

**Report to the Energy Efficiency Utility  
Contract Administrator**

**Verification  
Of  
Efficiency Vermont Year 2003  
Savings and Total Resource Benefit (TRB) Claim**

**Department of Public Service**

**July 13, 2004**

## Introduction

On April 1, 2004, Efficiency Vermont (“EVT”) filed its “Year 2003 Preliminary Annual Report and Annual Energy Savings Claim” for its calendar year 2003 activities and results operating as the statewide energy efficiency utility (“EEU”). As provided for in the contract between Efficiency Vermont and the Vermont Public Service Board (“PSB”), the Department undertook a review of EVT’s 2003 activities with the goal of verifying the annualized MWh savings and Total Resource Benefit (“TRB”) amount claimed by EVT. This report made to Michael Wickenden, Contract Administrator for the PSB, summarizes the results of that review.

The DPS provided preliminary findings to EVT and the Contract Administrator on June 8, 2004.<sup>1</sup> On June 23, 2004, Efficiency Vermont provided a response to the DPS preliminary findings on items where the DPS recommended an adjustment to the 2003 savings claim.<sup>2</sup> Agreement on savings adjustments was reached for a number of items identified in the DPS preliminary findings. However, agreement was not reached on other adjustments recommended by the DPS and apparently there remains substantive disagreement on these issues raised in the DPS review., In several cases EVT agrees to accept the DPS recommended adjustments to the 2003 EVT claims but disagrees with the reasoning behind the adjustment. Where there is agreement on the adjustment for 2003 but not on the issues raised, these issues are discussed under category 4 of the findings.

This report contains a fairly detailed discussion of the DPS findings and reasoning related to the proposed savings adjustment for which there is no agreement. Where there is agreement on the adjustment for 2003, the issue and its resolution are briefly described. As there are a number of issues where EVT agrees to a savings adjustment, but not on the DPS finding, there is a considerable discussion in this report.

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<sup>1</sup> The document “DPS Verification of EVT 2003 Claimed Annual MWh savings and total Resource Benefit (TRB) Preliminary Findings June 7, 2004” was provided to EVT and Michael Wickenden on June 8, 2004.

<sup>2</sup> EVT Memorandum to Robert Ide and Carole Welch of the DPS, June 23, 2003(sic) from Blair Hamilton and David Cawley of EVT, with attachment “EVT Response to DPS 2003 Savings Verification Findings 6/23/04”.

The DPS commends all EVT staff involved in this process. Their professionalism in sharing their time and knowledge has strengthened the DPS understanding of the issues confronting Efficiency Vermont and the DPS in our mutual desire to continue advancing the goals of the statewide energy efficiency utility. We look forward to continuing and strengthening EVT's efforts to improve the energy efficiency of Vermont's electric customers.

## Summary

The DPS recommends that EVT's 2003 annualized MWh savings be reduced from the claimed 45,188 MWh's to approximately 42,392 MWh's.<sup>3</sup> The recommended adjustments include those agreed to by EVT and those where agreement was not reached. The DPS proposed savings adjustment will reduce EVT's claimed savings by 2,800 MWh's or about 6.2% of that claimed in the EVT April 1 report. These adjustments will flow to associated reductions in KW savings and the claimed Total Resource Benefit (TRB) and will be recalculated by EVT. The DPS review also identified specific capacity savings modification that reduces the claimed summer coincident peak savings by 572 kW.

## Findings

This report and recommendation to the Contract Administrator summarizing the results of the DPS review is presented under one of four categories, as follows:

- Category 1: Unresolved Issues with Adjustments
- Category 2: Agreed-Upon Adjustments
- Category 3: Projects/Measures with Adjustments Pending
- Category 4: Issues to Address Prospectively
- Category 5: Other Issues

In general, items in all categories will require further action. Most, if not all, of the issues identified and discussed under categories 1 through 4 will be referred to the appropriate Technical Advisory Group (TAG). The report also includes some process

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<sup>3</sup> The results of the DPS review are quantified as reductions to annualized kWh or MWh gross savings at the customer meter. The EVT contract savings goals are expressed in MWh savings at generation, net free ridership and spillover effects. For this reason, these amounts are approximate and will be finalized by EVT when the changes are entered into the FastTrack tracking system.

issues and concerns identified during the review process that will require EVT attention and perhaps further discussion.

## **Category 1: Unresolved Issues with Adjustments**

### **Residential Efficient Products**

#### **Retail Products Compact Fluorescent Light Bulb Savings**

Efficiency Vermont's accomplishments in the retail products arena continue to be impressive. A significant number of Vermont households are purchasing energy efficient lighting technology for their lighting needs and a considerable number of those households are purchasing many products, making it likely that CFL technology is being installed in both high and low-use locations. This suggests that the average "hours of use" assumption currently used by EVT to estimate annual MWh savings from retail sales of compact fluorescent bulbs results in overstated annual savings claims.<sup>4</sup> Accordingly, the Department recommends EVT's 2003 annualized MWh savings claims be adjusted by assuming 2.9 hours-per-day average use instead of the 3.4 hours-per-day assumption used by EVT since the year 2000. The result is a reduction of 603,877 annualized MWh's to the 2003 EVT claimed savings for rebated compact fluorescent light bulbs sold at retail in EVT's retail products initiative.

The continued use of a "3.4 hours-per-day" assumption for interior lighting products is not supported by the facts and trends documented by the DPS in its preliminary findings over the past year or so. The 3.4 hours-per-day assumption was a reasonable estimate in earlier years, when participants were purchasing fewer efficient lighting products. Now previous participants are returning to purchase more products and overall the average number of purchases per participant is increasing. This trend continued through 2003, with almost half of the participants purchasing more than five lighting products over the past four years. At the beginning of 2004, almost 50% of total Efficient Products ("EP") program savings were from Vermonters who had purchased more than 5 lighting products during the previous four years. As the number of efficient bulbs per household grows, it is probable these bulbs are being installed in locations with lower hours of use.<sup>5</sup> This lowers the average hours-of-use for the lighting products. On

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<sup>4</sup> Note that reduced average hours of use per year should not reduce lifetime savings, as the bulbs will have longer lives with lower average use.

