Assessment of Rutland-Area Efficiency Potential: Final Report

DRAFT

PREPARED FOR
GREEN MOUNTAIN POWER

PREPARD BY
VERMONT ENERGY INVESTMENT CORPORATION

MARCH 18, 2015

Vermont Energy Investment Corporation

Empowering
A Resilient
Energy Future.

veic.org

Tel: (802) 658-6060
Toll-free: (800) 639-6069

VEIC Headquarters:
128 Lakeside Avenue, Suite 401
Burlington, VT USA 05401

1. Executive Summary

Reliability of energy supply, provided at the least cost is a long-standing, shared objective that has made Vermont's energy portfolio among the most admired in the United States. Green Mountain Power (GMP), the state's largest distribution utility, and Vermont Energy Investment Corporation (VEIC), a leader in the assessment and design of least-cost energy procurement, are among those who share the responsibility for this distinction.

VEIC has completed an analysis to quantify the demand reduction available through energy efficiency in two areas of Rutland, Vermont. A full description of the methodology used and the results is provided below. Through this study, VEIC has determined the following:

- By using the same level of effort employed and results achieved in 2009, which was the year with greatest geo-targeting historical savings in the Rutland area:
    - Summer peak demand savings of 4.52 MW are available in the Rutland Core Area (more than the target 4.2 MW); and
    - Summer peak demand savings of 7.66 MW are available in the Rutland Wide Area (less than the target 8.4 MW).
- To achieve these savings in the Core Area over 3 years, we estimate a cost range of $16M-$18M.

Based on these results, VEIC recommends that GMP include energy efficiency as a key measure in considering how best to meet its need for 4.2 MW in Rutland by focusing its efforts on the Core Area and providing incentives that cover 100% of measure costs.

2. Study Objectives

The purpose of this study was to quantify the amount of demand reduction available through untapped energy efficiency in two areas of Rutland (Core Area and Wide Area). The areas were not defined by town or zip code, but rather by a list of roughly 32,000 premises (most of them representing residential accounts) in the Core and Wide Areas. The Core Area is roughly comprised of West Rutland, Proctor, and Rutland. The Wide Area includes the entire Core Area, as well as premises in Rupert, Dorset, Pawlet, Danby, Mount Tabor, Wells, Middletown Springs, Tinmouth, Wallingford, Mount Holly, Poultney, Ira, Clarendon, Shrewsbury, West Haven, Fair Haven, Castleton, Benson, Hubbarton, and Pittsford. GMP asked VEIC to determine whether energy efficiency could deliver 4.2 MW within the Rutland Core Area and 8.4 MW in Rutland Wide Area, and if so, at what cost.

3. Methodology

To determine the amount of demand reduction available in these two areas, VEIC completed the tasks described below. Each task had defined deliverables that built on each other. Throughout the project demand data for premise-level savings and load was used when

available, and energy savings and consumption was used as a proxy to calculate demand savings and load for customers/premises without demand data.

Task 1: Collect and Review Customer Data for the Two Targeted Areas

The first step of the assessment consisted of collecting energy use data on GMP customers located in the two targeted areas. Customer data and savings information from the VEIC KITT database used for Efficiency Vermont operations was used to obtain the following information for each premise:

a. Annual kWh use from the last full year (2013)

b. For customers with peak demand data (that is, those on demand rates), the greatest peak demand (kW) for each premise during the months of June, July, August 2013, and December 2013 and January 2014.

c. Number of residential, commercial, and industrial customers (used to establish "bins" for various types of commercial customers and determine whether any large customers are currently under Efficiency Vermont account management

d. Total peak kW loads for each bin of customers

e. Summer peak demand reduction and kWh savings from Efficiency Vermont projects for 2009 to 2014

The way data is stored and used presented some difficulty: GMP works by premise while Efficiency Vermont historical savings data is by project. A project can include more than one premise and a premise can have had more than one project. This carries the risk of double counting, i.e., project savings present in premise level data would be counted for each premise and annual consumption within project level data would be counted for each premise involved with a project.

To arrive at the correct savings by premise, VEIC created a new table by premise and distributed savings data among premises involved in each project. VEIC weighted the savings data for each project based on kW demand if possible, or kWh consumption if no demand data were available. When this was complete, total demand, consumption, and savings were confirmed with the original tables. Task 1 provided foundational information about the two areas under investigation and the level of efficiency work completed to date.

