

**Verification of
EVT 2011 Claimed Annual MWh Savings,
Coincident Summer and Winter Peak Savings
And Total Resource Benefit (TRB)**

Final Report

**Submitted to the
Department of Public Service**

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I. Introduction

On April 2, 2012, Vermont Energy Investment Corporation (VEIC), operating under contract to the Public Service Board ("PSB") as Efficiency Vermont ("EVT"), submitted its "Year 2011 Preliminary Savings Claim" for calendar year 2011 activities. The Department of Public Service ("DPS" or "Department"), is required by the PSB to undertake a review to verify the energy, coincident peak, and Total Resource Benefit ("TRB") savings claimed by EVT for purposes of certifying achieved savings toward VEIC's performance goals. To complete this review, the Department contracted the services of West Hill Energy and Computing, who conducted the verification with assistance from Carole Welch, Cx Associates, GDS Associates and Lexicon Energy Consultants.

The verification process is a paper review intended to identify errors in calculation, assumptions and methodology made by EVT in their savings claim. For retrofit projects, a determination is also made as to whether savings are realistic in terms of pre-installation consumption. Project by project preliminary findings were provided to EVT as the project reports were completed. EVT provided comments on the preliminary reports for consideration by the Department and its contracted engineers. This process helped facilitate agreement between the Department and EVT on all of the project adjustments -- EVT has indicated it accepts all of the adjustments to the 2011 claimed savings recommended by the Department in this report. In some cases, EVT does not completely agree with the Department's rationale or methodology for the adjustment, and requests that the measure characterizations for 2012 be discussed more thoroughly through the ongoing DPS-EVT Technical Advisory Group (TAG) process. The Department has also identified several topics to be taken up in TAG process, as outlined in Section III. Since the parties are in agreement on the magnitude of the 2011 adjustment, the project by project issues and resolutions are only briefly described in the main report. Detailed discussion of the individual projects reviewed and the review outcomes are provided in Appendix A.

The DPS thanks the many staff members at Efficiency Vermont who coordinated the verification review, in particular Pierre Van Der Merwe, Bill Fischer, and Erik Brown.

The results of the Department's verification indicate that EVT's 2011 claimed energy savings claims are overstated by about 6.3%, or 6,371 gross annual MWh, and coincident peak savings are overstated by 6.2%, or 1,201 winter kW and 9.0%, or 1,315 summer kW. The Department's findings are the result of numerous adjustments both upward and downward. The overstatement of savings for the overall portfolio is greater than found in the 2010 program year.

In addition to the analysis of gross energy and demand savings, this review also covers net energy and demand savings, TRB, MMBtu savings from fossil fuels, and water savings. Some of the Department's recommended energy adjustments have significant impacts on these other indicators. When EVT's savings are revised in order for the Department to make recommendations relative to VEIC's 2009-2011 performance award earned and the EVT 2011 annual report, all of the relevant indicators will be re-calculated.

The above described recommended adjustments to EVT’s savings claims is based on the review of EVT’s entire portfolio, including review of a randomly selected sample of C&I projects and a comprehensive review of residential prescriptive measures. The sampling plan for the C&I projects is consistent with that undertaken for the Forward Capacity Market evaluation earlier this year, and the verification sample for program year 2011 will also be used for the FCM evaluation. The sampling process was designed to ensure that the sample was weighted toward the larger projects that embody greater variability and more complex methods for calculating savings. Since the projects under review are reasonably representative of EVT’s 2011 activity, the DPS is applying a proportional adjustment to the Business Sector (C&I) savings that were not included in the sample. This sampling and adjustment method should reflect what would result from a comprehensive savings review of all C&I projects, if resources and time permitted that approach.

Since many of the residential initiatives are primarily prescriptive in nature, the Department’s review of this sector consisted largely of verifying that the agreed-upon assumptions as compiled in EVT’s Technical Reference Manual (TRM) were correctly applied. This validation process is easily conducted for the entire data set, obviating the need for random sampling. Custom residential initiatives are relatively small in magnitude and the Department reviewed the larger residential projects with higher savings.

The adjustments to gross annual savings and coincident peak reductions for all initiatives are summarized in Table 1.

Table 1: Adjustments by Program Group

	Energy Saved		Winter kW Reduction		Summer kW Reduction	
	EVT Gross Claimed MWh	Realization rate	EVT Gross Claimed kW	Realization Rate	EVT Gross Claimed kW	Realization Rate
C&I and Multifamily						
Retrofit	24,652	84.1%	3,953	82.7%	4,036	84.7%
NC/MOP	20,618	88.7%	3,019	85.0%	3,460	80.5%
Stipulated Lighting	10,202	100.0%	1,741	100.0%	1,831	100.0%
Small Projects Not Sampled	1,886	100.0%	208	100.0%	208	100.0%
C&I Subtotal	57,358	88.09%	8,920	86.21%	9,536	85.79%
Residential						
Efficient Products	41,295	100.0%	9,832	99.7%	4,728	99.6%
Residential Retrofit/ Low Income Single Family	1,772	93.2%	313	88.1%	188	99.7%
Residential New Construction	801	100.0%	183	100.0%	77	100.0%
Residential Subtotal	43,869	99.7%	10,328	99.4%	4,993	99.6%
Portfolio Total	101,227	93.7%	19,248	93.8%	14,529	91.0%

The relative precision¹ for the realization rates associated with the energy savings (annual kWh) for the Business and Multifamily retrofit initiatives, and the Business and Multifamily New Construction and Market Opportunity initiatives is 9.5% and 6.2% at the 90% confidence level, respectively.

