City of Burlington Electric Department
2018 - 2020
Triennial Energy Efficiency Utility Plan

Prepared for the Vermont Public Utilities Commission

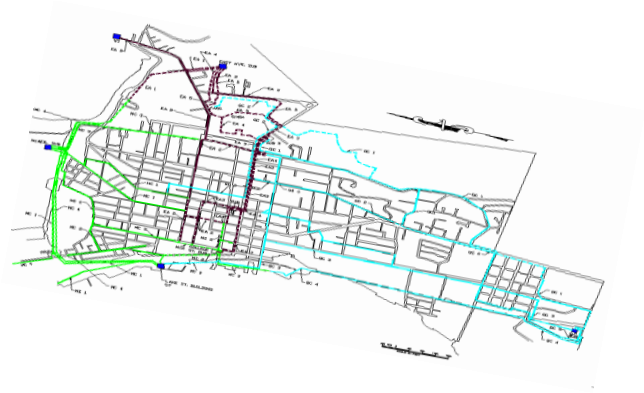
November 16, 2017

Contents

Quick Facts

Interesting facts about Burlington that provide additional context to the 2018 -2020 Triennial plan are included below.

- City of Burlington population: 42,500 (approx.)

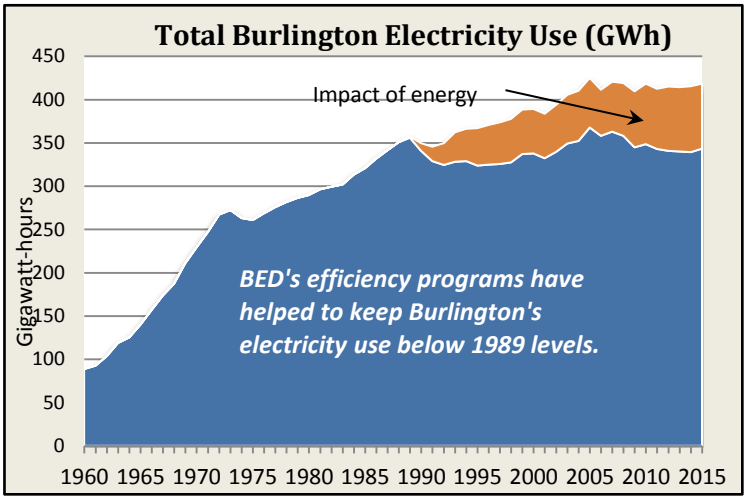


- Established in 1905, the Burlington Electric Department serves approximately 13 sq. miles, including the Burlington Airport.

- Customer count - 20,655
  Residential: 16, 806
  Commercial: 3,849

- Commercial accounts consume nearly 75 percent of total energy load.

- Top 20 commercial accounts consume nearly 50 percent of the total energy load delivered (approx. 350 GWh annually).



- Energy Efficiency has essentially helped to flatten BED's energy load requirement since the 1990's.

- Approximately 11,000 residential customers consume less than 500 kWh per month.

- 60 percent of residential, and 70 percent of commercial, customers rent or lease.

- 88 percent of residential, and 99 percent of commercial, buildings are served by natural gas.

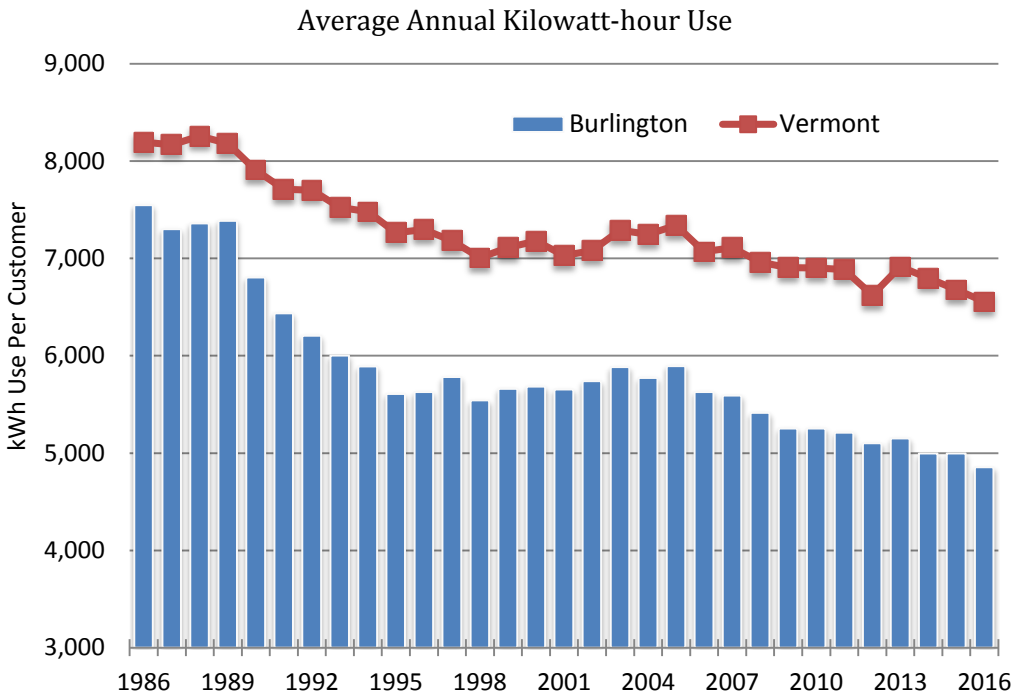
- BED turns over about 35% of its residential customers annually.

- BED's long-term energy efficiency efforts along with increasing appliance standards, and the high saturation of both natural gas and rental apartments, help to shape residential electric usage:

2016 Electric Utility Comparison

Average Annual kWh Use per Residential Customer

COMPANY		AVG USE	RANK
BARTON	MUNI	5,206	3
BURLINGTON	**MUNI**	**4,853**	**1**
ENOSBURG	MUNI	8,843	17
GMP	PRIV	6,772	13
HARDWICK	MUNI	5,787	5
HYDE PARK	MUNI	6,823	14
JACKSONVILLE	MUNI	5,450	4
JOHNSON	MUNI	6,483	11
LUDLOW	MUNI	5,198	2
LYNDONVILLE	MUNI	6,392	10
MORRISVILLE	MUNI	6,033	7
NORTHFIELD	MUNI	6,256	8
ORLEANS	MUNI	6,719	12
STOWE	MUNI	6,885	15
SWANTON	MUNI	8,033	16
VEC	COOP	6,315	9
WEC	COOP	5,889	6
VERMONT AVG		**6,556**	



Introduction

Pursuant to its Order of Appointment[1], BED provides below a description of the 2018 – 2020 triennial demand resource plan. The plan consists of three main sections:

- Resource Acquisition programs;
- Development and Support Services; and,
- Thermal Energy & Process Fuels programs (TEPF)

With this plan, BED proposes to invest up to $8.084 million in electric energy efficiency through six core resource acquisition (RA) programs; and, another $1.879 million in TEPF programs. BED anticipates that the 2018 – 2020 electric RA programs will achieve savings of 19,362MWh by calendar year end 2020. TEPF savings are expected to approximate 1,481 MMBTUs. A significant portion of the forecasted 2018 – 2020 TEPF savings are contingent upon the approval a new (pilot) program referred to as the VERMOD (described further below). Additional TEPF savings are anticipated to result from investments in a proposed District Energy system. Such forecasted savings (and investments) have not been finalized, however.

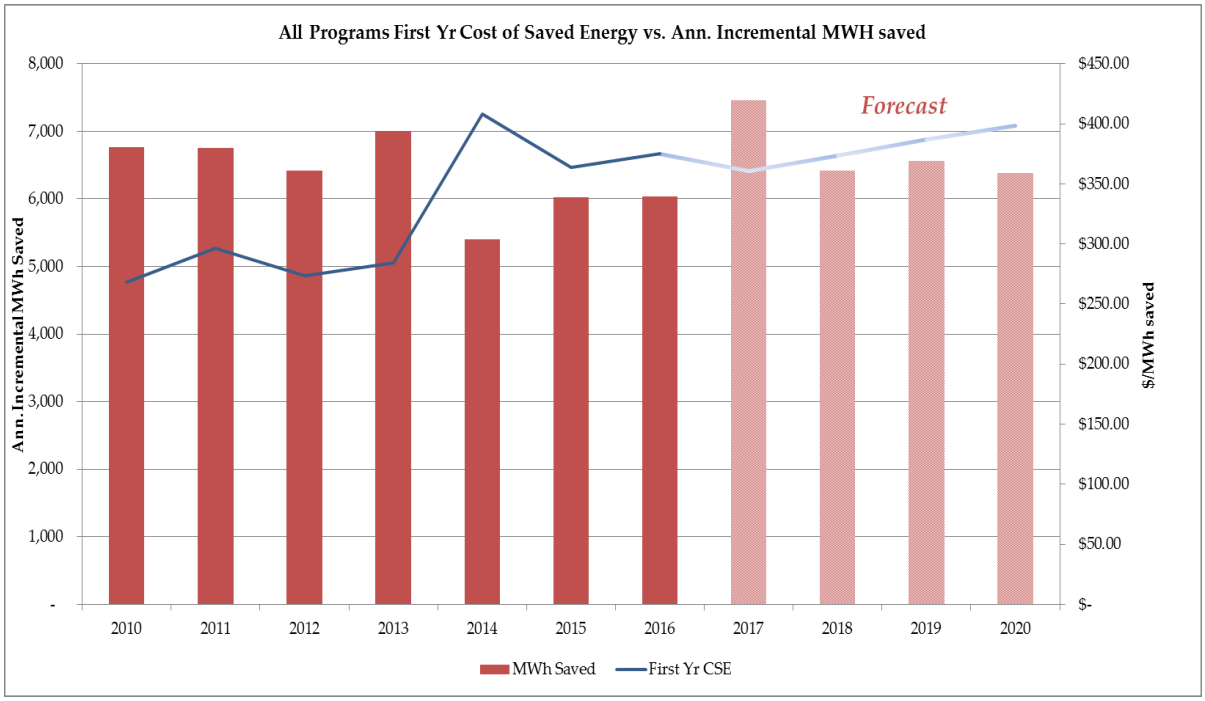
Electric Energy Efficiency Budget & MWh goals

The total 2018 – 2020 approved electric efficiency resource acquisition budget and aggregate MWh savings goals by sector is as follows:

Total Program Budget	2018	2019	2020	3 yr Total
Resource Acquisition				
Commercial	$1,796,987	$1,908,382	$ 1,908,382	$ 5,613,750
Residential	$ 598,996	$ 636,127	$ 636,127	$ 1,871,250
RA Program budgets	**$2,395,982**	**$2,544,509**	**$ 2,544,509**	**$ 7,485,000**
Decision Support Services	$ 191,678	$ 203,561	$ 203,561	$ 598,800
Total RA and DSS budget	**$2,587,660**	**$2,748,070**	**$ 2,748,070**	**$ 8,083,800**
Additional Regulatory Expenses				
Fiscal Agent & Audit	$ 2,487	$ 2,537	$ 2,588	$ 7,612
Independent EEU Audit Fees	$ 1,100	$ 1,198	$ 1,222	$ 3,520
DPS evaluation	$ 41,000	$ 53,000	$ 73,200	$ 167,200
Total DRP Budget	**$2,632,247**	**$2,804,805**	**$ 2,825,080**	**$ 8,262,132**

[1] See; PUC Order of August 25, 2016, Docket 8606.

As shown below, the first year cost of saved energy across all RA programs is expected to continue increasing over the triennial period. On average, the total first year cost of the electric savings is expected to range between $373/MWh and $400/MWh. On a levelized basis, such savings will likely cost ratepayers a little as $0.03/kWh to $0.04/kWh.



Rising first year costs are expected to continue into the foreseeable future as lighting standards improve and the lighting market becomes transformed. Such lighting savings, which have to date been relatively inexpensive, will be replaced with savings from more expensive measures and emerging technologies.

TEPF Budget & MMBTU goals

The total TEPF proposed budget and aggregate MMBTU savings goals that BED can estimate at this time are as follows:

Net Revenue Projection from BED's participation in FCM & RGGI						
		2018		2019		2020
Net RGGI Revenue	$	99,534	$	99,534	$	99,534
Net FCM Revenue	$	581,456	$	580,239	$	418,406
Total Net Revenues	**$**	**680,990**	**$**	**679,774**	**$**	**517,941**
Cumulative Net Revenues					***$***	***1,878,704***
TEPF Spending (Proposed)						
TEPF - Traditional programs	$	113,655	$	115,928	$	118,247
VERMOD	$	92,000	$	92,000	$	92,000
DES Support	$	475,335	$	471,846	$	307,694
Total Spending	**$**	**680,990**	**$**	**679,774**	**$**	**517,941**
Cumulative Spending - Traditional programs					**$**	**347,830**
Cumulative Spending - VERMOD					$	276,000
Cumulative Spending/reserve - DES					**$**	**1,254,875**
Cumulative Spending - Total TEPF					**$**	**1,878,704**

	2018	2019	2020	3 Yr Total
Traditional TEPF				
RES MMBTU Savings	285	285	285	855
COM MMBTU Savings	35	30	35	100
Total MMBTU Savings	320	315	320	955
VERMOD	**175**	**175**	**175**	**526**
Total MMBTU Savings	**495**	**490**	**495**	**1481**

Resource Acquisition Programs

For over 17 years, BED has managed six core electric efficiency programs:

- Retail Efficient Products (EPP)
- Residential New Construction (RNC)
- Residential Existing Buildings (REB)
- Income – eligible home owners and renters
- Business New Construction (BNC)
- Business Existing Facilities (BEF)

As in previous years, BED will continue to implement its energy efficiency programs in accordance with 30 V.S.A. 209(d) and shall strive to acquire all reasonably available, cost effective electric energy savings. To acquire such savings, BED will need to effectively address multiple markets at the same time in a coordinated manner. Thus, each core program referenced above is structured to address a specific market. Other cross sectional programs and initiatives, described below, will seek to raise awareness about energy efficiency and enable cost effective efficiency projects to move forward. The Retail Efficient Products program (EPP), for example, buys down the cost of high efficient LED bulbs at retail hardware stores, including Lowe's, WalMart and Home Depot, in order to improve the cost competitiveness of such products vis-à-vis less efficient but inexpensive CFL bulbs. Similarly, business customers can access technical assistance from BED's energy services staff (or other contractors) to identify opportunities to improve the efficiency of existing equipment that has either reached the end of its useful life[2] or can result in operational savings.[3] Through these programs, BED provides financial incentives and technical assistance to its customers and other market participants to implement efficiency projects which benefit all ratepayers when successfully implemented.

Less obvious market segments, however, deserve attention too. Indeed, a better and thorough understanding of important sub-segments of the local market can lead to additional cost effective savings if properly identified. Relevant market sub-segments include retail stores, restaurants; convenience stores, condominium associations and offices, as well as the City's New Americans community. By segmenting markets into identifiable sub-sectors, BED can focus on specific energy solutions that resonate with the customers in that targeted sector. The goal for such initiatives is to fully engage customers on their terms and to hopefully influence their energy related decisions and habits.

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[2] These projects are generally referred to as market driven, replace on burnout opportunities.

[3] These projects are generally referred to as early retirement/retrofit opportunities. Such projects seek to replace older but still working equipment with more efficient equipment or - in some cases – entirely different processes.

In addition to paying close attention to the various market sub-sectors within the City, BED will continue to assess new technologies and determine whether adoption of such technologies would result in cost effective customer and societal savings. As both a distribution and an energy efficiency utility, BED is in a unique position to offer customers a bundled suite of efficiency, demand response and strategic electrification solutions. One example of a new technology initiative that has recently been rolled out involves a new control device known as a packetized energy management service or PEM.

Packetized Energy was founded by researchers at the University of Vermont to develop a remotely controlled water heater device (i.e. "PEM") to seamlessly and reliably manage electric hot water loads in concert with BED's system-wide load requirements and renewable resources. The PEM builds on approaches that are used to manage data packets in communication networks without centralized control. In theory, the PEM system will allow small end-use devices commonly found in households and businesses to cooperatively balance energy supply and demand in real time without jeopardizing grid reliability or the quality of service to consumers. The development of this technology is backed by an ongoing award from the U.S. Department of Energy's Advanced Research Project Agency.

Packetized Energy Electric Water Heater Pilot Device Installation Instructions

This pilot program – which is not being funded through the EEU - will be the first real-world implementation of PEM devices in the City and should help to evaluate Packetized Energy's hypothesis: which is; whether coordinating the energy consumption of equipment (i.e. hot water heater) that people already own can solve dynamic grid related challenges while providing real benefits to those who use electricity. Packetized Energy is currently developing solutions for other consumer devices in addition to water heaters such as electric vehicle chargers, battery storage systems, pool pumps, and air conditioners.