<sup>5</sup> Based on an informal memo provided via e-mail to the DPS in early December 2001, "Thoughts on CFL Op-Hour Issue From Ralph Prah", EVT's evaluation consultant Ralph Prah appears to agree. To quote: "As should be apparent, I'm somewhat skeptical of the assertion that 3.4 hours a day is an unrealistic assumption. However, there's one scenario I can imagine under which this assertion might be true, despite all of my experience to the contrary that I describe above. It's conceivable that, as CFLs have

average the program is claiming savings equivalent or greater than what is typically achieved in a direct install program. Since the direct install approach is based on trained auditors installing CFL bulbs in all cost effective locations, it is reasonable to assume that these programs achieve the maximum potential lighting savings in each home. Thus, a direct install program is expected to save more on a per household basis than point-of-purchase programs.

The Department first raised concerns about EVT's lighting savings assumptions at the end of 2001 that resulted in some change to the assumptions for average wattage reduction as well as revised free ridership and spillover assumptions. In the 2002 verification process, the DPS produced a number of analyses indicating the need to revise the assumed hours of use used to estimate retail lighting product savings. As a result of the 2002 savings claim verification process, the parties agreed to revisit these assumptions in the 2003 TAG process. The Department planned evaluation activities that would inform this discussion so that agreement would be made about the appropriate assumptions going forward.

At this time, the anticipated evaluation studies have not been completed.<sup>6</sup> However, a trend is emerging that supports lower hours of use assumptions to calculate retail lighting products savings and EVT has an ongoing obligation to revise and update the assumptions it uses to estimate savings obtained through its efforts. The attached December 31, 2003 West Hill Energy & Computing document provides such information and analysis, much of which was shared in the TAG process during the summer and fall, 2003. On the national level, DOE estimates that CFL bulbs are used an average of 2.3 hours per day.<sup>7</sup> A 2003 Evaluation of California's Major 2001 CFL Programs (based on self reports) clearly identified a trend linking a higher number of bulbs purchased to lower per bulb daily usage. Applying the results of that study to EVT's participant patterns produces an average 2.87 hours of use.<sup>8</sup> Currently, an average burn time of 2.4 hours/day

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gained wider currency over the past five years or so, average op hours may have gone down, as the bulbs started getting installed in lower-priority fixtures with fewer op hours.”

<sup>6</sup> Vermont is now participating in a residential lighting impact study being undertaken by Nexus Market Research for some Massachusetts and Rhode Island utilities and Vermont that will produce preliminary results by early Fall 2004 and final results incorporating longer-term light logger results by the spring of 2005. The results of this study should provide additional insight into this issue. Also, the Department plans to undertake a study of EVT participants who have purchased a high number of products over the past few years to find out where and how these products are being used.

<sup>7</sup> *Volume I: National Lighting Inventory and Energy Consumption Estimate*, Building Technologies Program, Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy, 2002, p. 40 and 52 (PDF version)

<sup>8</sup> 2003 Evaluation of California's Major 2001 CFL Programs.

is being used by some Northeast utilities in calculating CFL savings, based on lighting studies completed in 2002.<sup>9</sup>

Efficiency Vermont's response to the DPS preliminary findings on this issue are summarized as follows:<sup>10</sup>

1. *The hours of use is an assumption that has been used for several years. As such, the savings verification is not the time or appropriate venue for measure re-characterization.*
2. *The few studies the DPS cites to support a change are but a modest subset of the possible references that could be used to support development of a new assumption (note that at least one of the studies cited doesn't even relate to a retail lighting program).*
3. *Such changes should be made in the context of a process (e.g. TAG) that can carefully consider a full range of data sources – including some that suggest that the EVT assumption is reasonable – in a comprehensive way.*
4. *It is unclear from the citations provided by the DPS whether the average hours of use coming from other studies were averages across all products sold, including those that did not get installed or stay installed.*
5. *EVT uses a 10% not installed assumption that has the effect of reducing average hours of use for all rebated products down to 3.06 – not far from the 2.9 proposed by the DPS.*
6. *Finally, EVT believes that consideration of the best available information on program spillover (namely from the DPS' own evaluation work) suggests that an increase in the current spillover factor is reasonable. Such an increase would more than offset the reduction in savings that would result from the reduction in hours of use assumption that the DPS has proposed.*

Much of EVT's response suggests that savings assumptions should only be changed through the TAG process and that it is inappropriate for the DPS to recommend a savings adjustment in the verification process that was not vetted and agreed to in the TAG process. In effect, this response suggests the DPS annual verification of EVT's claimed MWh savings and TRB mandated in the contract between EVT and the PSB is but a savings claim quality control mechanism. That interpretation is not consistent with current and past DPS practice on energy efficiency program savings review.

The TRM review/TAG process is an important and useful tool that apparently works for the vast majority of assumptions and savings methodologies used by the EEU. In the

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<sup>9</sup> The 2.4 average burn time is based on two studies: the 2002 NSTAR Residential High Use Program Operating Hours Realization Rate Study and the 2002 Western Massachusetts Lighting Impact Study.

<sup>10</sup> Much of the language here is EVT's response, with minor rewording by the DPS.

DPS 2000 verification report, as well as in numerous subsequent TAG meetings, the DPS has been clear that while the TAG process is useful in reaching agreement on the assumptions and methodologies for EVT's savings claims, the DPS has the right and obligation to assess the impact of those assumptions in the annual verification process and reserves the right to challenge assumptions it believes are clearly incorrect or inappropriate. Nowhere is it stated the DPS is required to pre-approve savings estimates.<sup>11</sup> The annual verification process is the DPS opportunity to review the results of all savings assumptions and to propose modifications where warranted. That is what the Department is doing in this report and recommendation.

With respect to the other items raised by EVT in its response, there is little persuasive information offered. The argument that the hours of use assumption has been in use for many years does not make it correct to use now. EVT states the DPS cited studies are limited and in some cases flawed, but does not provide or offer additional information or studies for the DPS' consideration. Suggesting the TRM "hours of use" assumption is close if one includes the 10% non-installation rate is not responsive to the issue. Further, a table of existing savings assumptions used by the MA/RI/VT residential lighting impact study participants shows that, with one exception, EVT's "in service rate" for its residential retail lighting products is significantly higher than the other utilities participating in this study. EVT's continued position on spillover rates is well understood, but again no new information is provided. The DPS evaluation referenced by EVT is, like most other evaluation studies, informative but not definitive. The current 15% spillover rate, in conjunction with a 6% free rider rate, is in a range comparable to that used by other jurisdictions. Most reviewers involved in the DPS 2002 Efficient Products study completed by Xenergy concluded that additional study was needed before a spillover rate of 30 – 50 % would be incorporated into EVT's savings estimates.