The remainder of this report is divided into four sections. Section II describes the methods (including the sampling process) and Section III covers the detailed project and measure-level issues that provide the basis for the adjustments shown in Table 1 above. In Section IV, we discuss specific issues with program year 2011 (PY11) projects and other concerns to be addressed on a prospective basis.

¹ Relative precision is an indicator of the variability of the estimator, in this case the realization rate, in relationship to the magnitude of the estimator. It is calculated at the 90% confidence level as $1.645 * \text{standard deviation of the realization rate} / \text{mean realization rate}$.

II. Methods

A. Verification Process

Annual savings verification starts in mid-March, when EVT provides the list of projects and savings for the previous program year to the DPS, with the goal of completing the entire review and generating a final report by the beginning of July, a span of less than four months. EVT's entire portfolio is included in the review, which covers the energy savings, demand savings, other fuel savings or extra use and all other inputs into the total resource benefits (TRB). Given the short time frame and the scope of the work, there is insufficient time to conduct on-site verification or measurement or participant surveys of any type. Consequently, the verification review consists almost entirely of review of EVT's project files and program tracking database. On a case-by-case basis, and time permitting, participant billing data may be reviewed or the DPS Evaluation Team may contact a participant to request additional information.

In this context, it is necessary to prioritize and identify the key components of the portfolio requiring more intensive review. The portfolio is divided into four primary components:

- Commercial and Industrial (C&I) Custom Projects
- C&I Prescriptive Projects
- Residential Prescriptive Savings
- Residential Custom Projects

The approach to each of these components is discussed briefly below.

1. C&I Custom

C&I custom projects account for 82% of the total C&I sector savings and 47% of EVT's total portfolio savings for PY2011. These projects are varied, ranging from relatively simple lighting system to highly complex industrial processes. Due to the characteristics of the projects and their relative importance to EVT's portfolio, the DPS Evaluation Team selects a random sample of projects to review and applies the results to this component of the portfolio. The following section on sampling relate to this component.

The DPS Evaluation Team reviews the project files to assess whether the savings estimates are reasonable. This process is almost entirely dependent on the information provided by EVT. In a few cases, billing data was reviewed or the participant was contacted by the DPS Evaluation Team to fill in missing information.

2. C&I Prescriptive

C&I prescriptive projects are rather loosely defined as projects that use the stipulated lighting profiles as determined through regional studies conducted for the Northeast Energy Efficiency Partnership (NEEP). This definition was developed for the FCM sampling, and was also used for the SV sampling, as the SV sample is subsequently used for the FCM evaluation. Some of these projects rely on prescriptive rebates, and others installed lighting measures through more custom channels.

Prescriptive projects account for 18% of the C&I energy savings and 10% of EVT's total portfolio savings. As is consistent with the FCM evaluation, no additional verification was conducted for these projects.

Some projects consist of measures that fall into both the C&I prescriptive and C&I custom categories, in that the project combined "prescriptive" lighting measures with custom measures. If the project has both prescriptive and custom measures, it was included in the C&I custom category.

3. Residential Prescriptive

Most of the residential savings are associated with prescriptive measures and the verification process involves ensuring that EVT's claimed savings match the TRM. The Efficient Products Program (EP) accounts for 94% of EVT's claimed energy savings in the residential sector.

4. Residential Custom

All of the remaining residential initiatives (Low Income Single Family, Home Performance, and the Vermont Energy Star Homes) accounting for the remaining 6% (and about 2% of the total portfolio savings). Many of these measures are also prescriptive and were reviewed by comparing the claimed savings to the TRM.

The DPS evaluation team looked at a census of projects in the Home Performance with Energy Star that saved 5000 kWh/yr or more. These 12 homes accounted for approximately 33% of the annual kWh savings from this initiative. Initially, two aspects of each project were reviewed. The first was the project documentation provided by EVT. The second was the electric billing history available from the EVT KITT system.

After this review was submitted to EVT, additional documentation was provided through the on-line system, called HERO, used by home performance contractors to report projects to EVT. This additional information was reviewed before final adjustments were made. As this review involved looking only at a census group of the projects with the largest kWh savings, the results should not be interpreted to reflect the savings from the initiative as a whole.

B. Sampling

1. Overview

To review EVT's claimed savings from custom C&I and multifamily projects, a random sample of projects was reviewed. During the past three years, the sample has been used for two purposes: annual savings verification and the FCM evaluation. Since the FCM standards are more rigorous, the sample plan was designed for FCM and the coincident peak kW was used to define the size categories. Stratified ratio estimation was used to design the sample and calculate the realization rates.

