City Council - Transportation, Energy and Utilities Committee

Tuesday, August 19, 2025, 5:00 PM, Spark Space Conference Room, Burlington Electric Department, 585 Pine St, Burlington, Vt

Join via Zoom: https://zoom.us/j/84603122855
To call into the meeting, including to speak during public comment:
Phone: 312-626-6799, Webinar ID: 846 0312 2855

1. Agenda

1.1. Motion to adopt/amend

2. Adopt Minutes

2.1. Minutes of 7/24/25

3. Public Forum

3.1. Public Comments - 15 min
Written public forum comment received before 8/19 will be included with the meeting agenda. Send comments to rgoulding@burlingtonvt.gov

4. Deliberative Agenda

4.1.
GMT Assessment Methodology Study - Information - 20 min

4.2.
BED Synapse & Building Electrification Institute Presentation - Information - 60 min

4.3.
BED Forestry Study Update - Information - 10 min

4.4.
Downtown Parking Item - Information - 30 min

5. Director's Report

6. Councilor Items

7. Next Meeting

7.1. Tentative - 9/23/25, time TBD

8. Agenda

9. Adjournment

Weatherization and Electrification Case Study Analysis

Prepared for Burlington Electric Department

August 19, 2025

Shelley Kwok, Philip Eash-Gates

Synapse Energy Economics

- Founded in 1996 by Bruce Biewald and Jean Ann Ramey
- Leader for public interest and government clients in providing rigorous analysis of the electric power and natural gas sectors
- Staff of 40+ includes experts in energy, economic, and environmental topics
- Has provided support for the development and implementation of building performance standards to multiple municipalities in Massachusetts, including Boston, Newton, and Cambridge
- Was involved in the development of Burlington's Net Zero Energy Roadmap in 2019 and subsequent updates.

Project Goal

- Burlington Electric Department (BED) engaged Synapse to conduct a net-present-value cost analysis of three sample buildings in Burlington if they were to install energy efficiency measures to decrease their energy use intensity (EUI), with a focus on reducing energy used for space heating.
  - EUI is defined as the amount of energy consumed per square foot of building floor area.
- The goal of the analysis is to help inform future policy that would impact buildings between 25,000 and 49,999 square feet.
- For purpose of the analysis, we chose to model two office buildings of different vintages, as well as a retail building.
- Synapse created an Excel model to calculate the difference in capital costs and electricity/fuel costs between a fossil-fuel space heating system and the existing building envelope versus an electrified space heating system with a tighter building envelope if applicable.

Analysis Overview

- Synapse used NREL's ComStock model to estimate the energy savings from installing upgrade measures in BED's selected buildings.
  - ComStock is a highly granular model that uses multiple data sources, statistical sampling methods, and advanced building energy simulations to estimate the annual energy consumption of the commercial building stock across the United States.
- We used electric and gas rate forecasts as supplied by BED and VGS, accounting for rate class changes as a result of electrification.
- We relied on publicly available equipment cost data from sources such as the U.S. Energy Information Administration, as well as California and Massachusetts energy efficiency programs with locational adjustment factors for Vermont from RSMeans.
- BED provided estimates of the incentives that would be available for these case studies.

Analysis Overview

- Assumptions:
  - The base case assumes a one-for-one replacement and the retrofit case assumes an all-electric replacement. Full system replacement would occur upon failure of existing system. In this analysis, we assume the full system is replaced at once. In reality, some buildings are more likely to use a phased replacement approach.
  - The analysis timeframe starts in 2030 and extends for 15 years.
- Caveats:
  - Capital costs for electrification and weatherization can vary wildly from project to project. Cost inputs used in this analysis are very high-level estimates that are not Burlington-specific or project-specific.
  - The ComStock model estimates savings based on buildings with similar characteristics as those selected by BED and is not an exact replica of the particular building selected.