The DPS agrees with EVT that it is appropriate that all the assumptions used to estimate retail product lighting savings should be considered in determining a reasonable savings impact, including spillover and free rider rates. Such a process will likely be undertaken once the MA/RI/VT lighting impact study results are available. In the meantime, however, the Department cannot be prohibited from recommending a savings adjustment prospectively where the evidence clearly indicates such an adjustment is indicated. The available evidence strongly suggests that the current "hours-of-use" assumption being used is resulting in an overstated annualized MWh savings claim for these products.

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<sup>11</sup> As the May 2, 2001 DPS report "Verification for Efficiency Vermont Year 2000 Savings and Total Resource Benefit (TRB) Claim" pointed out, the Board addressed this issue of the DPS "signing off" on savings assumptions in its 1994 order in Docket 5701/5724.

## Business Existing Facilities (“BEF”)

### University of Vermont - County Apartments.

Projectid: J00000018255    MAS90Job: 6012    MAS90Project: 1317

The Department understands that EVT assisted UVM with replacing Rinnai natural gas space heaters and secondary electric baseboard heating with wall-hung natural gas boilers. EVT explained the savings calculations as follows:

*“Where there was no turnover, we used the average of all years. When the electric bills indicated that turnover had taken place, with variation in electric heat usage depending on the tenant, we chose the highest electric heat usage, assuming that it represented full heating of the apartment, whereas the lower electric usage reflected under heating. This ‘base adjustment’ did not account for under heating of the other apartments (the ones with low or minimal electric heat usage) and was therefore considered to be conservative.”*

The project manager further explained that EVT has a policy of increasing the baseline use for space heating when it is clear that the unit was under heated, and also for lighting if the unit is obviously underlit.

The Department does not agree with EVT’s approach. Fuel switching is screened over thirty years, and the baseline electric use should reflect the average use for the unit. If multi-year billing data is available as was the case with this project, then the best estimate of electric space heating usage is the average over several years. If the home is continuously occupied throughout the winter and electricity is the primary space heating fuel, then normalizing the usage to 10-year weather conditions may be appropriate.

*In its response to the DPS preliminary findings, EVT states the “adjustment of the baseline is an appropriate way to account for under heating of residential units. This compensates for the intangible benefits of fuel switching such buildings, such as occupant comfort and health, and allows projects to pass cost-effectiveness screening that might not otherwise. It is our belief that tenants should not be penalized for the fact that their source of heat is too expensive for them to fully heat their homes. In addition, just because the current occupants are under heating does not mean that future occupants will also under heat. Note that the adjustment in this case was conservative because we did not adjust the savings for apartments with consistent tenancy, even if their usage was low enough to suggest under heating.”*

This is not convincing. The purpose of using the five-year average is to take into account the variation in usage patterns. The DPS recommends adjusting the savings to reflect the *average* actual usage over five years with no assumption of vacancy and no hypothetical temperature setting adjustment. The DPS estimates the reduction to be

43,711 gross annualized kWh, with the associated TRB and KW reductions still to be calculated.

### **Cabot Warehouse III**

Project ID: J00000018659

MAS90Job: 6013 MAS90Project: 2769

EVT's analysis did not model the energy use of the refrigeration system with the evaporator that was installed. The selection of the evaporator is important because it affects the system energy usage and performance. In its preliminary findings, the DPS recommended that either EVT model the energy savings of the entire refrigeration system with the new compressor or discount the savings by ten percent.

*In response, Efficiency Vermont disagreed with the DPS finding, stating “the equipment upgrades was a compressor and the upgrade was from a hermetically sealed compressor to a discus-type compressor. The rated efficiencies on which our savings calculations were based assumes that the evaporator would have been the same regardless of which compressor was selected. A systems analysis is unlikely to result in a 10% reduction in the savings in this situation.”*

The Department stands by its preliminary finding. Energy consumption for a refrigeration system depends upon the performance of the evaporator. A system with an efficient evaporator moves heat more quickly than a system with a less efficient evaporator. This enables the compressor to run fewer hours per year. Comparing compressor “A” with “X” wattage to compressor “B” with “Y” wattage does not provide enough information to calculate energy savings. It is necessary to know the hours per year both compressors would operate.

Without performing a system analysis, EVT does not know how many hours per year the refrigeration system will operate. Without knowing the hours of operation, it is impossible to calculate energy savings accurately. Absent a systems analysis, the compressor savings of 39,236 kWh should be discounted 10% or 3,924 kWh to account for the potential discrepancy between the customer's actual savings and EVT's claimed savings.

### **Multifamily Buildings (These projects are listed under a number of different tracks in the FastTrack database.)**

**Ventilation.** Ventilation in multifamily buildings is primarily a health and safety issue, rather than an energy efficiency measure. The most-often cited purpose is the need for moisture mitigation. The Department supports EVT's efforts to focus attention on the

need for ventilation and the positive impacts on health and safety. The Department is also cognizant that these measures can have a negative impact on energy usage by increasing the electric and heat load.

The Department has two concerns regarding the methodology and assumptions used to calculate fan savings for buildings with constant ventilation: the baseline wattage is too high and the savings should not be based on 24-hours of use per day.

In the TRM, the REEP ventilation measure is characterized as reducing the fan wattage from 80W to 20W for eight hours per day, with annual savings of 169 kWh. However, when the participant elected to run the fans 24 hours per day, the baseline fan is defined (in the CAT tool) as a 128 W fan, replaced with a 15 W fan. EVT agrees that the correct baseline wattage should be 80W, replaced with either a 15 or 17W fan. EVT further pointed out that they have not adjusted the fan wattage for reduced speed operation and suggest that “discounting the rated wattage by 25% is a reasonable estimate of the reduced speed wattage in the absence of actual test data.” In its response, EVT supports a savings reduction of 119,728 annualized kWh.