For program year 2011 FCM evaluation, the strategy was taken one step further as only the largest projects in the census strata are to be verified and the realization rates for the smaller projects from the PY2010 FCM evaluation will be applied. Since the sampling for annual savings verification and FCM have been linked, this decision also affected the sample design for PY2011 savings

verification. To maintain the integrity of the sampling process and accommodate this approach, it was necessary to use the same sample design from PY2010, including the definition of the sampling unit and size categories. However, unlike the FCM evaluation plan, a random sample of projects in the smaller size categories was selected and reviewed for annual savings verification.

The guidelines for the SV10 sampling process are listed below.

- The primary sampling unit was the project. All measures associated with the project were reviewed.
- The primary sampling variable for establishing the size strata was the higher value of the kW peak reduction, either winter or summer with any stipulated savings subtracted.
- Sampling was conducted separately for two broad categories of initiatives, i.e., retrofit and MOP/new construction. Multifamily projects were included with the C&I projects.
- Stratification by project size was conducted, resulting in a total of five size strata for each of the two broad categories of projects.
- Projects with stipulated lighting measures only were excluded from the sample, except for those stipulated lighting measures and projects that fell into the "very large" stratum. Projects that included both stipulated and non stipulated measures were included when the non-stipulated savings were greater than 0.80 kW.
- A census of the largest projects in the each broad category was reviewed.
- Weighting was done on the basis of the number of projects.
- The cut offs for the strata and sample sizes within each stratum were determined according to the methodology presented in the California Evaluation Framework.
- As was done for the SV08, SV09 and SV10 samples, projects with maximum kW reduction less than 0.80 kW were removed from the sampling frame.

In applying the PY2010 sample design to the PY2011 projects, the census stratum for the NC/MOP projects was found to include 26 projects. Given the time constraints of annual savings verification and the importance of ensuring timely completion as EVT's three year contract cycle is coming to an end, the Department's evaluation team decided to verify 11 of the 26 NC/MOP largest projects. As was done in the past, all of the projects in the largest stratum of retrofit projects were reviewed.

2. Summary of Projects

The first step in the sampling process was to determine the non-stipulated savings for retrofit and MOP/NC projects.² Projects with only stipulated savings were excluded from the sample. In addition, projects with less than 0.8 kW of savings account for a relatively small proportion of the savings and were not included in the sample. Including these projects would increase evaluation costs substantially without a commensurate improvement in the accuracy of the findings. Table 2 shows the number of projects in each of these three components and the total savings.

² Savings for some measures were calculated using coincidence factors based upon a study of regional and local evaluation studies conducted by RLW Analytics. These measures were considered to be stipulated.

Table 2: Summary of C&I Projects

Category	Number of Projects	MWh Savings
Retrofit	802	24,652
MOP/NC	628	20,618
Small & Stipulated Lighting ³	1,281	12,088
Totals	2,711	57,358

The savings size cut offs for each stratum were calculated according to the methodology presented in the California Framework (Framework).⁴ Sample sizes were established based on previous experience and the time constraints specific to SV11.

Using the Framework methodology, the number of projects selected from each stratum should be equal, with some exceptions. Examples of exceptions include fewer projects in a specific stratum than the selected sample size for each group or sampling a census in a single stratum. However, since the PY2010 sample design was applied, the distribution of PY2011 projects and savings into the pre-designated size categories was different from PY2010 and modifications to the distribution of sample sizes among the strata were made to reflect the magnitude of savings in each stratum. The sample included 32 retrofit and 32 MOP/NC projects.

3. Sampling Results

An overview of the sample is shown below in Table 3. The sample custom projects account for about 25% to 35% of total energy savings.

Table 3: Overview of the Sample

Program	Total # of Projects	Total MWh Savings	Sample # of Projects	Sample MWh Savings
Retrofit	802	24,652	32	6,603
MOP/NC	628	20,618	32	6,602
Small & Stipulated Lighting	1,281	12,088	0	0
Totals	2,711	57,358	64	13,205

The distribution of sampled projects in terms of the size of the projects is presented below in Table 4. This analysis shows that projects vary in size from small increases in kW use to a 430 kW reduction.

³ Includes both small and stipulated savings. Stipulated savings were reviewed to ensure measures savings adhered to agreed values.

⁴ TecMarket Works, et. al. The California Evaluation Framework. Project Number: K2033910. Prepared for the California Public Utilities Commission and the Project Advisory Group. June, 2004. Pages 327 to 339 and 361 to 384.