If successful, Packetized Energy will further develop other innovative hardware and software solutions to integrate and coordinate generation, transmission, and end-use energy systems at various points on the electric grid. These control systems will enable real-time coordination between distributed generation, such as rooftop and community solar assets and bulk power generation, while proactively shaping electric load. This will

alleviate periods of costly peak demand, reduce wasted energy, and increase renewable generation on the grid.[4]

The tables below provide an overview of the 2018 – 2020 triennieal plan by program:

Resource Acquisition only Program budgets	2018	2019	2020	3 yr Total
Efficient Products	**$ 239,598**	**$ 254,451**	**$ 190,838**	**$ 684,887**
Residential New Construction	*$ 209,648*	*$ 222,645*	*$ 286,257*	***$ 718,550***
Residential Existing Homes	*$ 89,849*	*$ 95,419*	*$ 95,419*	***$ 280,688***
Income Qualified	*$ 59,900*	*$ 63,613*	*$ 63,613*	***$ 187,125***
Total Residential	**$ 359,397**	**$ 381,676**	**$ 445,289**	**$ 1,186,363**
Business New Construction	*$ 808,644*	*$ 954,191*	*$ 1,049,610*	***$ 2,812,445***
Business Existing Facilities	*$ 988,343*	*$ 954,191*	*$ 858,772*	***$ 2,801,305***
Total C&I	**$ 1,796,987**	**$ 1,908,382**	**$ 1,908,382**	**$ 5,613,750**
Total RA Program Budgets	**$ 2,395,982**	**$ 2,544,509**	**$ 2,544,509**	**$ 7,485,000**

Resource Acquisition only Savings Goals	2018	2019	2020	3 yr Total
Efficient Products	882	779	678	2,339
Residential New Construction	521	657	718	1,896
Residential Existing Homes	115	114	125	354
Income Qualified	85	92	75	252
Total Residential	**1,603**	**1,642**	**1,596**	**4,841**
Business New Construction	1,924	2,216	2,394	6,534
Business Existing Facilities	2,886	2,708	2,394	7,988
Total C&I	**4,811**	**4,924**	**4,787**	**14,522**
Total RA Savings	**6,414**	**6,565**	**6,383**	**19,362**

[4] See; https://arpa-e.energy.gov/?q=slick-sheet-project/packetized-energy-management; accessed September 25, 2017,

Retail Efficient Products (EPP) Program

The Retail Efficient Products program addresses market driven and replace-on-burnout opportunities by reducing the initial cost of Energy Star qualified lighting products, appliances and consumer electronics.

PROGRAM HIGHLIGHTS - 2018

- Est. investment: $239,589
- Forecasted saving: 882 MWh
- Est. Summer kW reduction: 112
- Est. Winter kW reduction: 175
- First Yr CSE: $0.27/kWh

Primary Objectives

- Create price parity between efficient products and standard products
- Build and maintain relationships with retailers and distributors operating in the region
- Increase inventory of energy efficient products on retail/distributor shelves
- Elevate the level of energy awareness and product knowledge

Implementation

This program is managed and implemented by Efficiency Vermont with BED's input and financial assistance.

In large part, EVT works with national organizations and other program administrators to promote the Energy Star© brand and Energy Star certified products. The objective of these organizations is to develop a list of qualified products as a means to enhance the customer's confidence in products carrying the Energy Star logo. In this way, customers are then able to discern between quality efficient products and others. The EPP program spends additional ratepayer funds to further develop promotional literature and in-store display advertisements that seek to promote EVT's image as an energy resource. EVT also works with retail sales staff to increase product awareness, savings and features.

Over the triennial period, BED will periodically augment EVTs outreach with its own public education and product awareness campaigns using relatively inexpensive social media channels and newsletters such as the BED's "Bright Ideas" online newsletter that will be predominately hosted on the Burlingtonelectric.com website. This newsletter will include staff written blogs and pointers about products and "ways to save" ideas. Articles will be timely and relevant to suit the needs of BED's wide cross section of residential customers. As an example, as the season transitions into fall and colder weather, a blog will be written to remind customers to have their local technician tune up their heating equipment in advance of colder weather. Also, quality lighting products will be included as the nights get longer. EPP is also promoted through BED's and VGS's energyChamp effort.

Risks and potential barriers

Risks & Potential Barriers	Management Strategies
Low quality, cheap lighting products	Increased use of customer outreach and education about so called "ish" bulbs and their inferior quality. Promote Energy Star Logo.
Consumers remain unfamiliar with incentive programs and benefits of LEDs and other advanced products.	Aggressive marketing and promotion campaigns aimed at expanding consumer knowledge via various media outlets (print, radio, and social marketing) and public outreach.
Waning trade ally support and referrals at retail store level	Direct account management and sales training
Ensuring program cost effectiveness as appliance standards continue to increase over time.	Keeping program overhead costs as low as possible while continuously seeking to incentivize new Energy Star qualified products.

Residential New Construction

The RNC program provides technical and financial assistance to home owners, home builders, developers and architects to design new homes, or take on major renovations, that meet or exceed the Vermont Energy Star Home standard. This service is available to single-family homes, multi-family homes and low-income multi-family buildings.

PROGRAM HIGHLIGHTS - 2018

- Est. investment: $209,648
- Forecasted saving: 521 MWh
- Est. Summer kW reduction: 66
- Est. Winter kW reduction: 103
- First Yr CSE: $0.40/kWh

Primary Objectives

- Provide technical and financial assistance to building owners with projects that exceed current energy codes.
- Influence market actors to build high performance homes and buildings

Implementation

Working with Burlington's planning and zoning office, City building inspectors, Vermont Gas, Yestermorrow and Efficiency Vermont, the RNC program will engage designers, builders and homeowners provide technical assistance, energy rating services, financial incentives and project management. The RNC program also intends to provide market actors with relevant and timely information on technologies and design - build strategies that address all major end uses in new buildings; such as, thermal envelope, space conditioning, water heating, ventilation, major appliances and lighting.

The intent of such efforts shall be to further encourage the development of low-load or net zero energy homes. Indeed, BED has already co-sponsored several design build seminars with Yestermorrow for local designers and builders in Burlington. Such advice and training may also include, where appropriate, the development or renovation of homes built to the Passive house standard, or similar high performance building standards. Meeting the Passive House standard has been reported to result in energy load reductions of between 80 and 90 percent.[5]

In addition, BED will continue its current effort to develop new financial products to encourage high efficiency renovations with local banking institutions. Product ideas under review include methods for streamlining the customer acquisition process for banks. If these partnerships are successful, BEDs processes will help to lower the overhead costs for participating lenders and thus keep them more interested in providing valuable loan services to the City's building owners. Additional efforts are also underway to verify

[5] For additional information regarding Passive house, see BED's Tier III plan dated November 1, 2017.

energy related savings so that participating lenders become increasingly more confident in the program's ability to produce meaningful cash savings for owners of high efficiency buildings. Verifiable energy savings should, in turn, help to improve the creditworthiness of prospective borrowers as such savings may increase their debt repayment capacity relative to borrowers living in less energy efficient buildings.

To help promote program objectives, BED intends to actively participate in regional events such as the Better Building by Design conference and work with relevant associations such as the Yestermorrow School, Vermont Green Building Network, Vermont realtors and the Vermont Passive House Association.

Risks and potential barriers

Risks & Potential Barriers	Management Strategies
Economic uncertainty and interest rate changes that effect new housing starts and major renovations	Educate homeowners about the longer term benefits of low to net zero energy homes i.e. increased property values vis-à-vis standard homes, lower heating and maintenance costs and improved comfort.
First costs	Provide financial incentives to conduct energy modeling and design reviews, develop additional financing products to help customers qualify for energy efficiency loans that take into account energy related savings.
Lack of knowledge	Regularly engage market actors and provide timely information relative to new design methods and energy efficient measures.

Residential Existing Buildings

The REB program will continue to target both market driven and discretionary, early replacement/retrofit opportunities to reduce energy consumption in single family homes, multifamily buildings and condominiums. Additionally, the program will serve as a point of contact for customers seeking advice about electric vehicles; electric vehicle charging equipment and other transportation related measures, as well as cold climate heat pumps.[6]

PROGRAM HIGHLIGHTS - 2018

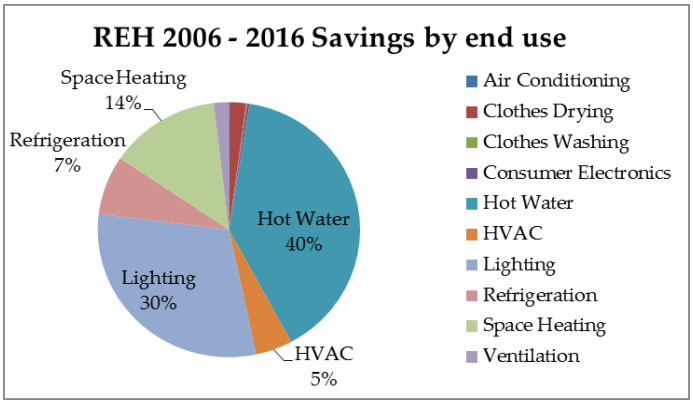
- Est. investment: $89,849
- Forecasted saving: 115 MWh
- Est. Summer kW reduction: 15
- Est. Winter kW reduction: 23
- First Yr CSE: $0.78/kWh

Primary Objectives

- Address energy efficiency and strategic electrification opportunities across all – fuels by increasing customer awareness about new technologies and practices.
- Develop and encourage the use of online tools that have the potential to empower customers to take more control of their energy consumption.
- Integrate whole building approach to enhancing energy efficiency in the built environment.

Implementation

Although program savings have historically been acquired from a variety of end uses, a significant percentage has resulted from BED's aggressive efforts to fuel switch electric hot water heaters to natural gas water heaters. These efforts to fuel switch water heaters have slowed down in 2017, and will be discontinued in 2018 as the potential for future cost effective savings is diminishing. Continuation would also undermine BEDs overall vision of transitioning Burlington into a Net Zero Energy City. Moving forward, the program will focus on working directly with building owners, property managers, contractors and residents to identify whole-building energy savings wherever they may exist. BED intends to encourage customers to increase insulation levels, seal air



[6] With respect to cold climate heat pumps, services will be limited to the non-natural gas customers.

leaks, tune - up (or replace) boilers/furnaces, and install LEDs, smart strips and high-efficiency appliances.

Although BED is unable to provide financial incentives for natural gas equipment and weatherization measures, BED will continue to work closely with VGS and other stakeholders to deliver energy efficiency services in a streamlined manner in order to help customers reduce their overall energy expenses. Streamlining customer communications and educational opportunities, preferably through a single point of contact, would be more convenient for customers, help them assimilate complex information and it would lower BED's customer acquisition costs by sharing such costs with VGS. Also, offering whole building technical assistance, even though the organization is unable to claim natural gas thermal savings, is a value – added service that customers appreciate and it enhances BED's role as a total energy solutions provider. In addition to providing building related technical advice, BED will begin to actively address transportation related questions and opportunities starting in 2018.

As further described BED's Tier III Plan, the energy services group will begin to provide assistance to customers inquiring about electric vehicles, EV chargers and other transportation options. These tier related services will include technical advice about the type of electric cars available, their characteristics, incentives and the potential for fuel and operating savings depending on vehicle miles driven per year.

Additional program efforts to motivate customers to take specific actions to reduce their building energy consumption are either currently underway or will be soon. One specific initiative that was officially launched in 2015, and continues to generate projects in 2017, is the Energy Champ Challenge. The Energy Champ challenge was a BED – initiated campaign with VGS to encourage rental property owners in the City to implement retrofit projects. Effectively addressing this market has traditionally been challenging due to split incentives and high costs. Since its launch, 163 buildings have requested energy audits and 63 projects have been completed resulting in lifetime savings of approximately $637,000. Although electric energy savings resulting from the campaign were small – most of the electric savings opportunities were limited to lighting products and smart strips – BED nevertheless considers the Energy Champ challenge to be a success. The campaign attracted considerable media attention and increased energy awareness throughout the City. The only questions about this initiative that remain include the following (a.) how to extend the campaign's proven effectiveness to reach new multifamily owners; and, (b.) whether the lessons learned from the initial campaign can be applied to other markets such as single family home owners.

To address question (a.), BED and VGS will continue to reach out to all residential building owners and provide services aimed at identifying cost effective energy savings opportunities. As needed, and when appropriate, additional marketing efforts through social media and/or other channels will seek to remind customers about the program and financial incentives. Early to late spring is typically an excellent time to engage in such marketing efforts in advance of the summer season when many construction projects are completed.

Concerning question (b.) above, BED is testing customers' interests in self – assessing their energy consumption and whether such self-assessments would lead to specific actions like purchasing LEDs, swapping out an old refrigerator or weatherizing their attic. One test includes an online tool (https://energychamp.org/) that allows customers to compare their energy use intensity (EUI) to other similarly situated customers. As the graph below demonstrates, customers can determine whether their EUI is higher or lower than the most efficient customers in the City. The black lines in the graphs below represent energy use intensity by fuel type relative to cohorts in the 30th percentile. Thus, the distance between the black line and the shaded areas of the graph represents the amount of efficiency – in relative terms – a customer needs to achieve in order to get into the top percentile of efficient customers. In other words, customers become an energyChamp by closing the gap. After customers complete their assessment, they are re-directed to other webpages to download rebate forms for efficient products or they can call an Energy Services rep for assistance. Also, tips for saving energy are highlighted on this webpage in case customers are looking for even more inexpensive ways to save.

A secondary focus for the program will be to look for additional avenues to leverage the work of other sister agencies in the City. As an example, BED is currently in discussions with CEDO about their recently announced LEAD abatement program.

In June, 2017, the City of Burlington was awarded $2.9 million in program funding, one of only 28 Lead-Based Paint Hazard Control grant recipients in the nation. As part of the award, CEDO also received a $400,000 Healthy Homes grant. These additional funds can be leveraged with the LEAD abatement program and EEU incentives (from BED and VGS) to reduce other housing-related health and safety hazards such as mold, mildew and pest infestation. Participants in the program will be able to access these federal funds to replace old, drafty windows with new energy-efficient windows and repaint the exterior of their buildings.

In partnership with area nonprofit groups, CEDO will build upon its past success and perform hazard assessments and remediation on 162 pre-1978 rental and owner occupied housing units. By partnering with CEDO, energy services staff will be on hand to provide additional energy related technical assistance regarding efficient products and weatherization as well as process incentives, if applicable. More importantly, BED Staff will be able to help sequence projects in order to avoid any lost opportunities.

Risks and potential barriers

Risks & Potential Barriers	Management Strategies
Split incentives between tenants and building owners.	Engage in both "push" and "pull" marketing tactics; meaning, effectively market the tools and services tenants need to take more control of their energy consumption (push), while at the same time encouraging building owners to highlight the low energy use intensity of their apartments as a means to increase the marketability of their buildings (pull).
High tenant turnover	Continue to work with UVM and Champlain College housing directors to help off campus students assess and find energy efficient apartments.
Customers conclude that online tools are less appealing than BED's assumes and do not motivate customers to take specific energy efficiency actions.	Create and maintain an online presence that is informative, fresh and entertaining. BED's online tools will need to compete for Customer's attention and screen time.

Income Qualified Customers

This program seeks to reduce energy consumption and bills for income-qualified customers through technical assistance, incentives and educational outreach. BED partners with the Champlain Valley Weatherization Service (CVWS) to delivery most of these services but also works with the Burlington Housing Authority, Champlain Housing Trust and Cathedral Square Corporation

PROGRAM HIGHLIGHTS - 2018

- Est. investment: $59,900
- Forecasted saving: 85 MWh
- Est. Summer kW reduction: 11
- Est. Winter kW reduction: 17
- First Yr CSE: $0.70/kWh

Primary Objectives

- Reduce the economic burden of energy consumption for customers with incomes equal to or less than 80 percent of the median incomes.
- Increase energy consumption awareness in order to help customers find ways to save money on their energy bills.
- Increase program participation.

Implementation

This program is primarily implemented through CVWS since they work closely with various clients in the City living in Section 8 housing, other subsidized housing or market rate single family housing, including mobile homes. BED, along with VGS and EVT, enter into annual program implementation agreements with CVWS so that they can assist qualified residents to identify and implement energy efficiency upgrades. This partnership allows electrical efficiency measures to be delivered at the time they receive thermal shell, space heating and water heating improvements.

This program also works closely with high usage households, who may not be eligible for CVWS services. For high – usage customers, BED provides on-site energy audits, customer energy education, appliance meter loans, and technical assistance and cash incentives for eligible measures. Additionally, energy services staff regularly encourage customers to access BED's energyChamp tool as well as Energy Engage to self-assess their electric usage. The energy engage tool has been particularly helpful in demonstrating to customers how and when they use electricity. Armed with this type of usage granularity, customers are in

a better position to determine how best to reduce their usage and lower their electric bills.

Similar to the market rate programs noted above, implementation of the program shall emphasize a holistic, whole building approach to energy efficiency including health and comfort issues. Accordingly, Vermont Gas is an important partner and is relied on to provide financial incentives and technical assistance for thermal and gas appliance measures.