The “hours-of-use per day” in the savings calculation still remains an unresolved issue. Two project managers informed the Department that 8 hours of ventilation is generally sufficient to address moisture problems. In two specific cases reviewed by the Department, the participant decided to run the fans continuously although EVT’s initial recommendation was for 8 hours. In addition to increasing the electric demand and heat load, this approach also raises safety concerns, since the residents may not be able to turn off the fans in the event of a fire or other emergency.

In its response to the Department’s preliminary findings, EVT provided the following explanation:

*“EVT recommends minimum ventilation rates for multifamily applications based on the ventilation needs of the units. Although our prescriptive checklist, and often our contracts, stipulate that fans must be run a minimum of 8 hours per day, that does not necessarily reflect our project-specific ventilation recommendations, which often exceed 8 hours per day. For most current projects, we recommend 24 hour operation at a reduced speed (although the tenant can turn the fan up to full speed for brief periods as needed to provide additional ventilation). Based on our experience and understanding of building science, we have determined that, in many multifamily applications, 24-hour operation of exhaust fans (usually at reduced speed) is preferable to timed switching for a variety of reasons, including tenant acceptance, better air quality and moisture control, and less cross-contamination of odors from adjacent apartments.”*

This written response provided by EVT is inconsistent with previous information provided by EVT staff. In the DPS review process for the UVM County Apartment and

Highgate projects, both EVT project managers suggested an 8-hour run time for the ventilation fans was sufficient for their respective projects and is generally adequate for most multifamily applications. The hard copy files reviewed by the DPS for these projects is consistent with this information. There was no indication that 24-hour ventilation was recommended for these projects. Both EVT project managers stated the installations were not in accordance with EVT's recommendations.

In its written response to the DPS preliminary findings, EVT further suggests that a 24-hour run time is desirable in many multifamily applications. However, the benefits attached to the increased run time are not energy related and it is unclear whether the same level of benefits could be achieved by other means with a reduced run time.

The Department stands by its adjustment, which is based on the following:

- The baseline fan wattage was reduced from 132 to 80 Watts
- Savings for continuous operation were allowed for the two projects clearly identified by EVT as requiring this level of ventilation, Sycamore C and Mountain View Housing; the baseline and efficient wattages were also adjusted for reduced operating speed.
- For the other projects, the savings were based on 8 hours of use per day and no reduction to the rated wattages.

The Department recommends a reduction of 169,323 gross annualized kWh, and corresponding reductions to the summer peak KW savings and TRB.

## **Low Income Single Family (LISF)**

### **Water Heating Fuel Switches.**

EVT continues to use the electric bill disaggregation tool to estimate savings for water heating fuel switches. The Department has already discussed its opposition to the use of this tool in previous verification reports. As in previous years, this approach, as applied in this program, has resulted in numerous projects with high savings. About 25% of the hot water fuel switches are expected to save more than 6,000 kWh per year each, with the highest savings projected to exceed 11,000 kWh per year.

In addition to the inaccuracies inherent in the approach employed by EVT, the Department does not support estimating savings on the basis of the usage patterns of the occupants at the time of the audit. Water heating fuel switching is analyzed over a thirty-year period. Consequently, it seems more reasonable to screen this measure using average usage patterns, assuming that the particular characteristics of the household will change

over the analysis period and average usage is more likely to reflect the reality over the entire analysis period. This principle was discussed and accepted in the TAG meetings.

As discussed during the 2003 TAG process, the Department prefers that estimates of water heating energy use savings be based on the number of bedrooms in the home. This information is not available in the LISF participants' files. Accordingly, the Department adjusted all hot water fuel switches to an average savings value based on residential water heating electric use information from BED and other utilities.

In its response to the DPS preliminary findings, EVT disagrees with the Department's across-the-board reduction in comparison to the adjustments made only to the projects with unusually high savings estimates done in previous years. However, the two different approaches to adjusting savings are likely to produce similar results. By setting the average savings level at 4,200 kWh per year, the Department did not only reduce the projects with high savings, but also increased the savings for projects with estimated savings below 4,200 kWh per year.

The average savings claim for water heating fuel switches installed through EVT's LISF initiative during 2003 is approximately 5,200 kWh per year. The Department has adjusted the average savings to 4,200 kWh. These adjustments result in a total reduction to gross annualized kWh of 96,187.

### **Lighting.**

EVT calculates lighting savings in this program based on self-reported usage patterns, i.e., the participant tells the auditor how many hours a day the lamp is used and savings are estimated on that basis. This process has resulted in a number of households projected to achieve lighting savings that are far beyond what could reasonably be expected.

Twenty-one participants are projected to save more than 2,000 kWh per year, substantially greater than current projections of annual residential lighting usage, generally in the range of 1,400 kWh per year. EVT's response to the Department's questions indicates that EVT does not compare these savings to actual usage to assess whether they are reasonable. In the few cases checked by the Department, actual usage patterns do not support the projected high savings for lighting. EVT should ensure that savings do not exceed what is reasonable based on past usage history.

In its response to the DPS preliminary findings, EVT points out that these particular homes represent only 2% of the participants and they may have lighting savings much higher than the average levels. However, no supporting documentation was provided to show that the lighting savings for these homes was appropriate.

Recognizing there is a range of lighting usage patterns in the residential sector, the Department has adjusted the LISF lighting savings for this group of participants to an average of 2,000 kWh per year. This adjustment accounts for the possibility that lighting usage in these homes may be substantially higher than average. The reduction comes to 16,674 gross kWh per year.

## **Residential New Construction**

### **RNC Lighting Savings**

In the process of verifying the savings for EVT's 2002 program year, the Department raised concerns that the per household savings for the RNC program were too high. In the 2003 TAG process, the Department and EVT agreed to modify the RNC lighting savings with the goal of ensuring that the average per household savings did not exceed 1,000 kWh per year. EVT decided to modify the per fixture prescriptive savings to meet this goal, based on 2002 program performance. However, when these numbers were applied to the 2003 participants, the average per household savings came to 1,071 kWh per year.