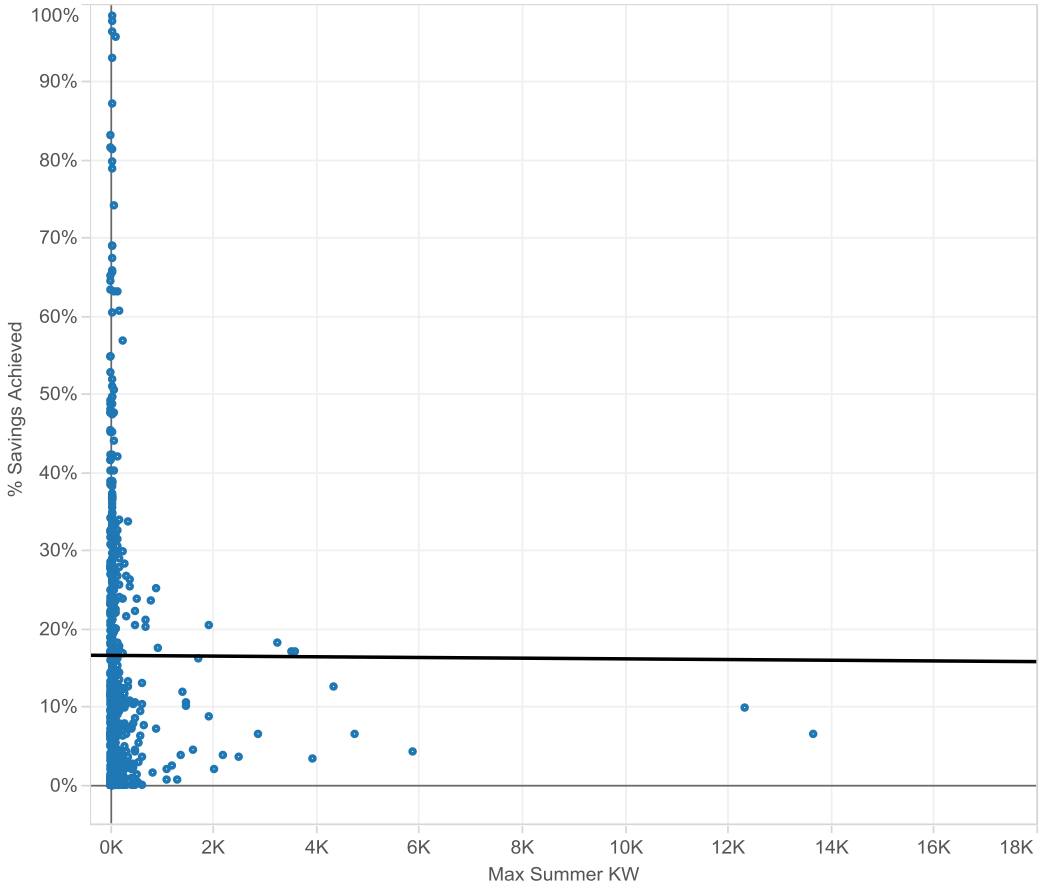
Task 2: Complete Two Dispersion Scenarios Quantifying Efficiency Levels

VEIC compared savings achieved at each premise 2009-2014 with 2013 demand or consumption to calculate the percent savings at each premise. For this analysis, baseline demand or consumption was assumed to be the sum of savings achieved during 2009-2014, and current demand or consumption. VEIC calculated average savings for several groups of premises to serve as a savings target for estimating remaining savings potential. Premises with historic savings above 70% of their demand or consumption were not included in the averages to avoid skewing the average too high.

VEIC used mean values for all analyses within this study. Using the median instead of the mean would be another way to analyze the existing data, and could be a way to avoid strong effects of a few high data points. VEIC elected to use mean values to allow the effects of all data in the sample to be felt, and because it was considered appropriate for predicting the total potential for a future effort similar to the historic data. The future effort will include some high and low "outliers," so including them in the analysis is valid. The drawback of using the mean is that it may over predict the savings available at any one premise, but given that this is an aggregate analysis of the Core and Wide areas, the project team believes that mean values provide better insight. As this work progresses toward customer-specific implementation planning, the median values may be more appropriate.