Table 4: Distribution of Sample by Project Size⁵

Program Group	Size Stratum	# of Projects	Min (Higher KW Reduction)	Max (Higher KW Reduction)	Mean (Higher KW Reduction)	Sample Size
Retrofit	0	598	-0.631	0.797	0.287	0
Retrofit	1	539	0.801	3.692	1.788	6
Retrofit	2	144	3.732	8.605	5.581	5
Retrofit	3	84	8.646	21.793	13.510	7
Retrofit	4	26	22.336	39.078	28.519	5
Retrofit	5	9	45.820	431.204	124.931	9
Subtotal Retrofit		1,400	-0.631	431.204	3.528	32
MOP/NC	0	279	-1.395	0.799	0.336	0
MOP/NC	1	314	0.805	3.270	1.824	4
MOP/NC	2	179	3.303	7.207	4.900	7
MOP/NC	3	85	7.390	13.423	10.009	6
MOP/NC	4	24	14.258	24.775	17.169	4
MOP/NC	5	26	26.427	233.197	59.749	11
Subtotal MOP/NC		907	-1.395	233.197	4.807	32

Table 5 compares the mean and median project KW reduction for the sample and the population. This analysis indicates that the average energy savings for some strata are substantially higher in the sample than in the population.

⁵ Stratum 0 for both Retrofit and MOP/NC includes both small projects and projects that were entirely stipulated lighting.

Table 5: Comparison of Sample and Population

Program Group	Size Stratum	Sample Mean kWh	Population Mean kWh	Sample Mean Max KW	Population Mean Max KW
Retrofit	1	14,761	7,699	2.126	1.788
Retrofit	2	53,839	27,461	6.722	5.581
Retrofit	3	91,815	69,648	15.220	13.510
Retrofit	4	175,528	144,437	25.060	28.519
Retrofit	5	522,615	522,615	124.931	124.931
MOP/NC	1	7,357	8,406	1.495	1.824
MOP/NC	2	25,601	21,228	4.612	4.900
MOP/NC	3	67,718	40,356	9.805	10.009
MOP/NC	4	88,136	66,385	16.884	17.169
MOP/NC	5	432,450	294,139	84.697	59.749

The expansion weight is the total number of projects in the stratum divided by the number of projects in the sample. The small size strata have the highest expansion weights, since these strata have the greatest number of projects.

Table 6: Expansion Weights by Stratum

Program Group	Size Stratum	Total # of Projects	# of Projects in Sample	Expansion Weight
Retrofit	1	539	6	89.833
Retrofit	2	144	5	28.800
Retrofit	3	84	7	12.000
Retrofit	4	26	5	5.200
Retrofit	5	9	9	1.000
MOP/NC	1	314	4	78.500
MOP/NC	2	179	7	25.571
MOP/NC	3	85	6	14.167
MOP/NC	4	24	4	6.000
MOP/NC	5	26	11	2.364

A few issues arose in the process of conducting the sampling, as described briefly below.

- Twenty-two projects were incorrectly omitted from the sample frame. Most of the projects (18) were inadvertently dropped by West Hill Energy; these projects were part of the all fuels initiatives and were excluded from sampling in previous years but intended to be included for PY2011. Four projects were identified as BED projects in the EVT database; however, EVT subsequently recognized that they were not in BED territory. In aggregate,

these projects account for 207 MWh, 9.2 winter kW and 10.0 summer kW. All except two of these projects belonged in the "too small to verify" category, and the remaining two projects were also included in this group in the realization rate analysis to simplify the calculation process.

- The size boundaries were based on the maximum kW demand reduction (winter or summer) due to the requirements of the FCM evaluation, but energy (kWh) savings are the critical variable for annual savings verification. In terms of kWh, the size strata are not a perfect fit as there are substantial overlaps among strata, i.e. there may be smaller projects in Size Stratum 2 than in Size Stratum 1. This situation created issues with the application of the weights, as discussed further in the following section.
- The initial sample pull was more heavily weighted toward lighting projects than EVT's sample as a whole and seemed to be non-representative; the DPS Evaluation Team decided to re-draw the sample. The second sample pull was a better match for EVT's C&I portfolio as a whole, but was inadvertently selected by EVT's project ID rather than the randomly assigned numbers, which was not realized until very late in the process. The DPS Evaluation Team understands that EVT's project numbers are assigned as participants enroll in the program and thus ordering by project ID would affect only the timing of the project, not the complexity or range of measures installed. A comparison of the sample and population indicates that approximately the same percentage of projects (55% and 60%) were completed in the first half of the program year, indicating that ordering by project ID would not be expected to introduce bias to the results.

C. Calculation of the Realization Rates

The realization rates were calculated for each of the components described above and then applied to the whole portfolio based on the relative contribution of each component to the total portfolio savings. The calculation of the realization rate for the critical components are discussed below. The realization rate for the stipulated (prescriptive) lighting projects was assumed to be 100%.