Efficiency Vermont does not agree with this adjustment, as expressed in EVT's response to the Department's preliminary findings: *"First, we believe that savings verification is not the appropriate time or venue for revisiting measure characterizations. Second, the DPS' position on this issue seems to be that even if it increases the number of efficient lighting products installed per home, Efficiency Vermont should get no savings "credit" for doing so. That, in turn, gives EVT the perverse incentive to revise its program design so that it does not continue to promote greater penetration of such measures."*

Through the TAG process, the Department and EVT agreed that RNC lighting savings should not exceed 1,000 kWh per year on average and EVT chose its method of implementing the agreement. This decision was intended to reflect the reality that simply installing additional fixtures does not affect usage to any great extent if the fixtures are in very low use locations. Allowing EVT to claim savings that are not in proportion to actual lighting usage could create an incentive for EVT to promote over lighting of homes.

The Department recommends the RNC lighting savings be adjusted to reflect the 1,000 kWh per year limit. This adjustment results in a reduction of 26,128 gross, annualized kWh. The associated KW and TRB adjustments should also be made.

## **Category 2: Agreed Upon Adjustments**

EVT and the DPS have reached agreements on specific adjustments for the following projects, also listed in the attached chart. While agreement has been reached on the adjustment, EVT's response to the DPS preliminary findings indicates it is not in agreement with the DPS on the findings and intends to address some of these findings in future revisions to the TRM and in the TAG process.

### **Business Equipment Replacement**

#### **Cabot Creamery**

Project ID:J00000017483      mas90job:6013      mas90project: 2618

The Department recommends a reduction to the savings for this project due to the inability to ascertain the validity of the savings calculations. It appears that the VFD savings were calculated using a modified exponent based on the fan law that does not apply to this project or other process VFD projects. The specific issues were presented to EVT and EVT agrees with the adjustments.

The Department recommendations are based on the following adjustments:

- (2) Milk Pumps: disregard the savings with the assumption that reduced speed results in increased runtime; if neither pressure nor flow is reduced, there are no savings.
- (1) Permeate Pump: adjust the exponent to 2.0, assuming that the flow is not reduced over the course of a day, but that the pressure is reduced.
- (1) Separator: adjusts the exponent to 2.0.
- (2) Water Pumps: adjust the exponent to 2.1, assuming that the flow is reduced somewhat as the pressure is reduced.

These adjustments result in a reduction of 89,281 gross annualized kWh, and related modifications to TRB and peak savings.

#### **Process VFDs.**

The Department's review indicates that the incorrect application of the standard VFD calculations for process motors, as discussed in the Cabot Creamery project above, is systematic. Accordingly, the savings claims for projects with VFDs installed in process applications will be reduced by 14%. This adjustment amounts to 246,992 gross annualized kWh. The projects are listed in the attached spreadsheet.

**Pike Industries Williston – VSD**

Project ID: J00000010011 MAS90Job: 6013 MAS90Project: 2049

Savings for this project will be adjusted to reflect the lack of commissioning,, consistent with EVT’s Technical Reference Manual which states the full savings can be claimed only when a variable speed drive (“VSD”) is commissioned.

The savings will be reduced by 8,638 kWh per year.

**Pike Industries Berlin – VSD**

Project ID: J00000010012 MAS90Job: 6013 MAS90Project: 2050

The VSD measures for this project were identical to the Pike Industries Williston – VSD (Project 6013 2049). EVT agrees to the DPS recommended the savings adjustment of 8,638 gross kWh per year.

**Progressive Plastics - Injection Molding**

Projectid: J00000016669 MAS90Job: 6013 MAS90Project: 2493

The Department recommends all process related measures be screened using a 15 year analysis period to reflect the uncertainty associated with the longevity of industrial processes. EVT agrees to a measure life reduction from 30 years to 15 years for this project.

In addition, the annualized MWh savings claim will be reduced by 25% or 27,946 kWh. EVT’s estimate assumed the equipment would be operating 100% of the time. The adjustment incorporates an estimated up-time of 75% and reflects estimated down time for mold changes, routine maintenance, scheduled and unscheduled shutdowns.

An in-depth discussion of this project is contained in the June 7, 2004 DPS preliminary findings document. Industrial process measure lifetime assumptions will be pursued in the TAG process.

**Progressive Plastics - Injection Molding 2**

Projectid: J00000019986 MAS90Job: 6013 MAS90Project: 2890

Similar to the previous project, savings will be adjusted to reflect an estimated 75% up-time. The adjustment is a reduction of 39,740 annualized kWh.

**EHV Weidman - Lighting**

Projectid: J00000018965 MAS90Job: 6012 MAS90Project: 1344

An upward adjustment of 2,800 kWh will be made to incorporate the waste heat savings in the office areas of this custom lighting project. In addition, EVT will account for the increased heating resulting from reduced waste heat, based on the formula (from the TRM)  $\Delta\text{MMBTU}_{\text{WH}} = (14,000 \text{ kWh/year}) \times 0.003413 \times 0.39 / 0.75 = 24.8 \text{ MMBTU}$ .

### **VSF Office Building (McFarland) Lighting**

ProjectID: J00000000517    MAS90Job: 6014 MAS90Project: 1087

The savings estimate for this project will be reduced by 7,795 annualized kWh.

### **Snow Making Projects**

EVT agrees with the Department recommendation that 25% of the electric savings be re-assigned to diesel for the selected snowmaking projects listed in the attached spreadsheet, resulting in a total downward adjustment of 1,381,679 gross annualized kWh and related TRB and KW adjustments.<sup>12</sup> In addition, the Department has accepted EVT's proposed reduction of 6,200 winter peak KW to correct the identified errors.

### **Jay Peak Fuel Switching**

In four of the twenty-four units switched in 2003, the electric space heating unit in the affected space was not removed. If the electric space heat is not disabled in the affected area, EVT cannot assume that it will not be used. For this reason, the Department requests EVT to reduce the savings from the space heating fuel switch by 50% for the remaining five units. The adjustment comes to 15,946 gross annualized kWh and the associated peak and TRB reductions.

### **Early Replacement Refrigerators**

A number of data entry errors in the savings for refrigerator replacements in this program were identified. The net effect of these errors is a reduction of 16,651 gross kWh per year. The specific projects to adjust are listed in the attached spreadsheet.

### **Retail Products Air Conditioners (Summer Coincident Peak Demand Savings)**

The summer KW reduction claimed for air conditioners in the EP program does not match the values in the TRM. EVT agrees to a summer peak capacity savings reduction of 572 kW to correct this error.

