**100%**

Source: NYSERDA Tracking Spreadsheet, 12/12/01.

Findings / Recommendations. Based on the programs reviewed, NYSERDA's **New York Energy $mart**[SM] New Construction Program is estimating energy and demand savings in a manner that is consistent with similar efforts nationwide. Moreover, it is believed that NYSERDA's overall methodology is slightly more conservative than similar efforts due to their assumption that standard commercial building practice is at a level 5% above the New York energy code. Following are brief highlights of GDS' recommendations made for each of the categories associated with the major assumptions used in estimating energy and demand savings.

Wind Power Programs

Overview. The goal of the wind power programs is to foster the establishment and growth of companies focused on the development of clean and sustainable wind power generation. This includes companies involved in all stages of green power development such as installation, maintenance, engineering and planning professionals. Two major wind-related research and development (R&D) efforts are being implemented by NYSERDA: the Wind Prospecting Program and the Wind Power Plant Demonstration Program.

In reviewing NYSERDA's method of estimating savings, data were gathered from the following sources:

1. Moorhead Public Service (Moorhead, MN; Minnesota Capture the Wind program);
2. Madison Gas & Electric (Kewaunee County, Wisconsin);
3. Wisconsin Public Service (Kewaunee County, Wisconsin);
4. Platte River Power Authority (Wyoming); and
5. Vestas Wind Systems of Denmark.

Savings Estimation. The following table shows the assumptions and values used by NYSERDA and GDS recommendations:

Table 9

Assumption	Value	Comments / Recommendations
Availability Factor	95%	Revised value based on Sources 2 & 4.
Capacity Factor	30%	Consistent with Sources 1-3.
Turbine Lifetime	20 Years	Consistent with Source 5.
Power Output	Specified power rating	Consistent with Sources 1-4.

A. Energy Savings (kWh)

Wind power programs do not reduce power consumption or demand but offer a renewable, non-polluting, generation alternative to power generated using fossil fuels. Estimated energy produced is based upon the rated generating capacity of the installed turbines and the estimated factor by which the turbines will be operated at that capacity. NYSERDA assumes this capacity to be 30 percent. GDS recommends that NYSERDA modify its annual energy calculation formula by including a 95% availability factor to consider maintenance and outage down-time or use a combined availability/capacity factor of 28.5% (95% estimated availability x 30% current capacity factor).

As part of its Wind Prospecting program, and hourly monitoring of its Wind Power Plant Demonstration projects, NYSERDA should continue its attempts to get the best historical wind information it can for use in calculating annual energy generation. Given the seasonal and annual fluctuations in (and site-specific nature of) wind speeds and frequencies, the longer the period of historical data, the more realistic an annual energy estimate can be derived.

B. Demand Savings (kW)

NYSERDA has not attempted to estimate the coincident peak demand contribution of the wind plants. GDS proposes an approximate value based on the monthly kWh generation values calculated by AWS Scientific, Inc. for Madison Windpower. From the monthly generation values, a dependable capacity factor can be assigned on a monthly basis. The Madison Windpower data indicates a capacity factor of 12% for the month of August, which is the typical peak summer month.

C. Measure Life

As a conservative estimate, GDS recommends that NYSERDA continue to use the manufacturer's rated life of twenty years for the purposes of lifetime energy savings estimates.

Findings/Recommendations. Based on the projects reviewed and the performance of the Madison Windpower plant to date, it appears that NYSERDA's **New York Energy $mart^{SM}** Wind Power Research and Development Programs are projecting accurate electricity generation values for their potential wind projects. To improve the accuracy of energy production estimates it is recommended that NYSERDA modify its annual energy calculation formula by replacing the current estimated 30% capacity factor with a combined availability/capacity factor to account for documented history of turbine down time.

Technical Assistance Programs and Institutional Performance Contracting Assistance Program

Overview. The technical assistance programs consist of Technical Assistance, FlexTech, Energy Audit Pilot, and Institutional Performance Contracting Assistance. These programs target commercial, industrial, not-for-profit, institutional, and government facilities.

In reviewing NYSERDA's method of estimating savings, the following projects and studies were considered:

1. U.S. Department of Energy's Industrial Assessment Center (ICA) Program;
2. Brazos Valley Energy Conservation Coalition (BVECC) ;
3. Seattle City Light's Lighting Retrofit Program; and
4. U.S. Department of Energy's Federal Energy Management Program (FEMP).

Savings Estimation.

A. Energy Savings (kWh)

NYSERDA estimates that for each dollar of technical assistance funding, energy savings equal $4. This ratio was derived from evaluation studies conducted for FlexTech. Of the $4, the annual electric savings portion is estimated to be $2.50, natural gas savings is estimated to be $1.25 for, and oil savings is estimated to be $0.25. Based upon an assumed cost of electricity of $0.10 per kWh, the estimated energy savings (kWh) is 25 kWh per $1.00 of funding.

Because the method of applying the ratio of 25 kWh for every $1 of program funding is based on an evaluation of a large sample of NYSERDA projects, the resulting energy savings estimates reflect the best available information.

B. Demand Savings (kW)

NYSERDA currently derives demand savings by applying a kWh/kW factor of 3,760. The value represents an average from past energy efficiency programs. The factor is also comparable to NYSERDA’s performance contracting program and New York State’s average load capacity factor.

C. Measure Life

The reviewed sources indicate that typically recommended measures have measure lives of 15 years or more. It is recommended that NYSERDA use 15 years as an estimate for a measure life to determine lifetime savings from technical assistance projects.