1. Custom C&I Projects

The realization rate (RR) is the ratio of verified energy savings to the program's reported savings. The RR represents the percentage of program-estimated savings that is actually achieved based on the results of the evaluation M&V analysis. The RR was calculated as follows:

$$b = \frac{\sum_{i=1}^n w_i y_i}{\sum_{i=1}^n w_i x_i}$$

where,

b is the realization rate (ratio estimator)

i represents the project number

n is the total number of verified projects in the sample

w_i is the expansion weight

y_i is the verified savings for project *i*

x_i is the original claimed savings for project *i*

The basis for these calculations and the method for calculating the variance are provided in *The California Evaluation Framework*.⁶

2. Residential Prescriptive Measures

No discrepancies between EVT's claimed savings and the TRM were found for the energy (kWh) savings, and the realization rate was set to 100%. Small adjustments were found for the winter and summer kW demand savings, and all of the measures with discrepancies were adjusted.

3. Residential Custom Projects

The Home Performance projects with the highest savings were reviewed and adjustments were made for these projects only. All other measures were assumed to have a realization rate of 100%. This approach is appropriate as the Home Performance projects chosen for review were not randomly selected, and the other HP projects represent a small part of EVT's overall portfolio.

⁶ TecMarket Works, et. al. *The California Evaluation Framework*. Project Number: K2033910. Prepared for the California Public Utilities Commission and the Project Advisory Group, June, 2004, 327 to 339 and 361 to 384.

III. Project and Measure-Specific Adjustments

A. Commercial & Industrial Business Sector Projects

The random sample consisted of 64 Commercial and Industrial (C&I) and multifamily projects covering the range of EVT initiatives in those sectors. The Department's adjustments are based on thirty-three of the selected C&I and multifamily projects, i.e., issues were found with the savings claimed in over half of the selected projects. Many adjustments were relatively small in magnitude.

Table 7: Summary of Adjusted Projects

	Total # of Projects⁷	# of Projects in Sample	# of Projects with Project-Specific Adjustments	# Projects with kWh Adjustments >+5%
NC/MOP	628	32	17	12
Retrofit	802	32	16	12
Totals	1,430	64	33	24

Tables 9 and 10 provide a brief summary of the projects in the sample where the savings were adjusted and either the energy or the summer peak savings were revised by 5% or more. Realization rates by project as well as the project stratum and reason for adjustment are provided in Table 9 for C&I retrofit projects. Table 10 provides the same information for C&I New Construction and Market Opportunity projects in the sample. A detailed report for each project with an adjustment is attached in Appendix A.

⁷ There were 767 projects with the maximum coincident peak reduction less than 0.8 kW. These projects were considered to be too small to evaluate and were not included in the sample or in this table. An additional 1,223 projects had at least one stipulated lighting measure; some of these projects may also have non-stipulated measures and be included in the table above. The stipulated lighting projects were also omitted from this table since the subgroup of lighting projects was not sampled for the 2010 verification.

Table 8: Realization Rates for C&I Retrofit Projects

Project ID	Title	Size	RR kWh	RR kWWin	RR kWSum	Reason for Adjustment
355472	Bernstein Display - Lighting 2	5	0.772	N/A	0.736	Change in Quantity Installed
379372	Cabot Creamery Cooperative - Cut And Wrap - CAS	5	0.767	0.743	0.853	Change in schedule or hours of operation
378244	Century International Arms, Inc. - Compressed Air	1	0.709	N/A	0.707	Incorrect Baseline
370854	Energizer - Saint Albans - CAS 2008	4	1.086	1.605	1.607	Analysis Error
373688	Essex Junction, Village Of - WWTF - Fuel Switch	1	0.408	1.000	1.000	Analysis Error
370702	Husky Injection Molding Systems - Henry System Improvements	2	0.000	0.000	0.000	Project not completed in 2011
376176	Lyndon Town School - Various Measures	4	0.975	0.878	0.392	Coincidence Factor or kW adjusted to meet standard. Change in schedule or hours of operation
378741	Mill River Lumber - Carriage System Motor	5	0.992	N/A	0.788	Change in schedule or hours of operation
381618	Mount Abraham - EECBG #1 - Various Measures	4	0.867	0.806	0.317	Change in schedule or hours of operation and Change in Quantity Installed
374828	Price Chopper - Colchester - Fit Up	3	0.993	0.784	0.814	Coincidence Factor or kW adjusted to meet standard
377640	Reinhart Foodservice - Cooler Door	3	0.500	0.500	0.500	Insufficient Documentation
400327	Stratton Mountain - 2011 Snow Guns	5	0.176	0.248	N/A	Difference in Analysis Technique
400974	Sugarbush- Snowgun Replacement 2	5	0.604	0.795	N/A	Change in schedule or hours of operation
356572	VSB - Corrections - SESCOF	1	0.000	0.000	0.000	Insufficient Documentation
389873	Weidmann - Dust Collection	5	0.799	0.838	0.861	Analysis Error