VEIC calculated average savings for each sector (commercial, industrial, and residential) separately for those customers with and without demand charges. The team explored disaggregating further, creating different potential savings bins based on consumption within each sector, however, the data show a very weak relationship between demand and savings to date. This data is shown in Figure 1, and the nearly horizontal trend line shows this weak relationship. Using this view and others, including histograms, the team decided against binning within sector by size.

Figure 1: Relationship of Premise Demand and Historical Savings Achieved



The average savings by sector helped establish a percent target for the remaining depth of savings for each customer that VEIC considers feasible and defensible. VEIC calculated the remaining depth of savings for each premise as the average savings percent for the sector multiplied by the premise demand or consumption minus the premise savings to date. To ensure the validity of the remaining savings target, VEIC Consulting interviewed Efficiency Vermont Account Managers handling large industrial and commercial accounts in the targeted area, confirming the availability and scale of remaining savings.

Remaining savings potential for each sector and within each area were aggregated into the totals presented in Task 2. VEIC then compared energy savings achieved in the two geographic areas in 2009 - 2013 to the total area load (as a percent). The assessment examined energy savings achieved from prior Geographic Targeting undertaken by Efficiency Vermont from 2009 through 2011. In addition, we reviewed statewide efficiency projected in the Demand Resources Plan (DRP) [1,2] for 2015-2017. These savings estimates were compared proportional to total loads in the target areas (GT, core, wide). This enabled the project team to assess expected levels of efficiency to be achieved during 2015-2017 based on the DRP along with additional / incremental levels of efficiency that would need to be achieved to meet GMP's targets.

Task 3: Quantify High, Moderate, and Low Penetration Levels of Efficiency

During this task, VEIC focused on the costs to achieve the demand savings identified in Task 2. VEIC determined the average incentive value for historical Efficiency Vermont Geographic Targeting (GT) areas in Rutland as well as incentive costs for statewide programs, and compared the total project costs to incentive costs.

VEIC then created three cost scenarios, as described below:

- low penetration, with a cost comparable to the Efficiency Vermont statewide cost of program delivery;
- medium penetration, with incentives covering approximately 80% of project cost (buying it down to achieve an approximate 1-year payback for the customer); and
- high penetration, with incentives covering 100% of total project cost.

Cost and savings for the low penetration scenario were derived from the 2015-2017 Demand Resource Plan.

Savings for the high penetration plan were calculated using the 2009-2011 GT results. VEIC used data from the GT year with greatest savings achieved (2009) and scaled it up using a ratio of the GT area total load to the core and wide total load. The results were tripled to reflect how

[1] *Triennial Plan 2015-2017,* Prepared by Vermont Energy Investment Co. for the Vermont Public Service Board, December 1, 2014, https://www.efficiencyvermont.com/docs/about_efficiency_vermont/annual_plans/evt-triennial-plan-2015-2017.pdf.

[2] EEU-2014-07, ORDER REGARDING EEU TRIENNIAL PLANS FOR 2015-2017, Vermont Public Service Board, February 13, 2015, http://psb.vermont.gov/sites/psb/files/orders/2015/2015-02/EEU-2014-07%20Order%20Re%202015-17%20Triennial%20Plans.pdf.

much savings might be achieved in 3 years of results equal to the 2009 GT. The estimates were compared to the total potential savings available calculated in Task 2. The lesser of the two values was established to be the savings available to GMP given geographic, temporal and savings-per-premise constraints. Table 1 shows these values for the Core and Wide Areas with the lower value that went forward in the analysis in bold. Where the Task 2 bottom up potential savings available was the lesser of the two values, as in the Core, the value was multiplied by a 90% factor to reflect Efficiency Vermont experience that, even with 100% incentives, only 90% of targeted customers participate. When the Task 3 value was lower, as it was for the Wide Area, it was assumed the uptake rate was already reflected in the historic GT data used to determine the potential and no additional factor was used.

Table 1: Potential Savings Constraints

	Task 2 Summer PeakSavings (Based on remaining savings in premises)	**Task 3Summer Peak Savings** (Based on 3 years of 2009 GT effort)
Core	**5,020 kW**	5,350 kW
Wide	11,700 kW	**7,660 kW**

Similarly, savings for the medium penetration plan with 80% incentives were calculated to be 75% of summed premise-level potential, based on Efficiency Vermont's experience with similar initiatives such as Lighting Plus.