Findings/Recommendations. Based on the programs reviewed, NYSERDA’s technical assistance programs are estimating energy and demand savings in a manner that is based on sound assumptions and the most accurate data available. GDS suggests that NYSERDA continue to track energy savings by measure, building up their current database of evaluation results.

Based on the kWh/kW demand factors reviewed, it appears that the current NYSERDA value of 3,760 kWh/kW is a reasonable estimate for determining demand reduction from the technical assistance programs.

Peak Load Reduction Program - Permanent Demand Reduction Efforts

Overview. Although the **New York Energy $mart[SM]** Peak Load Reduction Initiatives encompass several component programs, only the Permanent Demand Reduction Efforts component is included in this Review. With the implementation of the Peak-Load Reduction Program, the Cooling Recommissioning Program has been discontinued as a stand alone program. The Permanent Demand Reduction component is now encompassing these efforts and includes a focus on the issues formerly addressed by the Cooling Recommissioning Program.

For the Permanent Demand Reduction Efforts, NYSERDA has required that all projects in excess of 50 kW summer peak demand reductions (10 kW ac for PV) install permanent metering equipment which records and stores 15-minute interval data and is connected to an internet monitoring site. In addition, NYSERDA stipulates that they have open access to this data for a minimum of two years. Although specific tracking protocols and follow up analyses have not been fully developed, the availability of the metered data is a critical first step in laying a solid evaluation platform for improving future programs and tracking current savings levels.

In addition to reviewing NYSERDA's method of estimating peak demand reduction, the following programs and /or studies were considered:

1. ACEEE Report: Using Targeted Energy Efficiency Programs to Reduce Peak Electrical Demand and Address Electric System Reliability Programs;
2. Anaheim Public Utilities' Commercial / Industrial Energy Efficiency Programs;
3. Sacramento Utility District's (SMUD) Retrocommissioning Program and;
4. Report by the MA Division of Energy Resources - 1999 Energy Efficiency Activities

Savings Estimation.

A. Energy Savings (kWh)

The primary goal of the Peak Load Reduction Program is to significantly reduce coincident system summer peak demand for electricity in New York State. Therefore, kWh savings associated with the Peak Load Reduction Program components are estimated based on their associated demand savings estimates. These energy savings, however, were not used as a screening mechanism in determining the viability of program participants.

For estimating savings associated with the Permanent Demand Reduction Efforts, it is recommended that the specific end use/system analyses that are conducted to determine the level of summer demand reduction be expanded to also yield kWh savings by assuming average run times of the equipment/system being analyzed. As a reference for estimating kWh savings associated with various Permanent Demand Reduction Efforts, the kWh/kW values shown the following table can be used. By using the factors shown for NYSERDA's New Construction Program, estimates will consistently fall on the conservative end of the range (*i.e.*, resulting in lower estimates for energy savings for its Permanent Demand Reduction Efforts).

For the Cooling Recommissioning Program, it is recommended that NYSERDA use a value of 1,950 kWh/kW for estimating the savings associated with the Cooling Recommissioning projects. This is based on the findings by ACEEE, which reported that the Commonwealth Edison value of 1,950 kWh/kW was a reasonable value for estimating energy savings associated with recommissioning projects. While there will be variability in the value of energy savings based on the mix of measures included in the recommissioning projects, this value is reasonable until a New York-specific history of field data becomes available.

Table 10: Demand Factors Used by NYSERDA's New Construction Program

Measure	NYSERDA's Demand Factors (kWh/kW)	Comments / Recommendations
Lighting	3,085	Consistent with Sources 4 and 5
Motors	6,216	Consistent with Sources 4 and 5
HVAC	1,826	Consistent with Sources 4 and 5
Cooling	3,503	Consistent with Sources 4 and 5
VSDs	4,628	Revised value based on Source 5
Custom / Other	3,710	Consistent with Sources 4 and 5
All Measures	2,405	

B. Demand Savings (kW)

The estimated level of coincident peak demand for the Permanent Demand Reduction Efforts is derived directly from customer reported values as identified on their program application forms. Application deadlines were extended from May 15, 2001 until June 1, 2001. The preliminary estimates will be revised when the customer reported levels of demand reduction are verified by NYSERDA through a technical assessment and site verification of equipment installation and operation. NYSERDA requires that by November 30, 2001, one month after the Summer Peak Reduction Period ends, each participant submit a final report that includes: 1) total kW contracted for the program; and 2) actual system coincident peak demand reductions realized.

Although the methodologies being use by NYSERDA for estimating demand reduction are based on generally accepted engineering practices, the estimated reductions for the Permanent Demand Reduction Efforts, are maximum demand reductions as opposed to reductions that can be expected at the time of the New York State system peak. In order to calculate coincident peak reduction values from the current estimates, diversity factors must be applied to the various end uses that are generating the savings. In order to provide a reasonable estimate of the demand reduction values that are coincident with the system peak, until a New York-specific history of field data can be developed, it is recommended that NYSERDA apply the summer diversity factors as reported by National Grid for their Design 2000 program, as shown in the following table.