Summary

- Our analysis showed that showed that space heating decarbonization decreased energy use intensity by up to 70 percent (see Table 1 below).
- Cost impacts on total utility bills were relatively small.
- Capital costs for electrification tended to be higher than installing baseline equipment, particularly for buildings currently using water-based systems like boilers.
  - Note: we present the impact of available incentives from BED that could decrease electrification costs

Table 1: EUI Summary

Case Study	EUI Improvement
Newer office building	~45 percent reduction
Older office building	~65 to 70 percent reduction
Retail building	~50 percent reduction

Results

Retail Building Overview

- Existing building characteristics:
  - Square footage: 23,000 square feet
  - Built in the 1920's
  - Very little wall insulation
  - Heated by natural gas rooftop units
  - Wooden siding
- Retrofits:
  - All-electric, heat pump rooftop units with electric resistance backup
  - 3" of exterior wall insulation (optional)

Image description: Example of rooftop units

Retail Building Energy and Cost Breakdown

- Original thermal EUI: 18.3 kBTU/SF
- Post-retrofit thermal EUI: 9.2 kBTU/SF (49 percent reduction) **without** envelope upgrades
- This results in a total cost increase of 1 to 3 percent over a 15-year period
- Baseline upfront capital cost, heating system: $20,000
- Retrofit upfront capital cost, heating system: $22,000. Potential for BED incentives up to $7,800.

Figure 1: EUI results

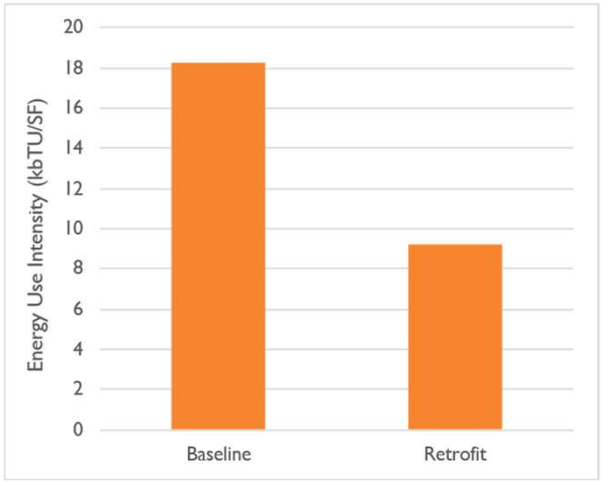


Figure 2: Annual Utility Costs, 2030

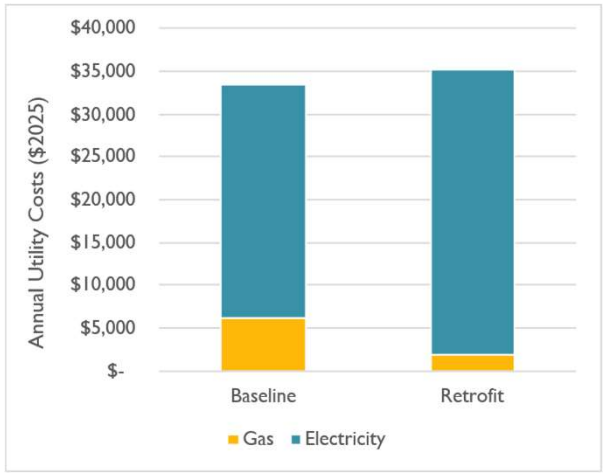
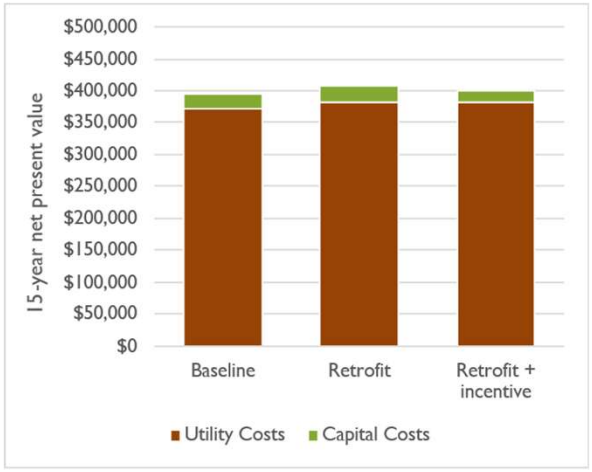


Figure 3: 15-year net present value results



Retail Building Energy and Cost Breakdown (cont.)

- Original thermal EUI: 18.3 kBTU/SF
- Post-retrofit thermal EUI: 8.7 kBTU/SF (52 percent reduction) **including** envelope upgrades.
  - The upgrade assumes that rigid exterior insulation would be installed at the same time siding needs to be replaced naturally.
- This results in cost increase of 8 to 14 percent over a 15-year period.
- Retrofit upfront capital costs, envelope: $60,000. Potential for BED incentives up to $20,000.