BED will continue to cultivate partnerships, and pursue initiatives that allow for additional opportunities to engage with the low income community. Examples of such include the following:

- BED, VGS and CVWS meet quarterly to discuss projects and overall program progress.
- As mentioned in the REB section, BED and VGS plan to collaborate more closely with CEDO's Lead/Healthy Homes Program.
- BED and the City's Department of Public Works Rental Housing Code Enforcement staff meet quarterly to review program coordination and outreach efforts. These meetings oftentimes provide BED with additional leads for new program participants.
- BED awarded CVOEO a Community Energy Partner grant, for 2017-2018, that focuses on customers living in the North Avenue Co-op mobile home park. This work includes energy coaching, free LED's, power strips, water savers, etc. Customers are encouraged to apply for CVWS weatherization or for deeper assistance from BED.
- BED has added a language translator engine to its website so our New American customers have easier access to information and services.
- BED is working with VEIC on a joint low-income energy behavior pilot study in several multi-family apartment complexes, owned by Champlain Housing Trust, in Burlington and South Burlington.
- BED, VGS, Optimal Energy and the UVM Medical Center are in early discussions regarding the potential coordination between on-site energy efficiency programs and health prevention measures around asthma triggers and other issues.
- As described in the TEPF section, BED is working with CVOEO's Mobile Home project, and VEIC, to encourage VERMOD replacements for residents needing to buy new homes.

Risks and potential barriers

Risks & Potential Barriers	Management Strategies
First cost	Provide incentives that cover up to 100 percent of the measure's full cost
Split incentives	Work with local agencies to reach out to income eligible customers and raise awareness about available options to reduce energy bills.
English as a second language	Work with local agencies with staff who are fluent in multiple foreign languages.

Business New Construction

Burlington continues to experience significant growth in the number of large commercial new construction projects. The trend will likely continue throughout the next triennial period as a number of large projects work their way through the City's planning and zoning process. To ensure that BED is fully prepared to effectively address the new construction market, the proposed budget is about fifty percent greater than previous budgets.

PROGRAM HIGHLIGHTS - 2018

- Est. investment: $808,644
- Forecasted saving: 1,924 MWh
- Est. Summer kW reduction: 212
- Est. Winter kW reduction: 281
- First Yr CSE: $0.28/kWh

Primary Objectives

- Provide financial incentives, technical assistance and project management for new construction and major renovation projects designed to meet or exceed existing commercial new construction codes.
- Help customers through the decision-making process and help them to maximize energy investments.
- Integrate heat pump technologies and transportation alternatives into the design and development of new buildings.

Implementation

When new buildings or major renovations are being designed and proposed, there is a relatively small window of opportunity to influence the energy consumption of such new buildings at a modest cost to ratepayers. Accordingly, it is vitally important for BED to remain consistently engaged with local stakeholders as projects are being proposed and designed. As noted above, a number of significant and large commercial new construction projects are currently underway and going through their initial design phases. Many of these projects will either be completed before the end of the 2018 – 2020 triennial period, or nearly so. Projects include the Burlington Towne Center, Cambrian Rise, UVM STEM building complex, UVM Medical Center Bed Tower, City Market South, and Champlain College's Eagles Landing dormitory building. BED is also actively engaged with UVM on the proposed renovation and expansion of the athletic facilities. Without approval of the above-noted budget, BED's ability to reduce energy consumption and carbon emissions in these future buildings could be lost for many years into the future – potentially for as many as 50 to 75 years.

Figure 1: Burlington Town Ctr.

Figure 2: Cambrian Rise

Figure 3: UVM STEM Building

To further promote the inclusion of cost effective energy efficiency and strategic electrification solutions into the above noted building projects (and others), the BNC program will continue its tradition of actively addressing market-driven/lost opportunities by providing financial incentives and design assistance to building owners and developers, architects, builders and engineers. BED program managers will encourage these stakeholders to take a comprehensive, whole building approach to developing their projects. This collaboration is designed to encourage full integration of efficient building components (building envelop, HVAC, lighting systems etc.), building management systems and building component controls into their decision making processes as buildings are being designed and built.

The program will also continue to provide performance-based tiered incentives. Under a performance based incentive design, BED pays 50 percent of the total estimated incentive upon project completion, provided the building has been built to the agreed upon specifications. The remaining incentive will then be paid about 12 months after project completion. Approval of the remaining balance is contingent on a comparison of the actual, post-occupancy energy use to the results of the baseline energy model performed during the design phase. It is often the case that the baseline energy model needs to be calibrated to reflect actual operations of the occupied building including actual plug loads, HVAC set-points and operating hours.

It often takes about a year for larger commercial buildings to be fully occupied, equipped and debugged of its performance issues. This tiered approach allows for deeper BED involvement, more accurate savings claims and ensures that building operators are encouraged to optimize the performance of their buildings. BED has been informed that this approach is effective and has been well received by stakeholders.

Often times, encouragement shall also include offering financial and technical assistance to perform in-depth energy analysis of buildings using software tools. Some of these tools are under development; others are widely available and in commercial use today. Either way, customers retain the option to use such software tools if they're convinced that energy modelling software adds value to their project. BED, for the most part, encourages customers to model the energy consumption of their new buildings. One tool that BED is currently assessing has been developed by the Weidt Group, a regional consulting firm with vast experience working in the energy engineering space. The tool, which was built off the industry-standard DOE – 2 energy simulator and eQuest platform, can be used for comparative analyses of the completed building's forecasted energy consumption relative to existing commercial code as well as to various building system options. For example, the Weidt group's Energy Design Assistance tool© allows the owner

to select various building system options depending on their budget and overall goals.[7] Thus, building owners can maximize the expected energy savings given their available budget. The tool rank orders building system components based on energy savings as measured in annual kWh and therms, energy costs, and incremental cost of building components. Ranked building component systems are then bundled together into "energy bundles" to allow for a more streamlined decision making process. The table below includes an example of the tool's output.

Strategy Results and Bundling

			Savings versus Baseline		
			Bundle 1	Bundle 2	Bundle 3
Project Name:	Burlington Electric Demonstration	Energy Cost Savings	$2,316	$14,304	$30,634
Building Type:	Office	Peak kW Savings	6.0	33.7	80.9
Area:	30,000	kWh Savings	15,553	89,286	175,398
		Therm Savings	66	1,715	6,662
Existing HVAC System	Office Tenant 3: Packaged single zone with gas furnace and DX; Office Tenant 2: Packaged single zone with gas furnace and DX; Office Tenant 1: Packaged single zone with gas furnace and DX	Incremental 1st Cost	$7,303	$46,187	$132,934
		Projected Incentive	$0	$0	$0
		Payback with Incentive	3.2	3.2	4.3
		EUI kBtu/sf	127	113	87

Irrespective of the tools used, if any, BED will ensure that the results of the modelling exercise are valid, as it is important for all parties involved in the project to have confidence in the use of the tool and its recommendations. Use of this tool, and others, provides for an in depth assessment of available options and cost of various components. It helps customers prioritize systems, as well as ensure efficiency becomes a vital input into stakeholder decisions.

To further ensure that customers have a comprehensive assessment of their building and system designs, BED will also continue to coordinate with Vermont Gas Systems (VGS) on projects, when appropriate. As noted in previous Commission filings, BED and VGS collaborate regularly and notify each other when projects are identified or when major changes are considered by the developers or the design teams. Since natural gas is so prevalent in the City, this partnership has proven to be mutually beneficial to stakeholders and ratepayers.

[7] The same tool can also be used by existing building owners contemplating energy efficiency retrofit projects.

As BED has explained in other EEU proceedings, heat pump technology is becoming a popular alternative for building space conditioning, even when natural gas service is available. Accordingly, BED will continue to evaluate the costs and benefits of various HVAC systems such as cold climate heat pumps and ground source heat pumps. To further advance the adoption of these technologies, particularly ground source heat pumps, BED is considering its options to use Tier 3 funding to help offset the initial cost of ground source heat pump systems. BED believes that combining Tier 3 and EEU funds together could help to further the City's transition away from fossil fuels to renewable electricity. In BED's view, Tier 3 funds can be used to influence heat pump adoption and EEU funds could be applied toward the highest efficiency water source heat pumps and thermal shell measures (including building envelope commissioning). As an added benefit, it is important to note that ground source heat pump systems can provide for a more efficient central cooling system which would help to reduce summer peak issues.

In addition to promoting alternative building space conditioning technologies, BED will also seek to influence developers' decisions with respect to electric vehicle charging equipment - or to at least ensure that appropriate trenching and/or other "make –ready" infrastructure is made available to accommodate future installations of EV charging equipment. BED believes that such encouragement would help to prepare building owners and developers to better serve their customers/tenants as EV's start to become more prevalent on Vermont's roads in the near future.

Risks and potential barriers

Risks & Potential Barriers	Management Strategies
Perception that additional costs will not yield addition financial returns	In addition to financial incentives, develop case studies demonstrating how energy efficient measures and building operations reduce building operating costs and increase tenant comfort and satisfaction.
Uncertainty over realizing modelled energy savings	Provide commissioning and post project savings verification. Encourage building operator training in advanced building management systems, as part of the commissioning process, to reduce out of bounds building operations. The commissioning process can also include the development of appropriate building/mechanical maintenance schedules.
Lack of knowledge about the program	Conduct regular outreach

Too much of a hassle to participate and tight timelines to complete projects	Assume more responsibility in project management and documentation. Engage project managers, designers early and often.

Business Existing Facilities

Historically, BED's largest and most successful program, the BEF program pursues market –driven and discretionary retrofit energy efficiency opportunities that are determined to be cost effective. Market driven opportunities include naturally occurring equipment replacements on burn out. Discretionary retrofits typically include custom projects focused on functioning but inefficient equipment and building systems. Such custom projects also take a holistic approach to identifying electric, thermal and, now, transportation related savings.

PROGRAM HIGHLIGHTS - 2018

- Est. investment: $988,343
- Forecasted saving: 2,886 MWh
- Est. Summer kW reduction: 319
- Est. Winter kW reduction: 422
- First Yr CSE: $0.51/kWh

Program managers assist commercial customers of all sizes to fully understand their energy usage and then compare that usage to their actual energy and demand requirements. This initial assessment uncovers cost effective opportunities to "right-size" equipment, optimize building operations and processes, and ultimately reduce energy costs.

Primary Objectives

- Acquire cost effective market-driven and discretionary retrofit energy efficiency.
- Focus on total energy solutions that take into account demand response opportunities, system controls and building management systems.
- Expand the number of small to medium size businesses participating in the program.
- Further develop the HVAC solutions to prevent lost opportunities as customers consider alternative heating and cooling solutions.

Implementation

The BEF program will continue to assist commercial customers evaluate their best options to optimize the overall energy performance of their business spaces. This work includes: meeting with customers and their contractors, reviewing and evaluating efficiency proposals, modelling building energy consumption and trends, sharing information and data on best practices; project management and documentation; proposing and processing incentives including on-bill financing options; and, evaluating, measuring and verifying energy savings upon project completion.

To effectively deliver these tasks, BED will pursue three main courses of action: active large account management, targeting small to medium businesses, and market segmentation.

Large account management[8]

The BEF program has been in operation for over 17 years. Over the years, the program has evolved to better serve its customers. As with many other types of services, it has needed to evolve in order to keep up with customers' demands. Today, customer expectations are much higher than they were even a few years ago. Customers, especially large customers, have become increasingly more sophisticated with respect to energy consumption. Reliability has been and continues to be a customer priority. But so are lower energy bills, more efficiency across multiple uses and sustainability. To further address the needs of BED's larger customers, the BEF program will continue its tradition of active account management and augment its menu of services to include electric and thermal efficiency, demand response and transportation related solutions.

Like other mature efficiency programs, the preponderance of program savings is generated from custom projects completed by large customers. These customers, with BED's assistance and coaching, have generally moved away from episodic, emergency equipment replacements on burnout – although such replacements still occasionally occur. Instead, these customers are beginning to think in terms of continuous improvement and building renewal over time. Managers of these customers are increasingly more committed to energy efficiency. They allocate sufficient financial resources to efficiency projects scheduled over multiple years. Typically, such customers also have trained facilities managers on staff who are responsible for managing buildings and building systems. BEF program managers will continue to engage with its customers at all levels of the organizations they serve to ensure that their needs are met, and shall also continue to promote best practices. Accordingly, BED will continue to assign one energy engineer to the UVM account, while three additional engineers and specialists manage BED's top forty customers.

This continuous improvement approach has been recently characterized by numerous energy efficiency administrators as Strategic Energy Management (SEM). It is, however, an approach that BED has pursued for numerous years. As a part of this approach, BEF account managers focus on implementing holistic energy related solutions. Such solutions will naturally include commodity - like, prescriptive measures such as lighting, motors and drives, pumps, hot water and refrigeration. But, more importantly, the approach incorporates practices that integrate building management systems and controls, and sustainability. As a means to further promote these holistic energy

[8] Large accounts include UVM, UVM Medical Center, Champlain College and Burlington municipal buildings, including all schools.

solutions, multiple initiatives will continue to move forward over the next triennial period. These include third party energy engineering services and strategic electrification.

Energy Engineering Services

Starting in 2015, through an RFP process, BED began working with commercial energy engineering professionals to conduct initial high level energy surveys on commercial buildings. The primary purpose of these surveys is to quickly identify energy waste, prioritize potential energy efficiency opportunities and provide estimates of project costs and savings – both electric and thermal. BED's goal is to provide customers with an initial high-level energy efficiency analysis report and recommendations as soon as practical from the date of the customer's request. This approach is a more targeted version of the Retro-commissioning or re-commissioning process that is used with complex manufacturing facilities and very large office buildings. This type of streamlined energy engineering service is especially appropriate for customers who, unlike the large accounts noted above, do not have the personnel or the time to identify cost effective energy efficiency opportunities.

BED is using this initial information to present customers with estimated energy savings, potential maintenance and/or building comfort benefits, estimated BED incentives and on-bill financing details. With this information, customers may be persuaded to pursue additional (deeper-level) energy analysis, beyond the initial high-level survey, to finalize savings estimates and overall project cost.

The overarching objective for this initiative is to streamline project identification and implementation processes, as well as increase the overall pipeline of future projects. If customers decide to move forward with identified projects, additional measurements of building systems may need to be evaluated. From there, the energy engineering consultants develop a "roadmap" to ensure successful implementation of project recommendations and energy savings are achieved.

Strategic electrification

As further described in BED's Tier 3 plan, BED will provide financial and technical assistance to offset the fossil fuels consumed by its customers. Primarily such assistance will focus on electrifying a customer's auto fleet, providing EV chargers for employees to use, and, where appropriate, heat pump technologies. These efforts will not be paid for with EEU funds.

Medium to small customers

Small to Medium Business (SMB) customers consume between 10 and 40 MWhs annually. In addition to being small and diverse in terms of the type of business, SMB

customers have historically been difficult to serve. Barriers to efficiency are well known and stubbornly persistent. Barriers include but are not limited to: split incentives, perceived complexity, and lack of knowledge and competing priorities for capital and time.

To effectively address SMB barriers, BED and Efficiency Vermont are striving to transform the market upstream to the customer. Working with distributors, manufacturing representatives, equipment installers and other professionals serving the SMB sector, BED influences the purchasing decisions of SMB customers.[9] The existing SmartLight program is a primary example of an upstream program but upstream efforts also include motors, cold climate heat pumps, heat pump water heaters and other HVAC equipment.

The upstream model leverages existing distributor networks to influence the decisions of thousands of customers and contractors that are made on monthly basis. Under this program structure, energy efficiency funds are used to buy down the cost of qualified efficient products at the distributor's counter. These buy-downs are, in theory, passed on to the end user customer in the form of lower prices for equipment. In this way, the more efficient products are cost competitive with standard equipment; making the customer's decision a little easier. Over the next triennial period, BED will continue to participate in the SmartLight program, as well as other upstream programs. However, BED will continue to explore how it can move beyond lighting as the dominant savings measure, as the lighting market becomes transformed. Long-lasting LED technology is being widely adopted throughout the marketplace. Accordingly HVAC, and other measures, will need to play more prominent roles in this sector (and others).

Market segmentation

Since SMB customers are fragmented across multiple business types, BED intends to expand on existing efforts to segment the market into subsectors in order effectively message the value of efficiency. To be clear, market segmentation is a process of accurately defining and subdividing customers into readily identifiable categories with similar needs. Categories include offices, banks, retail shops, convenience stores, medical offices, restaurants, real estate investors, institutional agencies, non-profits and others.

By tailoring messages to these categories or subsectors with an effective narrative that resonates, BED can begin to address some of the existing barriers to efficiency that these customers face. By targeting specific market segments with a list of easy-to-

[9] The upstream strategy is being pursued by many other energy efficiency administrators in the Northeast and elsewhere across the nation.

implement efficiency options, BED hopes to be able to cut through the clamor that small business owners contend with on a daily basis. Once markets have been appropriately segmented into similarly situated groups, case studies can then be published and widely distributed to other like-minded and similarly situated customers. Case studies can describe how BED's services, incentives and on-bill financing can lead to improvements in the business's performance; i.e., lower energy bills, increased occupant comfort and lower maintenance costs. Since electrical savings alone are typically insufficient to attract much attention from the business owner, BED intends to collaborate more with VGS in order to increase program participation. Although BED and VGS have collaborated on a number of projects, and successfully implemented the Energy Champ challenge, it is time to address additional SMB markets.