Table 11: Summer Diversity Factors

Measures	NYSERDA's Diversity Factor	Comments / Recommendations
Lighting - Systems	0.650	Revised value based on Source 5
Lighting - Occ. Sensors/Controls	0.241	Revised value based on Source 5
Motors	0.757	Revised value based on Source 5
VSDs - Supply Fans	0.291	Revised value based on Source 5
VSDs - Return Fans	0.361	Revised value based on Source 5
HVAC - Packaged AC	0.441	Revised value based on Source 5
HVAC - Chillers	1.000	Revised value based on Source 5
HVAC - Controls	0.300	Revised value based on Source 5
Custom Measures	0.980	Revised value based on Source 5

Source: National Grid's Design 2000 Program.

C. Measure Life

For NYSERDA's Cooling Recommissioning Program and future projects involving recommissioning, GDS recommends that NYSERDA use the seven-year measure life as reported by the ACEEE. For other Permanent Demand Reduction Efforts, GDS recommends that NYSERDA use the same measure life as other NYSERDA programs that address the same end-use technologies (*e.g.*, the New Construction Program).

Findings/Recommendations. The Permanent Demand Reduction Efforts of NYSERDA's Peak Load Reduction Program, including the now closed Cooling Recommissioning Program, is estimating energy and demand savings in a manner that is consistent with similar efforts nationwide.

Low Income Direct Installation Program

Overview. The Low Income Direct Installation Program addresses the inability of low-income residents to pay for investments in energy efficiency measures. In cooperation with the federal Weatherization Assistance Program (WAP), the Direct Installation program assists residents by installing electric energy conservation measures.

Income-eligible households may participate in the program. Multi-family building owners are eligible to receive common area items (primarily lighting) if at least two-thirds of occupant households meet eligibility requirements. Participating building owners must match WAP funds and pay for a portion (depending upon the measure) of the cost of installation under the Direct Installation Program.

In reviewing NYSERDA's savings estimation methodology, the best practices of the following regions/organizations were identified and considered:

1. NSTAR Electric, (Residential High Use Program);
2. National Grid, (Low Income Program including Appliance Management Program)

3. Consolidated Edison (ConEdison) Low Income program and;
4. New York State Electric & Gas Corp (NYSEG) Low Income program.

Note: The corresponding numbers are used to reference the various sources within this summary.

Savings Estimation.

A. Energy Savings (kWh)

Initial program savings are determined by combining actual savings calculations from completed projects with estimated energy savings for completed projects where data has not yet been captured.

The data is obtained during the initial audit and during the post-installation site visit. For Small Homes, defined as structures containing one to four units, all existing refrigerators are metered with line loggers during the two-hour energy audit to estimate their annual electric energy consumption. For Multi-Family units, information from the appliance name-plate is cross-referenced with AHAM tables to establish baseline consumption. For those models where name-plate information is not available, line loggers are used to estimate annual electricity consumption. The savings from custom measures, including space heating fuel conversion, are estimated using standard engineering practices. Energy savings from lighting measures are estimated from each measure installed. The following algorithm best describes the lighting measure savings estimation:

$$\text{Gross Savings (kWh/yr)} = \left(W_{base} - W_{eff}\right) \times H$$

Where,

W_{base} = The rated wattage of the existing equipment (attained during audit);
W_{eff} = The rated wattage of the efficient equipment (attained during installation);
H = Daily hours of use per fixture location (RECS, 1993).

Hours-of-use assumptions are taken from the U.S. Energy Information Agency's Residential Energy Consumption Survey (RECS) data. Common area lighting is assumed to be in use twenty-four hours per day. Since the program also addresses the health and safety of low income residents, new lighting fixtures may be installed where previously none existed, resulting in negative savings for a specific measure.

About 62% of the reduction in electricity use from the Direct Installation program is due to lighting improvements; electricity savings from refrigerators account for the remaining 2.5 million kWh (38%).

B. Demand Savings (kW)

Estimated peak reduction from the Low Income Direct Installation program is based upon factors applied to the estimated kWh savings. A factor of 6,556 kWh/kW is applied to the energy savings attained through the installation of efficient refrigerators, and a factor of 7,634 kWh/kW is applied to the estimated energy savings gained from lighting measures. These values are based on the data compiled for the Preliminary Electric Savings Method and Peak Demand Review for NYSERDA's Residential Appliances and Lighting Program and ENERGY STAR® Public Awareness Program. The demand factor values are consistent with those used by the MA Electric Utilities, are significantly more conservative that the values used by National Grid, and slightly less conservative than the estimates used by NYSEG.

C. Measure Life

The measure life estimates for refrigerators and lighting measures shown in the table below were taken from the Preliminary Electric Savings Method and Peak Demand Review for NYSERDA's Residential Appliances and Lighting Program and Energy Star® Public Awareness Program. The CFL measure life estimate is based upon an 8,000 hour life used an average of 4 hours per day and equals approximately 5.5 years.

For determining a program level measure life for estimating lifetime kWh savings, NYSERDA assumes the measure life expectancies for applicable measures as shown below.

Table 12

Measure	Lifetime	% of Savings
Refrigerator	19	39%
CFL	5.5	32%
Lighting Fixture	20	14%
Torchiere	7.2	15%
Weighted Measure Life	**13**	**100%**

Source: NYSERDA Tracking Spreadsheet, 12/12/01.

Findings / Recommendations. Overall, the methods used by NYSERDA for estimating program savings for the Low Income Direct Installation program are consistent with those methods used by other organizations to estimate savings from low income programs. The primary source for assumptions leading to savings estimates is actual data obtained during the site visits and the methods applied to these actual values are based on accepted engineering practices.