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<sup>12</sup> The projects are located at Okemo (2), Killington, Jay Peak, and Bromley.

## **Category 3: Projects/Measures With Adjustments Pending**

### **Incorrect Project Market Categories**

The Department found through its verification process that some projects were not classified in the correct market track.

A number of units of multifamily housing at Jay Peak were classified as “C&I Retrofit” (6012CNIR). EVT agrees to re-categorize the Jay Peak condominiums as 6012MFMR (Market-rate multifamily retrofit). The Department accepts EVT’s adjustment proposal for the 2003 program year as discussed above. The DPS also requests that EVT calculate the adjustments from any change in the associated free rider and spill over factors.

The DPS preliminary findings identified a number of other large projects that were incorrectly categorized. Efficiency Vermont agrees that the Barstow School and Hannafords in South Barre projects were incorrectly categorized. The Department requests that EVT calculate the adjustments from any change in the associated free rider and spill over factors associated with this correction. EVT asserts the Vermont Precision Tools project was correctly categorized in the Act 250 New Construction track although the CAT for the project did not label the project as Act 250. There was no effect on savings because the baselines were not affected and therefore no adjustments are required for this project.

Accurate project categorization into the appropriate market segment is discussed further in Category 4 of this report.

### **Act 250 Adjustment Factor**

The policy on the Act 250 adjustment factor is that it should be applied *after* a project has been adjusted for freeridership and spillover. EVT is using a formula that multiplies free ridership by the Act 250 adjustment, *then* factors for spillover.

EVT agrees to correct this error, resulting in an estimated reduction to net savings of approximately 2,700 annualized kWh. EVT will make the correct calculation.

## **Category 4: Issues to Address Prospectively**

### **Incorrect Project Market Categorization**

The Department found through its verification process that some projects were not reported in the correct market track. As only a fraction of EVT's business projects were reviewed, it is likely that other 2003 projects are not correctly categorized.

Project market categorization is important for two major reasons; (1) to be able to assess the impacts in the market, and (2) to ensure that savings and costs are correctly calculated. The primary reason for the Department's request to organize reporting by market segment is to be able to understand EVT's performance in each market. When the delineations among market segments are lost, it becomes difficult to understand the market effects. Also, baselines for estimating savings and costs vary according to the market, and projects that are incorrectly categorized may result in understated or overstated savings and/or costs. Another impact of the misclassification is that it makes it more difficult for the Department to conduct its review process, effectively increasing the administrative costs of verification.

EVT and the DPS agree that clear definitions and guidelines need to be established where they do not currently exist for mixed markets and "new construction" projects. This topic will be further pursued in the TAG process.

### **Snow Making Projects**

As noted in the previous section the Department has some serious concerns about the characterization and savings calculations associated with snow making projects. The two primary issues identified are the correct assignment of savings to electricity and fossil fuels, and the methodology for estimating peak savings. While the reduction for savings year 2003 has been resolved, EVT's response to the Department's preliminary report indicates that further clarification is needed. Below is a synopsis of the Department's rationale, EVT's response and the Department's position clarification.

In conversations with EVT staff and the review of snowmaking projects, the DPS understands the primary purpose of these projects, from the ski areas' perspective, is increased snow making capacity. The ski areas generate the needed compressed air for snowmaking by a combination of electric and diesel compressors, with a significant amount of the capacity being provided by diesel. Apparently, EVT's underlying assumption in defining the base case is that the ski areas cannot increase diesel use due to environmental regulations but can increase electric load. As a result, the tower gun savings are considered only electric savings. The DPS does not agree this is the correct assumption or result.

The DPS' preliminary findings related to this issue are reproduced as follows:  
*Energy Savings Estimates.* The water-cooling tower at Okemo is an example of a reasonable methodology for estimating savings from complex snowmaking projects. EVT's analysis of the addition of the water cooling tower was well documented, and used

the difference in the energy per unit to produce an acre foot of snow with and without the cooling towers as the basis for the savings. Savings were calculated for both the electric and the diesel compressors, showing substantial savings for both fuels and taking into account the quantity of compression being provided by the diesel and electric air compressors at different temperature ranges and the hours of snowmaking that would occur at those temperatures ( 243 MWh and over 7,600 MMBtu of diesel). This is the type of analysis that should be considered for all snow making measures.

In contrast, EVT's tower guns savings estimates were much more simplistic. At Okemo, the kWh savings per tower gun are based on the "historical" value of approximately 16,900 kWh per year, developed from the Stratton study in 2000. This approach fails to take into account the actual operation of the equipment or the interactive effects between the cooling tower and the tower guns. It is based on the assumption that only the hours of use of the electric compressors will be reduced, even at temperature ranges in which all of the compressed air is typically supplied by diesel compressors.

In response to the DPS preliminary findings, EVT states

*“Electric compressor operation is less expensive than diesel compressor operation under current pricing, and the electric compressors are used preferentially in all temperature ranges, including the coldest temperatures. Diesel compressors are used when the ski area needs to make more snow than they can using the electric compressor capacity, and to prevent exceeding demand peak limits. Diesel use occurs primarily during November and December when the ski areas are building their base, while electric equipment is used consistently throughout the snowmaking season. Okemo is unique in that they have a larger number of diesel compressors, purchased in the 1970's when energy price projections suggested that diesel would be less expensive than electric.”*

This response suggests that EVT may have misconstrued the Department's position on snowmaking projects. The Department did not perform an analysis of the comparative cost of electric versus diesel for ski area air compression. Nor did the Department intend to imply that all ski areas have the same operational strategy as Okemo, although it is apparent from information provided by EVT that diesel accounts for a significant proportion of the air compressor capacity available to the ski areas. If, as EVT asserts, the economics of electric compressors are more favorable than diesel compressors, then diesel savings may actually represent a disproportionate amount of the energy savings captured by efficiency measures. EVT should be considering the economics of these projects across all fuel types in the cost effectiveness analysis.