Figure 1: EUI results

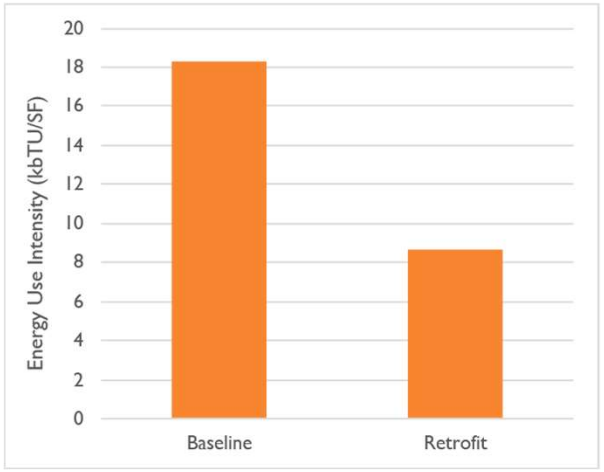


Figure 2: Annual Utility Costs, 2030

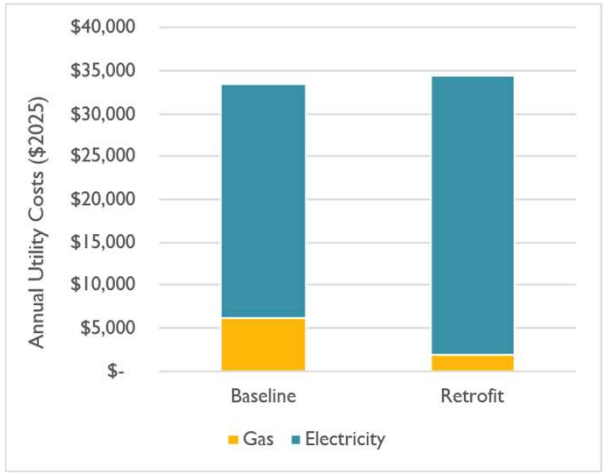
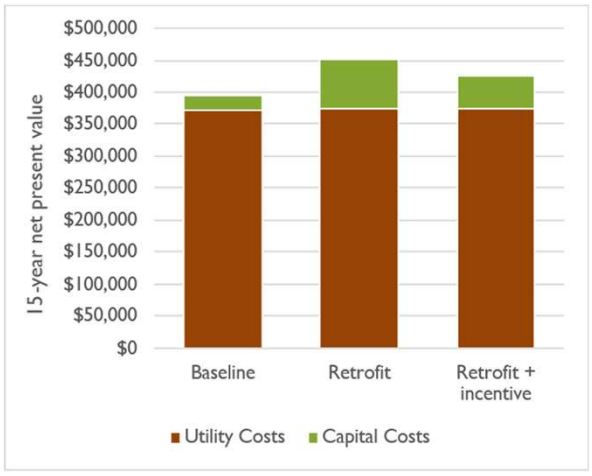


Figure 3: 15-year net present value results



Note: if siding costs are included as incremental costs, the cost differential increases to 25-40%. We recommend pairing the insulation upgrade when doing re-siding.

Newer Office Building Overview

- Existing building characteristics:
  - Square footage: 27,000 square feet
  - Built in the 2010s
  - Relatively good wall and roof insulation
  - Heated by natural gas water source heat pumps
  - Glass facade
- Retrofits:
  - All-electric, heat pump boiler units

Newer Office Building Energy and Cost Breakdown

- Original thermal EUI: 22.4 kBTU/SF
- Post-retrofit thermal EUI: 12.0 kBTU/SF (46 percent reduction)
- This results in a cost increase of 123 to 144 percent over a 15-year period.
  - Air-to-water heat pumps are still relatively newer to the market compared to air-to-air heat pumps and are more expensive as a result.
- Baseline upfront capital cost, heating system: $200,000
- Retrofit upfront capital cost, heating system: $1,336,000. Potential for incentives up to $175,000.