A weighted cost per kW savings value was calculated for each sector (commercial, industrial and residential) and for those customers who had and had not already received lighting upgrades as a part of earlier projects. VEIC also distinguished between the years 2009-2011 (years of prior geotargeting efforts) and 2012-2014 (years without geotargeting efforts) because different incentive levels affect the cost data. The weighting also reflected the different costs and expected installation rates related to end uses of lighting, heating and cooling, industrial process, refrigeration, and other measures.

For the low penetration scenario, which is based on the statewide savings anticipated from Efficiency Vermont's 2015-2017 budgets and goals and for the medium penetration scenario (incentives paid that equal 80% of the measure cost) it was assumed incentive costs accounted for 60% of the total Efficiency Vermont costs. For incentives paid that equal 100 percent of the measure cost, it was assumed that the non-incentive costs from the 80% incentives paid scenario would remain the same, reducing the incentive-to-total cost ratio.

Both the high and medium penetration costs were adjusted for inflation from 2009 to 2015 dollars.

4. Results

Task 1: Collect and Review Customer Data for the Two Targeted Areas

Table 2: Annual kWh for 2013

		Premises	2013 Annual kWh
Core Area	Commercial	2,350	112,197,000
	Industrial	4	74,115,700
	Residential	10,760	74,678,800
Core Area Total		**13,110**	**260,991,500**
Wide Area	Commercial	4,730	176,046,200
	Industrial	5	77,849,300
	Residential	27,100	195,812,300
Wide Area Total		**31,800**	**449,707,800**

Table 3: Highest kW[3] during June, July, and August 2013 and December 2013 and January 2014

		Premises	Percent with Demand Data	2013 Max Summer Peak	2013 Max Winter Peak
Core Area	Commercial	2,350	63%	35,200	30,200
	Industrial	4	100%	10,600	10,300
	Residential	10,760	0%	28	1
Core Area Total		**13,110**	**11%**	**45,830**	**40,500**
Wide Area	Commercial	4,730	52%	55,300	48,500
	Industrial	5	100%	11,600	11,200
	Residential	27,100	0%	70	34
Wide Area Total		**31,800**	**8%**	**66,900**	**59,700**

[3] Note that the Peak kW data are showing actual kW demand data and these values are only available for customers with demand charges. Very few residential customers have demand charges resulting in a low number here.

VEIC pulled data on all premises to understand the depth of savings and efficiency measures they have already implemented. During the five year period it is likely that some new premises have been built in the area and others may have changed or been removed so the number of premises would change slightly over time.

Efficiency Vermont uses Account Management for some larger Commercial and Industrial (C&I) customers and has more detailed information on their energy savings over time. The number of C&I customers who are account managed is shown in Table 4.

Table 4: Efficiency Vermont Data on Key Account Management

		Account Managed	Not Account Managed
Core Area	**Commercial**	185	2165
	Industrial	4	0
Wide Area	**Commercial**	294	4076
	Industrial	5	0

Task 2: Complete Two Dispersion Scenarios Quantifying Efficiency Levels

The target level of savings potential for each premise is equivalent to the average % savings achieved in the 2009-2014 period, as noted in Table 5 below. Premises with improbably high savings, higher than 70%, were excluded.

Table 5: Wide Area Demand Savings per Premise and Savings Target (Broken Out by Premises with and without Demand Data)

		Cumulative 2009-2014 Summer Peak Demand Savings (kW)	Average Summer Peak Demand Savings – % of premise load
Premises w/ Demand Data	**Commercial**	2,890	11.4%
	Industrial	1,140	8.1%
Premises w/o Demand Data	**Commercial**	50	13.9%
	Residential	50	17.6%
Wide Area Total		**4,130**	

As shown in

Table 6 below, geotargeted savings, despite coming from a smaller geographic area and over a shorter time frame, are higher than the savings from the Core Area. This demonstrates the efficacy of a geotargeted approach. Projects completed during the geotargeting program averaged more than twice the per-project peak savings as non-geotargeted projects.

Table 6: Demand Savings & Geotargeting Compared to Area Load

	2009-2014 Peak Savings	Percent of Area Load
GT (2009-2011)[4]	3,870 kW	7.7% of 50 MW
Core Area	3,360 kW	5.0% of 67 MW
Wide Area	4,130 kW	4.3% of 96 MW

Table 7 below shows the savings available in both of the target areas examined in this study. The first column "Remaining Potential by Category" assumes that all premises will achieve the category average savings rate. While significant savings potential exists in both areas, capturing all of these savings over 3 years will be a challenge given that the largest savings ever achieved in a single year in Rutland was 1.3 MW in the geotargeted area (in 2009).