Photovoltaics Program

Overview. Photovoltaic (PV) energy technologies are being promoted mainly through two separate programs: Residential PV and PV on Buildings.[1] These programs are designed to encourage the installation of grid-connected PV systems, foster New York's market for remote PV systems, and promote the installation of PV systems on commercial, industrial, institutional and certain multifamily buildings. In addition, these programs attempt to demonstrate product viability, identify and reduce key market barriers and strengthen the infrastructure for installation and operation of PV systems.

The Residential Photovoltaic Program provides incentives to expand the residential market for grid-connected PV energy. PV system installers are given incentives of up to 50% of installation costs in return for a one-year monitoring of all systems installed under this program.

The Photovoltaics on Buildings Program focuses on the installation of PV systems on commercial, industrial, institutional, and multifamily buildings. The program attempts to introduce PV technology to

[1] Incentives for PV are also provided through the New Construction Program, Peak Load Reduction Program, and the Loan Fund.

the public through various public outreach initiatives. The systems, operated and maintained by Alternative Power, Inc., will be monitored for a period of two years.

In reviewing NYSERDA's savings estimation methodology, the best practices of the following regions/organizations were identified and considered:

1. Hawaii Department of Economic Development and Tourism, (GDS Associates);
2. Massachusetts Electric;
3. Western Massachusetts Electric;
4. Sandia National Laboratory;

Note: The corresponding numbers are used to reference the various sources within this summary.

Savings Estimation.

A. Energy Savings (kWh)

Like the wind programs, PV projects will not reduce power consumption or demand but will offer a renewable, non-polluting, generation alternative to the fossil-fueled power generation facilities. NYSERDA's methodology for estimating energy production from PV installations is based upon the following equation, which has been slightly modified as part of this Review:

$$kWh = kW_r \times E \times C_f \times Hrs_a$$

Where,

- kW_r = the rated kW (nameplate) capacity of the PV systems being installed
- E = the efficiency of the PV system which includes conversion from solar to electric power and the inverter (90%)
- C_f = Capacity Factor, proportion of hours per year that total solar radiation will be available to the PV system (continue using NYSERDA's current 16%).
- Hrs_a = Number of hours per year that the PV system is estimated to be available for operation (8,760 x 85% estimated system availability).

The capacity factor accounts for the PV system's maximum availability and is equivalent to approximately 3.84 hours per day of available solar resource.

B. Demand Savings (kW)

Demand savings are reported as the cumulative sum of the installed systems, and, although not published, conversations with NYSERDA staff yields an in-house assumption of 60-70% of the installed (nameplate) capacity depending upon the location of the site. The New York City area has a much higher coincidence with peak load than places further way. Upstate areas, which have lower solar resource availability and less power generated at peak periods, have a lower coincidence factor.

The installer of PV systems for a Massachusetts program, Schott Applied Power, suggested that a peak demand coincidence factor of 85 - 90% is appropriate for their systems.

Based on this assessment a Peak Demand Reduction factor of 70% is appropriately conservative. As an alternative, NYSERDA may wish to consider using 85% downstate (NYC) regions and 60% for the rest fo the State.

C. Measure Life

Given the early stages of field implementation of these PV programs, NYSERDA does not currently report lifetime energy production. However, when producing lifetime cost and payback estimates, a 30 year time span is considered.

The PV module, with no moving parts, has an expected lifetime exceeding 30 years. However, the Balance of System (BOS) components including the controller, inverter and protection components are much more sensitive to wear and deterioration and will therefore shorten the measure life of the system as a whole. A typical DC/AC inverter has a 10-year life.

As a conservative estimate, NYSERDA should consider using a 20 year measure life when calculating lifetime energy production from its PV programs.

Findings / Recommendations. The general method used to estimate savings from the PV systems are consistent with those of others reviewed. As the monitored data from installed equipment becomes available, it will allow NYSERDA to further refine more site specific capacity factors and other underlying assumptions.

C/I Performance Program

Overview. The **New York Energy $mart**[SM] Commerical/Industrial Performance (CIP) program is designed to encourage the growth of Energy Service Companies (ESCOs) and their industry. The program's aim is at the stimulation of investment in energy efficient equipment by institutional, commercial and industrial clients of ESCOs through performance-based contracting.

The CIP program involves a relationship between four entities: NYSERDA, participating ESCOs, energy service customers, and the technical consultants hired by NYSERDA to verify the energy savings. As a performance-based program, CIP offers incentive payments to ESCOs for developing projects that bear confirmed annual electric energy savings.

To be eligible for this program, installed equipment must measurably reduce electric energy consumption or reduce the site's coincident maximum (summer) peak demand. NYSERDA provides a list of pre-approved measures and a list of excluded measures. Custom measures are to be reviewed by NYSERDA and, if eligible, assigned an incentive rating. Measures fall into one of three categories: lighting, motors/VSDs and cooling.

In reviewing NYSERDA's savings estimation methodology, the best practices of the following regions/organizations were identified and considered:

1. San Diego Gas and Electric (SDG&E);
2. Pacific Gas & Electric (PG&E);
3. Southern California Edison (SCE) and;
4. TXU Electric C & I Standard Offer Program (SOP) 2002

Note: The corresponding numbers are used to reference the various sources within this summary.

Savings Estimation.