The Department expects EVT's analysis of snowmaking projects to correctly characterize the expected pre and post use of these two fuels at the ski area where the project is implemented. This was at least partially done in the Okemo cooling tower

project but has not been done for snowmaking projects in general. This same principle should apply whenever a project significantly affects more than one energy source. In situations of multi-fuel use and savings, increased usage and or savings should be correctly allocated based on the proportion of the operational use of the fuel. The Department expects to work with EVT to ensure that savings for 2004 and subsequent years from snowmaking and other multi-fuel projects are calculated in a realistic manner.

The Department is also concerned that EVT's analysis fails to take into account all of the costs for the base case. If the ski areas are planning to increase their snow making capacity, the base case should reflect the potential alternative options. While the Department understands that ski areas often have restrictions on increasing the use of diesel compressors, it is equally clear that many areas are limited in their ability to obtain increased electric demand from the grid. Many ski areas (Mad River, Sugarbush, Killington, Okemo, Stratton) are located in areas already designated by Vermont's distribution utilities as having T&D constraints. Increasing electric load may add substantial costs to the project, costs that are not currently being incorporated into the cost effectiveness analysis. Increasing the efficiency of the equipment could be a very viable and least first-cost option for the ski areas even without intervention from EVT. In effect, the efficiency measures being installed may have a negative incremental cost.

Considering the limited options available to most ski areas, the Department recommends that the free rider factor on these projects be increased from 10% to 40% on a prospective basis.

### **Act 250 Adjustment Factor**

In 2003, EVT claimed full savings for certain large projects, predominantly snowmaking measures classified as retrofit, at resorts with Act 250 master plans. The DPS acknowledges this is consistent with the plain language of the January 2, 2004 agreement between EVT and the DPS regarding Act 250 adjustment factor for 2003 projects and is withdrawing its original proposal to adjust the savings from these projects by the Act 250 adjustment. However, for year 2004 and beyond, EVT should apply the agreed upon Act 250 adjustment factor to projects covered by Act 250 master plans, as well as Act 250 new construction projects.

### **Transformer Life**

EVT reports savings for Energy Star transformers using a 40-year measure life, as documented in EVT's technical reference manual ("TRM").

While these transformers may have a theoretical technical life of 40 years, or even longer, this is an optimistic assumption. Some transformers die before the end of their

useful life and others are replaced early because the size is incorrect. Utilities typically amortize the cost of transformers over 30 to 35 years. Therefore, the DPS asserts the assumed measure life for this technology should be 30 years.

In its response to the DPS preliminary findings, EVT recommended that this issue be reviewed as part of the TAG process. The DPS agrees.

### **Measure Code Concerns.**

In its verification review, the Department was unable to differentiate among process, dairy farm and HVAC VSD applications as they are all given the same measure code. Similarly, there was confusion concerning the appropriate measure characterization for certain interior CFL fixtures that turned out to be ceiling fans with lighting fixtures. The Department recommends that EVT provide and utilize unique measure codes for all measure applications that have significantly different characteristics. This would facilitate future evaluation and verification efforts. Redefining measures within the attribute table can only lead to confusion in the verification and evaluation processes and should be unnecessary.

### **Retail Products Lighting Savings Alternatives**

Category 1 of this report discusses the growing “per household lighting savings” trend and proposes a reduction in the lighting savings for the CFL installations through its retail products and residential new construction initiatives. The DPS and EVT should address this “per household” lighting use and savings trend and discuss alternative approaches to claiming savings for the Efficient Products market in 2004.

### **LISF Water Heating Efficiency Measures**

The Department is pleased to see that EVT has not claimed full electric savings for any water heating efficiency measures when the participant also switched fuels. However, it appears EVT is discounting savings for some of these measures in these situations by reducing the measure life to less than one year. This method correctly estimates lifetime savings, but overstates first year savings. Given the small magnitude of the adjustment, the Department is not recommending EVT reduce first year savings for 2003. However, EVT should correctly reduce the annual kWh savings for all measures installed after January 1, 2004.

### **Residential Retrofit Initiative and LISF Water Heater Fuel Switches**

EVT continues to use the electric bill disaggregation tool to estimate savings for water heating fuel switches in the residential retrofit initiative as well as in the LISF. The use of this tool and the collection of detailed data on household usage patterns continue to add administrative costs to the program while producing questionable savings estimates. The Department does not support the continuing use of the electric bill disaggregation tool during program year 2004.

### **LISF Lighting Savings**

The Department noted above a number of LISF projects with excessively high lighting savings. The Department recommends that EVT establish a mechanism to verify that the per household savings estimates fall within a reasonable range.

### **Lighting Power Density**

This efficiency measure compares energy savings from an assumed lighting baseline with the lighting actually installed. The measure applies to the following programs or market sectors: Commercial Energy Opportunities, Act 250 and Comprehensive Track. The baselines rely on so-called Lighting Power Density (expressed in “watts per square foot”) and reflect minimum energy code requirements more than a decade old. Improved lighting technologies and code updates now underway will significantly reduce the baseline in a manner that lowers lighting energy use and reflects contemporary practice. The new raised baselines will reduce watts per square foot savings by an estimated 10-25 percent.

EVT claimed 2003 energy savings under this measure that amount to about 1,282,000 MWh, or about 3.7 percent of its business sector savings, using this obsolete baseline. For 2004, EVT should examine and re-establish baselines for Lighting Power Density that reflect contemporary practice.

### **Snowmaking Projects**

As discussed above, the Department recommends that all snow making measures be analyzed using the type of approach applied to the water towers at Okemo, i.e., a detailed calculation of base case and efficient energy usage by temperature bin with savings based on the difference in the kWh per acre-foot of snow produced.

### **Analysis Period for Industrial Processes**

The Department recommends that the maximum analysis period for process-related measures should be fifteen years, due to the uncertainty associated with industrial processes.

### **Fuel Switching Auxiliary Electric Use**

The DPS recommends that EVT account for auxiliary electrical losses that can be integral with fossil fuel equipment when fuel switching from electric to fossil fuel systems. For example, with a conversion from electric heat to oil forced hot water, the electrical consumption of a forced hot water circulator pump should be considered when estimating savings.

### **Vendor Savings Estimates**

The DPS recognizes that obtaining some vendor savings estimates can be useful in determining energy savings. However, there are instances where EVT staff is not confident with a vendor savings estimate. In these instances, EVT staff should obtain or create a separate savings analyses to establish more reliable savings. Taking a questionable vendor savings figure and discounting it by an arbitrary factor is a flawed methodology and should be avoided.