Risks and potential barriers

Risks & Potential Barriers	Management Strategies
Unplanned postponement of energy related projects	Enlist customers into multi-year high performance energy improvement "contracts" that identify multiple energy projects and each party's roles and responsibilities.
Lack of time and knowledge	Offer turnkey, one-stop solutions and project expediters to address all the energy needs of each participating customer.
Lack of awareness concerning program services and benefits	Cut through the marketing noise by targeting market sub-segments for enrollment in programs addressing specific needs and interests of the segmented market.
First costs	Provide financing options as well as identify non-energy benefits to improving the energy performance of buildings.

Electric Development and Support Services

Development & Support Service (DSS) activities are essential support services that are not directly related to the acquisition of energy savings but are necessary to ensure that the RA program portfolio is well managed and forward thinking. DSS activities in research, education and training, for example, focus on new and emerging best practices to reduce barriers to efficiency, address potential lost opportunities and transform markets. In total, the DSS budget encompasses the following work areas: education & training, applied research, planning and reporting, evaluation, policy and public affairs, information technology and general administration. Within each of these general activity areas are several sub-activities which are explained in further detail below.

For the next triennial period, total DSS spending is forecasted to amount to nearly $598,800.

Electric DSS Budget - as approved 10/12/2017	2018	2019	2020	3 Yr Total
Education & Training	$ 35,690	$ 36,500	$ 36,500	$ 108,690
Applied R&D	$ 11,620	$ 11,800	$ 11,800	$ 35,220
Planning & Reporting	$ 57,270	$ 58,500	$ 58,500	$ 174,270
Evaluation	$ 19,090	$ 19,500	$ 19,500	$ 58,090
Policy & Public Affairs	$ 10,873	$ 11,100	$ 11,100	$ 33,073
Information Tech	$ 12,108	$ 14,800	$ 14,800	$ 41,708
General	$ 45,027	$ 51,361	$ 51,361	$ 147,749
Total	**$191,678**	**$203,561**	**$203,561**	**$598,800**

Education and Training

This category captures BED's work throughout the year on increasing customer awareness about energy efficiency and how to take specific actions to lower energy use. BED provides education to builders and contractors, real estate professionals, K-12 students and teachers, college and universities and the general public.

Additional activities include:

- Energy Codes and Standards Support
- Energy Literacy Project Support
- General Public Energy Education
- Better Building by Design Conference

- Building Energy Labeling & Benchmarking

Applied Research & Development

This work includes BED's collaboration with EVT and other entities on applied research and development activities designed to optimize the creation of cost-effective solutions to meeting BED's long-term resource acquisition goals.

The main focus of applied R&D is in the following three areas:

- Field-testing new implementation strategies such as digital engagement and social networking
- Technology demonstrations
- Research of emerging technologies and innovative efficiency implementation strategies

Sub-categories of activity in this area include

- Emerging Data services and analytics

Planning and Reporting

This budget line item covers the cost of informing the Vermont PUC , the DPS, and other stakeholders about BED's EEU activities. BED regularly submits monthly, quarterly, annual reports and an annual plan to the Commission and DPS. This activity also supports BED's engagement with the VSPC and the ISO-NE FCM program.

Sub-categories include:

- Annual Plan
- Demand Resource Plan
- Vermont State Planning Committee (VSPC)
- ISO-NE FCM Participation
- Reporting

Evaluation

Evaluation, measurement and verification (E,M&V) is integral to energy efficiency. Accordingly, BED will continue to conduct E, M&V of its programs over the next triennial period. Such *ex post* analyses not only boost BED's confidence that its programs are resulting in persistent and real savings, but E,M&V findings also point out how program

managers can implement improvements as market conditions evolve. Many activities in this work area are coordinated with the DPS and Efficiency Vermont.

Sub-categories include:

- Annual Savings Verification
- Technical Advisory Group (TAG)
- Technical Reference Manual (TRM)

Policy & Public Affairs

This DSS activity captures BED's participation in discussions about energy efficiency and EEU related issues that typically occur throughout the year with regulators, the media, the public and other stakeholders.

Sub-categories include:

- Public Affairs
- Regulatory Affairs

Information Technology

BED's IT activities mainly consists of continuing the support of, and improvement to, the DSM database system for the collection and processing of project data and program information critical to tracking, reporting and planning functions. There is a fairly regular need to alter existing tools or add new tools and functionality to the system which helps us to better understand and respond to changes in the Burlington marketplace.

General Administration

This category covers BED's costs for the overall management of EEU programs not specific to the individual programs and includes: general staff meetings, coordination of program implementation across all program functions, coordination with other EEU's and managing and monitoring of overall performance and spending.

This activity funds over 50 general energy services staff meeting per year, over 30 meetings with EVT, VGS, CVOEO and other stakeholders annually and almost weekly communications with broader BED staff on efficiency matters.

Thermal Energy & Process Fuels (TEPF)

In accordance with its Process and Administration requirements, BED manages additional programs aimed at increasing the thermal energy and process fuel efficiency of homes and businesses. In the past, the scope of these services has been fairly limited, as most of Burlington is served by VGS, who also implements thermal efficiency programs. New technologies and potential business partnerships, however, are now presenting BED with opportunities to provide customers with additional services.

Overall TEPF Budget proposal

With this filing, BED proposes to fully retain for its customers all appropriate FCM and RGGI funds to support a District Energy System (DES) and provide funding for the other TEPF priorities described below. Starting in 2018, BED's TEPF programs will be comprised of three main components designed to continue existing services and take advantage of new opportunities. The components include:

- Traditional programs;
- District Energy Services (DES); and,
- Advanced Manufactured Homes (a/k/a VERMODs)

Funding for TEPF programs is generated from forward capacity market (FCM) and regional greenhouse gas initiative (RGGI) revenues. Forecasting the proceeds from these sources has historically been challenging. Consequently, it is somewhat difficult to forecast thermal savings and budgets as the funding sources fluctuate from year to year. Nevertheless, BED is committed to continue serving the thermal needs of its customers where and when it can do so cost effectively. Indeed, as further explained in the sections below, BED is seeking ways to expand the scope of services it can offer.

For the three year performance period ending December 31, 2020, BED is seeking to invest and/or reserve $1.53 million, cumulatively, for the District Energy system and VERMOD program; and, to expend an additional $0.347 million on traditional TEPF programs. The amount of the request is driven by four factors. First, FCM values have been increasing. Second, in the interest of maintaining fairness and equity, BED seeks to assure its customers that the proceeds BED generates from the activities that they paid BED to undertake be reinvested in the City for their benefit. Third, achieving the State's clean energy goals necessitates aggressively pursuing all cost effective opportunities. Forth, advancements in new technologies are making VERMODs and District Energy economically more compelling. As discussed below, the budget is predicated on having the use of revenues from both the FCM and RGGI markets.

Net Revenue Projection from BED's participation in FCM & RGGI						
		2018		2019		2020
Net RGGI Revenue	$	99,534	$	99,534	$	99,534
Net FCM Revenue	$	581,456	$	580,239	$	418,406
Total Net Revenues	**$**	**680,990**	**$**	**679,774**	**$**	**517,941**
Cumulative Net Revenues					***$***	***1,878,704***
TEPF Spending (Proposed)						
TEPF - Traditional programs	$	113,655	$	115,928	$	118,247
VERMOD	$	92,000	$	92,000	$	92,000
DES Support	$	475,335	$	471,846	$	307,694
Total Spending	**$**	**680,990**	**$**	**679,774**	**$**	**517,941**
Cumulative Spending - Traditional programs					**$**	**347,830**
Cumulative Spending - VERMOD					$	276,000
Cumulative Spending/reserve - DES					**$**	**1,254,875**
Cumulative Spending - Total TEPF					**$**	**1,878,704**

The cumulative amount in the table above differs from the budget approved by the Commission in its Order of October 12, 2017, as the Order did not include RGGI revenues in the numerical value (although they were referenced in the text of the order). Such revenues were excluded from BED's original request as highlighted in its letter filing of August 15, 2017. BED is now seeking approval to also reserve these RGGI funds as further explained below. To the extent that BED is unable to invest TEPF funds in cost effective programs initially, or adoption lags, BED also seeks approval to carry forward (or reserve) these additional funds for future use (particularly in support of the DES). BED is highly confident that customer conversions onto the DES will accelerate after 2018 and beyond. As such, additional funds will be necessary to fund the program going forward. VERMODs, too, will likely become popular as residents of the North Avenue Cooperative experience living in a much more efficient and comfortable home that is less expensive to heat and maintain. The sections below provide additional detail on the nature and anticipated pace of program activity.

Traditional Programs

Primarily, these programs focus on providing non-VGS residential homeowners and businesses with energy audits to identify cost-effective weatherization opportunities and/or rebates on high efficiency boilers or furnaces. In addition, the program will continue to provide rebates for ccHPs, when appropriate.

For the three year performance period ending December 31, 2020, BED anticipates acquiring thermal savings equivalent to 955 MMBTU's; roughly the amount of energy needed to heat between 8 to 10 homes.

	2018	2019	2020	3 Yr. Total
TEPF RA Budget	$ 113,655	$ 115,928	$ 118,247	$ 347,830
RES MMBTU Savings	285	285	285	855
COM MMBTU Savings	35	30	35	100
Total MMBTU Savings	320	315	320	955
Cost	$ 355	$ 368	$ 370	$ 364

BED has established working partnerships with regional weatherization contractors and a select number of fuel dealers for the purpose of providing services to BED's TEPF customers. Through these relationships, BED's customers can access a number of statewide services and incentives though the following programs:

Home Performance with ENERGY STAR

The EEU's collaborate to deliver TEPF savings to residential customers through a network of Building Performance Institute (BPI) certified contractors installing comprehensive home energy thermal improvements. The unregulated fossil fuel residential market is relatively small in Burlington due to the high saturation of natural gas; over 85% of residential buildings use natural gas for space heating and domestic hot water.

Replacement of Commercial Heating Systems

BED customers are eligible for the same incentives as EVT customers for the installation of oil and propane boilers and furnaces in commercial buildings. BED and EVt share the same rebate form which helps to inform all contractors and distributors that this is a statewide offer. BED estimates that this is a very small market within Burlington as over 98% of commercial buildings are served by natural gas.

Commercial Building Performance

Technical assistance and incentives are provided to TEPF customer as a means to assist small businesses property owners with improving the insulation and comfort of their buildings.

Energy audits and improvements are performed by a participating Building Performance Institute (BPI) certified contractor.

TEPF conclusions

The limited unregulated fossil fuel market, as well as the housing characteristics of the unregulated fuels market, has presented challenges in attracting participants.

BED's current best estimate is that there are about 500 to 700 homes in the TEPF market. The market is made up of homes that are predominately located in the more affluent Burlington neighborhoods where the properties have been relatively well maintained and updated over the years. The City of Burlington's energy efficiency code (established in 1991) for new construction and renovation may also be a contributing factor to relatively higher levels of existing energy efficiency in buildings. The potential for energy efficiency savings in the condominium market is also limited (about 250 units heated mostly by LP-gas) but it too presents challenges as about 35% of the units are rentals. The rental property owner, who does not typically pay the energy bill, and will not benefit from the energy savings, is typically unmotivated to participate. For rentals, BED offers a 50% inventive for eligible weatherization improvements.

Condominium associations present other challenges in terms of bylaws and other restrictions regarding allowed building improvements. There are also common area issues that can require greater levels of communication outreach and project management.

TEPF Development & Support Services

For the next triennial period, BED estimates that TEPF decision support service spending will amount to approximately $32,000, as shown in the table below.

Years	2018	2019	2020	3 Yr. Total
Education & Training	$ 3,400	$ 3,500	$ 3,600	$ 10,500
Applied R&D	$ 750	$ 800	$ 800	$ 2,350
Planning and Reporting	$ 1,105	$ 1,100	$ 1,100	$ 3,305
Evaluation	$ 750	$ 800	$ 800	$ 2,350
Policy and Public Affairs	$ 1,000	$ 1,000	$ 1,000	$ 3,000
IT	$ 750	$ 800	$ 800	$ 2,350
General Administration	$ 2,600	$ 2,700	$ 2,800	$ 8,100
Total	**$ 10,355**	**$ 10,700**	**$ 10,900**	**$ 31,955**

DSS spending will support the following activities:

Education and Training

This work includes BED's efforts to build overall awareness of energy efficiency, weatherization, building performance issues and availability of efficiency services from BED, Vermont Gas Systems and the low-income weatherization program administrators. These activities are not tied to specific program goals. It includes presentations at public forums and workshops, and activities with Burlington's numerous educational institutions. Media responses and the development of monthly energy tips that submitted to various publications and blogs are also included. BED also shares program costs with EVT for the Home Performance with Energy Star Program.

Applied Research and Development

This activity supports research on "smart" thermostatic controls installed in buildings where there are multiple heating systems present. For example, a heat pump and some type of secondary fossil based heating system.

Planning and Reporting

This work includes BED's responsibility to provide the Board with detailed Annual Plans as described in the "Process and Administration of an Order of an Appointment" document. This work covers all required regulatory reports associated with BED's EEU activities. These reporting activities also help to keep the PUC, DPS, Burlington Electric

Commission and customers informed about how BED is meeting its established budgets and savings targets. Such reports include:

- DSM Annual Report- submitted each spring
- BED Monthly and Quarterly Reports
- Periodic Ad hoc reporting requests

Evaluation
This activity supports BED's TAG and TRM participation along with other general program evaluation activities such as conducting periodic savings verification studies.

Policy and Public Affairs
This activity supports BED's participation in broad energy efficiency public discussions and EEU related regulatory proceedings. The Thermal Energy Task Force and Building Energy Labeling working group are two examples of this type of work.

Information Technology (IT)
BED's IT activities mainly consist of continuing the support of, and improvement to, the DSM database system for the collection and processing of project data and program information that is critical to tracking, reporting and EEU planning functions. There is a fairly regular need to alter existing tools or add new tools and functionality to the system which helps us to better understand and respond to changes in the Burlington marketplace.

General Administration
This category covers BED's costs for the overall management of TEPF programs including: general staff meetings, coordination of program implementation across all program functions, coordination with other EEU's and managing and monitoring of overall performance and spending.

District Energy

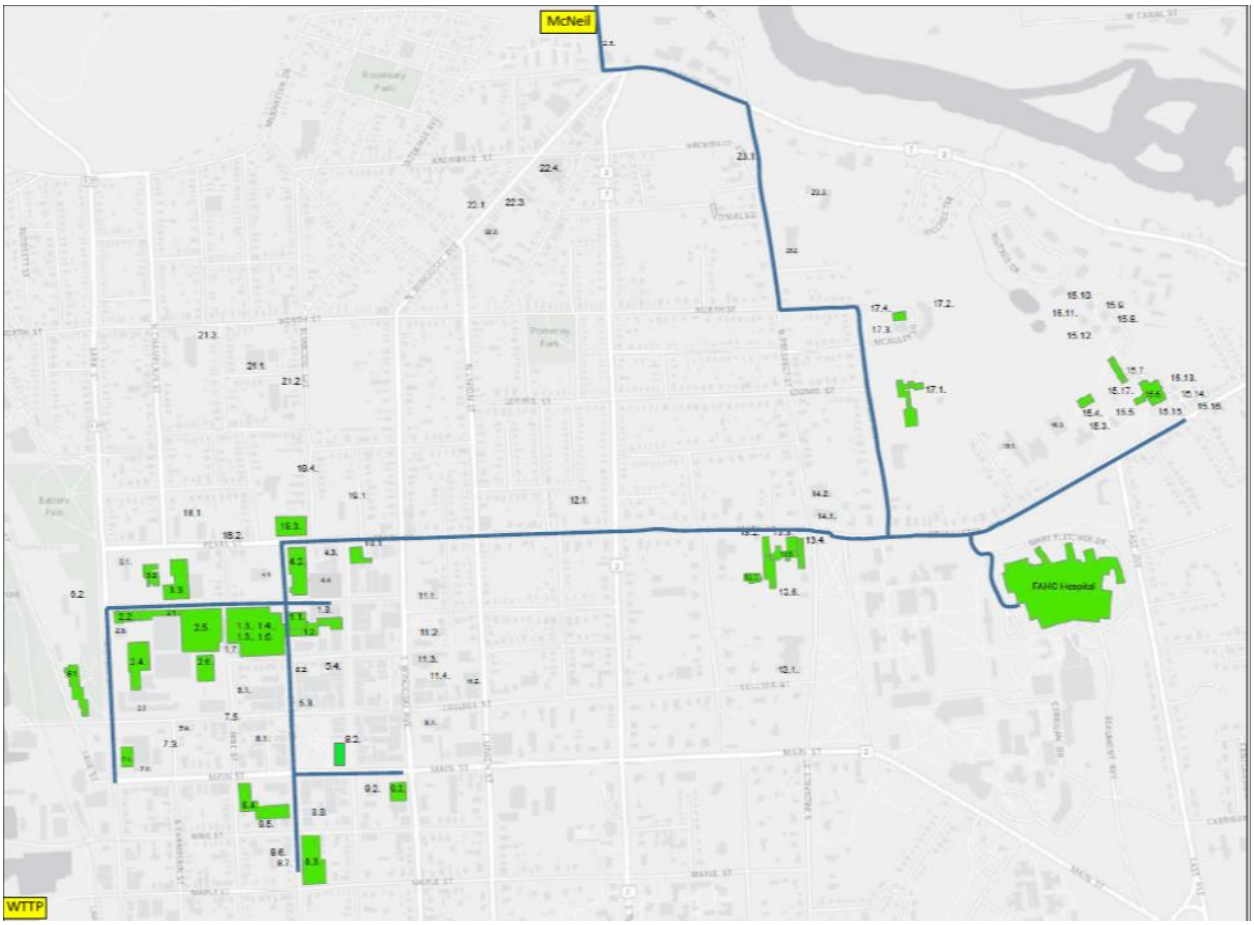
BED has been actively working with community leaders, businesses, residents and an internationally recognized district energy firm to construct a District Energy System (DES) in the City. Indeed, on September 28, 2016, The City of Burlington and Burlington Electric Department announced a partnership with key potential DES customers to renew efforts to bring district energy to Burlington. Potential partners have been willing to provide funding toward evaluating district energy feasibility.