A. Energy Savings (kWh)

Program savings reported by NYSERDA for the CIP program are derived from the Detailed Energy Analysis (DEA) submitted with the CIP applications. The CIP program compares the post-retrofit energy consumption levels against the consumption levels of scenarios from either current minimum efficiency standards or current standard practice. The result is considered to be the savings from the installed measures. Where no minimum efficiency standards or current standard practices exist, savings are based upon on-site energy consumption prior to the installation of new measures. Required metering is conducted in accordance with International Performance Measurement and Verifications Protocol (IPMVP).

Ninety-five percent of the estimates submitted with DEAs are confirmed and the awards are made with no adjustments to the estimated savings. The remaining five percent are typically adjusted downward by an average of twenty percent. For lighting measures, tables are provided and include wattages for the various fixture/ballast combinations that are to be used for calculating the difference between existing and proposed equipment. Annual hours of use for the lighting measures are estimated based on the application. Baseline estimates are based on state and federal minimum efficiencies standards from various sources as shown in the table below.

Table 13: Sources of Minimum Efficiency Standards for Qualifying Equipment

Measure	Standard
Lighting - Lamps	EPACT, 1992
Lighting - Ballasts	NAECA, 1987
HVAC	ASHRAE Standard 90.1-1999
Motors/VSD	ASHRAE Standard 90.1-1999

Source: C/I Performance Program Procedures v4.0, Appendix B, M & V Guidelines

B. Demand Savings (kW)

The peak demand period has been defined as the period between June 1 to September 30 and the hours between 11 AM and 6 PM, Monday to Friday, excluding holidays. Upon application and part of the required DEA, NYSERDA requests estimates of coincident peak demand reduction (kW). Since the CIP program began offering an additional $300 bonus for chillers that reduce power demand coincident with peak, applicants are now asked to provide estimated summer peak demand reduction with their applications as well as the necessary documentation supporting the calculated estimate.

The program stipulates the following algorithm for estimating summer peak demand reduction for upgrading electric chillers and unitary HVAC units:

$$kW_s = T_p \times (kW / Ton_b - kW / Ton_p) \times 90\%$$

Where,

kW_s = *Summer Peak Demand Reduction*
T_p = *Nominal capacity of proposed equipment (tons)*
kW/ton_b = *Rated load of baseline equipment**
kW/ton_p = *Rated load of proposed equipment**
90% = *Coincidence Factor*

* At the Air-Conditioning and Refrigeration Institute (ARI) standard rating conditions for water chilling equipment below 2,000 tons and for unitary equipment.

Estimated demand savings for measures that do not qualify for the kW incentives are based on a kWh/kW factor applied to the estimated kWh savings as reported in the DEA. The Summer demand factors, as shown in the table below, were calculated by Science Applications International Corporation (SAIC) using actual program data. With the exception of the value for Motors/VSD/Other/Custom, the factors are consistent with factors witnessed in NYSERDA's New Construction Program Savings Review. The high value for the outstanding category is likely due to the fact that the mix of measures that were included in the calculation have a very low impact on Summer demand.

Table 14: Summer Demand Factors (kWh/kW)

Measure	kWh/kW Factor
Motors / VSD / Other / Custom	56,818
Cooling	1,111
Lighting	6,897
Other	6,897
Weighted Average for Program	**4,497**

Source: SAIC Analysis, 10/3/00.

C. Measure Life

Based on a weighted average of estimated measure lives, it is recommended that NYSERDA use a life of 15 years for CIP projects.

Table 15: Savings-Weighted Measure Life

Measure	Measure Life	% of Savings
Motors / VSD	15	49%
Cooling	15	19%
Lighting (Systems & Controls)	15	32%
Other	10	0.3%
Weighted Measure Life	**15**	**100%**

Source: NYSERDA Tracking Spreadsheet, 12/12/01.

Findings / Recommendations. NYSERDA's approach in estimating energy and demand savings for the CIP program is consistent with those of performance contracting programs reviewed and is slightly more rigorous. The simplification of energy savings methodologies by other programs appears to be related to their allowing customers to participate without the intermediation of a sponsoring ESCO. For example, by developing matrices with pre-calculated energy savings, provisions have been made within the California program to allow for a more simplified method of estimating measure kWh savings. For NYSERDA, since one of the key goals of the program is to encourage the growth of ESCO's, the slightly more involved energy savings estimation requirements, as enforced through the submission and review of DEA's, seems warranted and should result in improved savings estimates.

Because these are performance-based programs, savings estimates can be verified against monitored savings results to confirm program impacts. NYSERDA staff is currently developing processes to update energy savings estimates using verified savings.

New York Energy $mart[SM] Loan Fund

Overview. The **New York Energy $mart[SM]** Loan Fund program is designed to promote energy efficiency by encouraging the use of current technology into building systems through reduced interest loans for financing energy efficiency improvements. The Loan Fund offers loans up to $500,000 and 5-year terms toward projects that reduce energy consumption.

The Loan Fund is administered with the cooperation of New York banks and/or other lending institution. After all necessary loan documents have been signed by both the borrower and the lender, and presented to NYSERDA, the lender is provided with a one time lump sum payment equal to the difference in approved loan amount and the discounted present value of the scheduled payments of principal and interest at the reduced rate. The reduced rate is founded upon the base interest rate minus the basis point reduction. The basis point reduction is 50% of the Prime Rate as published in the *Wall Street Journal,* plus 1%. As of July 1, 2001, the reduction is 450 basis points.

Facility improvements may include those on the Pre-Qualified Measures Worksheet (see table at the end of this Summary) and/or customized improvement measures subject to NYSERDA approval and acceptance.