## **Category 5: Other Issues**

### **Ongoing Issues.**

The Department has noticed that a few issues have been identified in multiple years, and is concerned that EVT has not successfully addressed them. Some examples are listed below.

1. *Interactive Savings.* For the fourth year in a row, the 2003 review identified cases in which the interactive effects were not correctly addressed. For example, the EVH-Weidman customer lighting project apparently did not take into account the interactive effects of the lighting and air conditioning loads. Interactive effectives were also ignored in the Okemo snowmaking projects. .
2. *Incorrect Application of TRM Savings.* The Department again found errors in the prescriptive savings established for the EP program.
3. *Delay in Providing Electronic Files.* For the past three years, the Department has requested that EVT provide its electronic files for all C&I projects. However, the Department has found each year in its review that the files for some projects are

missing and need to be specifically requested, which creates delays in the process and increases the administrative costs of the review.

4. *Residential DHW Conservation Savings.* In multiple years, the Department has identified problems in claiming savings for DHW conservation measures in homes that have decided to switch fuels for water heating.
5. *LISF Disaggregation Tool.* Although the Department has raised concerns about the use of the tool in the past two verification reports, it was still in use during 2003.
6. *Snowmaking Peak Reduction.* Although EVT and the DPS have an agreement about discounting winter peak savings, this agreement has not been consistently applied by EVT.
7. *Act 250 Adjustment Factor.* Again, EVT has apparently not applied the correction factor for Act 250 projects.

EVT needs to improve its quality assurance (QA) process by developing consistent and thorough mechanisms to avoid these errors.

### **File Documentation.**

In the 2000 verification report, the DPS noted that hardcopy files frequently contained numerous missing or undated documents. The DPS suggested that EVT institute internal procedures to assure that project documentation is complete and accurate and to identify where documentation resides (paper or electronic files) would be beneficial. The 2002 review also found continuing problems in this area. In the REEP program, many documents were undated, making it difficult to construct a chronology of critical events.

The Department has noticed some improvements in the REEP file documentation. For example, the file for the O'Dell project contained a very useful summary of the project, including the source of the savings calculations (TRM or custom.) This type of documentation simplifies the verification process and the Department encourages EVT to continue with this approach.

During the 2003 review, however, the Department encountered substantial difficulties in its review of the C&I files. Some files did not contain a complete description of the base case, EVT's recommended case, the assumptions and the savings calculations. Many documents in the files are undated or have incomplete dates (no year specified in a project spanning multiple years). Consequently, the Department was not always able to verify that the calculations were correct and the assumptions reasonable.

The Department recommends that each C&I file for custom projects include a one-page description of the base case, a corresponding description of the recommended case and a clear description of the methodology and assumptions used to calculate the savings.

In addition, all documents should be clearly and accurately dated to provide a flow of the project.

### **Custom Baselines.**

In a number of custom C&I projects reviewed by the Department, it appears that the baselines for savings and costs were not consistently and correctly defined. In some cases, the costs are estimated for a lost opportunities project, but the savings are based on retrofit savings. Sometimes the opposite occurs. More attention should be paid to defining the base case and efficient options as accurately as possible.

### **Verifying Savings for Large Claims.**

On large, complex efficiency projects, numerous assumptions are often required to establish savings estimates. Snowmaking projects are an example. EVT staff typically interviews the customer to establish certain critical assumptions, such as hours of operation, to support the energy-savings claim. This information is commonly gathered when EVT is inspecting measure installation, prior to incentive payment. With large, complex projects, future operation of energy using systems may not be known until systems are commissioned and adjustments made to account for newly acquired equipment, efficiency or capacity gains, etc.

On complex projects with large savings claims, EVT should consider information-gathering processes that result in higher levels of confidence in savings estimates. Follow-up interviews with the customer six months after measure installation, for example, could help fine tune original assumptions and provide valuable feedback on measure operation.

### **REEP Default Lighting Assumptions**

In the CAT tool used for screening REEP projects, the default values for the lighting hours of use assumptions far exceed the numbers in the recent National Lighting Inventory and Energy Consumption Estimate. The Department is particularly concerned about the cumulative effect of using the REEP default numbers. For example, if bulbs are replaced the dining room and kitchen, the REEP default savings would be based on five or more hours of use per day in each room. A comparison of the Lighting Inventory and default REEP assumptions for the most common rooms shows the differences.

Room Type	National Lighting Inventory (Hours per day per room)	REEP (Hours per day per room)
Bathroom	1.8	2.5

Bedroom	1.1	2.5
Dining Room	2.5	5.0
Kitchen	3.0	5.5
Living Room	2.5	4.5

The DPS recommends that EVT revise the REEP default assumptions using the National Lighting Inventory estimates, results from the Northeast lighting impact study currently in progress, and/or other recent relevant evaluation results.

**Multifamily Ventilation.**

As discussed earlier, the Department noted a number of cases in which EVT recommended ventilation on timers eight hours per day, but later discovered that the participant had installed continuous ventilation, sometimes without controls. This turn of events has some troubling aspects, including safety concerns if the residents are unable to turn off the fan in the event of a fire. In some cases, EVT paid substantial incentives to these participants although the measure was not installed as recommended.

EVT should not pay incentives for continuous ventilation that is not in accordance with EVT’s recommendations and building codes, and forego claiming savings for these projects in the future.

**Multifamily Baseline Adjustments**

In the process of review UVM’s county apartments, the Department learned that EVT has a policy of increasing the baseline use for space heating when it is clear that the dwelling unit was under heated, and also for lighting if the unit is obviously underlit. The Department does not support EVT’s policy, and recommends that EVT base the original conditions on the actual use.

**Early Replacement Refrigerators**

The Department is concerned that some of the retired refrigerators may end up back on the market, and recommends that EVT work with BED and others toward addressing this issue.

**Jay Peak Fuel Switching.**

The Department is concerned that EVT is offering an incentive for the installation of suboptimal equipment. The electric space heat was partially replaced with fireplace inserts having an efficiency of 80.5%. While this efficiency may be relatively high for fireplace inserts, it is at the bottom of the acceptable range for other fossil fuel space heating equipment.