The City selected Corix Utilities through an RFP to conduct a three-stage process. First, Corix would study whether a district energy system was economically feasible in Burlington and examine the costs and benefits of several potential heat sources, routes and service corridors (see attached Powerpoint entitled District Heating System Feasibility Results June 21, 2017). Next, Corix would look at whether the cost of a district energy system could be competitive with overall customer business-as-usual costs for heating services, including maintenance and operating expenses. This stage has been accomplished and district energy comparisons to business-as-usual operations have been presented to key customers. Finally, Corix would work to provide potential customers with individual service rates intended to be competitive with their individual customer comprehensive business as usual costs for heating and solicit their execution of a LOI to participate in the DES if certain cost criteria are met.

Currently the City and Corix are in stage three of this process, having determined that a McNeil plant-based DES has the potential to be economically feasible, and could be competitive with overall customer BAU costs for heating while reducing fossil fuel emissions. However, given the different positions of the potential customers with regard to their existing heating infrastructure (i.e. age of equipment, heating capacity requirements and construction), and the currently very low price of natural gas heating, each customer's decision cannot be considered a foregone conclusion when compared to their business as usual option. Accordingly, some improvement in the customer's economics would be of assistance to the adoption of district energy in Burlington.

The scenario agreed upon for further review by stakeholders would provide baseload heat from McNeil through an economizer and steam extraction. The scenario is based on operation assumptions consistent with how the McNeil plant is currently operating per its 2017 budget. Initially, peaking and back-up heating would be provided by natural gas boilers located at McNeil, with some larger customers retaining on-site back-up systems for reliability purposes that may or may not be incorporated into the system. The expected energy mix would be approximately 67 percent renewable heat produced by McNeil, with the remainder provided by the natural gas heat produced by the gas boilers. In the future, additional renewable heating sources could be integrated

into the system, assuming it is economic to do so. The DES route would run from McNeil up to the UVM Medical Center, with service extending to properties in the downtown core and potentially other parts of the University of Vermont campus.



The DES system would have an initial installed thermal capacity of 129.7 MMBtu/hr. Construction is being proposed to commence in 2018 and 2019, with initial service in 2019. Annually, the waste heat recovery system would enable McNeil to provide 97,316 MMBTU of energy for other uses, with an additional 145,842 MMBTU being available from steam extraction. The approximate capital costs for the total DES project would be $39.2 million, of which $3.17 million (8.1%) would be for the equipment to allow the extraction for use of both waste and process heat from McNeil.

Initial discussions with the McNeil equipment manufacturer has indicated that this level of steam extraction may be possible without reducing the net electrical output of McNeil as a generator (though with an obvious need for some additional fuel for the energy removed through steam extraction). A more detailed operational impact assessment for McNeil is being developed.

Based on the modeling performed by Corix to date, the benefits of the entire DES project include over 500,000 tons of greenhouse gas emissions reduction over 30 years, providing a reduction in the Burlington heating sector emissions of approximately 13-15 percent. BED staff has reviewed the assumptions used in the model to check on their reasonableness from a financial, engineering and markets perspective. If the TEPF funds are used for the heat extraction equipment at McNeil, it would seem reasonable that not less than 8.1%, and perhaps more, would be directly attributable to the use of the TEPF funds. If the DES expands over time, that emissions benefit could grow larger. The average levelized charge for customers of the DES is projected at $23 per MMBtu which should be generally competitive with current prospective customers total comprehensive heating service costs, although those costs vary for each customer.

However, the customer economics are close compared to continuing to heat with natural gas and individual systems. Education is an important component as it is important to note that the comprehensive heating service costs for customers under district energy (the $23 per MMBTU cited above) include not only natural gas service costs, but heating and plant equipment maintenance costs and capital investment costs over a multi-decade timeframe. Therefore, customers may be paying more in some cases for DES service (or at least paying different portions between utilities and capital costs), depending in part on their rate class, than they are for natural gas service costs excluding maintenance and capital. Regardless, there is strong interest from a variety of key potential customers in moving forward. For example, the City of Burlington draft development agreement with Burlington Center Place (BCP), a project to add new housing and commercial space downtown which represents approximately 10 percent of initial DES system load, includes a section that requires BCP to connect to the DES if certain system requirements are met (these requirements do have a cost component).

Given the significant potential for the DES to support several Vermont and Burlington policy goals in regards to renewable energy, thermal energy efficiency, and greenhouse gas emissions reduction, BED seeks to support the proposed DES in several ways including through the use of TEPF funds.

Due to overlapping service territories with VGS, BED has historically been barred from providing TEPF incentives to jointly served customers who are seeking space heating solutions. BED recognizes it cannot use TEPF funds to support fuel switching conversion investments for customers from natural gas to the DES without a statutory change. BED can and may choose to use Tier III incentive funds under the Vermont Renewable Energy Standard for that purpose. Nevertheless, BED believes that a careful reading of the current statute does allow for TEPF funds to be used to support a District Energy System in Burlington (the DES proposal), provided the funds are not used for fuel switching

conversion of regulated fuel customers. Under current statute, the proposed DES system in Burlington would be considered an unregulated fuel service under 30 V.S.A. §209(e)(3)(C), serving "thermal energy and process fuel customers other than electricity and natural gas delivered by a regulated utility." As currently envisioned, the proposed DES would serve customers through the City of Burlington via a concession agreement with Corix. Service would not be via a regulated electric or natural gas utility.

Therefore, BED contends that under current statute, it could appropriately invest TEPF funds to improve McNeil's process efficiency by installing steam extraction and waste heat recovery as part of the DES system. As mentioned previously, adding those components to McNeil is an estimated $3.17 million capital investment, which TEPF funds could support in part. The DES system would be an unregulated fuel service eligible for thermal energy and process fuel efficiency funding under 30 V.S.A. §209(e). In fact, 30 V.S.A. §209(e)(1)(A) finds that FCM revenues should give priority to "installation of high efficiency biomass heating systems and shall have a goal of offering an incentive that is equal to 25 percent of the installed cost of such a system." The proposed DES, using an estimated 67 percent biomass energy, would help meet this objective. Further, 30 V.S.A. §209(g)(1) calls for using TEPF funds in a manner that helps meet Vermont's thermal energy and greenhouse gas emission goals contained in 10 V.S.A. §581, which in turn specifically calls for reducing "total fossil fuel consumption across all buildings." In Burlington the initial phase of the DES is projected to provide over 350,000 MMBTU annually, with about 67 percent coming from biomass energy, thereby substantially reducing fossil fuel use in buildings in the City consistent with the goals in 10 V.S.A. §581.

As a co-benefit, adding the DES thermal load to McNeil will improve the efficiency of the plant. Of the anticipated heating demand produced for the DES, 27 percent of it is anticipated to be met through waste heat from McNeil that would be captured and utilized. That waste heat is currently lost due to the electric generation operations of the plant. To put this into perspective, the proposed 27 percent of the DES heating load represents about 97,316 MMBTUs annually; which is equivalent to the energy contained in approximately 700,000 gallons of heating oil. By capturing and utilizing this waste heat, McNeil and the unregulated DES can create even more value from the local sustainably harvested biomass supply, and diversify revenue for the plant which benefits ratepayers of the plant's joint owners – BED, Green Mountain Power, and Vermont Public Power Supply Authority as well as the Vermont forestry industry. Therefore, BED proposes making TEPF funds under available to support the DES in the manner described.

As outlined above, BED recognizes that the current statutory framework prevents BED from offering fuel switching incentives to natural gas customers using TEPF funds. That is why BED also intends to seek modifications to existing statute governing the use of

TEPF funds (particularly 30 VSA §209(e)(1)) in order to increase its flexibility to cost effectively use TEPF funds that would further support the DES in other segments of the project as well.

This project is inherently different from the other requests contained in this filing. The combination of the project's magnitude in terms of both dollars, and entities involved, makes an explicit statement as of the date of this filing about the exact expenditure of TEPF funds, and the amount of the total potential MMBTU credit attributable to the use of such TEPF funds, difficult to make at this time. Additionally, the magnitude of the project makes access to the TEPF funds over multiple years more desirable. However, BED would note that the corresponding potential benefit in terms of advancing Vermont's climate goals is commensurately large. BED has endeavored to provide as much tangible information to support this request as it can. As the DES project progresses, BED will commit to keeping the DPS and PUC informed on a regular and as needed basis.

If the Commission finds that the current statutory framework prevents BED from using TEFP funds for McNeil heat extraction equipment that would support the DES, BED would respectfully request that the PUC reserve the FCM and RGGI funds available to BED at this time in order to provide the Legislature with an opportunity to update 30 V.S.A.§ 209 to allow for TEPF support of a DES regardless of current fuel service of potential DES customers. BED believes that the DES offers significant benefits that support State of Vermont energy goals in 30 V.S.A. § 209, as well as greenhouse gas emissions reduction goals in 10 V.S.A. § 578 and goals contained in the Vermont Comprehensive Energy Plan issued pursuant to 30 V.S.A. § 202b. Accordingly, if the current statutory framework prevents the use of the TEPF funds to support the DES, BED would propose a modest update to provide flexibility to utilize TEPF funds to support this important project.

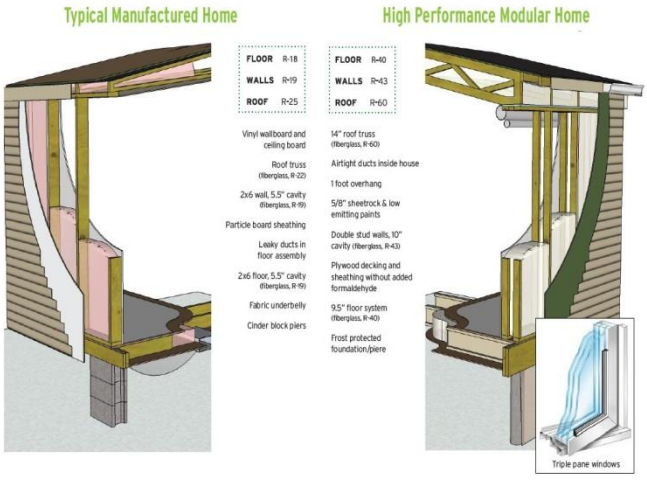
If the previous option is not acceptable, as an alternative, BED would ask that the budget requested here not be reduced, and that BED be allowed to redirect the funds into an expanded VERMOD program.

VERMOD – a Pilot program

The objective of this pilot program is to provide financial and technical support to income qualifying customers seeking to purchase hyper-efficient modular homes.[10] The program will focus primarily on the residents of the North Avenue Cooperative (NAC) but will also be open to other residents so long as the new modular home complies with the city's zoning ordinances. Also, qualified homes shall be limited to the VERMOD due to their efficiency relative to HUD compliant manufactured homes – although other modular homes may be considered in the future so long as the efficiency and quality of such homes is equal to or better than the VERMOD home.

Technology Description

The VERMOD is a relatively new housing product that is affordable to own and much more energy efficient compared to HUD[11] compliant manufactured homes. They are also more durable and can be financed over 30 years. VERMODs are constructed under factory – controlled conditions in Wilder, Vermont. Each home is reported to contain insulation levels in the walls (R-43), floor systems (R-40) and roof trusses (R-60) well in excess of code – compliant manufactured homes.[12] VERMODs are built with a great attention to air sealing in order to minimize cold drafts and thermal bridges.



Accordingly, the homes are perfect locations for cold climate heat pumps as their primary source of space heating and cooling. More importantly, the homes are designed to reduce energy consumption by as much as 75 percent (or more) relative to HUD compliant homes and can even become net zero energy with the installation of a 7 kW PV array. And, because VERMODs are electrically heated, home owners are mostly shielded from fossil fuel price inflation and volatility.

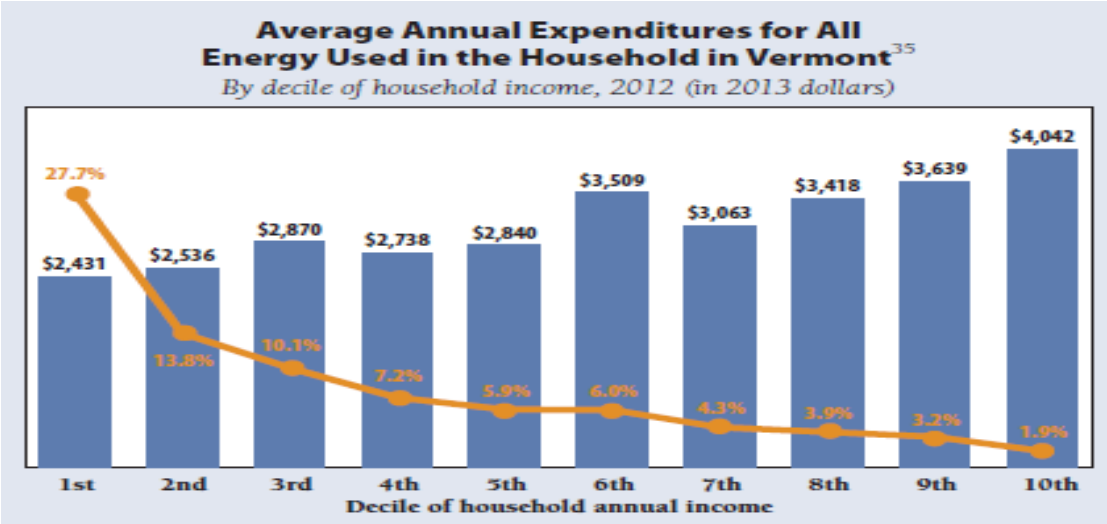
[10] For the purpose of this filing, income qualifying customers refers to individuals earning 80% or less of the median income in a specific region. For Burlington, a household of four earning less than $65,000 annually would qualify as "low income" or in BED's vernacular, income qualifying customers.

[11] HUD stands for the Federal Housing & Urban Development department.

[12] See VERMOD product specification sheets.

Program Purpose

In Burlington, there could be as many as 660 families with young children (under age 18) who live at or below the federal poverty line.[13, 14] For these families, the cost of energy, even at today's historically low prices, represents a significant financial burden relative to other households. Indeed, nearly 10 percent of families throughout the State spend nearly one-third of their income on energy expenses as shown in the graph below.[15]



Families that spend more than 10 percent of their income on energy-related expenses are typically considered "fuel poor". As the graph above indicates, 30 percent of Vermont's population - approximately 125,000 residents – experiences some type of fuel poverty. They face challenges staying warm during extended cold weather snaps because their home lacks appropriate levels of insulation. They endure heat exposure for longer time periods when it is hot and humid due to inefficient and costly air conditioning. They are likely to suffer from chronic health problems and, consequently, lose wages. Similarly, school age children living in fuel poor households experience higher truancy rates. "Fuel poor" residents also have trouble paying their electric bills in a timely manner and tend to drive up collection costs for distribution utilities. These costs are then socialized amongst all residential customers resulting in higher retail rates than would otherwise be the case.

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[13] Typically, individuals earning 80% or less of the median income in a specific region are characterized as living in poverty. For Burlington, a household of four earning less than $65,000 annually would qualify as "low income".

[14] See; Center for Rural Studies, accessed on 6/12/17.

[15] Allen, Riley, *Thermal Efficiency for Low-Income Households in Vermont – Economic Performance, Energy Justice and the Public Interest*, Regulatory Assistance Project, March, 2015.