In reviewing NYSERDA's savings estimation methodology, the best practices of the following regions/organizations were identified and considered:

1. Texas LoanSTAR program;
2. Tennessee Small Business Energy Loan Program;
3. Nebraska Energy Office, Dollar and Energy Savings Loan Program;
4. National Grid, 2000 DSM Performance Measurement Report;
5. American Council for an Energy Efficient Economy (ACEEE);
6. GasNetworks Regional Energy Efficiency Programs (Massachusetts);
7. NSTAR Electric's Residential High Use Program (Massachusetts); and
8. EPRI Engineering Methods for Estimating Impacts of Demand Side Management Programs, 1993.

Note: The corresponding numbers are used to reference the various sources within this summary.

Savings Estimation

A. Energy Savings (kWh)

NYSERDA assumes that the loan program encourages installation of energy efficient measures over conventional new equipment but does not cause early retirement of equipment. Savings estimates have been established for a pre-qualified list of eligible measures. This list, provided at the end of this summary, includes both current values used by NYSERDA as well as recommended values.

Savings from custom measures are estimated by the borrower upon the time of loan application. The borrower is required to describe the method by which the savings were estimated. NYSERDA reviews, and either accepts or declines the customer's proposed custom measures based upon the applicant's ability to meet threshold criteria. Thresholds include demonstrated energy savings, acceptable means of calculating those savings, and energy cost savings sufficient to payback the initial investment within a 10 year period.

Payback is calculated via the simple payback method by dividing the improvement cost by the value of the annual energy cost savings. (e.g. $50,000 ÷ $5,000/year = 10 years).

Participants with custom measure projects are also allowed to apply any increased commercial and industrial production capacity to the calculation of payback in lieu of decreased electricity consumption and demand. In these cases, savings are calculated as the difference in per-unit energy cost before and after implementation of the financed equipment.

B. Demand Savings (kW)

For measures installed to date, incremental demand savings have been estimated on a measure by measure basis. The incremental demand savings is based upon the variance between the efficient equipment being installed and the minimum efficiencies of the lesser efficient alternatives. The table at the end of this summary contains the incremental demand savings for each measure, where available.

Demand savings from custom measures are assessed based upon documented savings estimates provided with the applicant's technical review.

C. Measure Life

The following table shows measure lives typical of the pre-qualified measures addressed under the **New York Energy $mart**[SM] loan program. For a program level measure life, it is recommended that NYSERDA use a value of 15 years until data is available to calculate a weighted average based on each measure's proportion of savings. Although payback period is a required calculation within the loan application process, measures lives are not used within the prescribed calculation.

Table 16: Measure Lives of Pre-Qualified Measures

Measures	Measure Life	Findings/ Recommendations
Building Shell Measures	10-35	Consistent with Source 5
CFLs and A-line halogen IR lamps	3-12	Consistent with Source 4 and 5
Fluorescent lighting fixtures	20	Consistent with Source 4 and 5
Geothermal Heat Pump	25	Consistent with Source 4 and 5
High Efficiency Refrigerated Vending Machines	10	Consistent with Source 5
HVAC-Commercial Cooling	15	Consistent with Source 5
HVAC-Commercial Refrigeration	23	Consistent with Source 5
HVAC-Ventilation/Duct Sealing	15	Consistent with Source 5
LED Exit Signs	25	Consistent with Source 4 and 5
Occupancy Controls	15	Consistent with Source 4 and 5
Premium Efficiency Motors/VSDs	15	Consistent with Source 4 and 5
Water Heating	12-15	Consistent with Source 5

Findings / Recommendations. Overall, the methods used by NYSERDA for estimating program savings for the Loan Fund program appear reasonable when compared to those methods used by other organizations. Generally, the primary source for assumptions is incremental savings estimates applied to measure counts as reported through the application process. As described in the table at the end of this section, the incremental savings estimates are consistent with other reported values. For custom measures, methods applied are based on accepted engineering practices.

Notes on the Following Table of Incremental Savings Estimates

The following table includes incremental savings estimates for the pre-qualified Loan Fund program measures. This extensive list of more than 50 measures includes some that are found in other NYSERDA programs and in such cases, the savings estimates are consistent. As part of the Loan Fund Savings Review, GDS Associates replaced NYSERDA values where there was no backup information available for the existing estimate. In such cases, the original NYSERDA value is included in the Qualification / Assumptions area. Recommendations for savings estimates are offered as part of this savings review for those measures where NYSERDA has not yet developed savings estimates.

Table 17: New York Energy $mart[SM] Loan Fund Pre-Qualified Measures: Annual Incremental Savings Assumptions Used by NYSERDA