Table 7: Estimated Remaining Savings Potential

		Remaining Potential by Category (kW)	Total Remaining Potential (kW)	Savings Expected from DRP 2015-2017 (kW)	Savings Target from GMP (kW)	Incremental Savings Needed (kW)
Core Area	**Commercial**	2,170	5,020	820	4,200	3,380
	Industrial	20				
	Residential	2,830				
Wide Area	**Commercial**	4,670	11,700	1,090	8,200	7,110
	Industrial	50				

[4] Source data available at: http://psb.vermont.gov/sites/psb/files/projects/EEU/geographictargeting/CVPSResponsetoPSBGeotargetingQuestionsforWorkshop(09-29-08).pdf

	Residential	6,980				

Task 3: Quantify High, Moderate, and Low Penetration Levels of Efficiency

In Task 3, VEIC sought to answer these questions:

- How much of the maximum achievable peak demand potential (calculated in Task 2) can be achieved in 3 years?
- If GT level of effort applied to Core & Wide areas, what savings could we expect?

Table 8 below provides a summary of Task 3 results. The maximum achievable savings are based on the 2009 geotargeting results, which was the highest level of savings achieved in Rutland in a one-year period. This represents the expected results from a high level of effort. VEIC then calculated the maximum achievable savings by scaling those results to the Core and Wide geographic areas using area load. We note that the Core Area 3-year savings calculated here exceed the total potential as identified in Task 2. The lower of the two was used to as the estimate of potential, to calculate costs and is shown in bold in Table 8.

Table 8: Demand Savings Achievable in 3 Years

	Area Load	**Max Achievable Coincident Summer Peak Demand Savings**		**Max Achievable Coincident Summer Peak Demand Savings (Task 2)**
		Annual	**3 Years**	
GT-2009	50 MW	1,330 kW	3,990 kW	
Core Area	67 MW	1,780 kW	5,350 kW	**5,030 kW**
Wide Area	96 MW	2,550 kW	**7,660 kW**	11,700 kW

After determining the total kW available in both the Core and Wide areas, VEIC developed cost estimates. Total costs include incentive, program administrative costs, and marketing. Program administrative (non-incentive) costs were calculated as 40% of total cost when incentives = 80% of total project (measure) costs. These costs were held steady as incentive levels changed. These estimates were prepared at three different incentive levels:

- low penetration, with a cost comparable to the Efficiency Vermont statewide cost of program delivery;
- medium penetration, with incentives covering approximately 80% of project cost (buying it down to achieve an approximate 1-year payback for the customer); and
- high penetration, with incentives covering 100% of total project cost.

Results from this analysis are provided in Table 9 below.

Table 9: Cost of Savings Achievable in 3 Years

	Core Area			Wide Area		
	DRP (Baseline)	**Incentive: 80% Measure Cost**	**Incentive: 100% Measure Cost**	**DRP (Baseline)**	**Incentive: 80% Measure Cost**	**Incentive: 100% Measure Cost**
3 year Achievable Savings	820 kW	3,770 kW	4,520 kW	1,090 kW	6,380 kW	7,660 kW
Cost (Incentive)	$1.5M	$8.0M	$12.1M	$2.0M	$13.8M	$17.2M
Cost (Total)	$2.5M	$13.5M	$17.5M	$3.4M	$23.0M	$29.9M
Incentive Cost/kW	$1,800	$2,100	$2,700	$1,800	$2,200	$2,700
Total Cost/kW	$3,000	$3,600	$3,900	$3,100	$3,600	$3,900

5. Conclusion

Through this study, VEIC has determined the following:

- By using the same level of effort employed and results achieved in 2009, which was the year with greatest geo-targeting historical savings in the Rutland area:
  - Summer peak demand savings of 4.52 MW are available in the Rutland Core Area (more than the 4.2 MW target)
  - Summer peak demand savings of 7.66 MW are available in the Rutland Wide Area (less than the 8.4 MW target)
- To achieve these savings in the Core Area over 3 years, we estimate a cost range of $16M-$18M

In closing, to meet its need for 4.2 MW in Rutland, GMP should narrow its focus to the Core Area and plan for incentives that cover 100% of measure costs.