While fuel poverty in Vermont is well documented, progress toward improving energy affordability has lagged.[16]

The primary purpose of BED's VERMOD program will be to help alleviate fuel poverty, increase energy affordability among income qualifying residents and address issues related to energy injustice.[17] In particular, BED intends to target the North Avenue Cooperative where a high proportion of residents are considered to be "fuel poor". If successful, the program is expected to result in a societal benefit cost ratio – on average - of 1.19; meaning that every dollar invested in the VERMOD results in societal benefits of $1.19. Other benefits may include:

- Fewer illnesses ;
- Improved productivity;
- Increased fuel security;
- Lower collection costs and fewer service interruptions; and,
- Reduced GHG emission

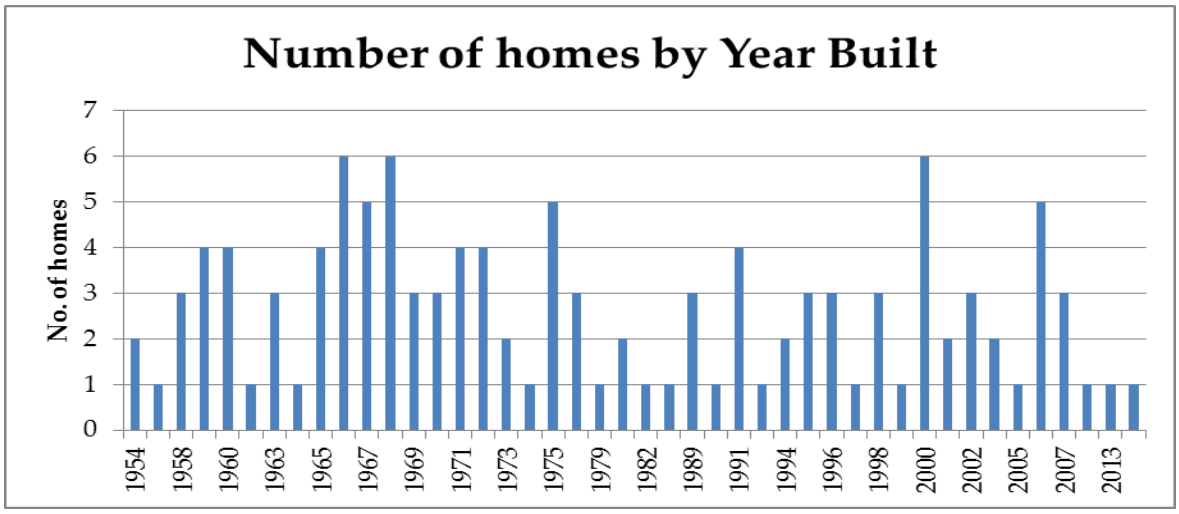
Program Design

As noted, the VERMOD is a relatively new housing product. Approximately 70 VERMODs have been sold throughout Vermont as of May, 2017; many of which were built and installed in the aftermath of Hurricane Irene.[18] However, none have been sold in Burlington – although a "cottage-style" home (shown here) has been available at the North Ave. Cooperative (NAC) for viewing by prospective buyers and a number of open houses have been offered.

Because of the product's relative newness, BED's program design is a work-in-progress. There is much that is unknown about the VERMOD's performance or its realistically achievable market potential in Burlington. Energy modelling suggests, however, that the VERMOD requires substantially less energy to maintain normal comfort levels compared to a HUD compliant manufactured home

[16] Allen, R at 14.
[17] See; Dworkin, M. & Sovacool, B.; *Global Energy Justice,* Vermont Law School, 2014.
[18] Per Steven Davis, owner of VERMOD, contacted by phone 6/28/2017.

and is, therefore, more affordable to own.[19] Evidence also suggest that the VERMOD is more durable. An indication that the VERMOD is indeed preceived to be a superior and more durable housing product is the fact that some Vermont banks[20] offer 30 year mortgage terms on the VERMOD but only 20 year loan terms for a manufactured home. Based on site visits and property assessment data, BED is also aware that a number of existing NAC homes are well beyond their useful lives. Currently, there are 116 manufactured home lots in the Cooperative neighborhood; two lots are currently vacant, 22 units are designated as rentals, and 92 are owner occupied.[21] The age of the NAC homes ranges from 2 years to over 60 years. As shown in the graph below, 86 homes are over 20 years old. [22]



As current residents consider their future options to either move to a new location and sell their land lot or upgrade their homes, BED believes that there is significant market potential for the VERMOD based on its efficiency, durability and potential to reduce overall housing cost relative to a HUD compliant manufactured home. But, transforming this market will take time, persistence, objective customer education and outreach, technical support and, most importantly, capital.

To learn more about how BED can transform this market, avoid significant lost market opportunities and address energy affordability issues head – on, BED intends to

[19] BED understands that home performance monitoring equipment has been installed be VEIC in some VERMOD's for the purpose of evaluating energy consumption.

[20] Vermont State Employee Credit Union.

[21] Per email of 5/31/17 from Todd Rawlings & J. Ward - CEDO, City of Burlington.

[22] See: Burlington City Socrata Datasets

keep the VERMOD pilot program design as simple and straight-forward as possible. BED is proposing to commence program implementation on January 1, 2018, subject to budgetary constraints and annual reviews of program results to ensure program assumptions are in line with current expectations. The program design includes a maximum $40,000 per unit incentive to buydown the cost of a VERMOD – although BED is also considering a sliding scale incentive based on income. The buydown shall be issued directly to the manufacturer upon the submission of closing documents to BED indicating that a VERMOD has been purchased by an income qualified resident of the North Ave. Cooperative and installed on the site. The number of units for which BED intends to offer finanical incentives will be capped per year in accordance with the budget table provided below; although, BED also proposes to retain the option to lift the annual cap so long as the total three year TEPF budget does not exceed the above noted budget caps. In addition, BED is considering whether to require home buyers to contractually agree to maintain residence in the VERMOD for no less than 24 months. Such a condition would help to ensure that potential buyers do not quickly resell the unit for profit.

Assuming that the housing site is suitable and alternative funding sources are available, the program design shall also include an option to install a PV array on the roof of the VERMOD. PV incentives from a third party may be provided for 7W systems or smaller.[23] Elements of the program design shall also include close collaboration with the North Avenue Cooperative Association, Burlington's Community and Economics Development Office (CEDO), CVOEO, VERMOD and VEIC.

VERMOD Specific TEPF Program Budget

BED anticipates that as VERMOD units are installed overtime, more residents will want to upgrade their homes when opportunities arise. In some cases, opportunities may occur when existing homes reach the end of their useful lives and the current resident transfers the land lot to a new resident who wants a better home; other opportunities will occur when existing homes are abandoned and the land lot is taken over by the NAC. Both of these examples are prime market opportunities to encourage adoption of the VERMOD and they should not be missed. But in order to make the VERMOD cost competitive relative to alternative homes, as well as to improve the "bank-ability" of income qualified NAC homebuyers, a substantial incentive will be necessary. Accordingly, BED is seeking to increase its TEPF R&D budget to $0.276 million over the next three years. With a $40,000 per unit incentive, BED anticipates that the program

[23] BED understands that VEIC has applied for a grant to fund a PV incentive program for income qualified Vermont residents. Such funds, if approved, would also be available to the residents of NAC.

should result in 6 installations and reduce consumption of fossil fuels by as much as 526 MMBTUs.

Plan year	Goal # of homes	Per unit incentives	Per unit Overhead cost	Total Budget	Total MMBTU Savings
2018	2	$ 40,000	$ 6,000	$ 92,000	175
2019	2	$ 40,000	$ 6,000	$ 92,000	175
2020	2	$ 40,000	$ 6,000	$ 92,000	175
3 Yr cumulative	**6**			**$ 276,000**	**526**

Key assumptions

- Base cost of the VERMOD unit does not exceed $116,400, approximately $60,400 more than a HUD compliant manufactured home;
- Champlain housing trust interest deferral of no less than $35,000;
- BED incentive of $40,000 per home; and, additional overhead costs do not exceed $6,000;
- Energy (MMBTUs) savings of 75 percent or more;
- PV incentive program is fully funded over the three-year planning period;
- PV installation costs do not exceed $2.50 per watt;
- PV incentives to income qualified residents are no less than $1.00 per watt;
- 1100 kWh/kW solar production;
- Energy loads do not exceed 23 MMBTUs annually;
- VERMOD achieves Net Zero Energy with PV installation;
- 2.2 percent annual fossil fuel inflation, 0.5 percent electric price inflation[24];
- 30 year term, 3.75% financing for VERMOD, compared to 20 years for HUD compliant manufactured home.
- 3.0 percent discount rate

Customer Economics

Because the VERMOD cost $60,400 more than a traditional manufactured home, a substantial incentive is necessary to achieve cost competitiveness and to bring down the cost of housing and energy. Accordingly, BED proposes to provide income qualified buyers with a maximum incentive of $40,000 per unit on a temporary basis, as noted. Meanwhile, the Champlain Housing Trust (CHT) will be providing a $35,000 "silent

[24] See: EIA Data

second" mortgage. CHT loans are offered at 0.00% interest, and all payments are deferred until the property is sold, transferred, or refinanced. The loans are also assumable, which allows the next home buyer to take advantage of this loan if they meet the program qualifications.[25] Combined, these incentives will make the homes more affordable than a HUD complaint home.

As the table below highlights, the monthly cost (principal, interest, taxes, insurance & NAC fees) of a VERMOD is slightly more than a HUD compliant manufactured home ($62/month to $111/month). Increased costs are due to higher capital costs and real estate taxes.[26] Once energy costs are factored into a resident's total housing expense, VERMOD home owners who elect not to install a PV could achieve annual savings of approximately $1,000. If solar is installed, the units could essentially result in zero net energy bills at the end of 12 months, which would greatly improve housing affordability as well as stabilize a resident's energy bills over the longer term. With a 7 kW array installed, VERMOD homeowners could save as much as $1,632 annually relative to a HUD compliant manufactured home. It is important to note that solar incentives are contingent on the availability of grant funds from VLITE.[27] However, even if solar incentives are not available, the total cost (PITI and energy costs) of home ownership without a PV array is still less than a HUD compliant manufactured home.[28] Such savings may even be higher as the analysis below excludes maintenance costs, which are reportedly much lower for the VERMOD compared to code compliant manufactured homes over their lifetimes.

If the VERMOD is unable to attain cost parity with existing new housing alternatives, it is highly likely that residents will continue to purchase less efficient homes, some of which can be found on Craigslist.

[25] For more information, see Champlain Housing Trust.

[26] VERMOD cost data has been provided by Efficiency Vermont. Based on discussions with the City Assessor in September, 2017, BED anticipates that real estate taxes could increase $50 to $100 per month relative to existing NAC homes based on current expected VERMOD valuations. Concerning home owners insurance, based on a phone call with Steven Davis (VERMOD owner), insurance costs go down relative to current code compliant manufactured homes due to the improved safety and durability of VERMODs.

[27] BED understands that a decision by VLITE on whether to extend the PV program another 12 months is expected in late December, 2017.

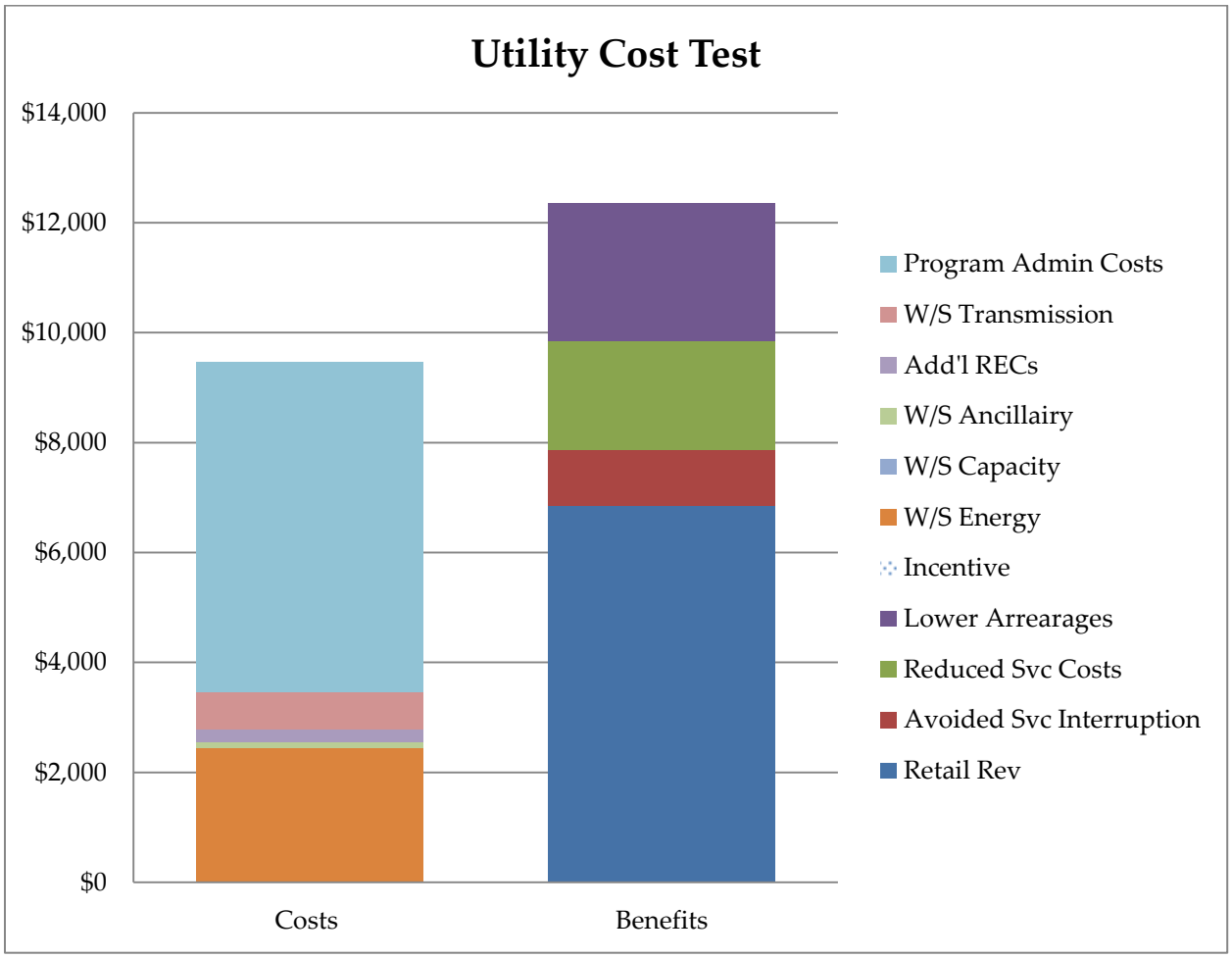
[28] Energy savings are based on recent blended fuel prices as reported by the Department in October/Sept 2017.

Customer Economics

	Code compliant Manuf. Home	VERMOD w/oPV	VERMOD w 4 kW PV	VERMOD w/7 kWPV
Base Cost	$ 56,000	$ 116,400	$ 116,400	$ 116,400
Vt Sales Tax	$ 3,360	$ 4,190	$ 4,190	$ 4,190
Site work	$ 9,500	$ 9,500	$ 9,500	$ 9,500
Delivery/Crane set up	$ 2,000	$ 7,000	$ 7,000	$ 7,000
PV Cost	$ -	$ -	$ 10,000	$ 17,500
Total Cost	**$ 70,860**	**$ 137,090**	**$ 147,090**	**$ 154,590**
Solar Incentive	$ -	$ -	$ (4,000)	$ (7,000)
BED Incentive	**$ -**	**$ (40,000)**	**$ (40,000)**	**$ (40,000)**
CHT Interest deferral	$ (27,500)	$ (35,000)	$ (35,000)	$ (35,000)
Final Cost	**$ 43,360**	**$ 62,090**	**$ 68,090**	**$ 72,590**
Downpayment	$ 4,336	2500	2500	$ 2,500
Interest Rate	6.50%	3.75%	3.75%	3.75%
Term (yrs)	20	30	30	$ 30
Monthly Mortgage Payment	**$291**	**$276**	**$304**	**$325**
No.A Coop fee	**385**	**385**	**385**	**385**
Real Estate Tax	123	200	200	200
Insurance	30	30	30	30
Total PITI	**$ 829**	**$ 891**	**$ 919**	**$ 940**
Incremental costs		**$ 62**	**$ 90**	**$ 111**
Energy Cost				
Total MMBTU Loads	94.50	23.41	23.41	23.41
PV MMBTU Offset	0	0	15	26
Net Energy Loads	94.50	23.41	8.40	-2.86
Avg. Mo. Energy Bills	$ 247	$ 100	$ 48	$ -
Mo. PITI and Avg. Energy cost	**$ 1,075**	**$ 991**	**$ 966**	**$ 940**
Incremental Savings		**$ (84)**	**$ (109)**	**$ (136)**

Utility cost test

To evaluate whether the program would result in positive net utility benefits, an analysis of the present value (2017$) of the benefits and costs that BED may incur was conducted using BED's cost effectiveness tool. This analysis determined that the net utility benefit would approximate between $2,800 and $8,800 per VERMOD, depending on how program administrative expenses are treated.[29]



Estimated benefits include:

- Additional retail revenue - $6,853
- Avoided Service interruptions - $1000

[29] To determine cost effectiveness, the analysis took a simple average of the benefit and costs streams that are expected to flow from three types of VERMODs ; a VERMOD with no PV, VERMOD with a 4 kW PV system, and a VERMOD with a 7 kW PV system installed. If PV is not installed, utility benefits would be greater still as retail revenues would increase well in excess of costs.