Table 9: Realization Rates for C&I New Construction and MOP Projects

Project ID	Title	Size	RR kWh	RR kWWin	RR kWSum	Reason for Adjustment
378448	Bacon Street Lofts - South Burlington	3	0.906	0.846	0.712	Incorrect Baseline
383507	Bank Of Bennington - Bennington - New Construction	2	1.000	0.995	0.914	Coincidence Factor or kW adjusted to meet standard
374419	Bennington College - CAPA Building - New Construction	4	1.000	0.691	0.795	Coincidence Factor or kW adjusted to meet standard
382329	Bennington College Corporation - VAPA Building - Ventilation	5	0.275	0.275	0.576	Incorrect Baseline
371945	Canal Street Veterans Housing - New Construction	4	0.631	0.653	0.397	Incorrect Baseline, Adjustments to Inputs
371376	Carbone Auto Sales And Service - New Construction	5	0.954	0.951	0.820	Incorrect Baseline, Coincidence Factor or kW adjusted to meet standard
384175	Cedars Edge Apartments - MF - New Construction	2	1.046	0.942	0.985	Change in Quantity Installed
379005	Charlotte Central School - New Construction – EECBG	2	1.037	0.467	0.634	Incorrect Baseline
378975	Commonwealth Dairy, LLC - New Construction	5	0.822	0.462	0.472	Incorrect Baseline, Calculation Error
381509	Grand Way II Senior Housing	2	0.960	0.775	1.000	Incorrect Baseline, Calculation Error
390487	Knox, Paul - Knoxland Farm – Lighting	5	0.532	0.505	1.260	Incorrect Baseline
382535	Price Chopper - Store #192 - Essex Expansion	5	0.830	0.955	0.775	Incorrect Baseline, Change in Quantity Installed
385117	Rutland City School District - Stafford Renovation	3	1.409	1.368	1.428	Incorrect Baseline, Error in Calculation
383561	Rutland Regional Medical Center - Kitchen Hood System	2	0.472	0.643	0.643	Incorrect Baseline
382232	Rutland Regional Medical Center - Server Virtualization	5	0.917	0.917	0.917	Calculation Error
376477	Springfield Area Parent Child Center - New Construction	4	1.000	0.960	0.657	Coincidence Factor or kW adjusted to meet standard
370616	Veterans Administration Medical Center - HVAC B1 - 09-101	3	0.928	0.999	0.942	Incorrect Baseline
226250	Waterbury, Town - New Construction - Fire Station	1	0.652	0.225	0.163	Change in Production Schedule or Use
377130	Weidmann - Pond Water Pumping	2	0.359	0.357	0.357	Incorrect Baseline , Change to Production Schedule or Use

1. Weighting Adjustment

One project with an adjustment was found to have an undue influence on the realization rates. The savings for the initial stage of the project installed in 2011 were removed as it appears that the savings would not be expected to be realized until the completion of the entire project in 2012. Since EVT informed the Department that its policy is to claim savings when the incentive is paid rather than when the measure is operational, the Department has no reason to assume that this project is unique.

Due to the sampling strategy of defining the size categories according to the peak demand kW rather than the kWh energy savings, this project fell into the smallest size category (which has the most projects and the highest weight). The energy savings are substantially higher than a large majority of projects in this stratum and are more similar in magnitude to projects in the next size category.

There is no single strategy for adjusting the results due to influential data. In this case, the simplest approach was to treat this project as if it were in size stratum 2. If the project were left in the original size category, the realization rate for the residential retrofit program would be 80%. Moving this project into size category 2 increases the realization rate to 84%. If no adjustment was made to the project, the realization rate would be 87%. The Department concluded that treating this project as if it were in size stratum 2 is a reasonable approach that continues to reflect the adjustment for this project without unduly influencing the overall realization rate.

2. Other Adjustments

Three small errors will be corrected by EVT for the final report. These issues are described briefly below.

- As part of this review, the Department identified that the FR/SO values in the 2011 database for measure LFHST5HB in the 6012CNIR track were incorrectly calculated. The correct calculation should have resulted in a FR factor of 0.88 and SO of 1.01, based on a blend of 12.3% with a T12 baseline (and thus 0.70 FR and 1.05 FR) and 87.7% other baseline (0.90 FR and 1.0 SO, per TRM). EVT has agreed to correct the FR/SO values for the final estimated savings.
- EVT informed the Department that four projects were incorrectly marked as BED projects and also that these projects were assigned a net-to-gross factor of zero, effectively removing the savings from the program totals. EVT will correct these projects and include them in the final estimated savings.
- EVT informed the Department that some fields in 251 projects involving ILED lighting were not modified to reflect the in-service rate that was derived in the 2010 Verification. These fields do not affect the Performance Indicators but the data will be corrected by EVT before the savings claim is finalized. This will result in a small decrease in gross kWh but will not affect net kWh.

B. Residential Initiatives

The DPS concentrated its review on the major components of EVT's portfolio. The Efficient Products Program accounts for 95% of EVT's claimed energy savings in the residential sector, with

all of the remaining initiatives (Low Income Single Family, Home Performance, and the Vermont Energy Star Homes) accounting for the remaining 5% (and about 2% of the total portfolio savings). Thus, the Department's review was focused on the Efficient Product Program.