Pre-Qualified Measure	Qualification / Assumptions		Incremental Savings (kWh)	Demand Savings (kW)	Note
Heating, Hot Water and Air Conditioning					
Air-source heat pumps	Electric split system and single package units with capacity under 65,000 Btu. No window units or other ductless systems. HSPF ≥ 7.6, SEER ≥ 12.0 (Source: FEMP)		1,390	.179	1
Air-source 65-135 Mbtu/hour	Split systems and single package units with capacity over 65,000 Btuh. EER ≥ 10.1, COP ≥ 3.2 (Source: FEMP)	Tier 1	1,513	.804	4
		Tier 2	2,143	1.14	4
Air-source 135-240 Mbtu/hour	Split systems and single package units with capacity over 65,000 Btuh. EER ≥ 10.1, COP ≥ 3.2 (Source: FEMP)	Tier 1	3,138	1.673	4
		Tier 2	4,445	2.368	4
Water-source 65-135 Mbtu/hour	Split systems and single package units with capacity over 65,000 Btuh. EER ≥ 13.0, COP ≥ 4.5 (Source: FEMP)	Tier 1	2,357	1.256	4
		Tier 2	2,784	1.483	4
Heat pump water heaters: add-ons	Hot water heating system replacing electric resistance heating system. Retrofit for existing electric storage with add-on heat pump water heater. ≥ 2 Energy Factor (Source: ACEEE) *[Original NYSERDA value was 2,031 kWh and 0.54 kW.]*		1,858	0.437	3
High-efficiency central air conditioning (residential)	Split system and single package units with capacity under 65,000 Btuh. No window units or packaged terminal units. SEER ≥ 12.0 (Source: FEMP, ACEEE)		515	1.04	3
Ground Source Heat Pump	Must meet EnergyStar guidelines--equivalent or better.		8,096	2.16	3
Chiller replacements	#300 ton; 0.65 kW/ton (Source: FEMP, ACEEE) *[Savings value assumes 1,800 hours of operation and standard efficiency of 0.84 kW/ton and a kWh/kW factor of 1,471. Original NYSERDA value was identical assumptions applied to a 200 ton chiller.]*		102,600	69.8	10
High-efficiency electric water heating	Standard 50-gallon water heater. ≥ .92 Energy Factor (Source: FEMP)		326	.03	3
Air-side economizers	System automatically uses outside air to reduce cooling and heating loads. Repair of existing economizers is not eligible. Replacement must have 100% OA differential dry bulb. (Source: ACEEE)		2,735	3.526	7
Packaged AC: Tier 1	Factory-made direct expansion space cooling system with self-contained or matched split evap coils. Must meet CEE Tier 1 standard:≤ 5.4 tons: 12.0 SEER; 5.4-11.25 tons: 10.3 EER; > 11.25 tons: 9.7 EER (Source: ACEEE)	Tier 1	1,712	.94	3
Packaged AC: Tier 2		Tier 2	2,750	1.51	3
Packaged AC	<65 kBtu/hr (weighted avg 36 kBtu/hr=3.0 tons)	Tier 1	639	.32	2
		Tier 2	886	.48	2
	65 to <135 kBtu/hr (weighted avg 90 kBtu/hr=7.5 tons)	Tier 1	1,431	.76	2
		Tier 2	2,012	1.07	2
	135 to 240 kBtu/hr (weighted avg 180 kBtu/hr=15.0 tons)	Tier 1	2,664	1.42	2
		Tier 2	4,599	2.45	2

Pre-Qualified Measure	Qualification / Assumptions	Incremental Savings (kWh)	Demand Savings (kW)	Note
Water-side economizers	System automatically uses water to reduce cooling and heating loads. Repair of existing economizers is not eligible. Replacement must be water cooled DX with water-side economizer. (Source: ACEEE)	N/A	N/A	14
Windows, Doors, Insolation, Infiltration				
Windows (C/I and Multi-family)	U-value ≤ .55 for glass and frame. *[Savings value assumes a 2,000 sq ft home with 300 sq ft of window area and savings are for electric air conditioning only. Original NYSERDA value was 36 kWh and 0.07 kW.]*	379	.74	3
Interior Storm Windows	Double glazed .07 (.0007 in.) clear plastic film affixed to aluminum frame with flex vinyl spline; U-value of 0.75 or better.	N/A	N/A	14
Weatherstripping (Air sealing)	Blower door guided air sealing. *[Savings value assumes 1,700 sq ft of living space and savings are from electric air conditioning only. Original NYSERDA value was 654 kWh and 0.17 kW]*	187		3
Pipe Insulation (per linear foot)	*[Original NYSERDA value was 654 kWh and 0.17 kW.]*	4.5		9
Insulation (per square foot)	*[Original NYSERDA value was 654 kWh and 0.17 kW.]*	1.5		9
Duct Sealing	*[Savings value assumes 1,700 sq ft of living space and savings are from electric air conditioning only. Original NYSERDA value was 1,052 kWh and 0.28 kW]*	331		3
System Controls				
Occupancy controls	Installed where controls do not exist. Infrared or ultrasonic sensors w/ interface. *[Savings value assumes a 4 fixture lighting zone.]*	273	.076	3
Energy Management System (EMS)	Systems control of HVAC and lighting loads.	N/A	N/A	14
Submetering		15%		6
Lighting				
Fluorescent lighting fixtures	T-8 lamp with electronic ballast. *[Savings value based on 3 lamps per fixture and 3600 annual hours of operation. Original NYSERDA value was 76 kWh and 0.01 kW.]*	65	.018	3
A-line halogen IR lamps	Replaced 75w incandescent with 50w HIR. *[Savings value based on 730 annual hours of operation. Original NYSERDA value was 26 kWh and 0.0 kW.]*	18.25	.025	3
Daylight dimming controls	Installed where controls do not exist. 4 fixture occupancy and photocell control systems to adjust lighting levels.	317	.088	3
T-5 lamps	2 lamp fixture with fluorescent lamps with electronic ballasts	36	.01	14
T-8 lamps	2 lamp fixture with fluorescent lamps with electronic ballasts	32	.01	14
HID fixtures for interior use	Units with pulse-start ballasts and matching metal halide lamps; >50 lumens per watt for sources < 100 watts; and >80 lumens per watt for sources > 100 watts (ACEEE).	348	0.073	7
Hardwired compact fluorescent fixtures (CFLs)	Permanently attached CFLs replacing standard incandescent lamps. *[Savings value based on replacement of 120 watt fixture with a 30 watt fixture and an assumed 1825 annual hours of operation. Original NYSERDA value was 289 kWh and 0.05 kW.]*	164	.09	3
High Pressure Sodium (HPS) and Metal Halide (MH) fixtures	Permanently attached HPS and MH fixtures replacing mercury vapor lamps.	816	0.15	