- Reduced Customer Svc costs - $2,000
- Lower Arrearages - $2,500

Estimated costs include:

- Program administrative costs - $6,000
- Wholesale energy costs - $2,431
- Wholesale transmission costs - $684
- Wholesale ancillary costs - $123
- Additional REC costs - $224

It is important to note that the $40,000 incentive was not included in the utility cost test analysis. Normally, it is. There are at least two reasons for excluding incentives from this analysis. First, incentives that will be offered to reduce the cost of the VERMOD will not be generated from BED's operating budget. Rather, the funds are derived from revenues – as noted above - from the FCM and RGGI markets, which are, in turn, originally generated from the electric energy efficiency surcharge on all customers' electric bills. Thus, the incentive could be considered a transfer payment of EEC funds to income qualified VERMOD homeowners. The second reason for omitting incentives from the analysis is that BED would be forfeiting these funds to the State's EEU program but for the implementation of the VERMOD program in Burlington. Admittedly, this approach is unconventional.

Societal cost test

To test whether the program would result in positive net societal benefits, an analysis was conducted of the monetary benefits and costs associated with the VERMOD program using the State approved cost effectiveness tool.[30] The State tool includes three important externality adders. The first represents the cost of carbon associated with fossil fuel consumption. In this analysis, the cost of carbon is set at $95/ton and is added to the avoided MMBTU cost of fuel. The second adder reflects the non-energy benefits that are associated with reductions in fossil fuel consumption and higher efficiency. Non energy benefits include water savings, and lower operating and maintenance costs that are associated with efficient products. This adder is equal to 15% of the present value cost of avoided fossil fuel consumption. The third adder is assigned to income qualified programs. This 15% adder generally reflects a set of extra costs that would theoretically be

[30] The state approve cost effectiveness tool is the same tool used to screen energy efficiency measures. But this cost effectiveness tool is **not** the same tool that BED uses for the purposes of assessing the utility cost test or Tier 3 programs.

avoided as well. These extra avoided costs are associated with higher levels of service interruptions, customer service calls, account arrearages and bad debt write downs that have been historically attributed to so-called lower income customers. Such cost could amount to as much as $7,300 per VERMOD.[31] The cumulative effect of the above noted adders is to increase aggregate net benefits as BED and/or society would avoid incurring a set of direct costs (i.e. energy costs) and so-called externality costs (i.e. carbon and bad debt) that cannot be directly tied to fossil fuel consumption.

Benefits

The present value societal benefits (2017$) of the program include the avoided cost of fossil fuel consumption over the expected 30 year life of the VERMOD. In the NAC, the primary heating fuels are propane and kerosene. Because the VERMOD is hyper – efficient, prospective home owners would be able to cost effectively heat (and cool) their home and water electrically with an advanced cold climate heat pump (ccHP) and water heater. Consequently, a VERMOD owner would avoid 100 percent of the fossil fuel that is typically consumed by a HUD complaint manufactured home owner. This means that 88 MMBTU's of fossil fuels would not be consumed annually.[32] This reduction translates into 950 gallons of propane and 6 tons of GHG emissions per year.

On average, the present value benefits amount to $57,669 per VERMOD installed. These benefits are inclusive of the avoided externality costs noted above.

Costs

The present value societal costs of the VERMOD program include the incremental cost of a VERMOD and additional electric energy costs.

The present value incremental cost of a VERMOD is $48,527. This cost represents the present value difference between a HUD compliant, new manufactured home and a VERMOD, as noted above. Additional electrical energy costs are associated with the cost of wholesale energy, capacity, transmission, replacement RECs and ancillary services. Since the VERMOD is an all-electric home, electrical consumption increases from 7 MMBTUs annually, which is the amount of electrical power consumed by a HUD compliant home, to 23 MMBTUs, which is the entire energy consumption of a VERMOD, including electric heat and hot water. The increase of 16 MMBTUs means that at VERMOD home owner will consume about 4,851 kWH more per year than an owner of a

[31] $48,527 * 0.15 = $7,279.

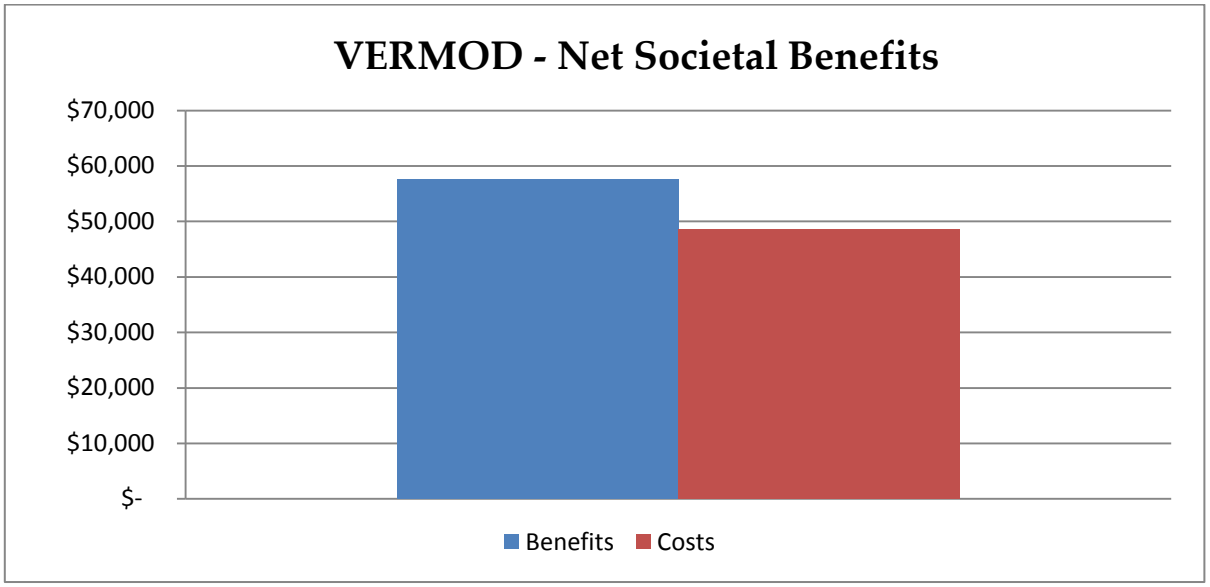
[32] Reductions in fossil fuels are estimates based on energy models that compare the consumption of a VERMOD to that of a HUD compliant manufactured home as reported in 2016 IECC book. See excel spreadsheet labelled "VERMOD" for additional documentation.

typical HUD compliant home. This increased load will result in additional wholesale electrical energy costs for BED.

On average, present value societal costs amount to $48,527 per VERMOD.

Net Societal Benefits

As shown in the graph below, the present value of societal benefits exceeds the present value of societal costs by $9,142 per VERMOD, on average. The Benefit Cost ratio is 1.19.



It is important to note that if solar incentives are unavailable, and none of the prospective residents installed a solar array, the program would likely result in a societal benefit cost ratio of 0.90 under current fuel prices, as 77 percent of the existing NAC homes currently heat with propane – which appears to be cost ineffective based on current screening inputs.[33] It is also worth noting, however, that ***in the state's screening tool, avoided propane cost appear to be exceptionally low compared to current prices***.[34] When the state's screening tool is updated in 2018 to reflect higher avoided propane costs – which BED anticipates will occur - then the benefit cost ratio would likely be greater than 1.0 without PV incentives for all customers regardless of their existing fuel type.

Nevertheless, if an equal number of VERMODs with and without PV are installed, and those homes displaced a proportional number of kerosene and propane fueled homes,

[33] .90 = (.85BCR*.77propane) + (1.09BCR*.23kerosene).

[34] See Appendix A.

the overall benefit cost ratio of the program would equal between 1.12 and 1.19, as shown in the table below.

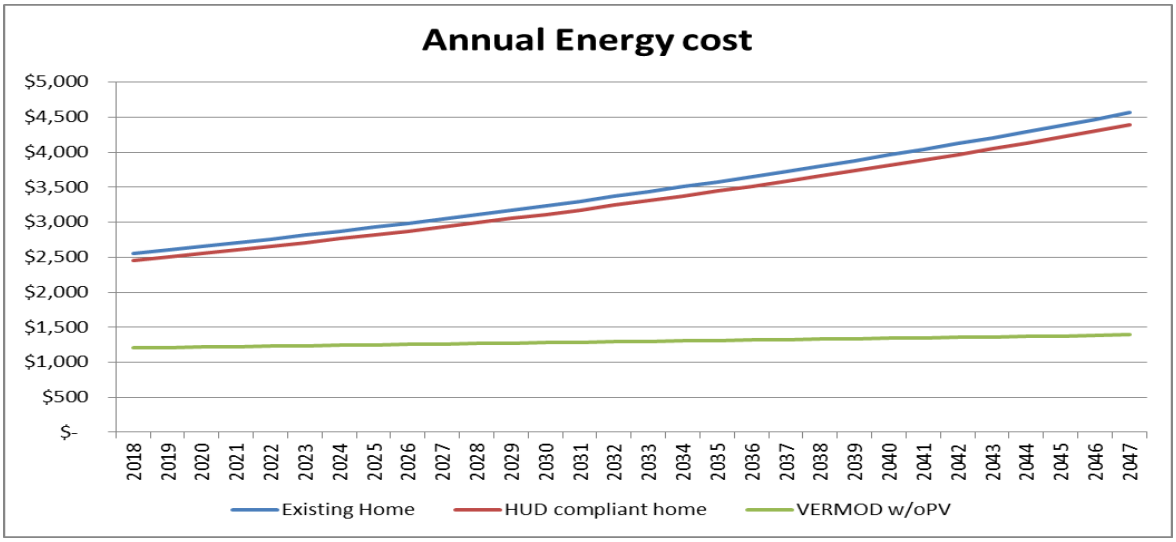
Avoided Fossil Fuel	PV of Measure Benefits	PV of Measure Costs	Benefit-Cost Ratio	PV of Net Benefits	Measure Name
Kerosene	$ 52,986	$ 48,527	1.09	$ 4,458	VERMOD - no PV
Propane	$ 41,187	$ 48,527	0.85	$ (7,340)	VERMOD - no PV
Kerosene	$ 68,086	$ 48,527	1.40	$ 19,559	VERMOD - 4 kW
Propane	$ 56,288	$ 48,527	1.16	$ 7,760	VERMOD - 4kW
Kerosene	$ 69,634	$ 48,527	1.43	$ 21,107	VERMOD - 7kW
Propane	$ 57,836	$ 48,527	1.19	$ 9,308	VERMOD - 7kW
Average	**$ 57,669**	**$ 48,527**	**1.19**	**$ 9,142**	

Marketing & Outreach

BED's marketing campaign will focus primarily on providing prospective buyers with objective information about the various benefits of owning a VERMOD. Such benefits include but are not limited to:

- Increased comfort, health and safety;
- Opportunity to build home equity;
- Reduced home maintenance costs; and,
- Lower energy bills.

However, the main point of providing this type of information is to demonstrate how VERMOD owners could save money in the long run and shield themselves from fossil fuel price inflation and volatility, as shown in the graph below. Additionally, information may be presented that compares the electric consumption and bills of current NAC residents compared to the estimated electric consumption and bills of a VERMOD (see appendix c).



Stakeholders in this project will also include:

- North Avenue Cooperative Association
- VERMOD manufacturing
- Champlain Housing Trust (including its homeowner assistance education center)
- VEIC

BED expects to work closely with the above stakeholders to maximize our collective outreach efforts to fully inform NAC residents of their options to buy a VERMOD. An important aspect of BED's outreach will be to incorporate CHT's consumer education programs. These programs help ensure that prospective buyers are well informed about their mortgage option.[35]

Implementation/Action plan

If the budget is approved, BED will further develop an action plan to begin implementing this program. At a minimum, any such plan would initially include a stakeholder meeting to determine next steps that would further BED's objectives to transform this market and provide meaningful assistance to current and prospective NAC residents. BED also intends to work with the Department to develop an effective implementation strategy.

[35] CHT is considered a national leader in home ownership education. A link to their educational programs can be found here: http://www.getahome.org/education.

Appendices

Appendix A: 20 year Electric RA budgets and Savings Goals

BED EEU DRP Electric RA Budgets and Savings Recommendations for 2018-2037

	2018	2019	2020	3-yr Total	2021	2022	2023	2024	2025
Electric Resource Acquisition									
BED Delivery Budget (real $)	$ 2,395,982	$ 2,544,509	$ 2,544,509	**$ 7,485,000**	$ 2,544,509	$ 2,544,509	$ 2,544,509	$ 2,544,509	$ 2,544,509
BED Delivery Budget (nominal $)					$ 2,700,253	$ 2,754,258	$ 2,809,344	$ 2,865,530	$ 2,922,841
mWh Goal	6,414	6,565	6,383	**19,362**	6,001	5,979	5,935	5,828	5,719
Proposed Budgets									
Commercial	$ 1,796,987	$ 1,908,382	$ 1,908,382	**$ 5,613,750**	$ 1,908,382	$ 1,908,382	$ 1,908,382	$ 1,908,382	$ 1,908,382
Residential	$ 598,996	$ 636,127	$ 636,127	**$ 1,871,250**	$ 636,127	$ 636,127	$ 636,127	$ 636,127	$ 636,127
Total	$ 2,395,982	$ 2,544,509	$ 2,544,509	**$ 7,485,000**	$ 2,544,509	$ 2,544,509	$ 2,544,509	$ 2,544,509	$ 2,544,509
Proposed mWh Savings									
Commercial	4,811	4,924	4,787	**14,522**	4,501	4,484	4,451	4,371	4,289
Residential	1,604	1,641	1,596	**4,841**	1,500	1,495	1,484	1,457	1,430
Total	6,414	6,565	6,383	**19,362**	6,001	5,979	5,935	5,828	5,719
Yield Rate ($/mWh)									
Portfolio wide	$ 374	$ 388	$ 399	**$ 387**	$ 424	$ 426	$ 429	$ 437	$ 445
Commercial Yld Rate	$ 374	$ 388	$ 399						
Residential Yld Rate	$ 374	$ 388	$ 399						
Proposed Summer CP-MW Goal	0.734	0.778	0.759	**2.27**	0.720	0.725	0.729	0.724	0.705
Commercial	0.531	0.570	0.556		0.540	0.542	0.549	0.547	0.531
Residential	0.204	0.208	0.202		0.180	0.183	0.181	0.177	0.174
Proposed Winter CP-MW Goal	1.02	1.01	0.97	**3.00**	0.878	0.873	0.858	0.840	0.831
Commercial	0.703	0.730	0.717		0.705	0.701	0.690	0.676	0.670
Residential	0.318	0.284	0.249		0.173	0.172	0.168	0.164	0.160
Total Resource Benefits (TRB)									
Commercial	$ 5,241,585	$ 5,902,657	$ 6,113,240	**$ 17,257,483**	$ 6,279,269	$ 6,530,302	$ 6,654,634	$ 6,882,336	$ 6,958,374
Residential	$ 861,280	$ 894,923	$ 926,668	**$ 2,682,871**	$ 987,311	$ 1,027,504	$ 1,064,500	$ 1,098,496	$ 1,125,931
Total TRB	$ 6,102,865	$ 6,797,580	$ 7,039,908	**$ 19,940,354**	$ 7,266,580	$ 7,557,807	$ 7,719,134	$ 7,980,832	$ 8,084,305

Appendix A (Cont'd) Electric Resource Acquisition	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	Total
BED Delivery Budget (real $)	$ 2,544,509	$ 2,544,509	$ 2,544,509	$ 2,544,509	$ 2,544,509	$ 2,544,509	$ 2,544,509	$ 2,544,509	$ 2,544,509	$ 2,544,509	$ 2,544,509	$ 2,544,509	$ 50,741,653
BED Delivery Budget (nominal $)	$ 2,981,298	$ 3,040,924	$ 3,101,742	$ 3,163,777	$ 3,227,053	$ 3,291,594	$ 3,357,426	$ 3,424,574	$ 3,493,066	$ 3,562,927	$ 3,634,185	$ 3,706,869	
mWh Goal	5,832	5,706	5,798	5,680	5,842	5,660	5,448	5,398	5,334	5,220	4,926	4,815	114,483
Proposed Budgets													
Commercial	$ 1,908,382	$ 1,908,382	$ 1,908,382	$ 1,908,382	$ 1,908,382	$ 1,908,382	$ 1,908,382	$ 1,908,382	$ 1,908,382	$ 1,908,382	$ 1,908,382	$ 1,908,382	38,056,240
Residential	$ 636,127	$ 636,127	$ 636,127	$ 636,127	$ 636,127	$ 636,127	$ 636,127	$ 636,127	$ 636,127	$ 636,127	$ 636,127	$ 636,127	12,685,413
Total	$ 2,544,509	$ 2,544,509	$ 2,544,509	$ 2,544,509	$ 2,544,509	$ 2,544,509	$ 2,544,509	$ 2,544,509	$ 2,544,509	$ 2,544,509	$ 2,544,509	$ 2,544,509	50,741,653
Proposed mWh Savings													
Commercial	4,374	4,280	4,349	4,260	4,382	4,245	4,086	4,049	4,001	3,915	3,695	3,611	85,862
Residential	1,458	1,427	1,450	1,420	1,461	1,415	1,362	1,350	1,334	1,305	1,232	1,204	28,621
Total	5,832	5,706	5,798	5,680	5,842	5,660	5,448	5,398	5,334	5,220	4,926	4,815	114,483
Yield Rate ($/mWh)													
Portfolio wide	$ 436	$ 446	$ 439	$ 448	$ 436	$ 450	$ 467	$ 471	$ 477	$ 487	$ 517	$ 528	
Commercial Yld Rate													
Residential Yld Rate													
Proposed Summer CP-MW Goal	0.681	0.658	0.795	0.747	0.811	0.762	0.731	0.832	0.810	0.781	0.776	0.760	15
Commercial	0.507	0.488	0.626	0.583	0.651	0.606	0.576	0.681	0.658	0.634	0.632	0.619	10
Residential	0.174	0.169	0.169	0.165	0.160	0.156	0.155	0.151	0.152	0.146	0.144	0.141	3
Proposed Winter CP-MW Goal	0.863	0.855	0.854	0.849	0.850	0.841	0.803	0.726	0.716	0.700	0.639	0.615	17
Commercial	0.704	0.700	0.704	0.701	0.707	0.699	0.664	0.591	0.579	0.569	0.509	0.489	11
Residential	0.159	0.154	0.150	0.148	0.143	0.142	0.139	0.135	0.136	0.131	0.129	0.127	3
Total Resource Benefits (TRB)													
Commercial	$ 7,027,421	$ 7,085,802	$ 7,865,899	$ 7,670,350	$ 8,467,339	$ 8,333,364	$ 8,261,190	$ 10,916,064	$ 10,998,001	$ 11,103,702	$ 11,358,524	$ 11,545,521	161,195,578
Residential	$ 1,156,778	$ 1,178,374	$ 1,221,274	$ 1,244,764	$ 1,254,359	$ 1,293,669	$ 1,339,966	$ 1,351,033	$ 1,391,575	$ 1,410,955	$ 1,445,397	$ 1,474,824	23,749,582
Total TRB	$ 8,184,199	$ 8,264,175	$ 9,087,174	$ 8,915,115	$ 9,721,698	$ 9,627,033	$ 9,601,157	$ 12,267,097	$ 12,389,577	$ 12,514,657	$ 12,803,921	$ 13,020,346	184,945,160