1. Efficient Products Program

Energy savings were found to match to the TRM values for all entries in EVT's database and only a few minor discrepancies were found with the winter and summer peak kW savings. The measures and per unit savings by measure can be found in Table 10. Upon adjusting these measures to reflect the TRM, the total kW adjustment for winter and summer were decreased by 27.867 and 21.149, respectively.

Table 10: EP Winter and Summer kW Adjustments

Measure ID	Measure Description	EVT Per Unit		TRM per Unit	
		kW Winter	kW Summer	kW Winter	kW Summer
CKLESWRP	Energy Star washer	0.038	0.028	0.034	0.025
EQPTLVSN	Efficient Televisions- LC < 50"	0.038	0.028	0.015	0.012
EQPTLVSN	Efficient Televisions- Plasma < 50"	0.020	0.016	0.017	0.013
EQPTLVSN	Efficient Televisions- Plasma >= 50"	0.035	0.027	0.029	0.022

2. Home Performance Program

The DPS evaluation team looked at a census of projects in the Home Performance with Energy Star that saved 5,000 kWh/yr or more. These 12 homes accounted for approximately 33% of the annual kWh savings from this initiative. The DPS evaluators were working with a limited amount of post installation billing history and had no information regarding savings from other fuels, such as heating oil or propane use. These are a significant part of the savings from Home Performance and cannot be evaluated in a meaningful way through the verification process.

None of the documented files contained sufficient information to review savings calculations. As a result, the DPS evaluators relied on past electric usage to ascertain if the savings claim was plausible. Tables 11 provides a project-by-project summary of the electric of the adjustments to the twelve projects, and the following table shows the verified MMBtu savings for homes where an adjustment was made.

Table 11: Electric Adjustments to HPwES Reviewed Projects

Project ID	Title	EVT kWh	EVT Winter kW	EVT Summer kW	Verified kWh	Verified Winter kW	Verified Summer kW
389903	4397661/ Londonderry	5,075	2.74	0	2,030	1.096	0
391631	4392543/ BENNINGTON	5,795	0.72	0.337	0	0	0
386272	4375578/ Winhall	5,835	3.15	0	0	0	0
402581	30-56759/Londonderry	6,013	3.137	0.051	5,254	2.741	0.051
394295	B1 & B2/Bondville	6,324	3.414	0	6,324	3.414	0
392018	4390692/ STOWE	6,571	3.547	0	0	0	0
396637	Worcester	6,979	3.659	0.051	544	0.185	0.051
403810	417969-17211/Northfield	7,504	4.051	0	4,490	2.424	0
394298	C10-C12/Bondville	9,208	4.971	0	9,208	4.971	0
389673	4145336/ QUECHEE	16,606	8.964	0	5,160	2.785	0.000
402937	4 Unit/Brattleboro	28,989	1.464	0.607	16,919	0.854	0.354
399711	1-11721/Brandon	66,093	15.983	0	0	0	0
Totals		170,992	55.800	1.046	49,929	18.471	0.456

Table 12: MMBTU Adjustments to HPwES Reviewed Projects

Project ID	Title	EVT MMBtu	Verified MMBtu
389903	Reed;4397661/Londonderry	27.09	10.836
391631	MUMFORD;4392543/BENNINGTON	52.4	52.4
386272	Scott;4375578/Winhall	20.3	0
402581	Rudnick;30-56759/Londonderry	2.4	0
389673	EVANS;4145336/QUECHEE	27.3	12
402937	Amidon;4 Unit/Brattleboro	57.2	-50.8
399711	Pagano;1-11721/Brandon	6.56	6.6
Totals		193.25	31.036

As can be seen from the tables, ten (10) of the 12 projects had adjustments to kWh, and substantial downward adjustments were made for many of these projects. These seemed to be primarily driven by data entry errors when Home Performance contractors report work to EVT and/or an “unresolved tool error” in EVT’s systems. A complete discussion of the issues associated with these projects can be found in Appendix B.

IV. Project and Measure-Specific Adjustments

A. Documentation

The Department understands the EVT has been working to improve documentation of projects due to comments in the savings verification reports completed in previous years. However, the Department still found documentation for some projects to be inadequate. All projects need to have adequate documentation to verify that measures were actually installed and to determine whether the savings are reasonable. Project-level documentation should include, at a minimum, copies of contractor invoices, receipts and/or inspection forms, detailed specifications of the baseline and efficient equipment, clear identification of other assumptions used in the analysis and the source of the values used, and a description of the methods used to calculate savings. For PY 2011, particular issues arose associated with proper documentation of contractor invoices, inspection forms and specifications of the baseline equipment.

In some cases, the Department was able to identify projects with inadequate documentation and in response, EVT was able to provide the necessary documentation at a later date. While this ultimately did not affect the Department's ability to verify project savings, it decreased the overall effectiveness of the review process. There were two cases where EVT was not able to provide adequate documentation at the Department's request.

Projects without documentation were handled in one of two ways. In the case of Project ID 377640, EVT was unable to provide specifications of the baseline equipment. The Department allowed 50% of the claimed savings based on the magnitude of savings from a similar project. This reasonable assumption allowed the Department in good faith to verify the project savings. In the case of Project ID 356572, EVT was unable to provide inspection forms. Since there was no basis to establish a reasonable assumption of savings, it was the Department's position that the savings could not ultimately be claimed.