Pre-Qualified Measure	Qualification / Assumptions		Incremental Savings (kWh)	Demand Savings (kW)	Note
LED Commercial and industrial exit signs	Permanently attached light emitting diode (LED) exit signs to replace standard incandescent signs or equivalent. Acceptable to applicable Institute of Traffic Engineers (ITE) specifications. *[Savings value based on a 2 lamp retrofit. Original NYSERDA value was 237 kWh and 0.01 kW.]*		324	.037	3
Appliances					
ENERGY STAR® Refrigerator	*[Note that savings value may need to be adjusted per federal standard change.]*		141	.02	3
ENERGY STAR® Clothes Washer	Motor only		59	N/A	13
	Electric DHW *[Original NYSERDA value was 477 kWh and .06 kW]*		404	.337	13
	Electric Dryer		64	N/A	13
ENERGY STAR® Freezer			132	.02	3
ENERGY STAR® Dishwasher	*[Assumes electric DHW. Original NYSERDA value was 140 kWh and .02 kW.]*		80	.008	13
High efficiency refrigerated vending machines	Equipment must have electronic ballasts and improved fan motor and compressor. (Source: ENERGY STAR®)		1,280	.1807	3
Drives and Motors					
Premium Efficiency Motors	Permanently wired motors from 1- 200 hp, operating over 2,000 hours per year. Must meet NEMA Premium™ guidelines.	***1 HP***	65	0.0238	11
		1.5 HP	79	0.0289	11
		2 HP	106	0.0385	11
		3 HP	118	0.0429	11
		5 HP	196	0.0714	11
		7.5 HP	381	0.1125	11
		10 HP	509	0.1499	11
		15 HP	474	0.1397	11
		20 HP	897	0.2644	11
		25 HP	789	0.1941	11
		30 HP	947	0.2329	11
		40 HP	1144	0.2813	11
		50 HP	1942	0.4775	11
		60 HP	2817	0.5285	11
		75 HP	3238	0.6077	11
		100 HP	2977	0.5586	11
		150 HP	3836	0.7377	11
		200 HP	7640	1.4693	11
Variable speed drives (VSDs)	VSD motors controls replace single-speed motors controls.	*Fan, supply*	648	0.137	7
		Fan, return	792	0.18	7
		Pump, Chilled H_20	1,746	0.187	7

Pre-Qualified Measure	Qualification / Assumptions	Incremental Savings (kWh)	Demand Savings (kW)	Note
Health and Safety Measures				
Smoke Detectors		none	none	
Carbon Monoxide Detectors		none	none	
Radon Detectors		none	none	
Non-Electric Measures		**Energy Savings (MMbtu)**		**Note**
Residential furnaces	Furnaces fired by natural gas and propane; AFUE≥ 90% (Source: FEMP)	18.5		12
Residential furnaces (oil)	Furnaces fired by oil; AFUE ≥ 85%	18.5		12
Residential boilers (hot water)	Boilers fired by natural gas, propane, and oil; AFUE ≥ 85% (Source: ENERGY STAR®)	14.1		12
Residential boilers (steam)	Oil-fired steam boilers; AFUE ≥ 84% (Source: ACEEE)	14.1		12
Residential boilers (steam)	Gas-fired steam boilers; AFUE ≥ 81.5% (Source: ACEEE)	14.1		12
Commercial Gas Boilers	AFUE ≥ 85% (Source: Provisional Standard)	14.1		12
Residential Water Heaters	Standard Residential 50 gallon water heater; ≥ 0.61 Energy Factor (Source: ENERGY STAR®)	2.8		3
Renewables				
PV grid-interactive	On-grid residential. May include PV, inverter, battery bank and charge control. May include wind turbine. Only projects installed under NYSERDA'S residential PV programs are eligible. [Savings value assumes panel with rating of 600 watt DC.]	750	0.54	5
PV off-grid residential.	May include wind turbine. Only projects installed under NYSERDA's residential PV programs are eligible. Site specific custom measures.	Site specific / Equipment specific		
Wind Power	Site specific custom measure	Site specific / Equipment specific		

N/A indicates that no incremental estimates have been found or developed.

As part of the Loan Fund savings review, GDS Associates replaced NYSERDA values in cases where there was no backup information available on the existing estimate. In such cases, the original NYSERDA value is included in the Qualification / Assumptions area of the above table. Recommendations for savings estimates are offered as part of this savings review for those measures that NYSERDA has not yet developed savings estimates.

Sources / Notes:

1. U.S. EPA, Space Conditioning Report, 1993. New York regional values.
2. NYSERDA New Construction Program Savings Review, 2001.
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13. NYSERDA Residential Appliances & Lighting Program Savings Review, 2001.
14. Sources and underlying assumptions for this estimate are currently be investigated.