Appendix B – 10 year TEPF Budget and Savings Goals

EEU 2016-03 BED EEU DRP Thermal Energy Process Fuels Program Budgets and Savings Recommendations for 2018-2027

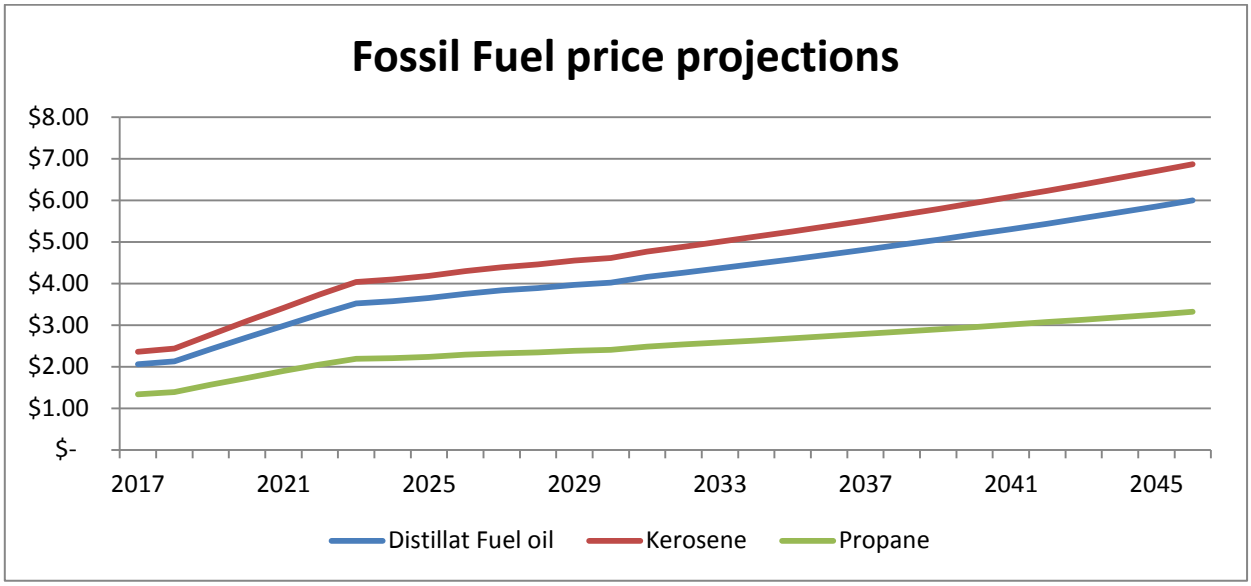
(no natural gas customers are included in these figures)

(the proposed VerMOD pilot project at the North Ave Cooperative mobile home park is not included in these figures)

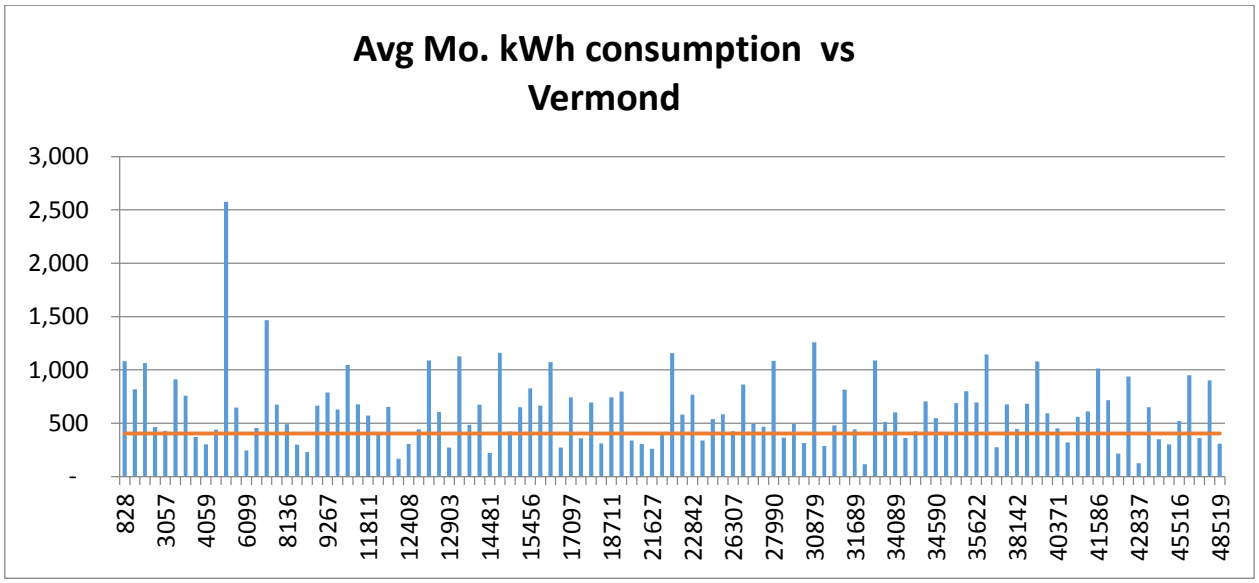
Years	**2018**	**2019**	**2020**	**3 Yr. Total**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
RA and DSS	$ 113,655	$ 115,928	$ 118,247	**$ 347,830**	$ 118,447	$ 118,647	$ 118,847	$ 119,047	$119,247	$119,447	$ 119,647
Total BED TEPF RA Impleme	$ 103,300	$ 105,228	$ 107,347	**$ 315,875**	$ 107,347	$ 107,347	$ 107,347	$ 107,347	$107,347	$107,347	$ 107,347
Residential (95%)	$ 98,135	$ 99,967	$ 101,980	**$ 300,081**	$ 101,980	$ 101,980	$ 101,980	$ 101,980	$101,980	$101,980	$ 101,980
Commercial (5%)	$ 5,165	$ 5,261	$ 5,367	**$ 15,794**	$ 5,367	$ 5,367	$ 5,367	$ 5,367	$ 5,367	$ 5,367	$ 5,367
			2%								
Residential Services											
Number of Projects											
Single-Family	15	15	15	**45**	15	15	15	15	15	15	15
Average MMBTU per Project											
Single-Family	19	19	19		19	19	19	19	19	19	19
MMBTU											
RES Total	285	285	285	**855**	285	285	285	285	285	285	285
Yield (MMBTU/$1000)											
Single-Family HPwES	3	3	3		3	3	3	3	3	3	3
Commercial Services											
Number of Projects											
Commercial Heating	1	0	1	2	0	1	0	1	0	1	0
Building Performance - Small Bu	0	1	0	1	1	0	1	0	1	0	1
Commercial Subtotal	1	1	1	3	1	1	1	1	1	1	1
Average MMBTU per Project											
Commercial Heating	35	35	35		35	35	35	35	35	35	35
Building Performance - Small Bu	30	30	30		30	30	30	30	30	30	30
MMBTU											
Commercial Heating	35	0	35	70	0	35	0	35	0	35	0
Building Performance - Small Bu	0	30	0	30	30	0	30	0	30	0	30
Commercial Total	35	30	35	100	30	35	30	35	30	35	30
Yield (MMBTU/$1000)											
Commercial Heating	7	0	7		0	7	0	7	0	7	0
Building Performance - Small Bu	0	6	0		8	8	8	8	8	8	8
Res. and Com TEPF Services N	320	315	320	955	315	320	315	320	315	320	315

Appendix C – VERMOD fossil fuel projections

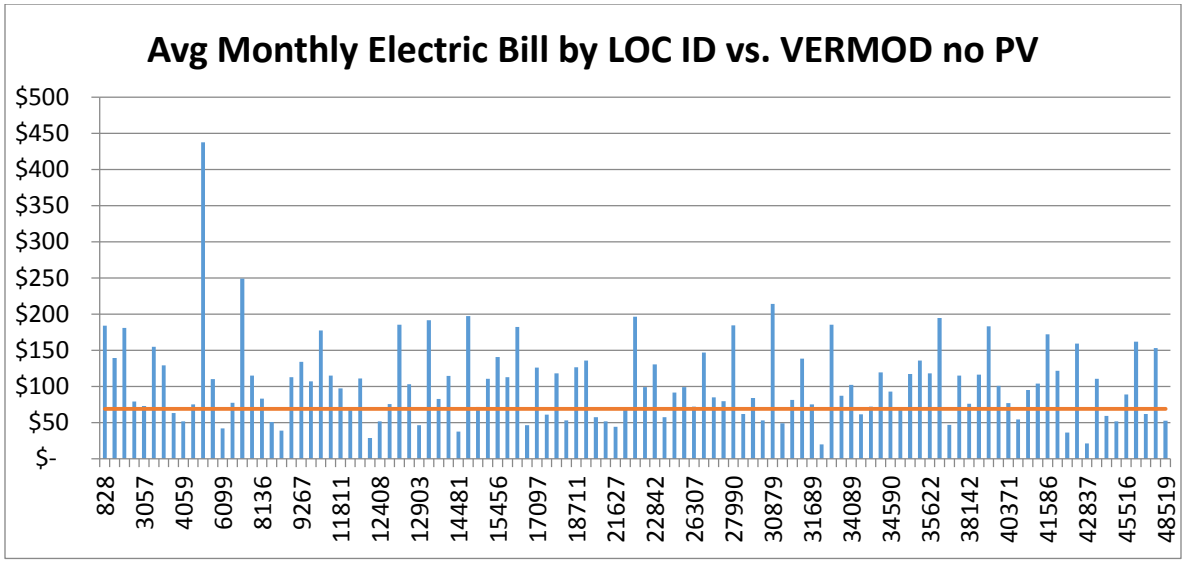
This graph reflects the avoided fossil fuel prices included in the state screening tool. As shown below, forecasted avoided propane costs appear to be significantly lower than today's prices of roughly $2.50 per gallon.



Actual Avg. Monthly kWh Consumption (2014 – 2016) by Location/customer ID compared to the estimated kWh consumption of a 980 sq ft "cottage style" Vermod, including heating, cooling, lighting and appliances (orange line).



Avg. Monthly electric bill (2014 -2016) by Location/customer ID compared to the estimated average electric bill of a 980 sq ft "cottage style" Vermod, including heating, cooling, lighting and appliances (orange line).



Appendix D – Quantified Performance indicators

BED 2018 -2020 BED Electric and TEPF QPIs and MPRs

QPI#	Title	Performance Indicator	Target	Policy Goal Advanced	Weight	Form of Verification	Entity Responsible
1	Total Resource Benefits	(a) Present worth of lifetime electric, fossil, and water benefits	$ 19,940,354	Encourage EEUs to design and implement efficiency initiatives that will maximize the lifetime electric, fossil fuel, and water benefits	33%	Annual Verification Process	Department of Public Service
		(b) Lifetime electric MWh savings	215,120 MWh				
2	Electricity Savings	Annual incremental net MWh expected savings	19,362	Annual incremental MWh savings indicator intended to encourage EEUs to design and implement efficiency initiatives that will maximize annual incremental electrical energy savings	25%	Annual Verification Process	Department of Public Service
3	Summer Peak Demand Savings (MW)	Cumulative net summer peak demand expected savings	2.27	Cumulative summer peak demand savings indicator intended to encourage EEUs to design and implement efficiency initiatives that will maximize the capacity reduction coincident with peak summer demand	17%	Annual Verification Process	Department of Public Service
4	Winter Peak Demand Savings (MW)	Cumulative net winter peak demand expected savings	3.00	Cumulative winter peak demand savings indicator intended to encourage EEUs to design and implement efficiency initiatives that will maximize the capacity reduction coincident with peak winter demand	14%	Annual Verification Process	Department of Public Service
5	Business Comprehensiveness of Savings	Increase the average kWh savings for commercial-sector participants over the 2018-2020 period	Improve 2018-2020 commercial sector average depth of savings by 10% or more when compared to 2015-2017 average commercial-sector savings.	Intended to ensure that energy efficiency initiatives are designed and implemented to acquire comprehensive savings	6%	Tracking System	Department of Public Service
6	Long-term Market Transformation	Provide technical assistance and date analysis services in order to ensure benchmarking of a specific number (and/or square feet) of commercial buildings by end of the performance period	25 buildings or 350,000 square feet	Encourage EEUs to design and implement efficiency initiatives that maximize market transformation	5%	Tracking System	Department of Public Service

Resource Acq. Minimum Performance Requirements

7	Minimum Electric Benefits (Equity for all Electric Ratepayers)	Total electric benefits divided by total costs	Equal or greater than 1.2 benefit/cost ratio	Equity for all Vermont electric customers as a group by assuring that the overall electric benefits are greater than the costs incurred to implement and evaluate the *EEU* and the *EEC*	MPR	Tracking System	Department of Public Service
8	Equity for Residential Ratepayers	A minimum level of overall efficiency efforts, as reflected in spending, will be dedicated to residential customers	A minimum of 70% of residential-sector share of total RA spending be in the residential sector.	Equity for residential customers by assuring that a minimum level of overall efficiency efforts, as reflected in spending, will be dedicated to residential customers	MPR	Tracking System	Department of Public Service
9	Equity for Low-income Customers	A minimum level of overall efficiency efforts, as reflected in spending, will be dedicated to Low-income customers	A minimum of 70% of the low-income sector share of total RA spending be on low-income services.	Equity for low-income customers by assuring that a minimum level of overall efficiency efforts, as reflected in spending, will be dedicated to low-income households	MPR	Tracking System	Department of Public Service
10	Equity for Small Business Customers	Number of total non-residential premises with annual electric use 40,000 kWh/yr. or less participating in energy efficiency programs.	225	Equity for small business customers by assuring that a minimum level of overall efficiency efforts, as reflected in participation, will be dedicated to small business accounts	MPR	Tracking System	Department of Public Service
11	Administrative Efficiency	Meet determined milestones on schedule including: a) Defining all administrative costs and providing the costs for the 2015 -2017 period. B) By July 31, 2018, submit a proposal on how these costs will be tracked and reported, including a metric on the ratio of incentive costs and total administrative costs as a percent of total budget for the current performance period.	TBD	This indicator is intended to define and track administrative costs and ultimately require the program administrator to assess operations to ensure delivery of services in a cost effective manner that maximize ratepayer value.	MPR	Tracking System	Department of Public Service

TEPF Requirements

1	Thermal & Mechanical Energy Efficiency Savings (Residential and Commercial)	Incremental net MMBTU savings (3Yr total)	955	Intended to encourage EEUs to design and implement efficiency initiatives that will maximize unregulated thermal energy savings	60%	Tracking System	Department of Public Service
2	Residential single family comprehensiveness	1) Average air leakage reduction per project 2) Percent of projects with both shell and heating systems measures installed.	1) 34% reduction per project 2.) 16% of premises	Intended to ensure that energy efficiency initiatives are designed and implemented to acquire comprehensive savings	40%	Tracking System	Department of Public Service
3	Equity for Residential Customers	Minimum level of overall efficiency, as reflected in "core TEPF"* spending, is dedicated to residential customers or 95% of total budget ($300,080), less 70% performance metric cap	$210,055	Equity for residential customers by assuring that a minimum level of overall efficiency efforts, as reflected in spending, will be dedicated to residential customers	MPR	Tracking System	Department of Public Service

*** Core TEPF program spending reflects BED'S 2018-2020 proposed budget without the proposed North Avenue Cooperative VerMOD pilot project that is still in devel**