B. Specialty CFLs

Specialty CFL products accounted for 68% of the gross kWh savings in the Efficient Product program. This category of CFL covers a range of products that did not have significant market share and include lamps that are dimmable, "3-way", candelabras, higher wattage and other attributes not found in standard CFL products. A brief synopsis of this initiative is as follows.

- The measure was originally added to the TRM in January of 2009.
- The assumptions that EVT used for wattage reduction was based on their analysis of available bulbs on the market and their judgment what the baseline bulb would be. It was supposed to be updated after a year based on actual bulbs purchased; however, this revision process did not occur as scheduled. Starting with program year 2012 the wattage assumptions was to be based on the NEEP Residential Lighting Strategy.⁸

⁸ http://neep.org/uploads/initiatives/NEEP_Residential_Lighting_Strategy_2012.pdf

- EVT's expectation that these products would only be used in high use locations. As a result, the hours of use was assumed to be 1241/yr for these lamps as opposed to the 659 hrs/yr for standard CFL's. The basis for this assumption is not well documented. It represents an increase in savings of approximately 44% from a standard CFL with the same wattage.
- In October of 2010, EVT began aggressively promoting these products with the "\$0.99 Specialty CFL Campaign."⁹ This price point was available to consumers throughout 2011.
- At the end of 2011, all CFL products were re-characterized based on the NEEP Residential Lighting Strategy. The assumption for hours of use for both standard and specialty CFL lamps will be 694 for program years 2012-2014.

EVT claimed higher hours of use for specialty CFL's during the 2011 program year. It is beyond the scope of this verification to ascertain whether this assumption was warranted during the 2011 program year. There are no studies or other hard data supporting the assumption that these products would be predominantly used in higher use locations. Considering the reduced cost of the product during PY2011, this assumption may be questionable and these savings may not be realized.

Through the TAG negotiation process, the DPS agreed to this level of savings through PY2011. Consequently, the DPS has decided not to adjust savings for these products through the verification process.

C. Upstream HVAC

EVT has established a process to prevent double counting of Tier II AC equipment that received upstream distributor incentives and could also possibly receive a customer rebate. The process involves matching specific equipment receiving end-user incentives to the upstream projects by make and model numbers at the end of the program year. The rationale for this approach was that EVT would not know the final purchaser of this equipment and that matching the equipment information was the most feasible approach. In response to this concern, as part of the 2009 FCM verification, the Department documented the unit serial numbers such that new installations could be verified in the future.

Despite EVT's diligent effort, the Department has reason to be concerned that double counting across years is an issue. EVT claimed savings associated with 85 HVAC units installed in the Jay Peak Hotel, Project ID 228290 in PY2010. The total claimed savings associated with these measures was 201,304 kWh annually. In response to past concerns coupled with the magnitude of the savings, the Department performed a cross check of the previously claimed FCM 2009 units and the Jay Peak Hotel units, and found them to be the same.

FCM 2010 savings associated with these units were ultimately disallowed as the units had previously been claimed and verified in a prior evaluation. This situation suggests to the Department that the process to prevent double counting of Tier II AC equipment needs to be reviewed.

⁹ Memo from EVT to the DPS in Feb 2012 "Specialty v Standard CFL Memo.docx"

D. Zero Energy Refrigerator Door Heaters

Currently, the TRM assumption is that these units operate for 8,760 hours per year. This assumption should be reviewed. As part of the review of projects in the sample, the DPS became aware that at least one large supermarket chain has a specific policy concerning the operating hours for automatic defrost heaters in refrigerated and freezer doors, resulting in much lower use (2,000 hours per year). This single chain of stores may represent a significant portion of the overall market and other chains may have similar corporate policies. Large supermarket chains generally operated in multiple states and the impact of their policies need to be accounted for in the characterization of market baseline. Claiming 8,760 hours of use for all applications can only overstate the actual savings from these measures.

E. T12 NTG Factors

There were systematic errors in the calculation of T12 freerider and spillover factors uncovered in the verification process. EVT has agreed to correct these errors prior to finalizing net savings and TRB numbers. Additionally, due to these errors and recent new T12 products that appear to meet the new federal lighting standards, NTG factors for T12 technology should be discussed through the TAG process.

F. Home Performance with Energy Star

Numerous errors found through the HPwES review seem to have been largely due to data entry errors made by Home Performance contractors. A lack of quality control on EVT's part may be a contributing factor. EVT should work with the DPS to accomplish the following three steps:

- conduct a more thorough review of HPw\ES projects to ascertain the extent of the data entry errors
- provide contractors with a QC trigger that will prevent the overestimation of savings in comparison to past usage and inadvertently claiming savings from multiple fuel sources when installing heating equipment
- fix known issues with the tools used by EVT and the HP contractors to calculate savings

This issue should be discussed further in TAG.