Figure 1: EUI results

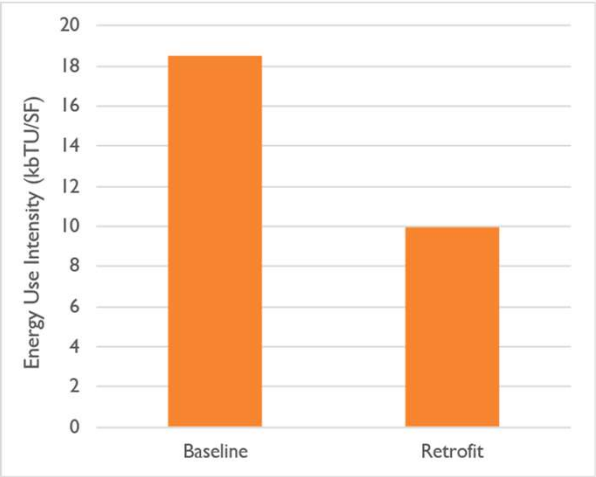
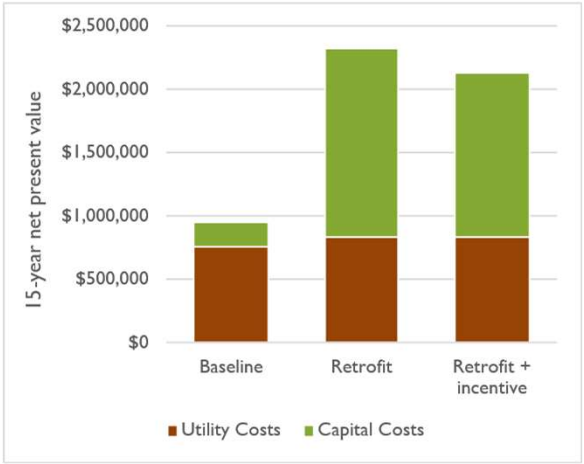


Figure 2: Annual Utility Costs, 2030

Figure 3: 15-year net present value results



Older Office Building Overview

- Existing building characteristics:
  - Square footage: 40,000 square feet
  - Built around 1900
  - Very little wall insulation
  - Heated by natural gas rooftop units
  - Brick exterior
- Retrofits:
  - All-electric, heat pump rooftop units
  - Electrical panel and wiring upgrade
  - Wall insulation (optional)

Older Office Building Energy and Cost Breakdown

- Original thermal EUI: 28.7 kBTU/SF
- Post-retrofit thermal EUI: 10.7 kBTU/SF (63 percent reduction) without envelope upgrades.
- This results in cost increase of 1 to 5 percent over a 15-year period.
- Baseline upfront capital cost, heating system: $52,000
- Retrofit upfront capital cost, heating system: $57,000. Potential for up to $20,000 in incentives.

Figure 1: EUI results

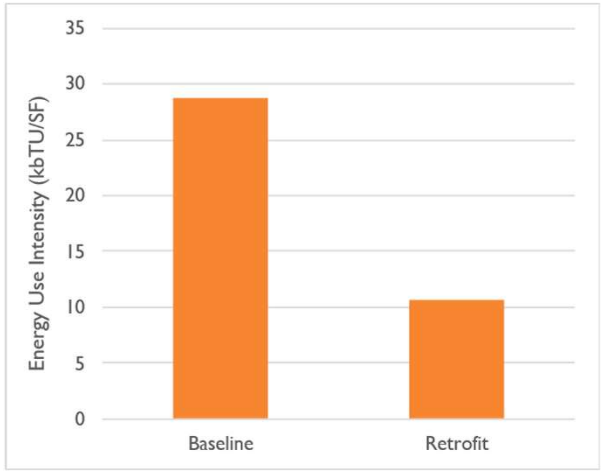
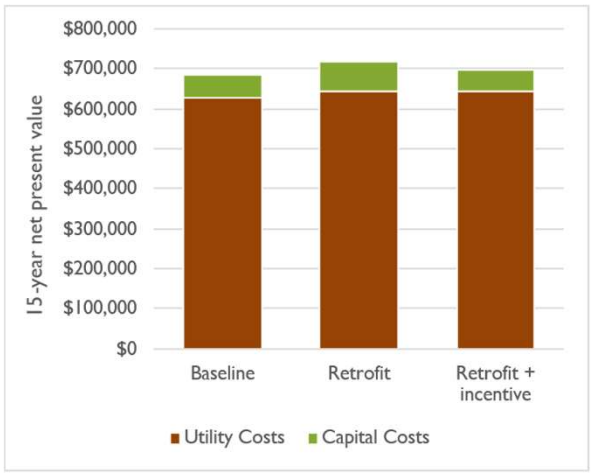


Figure 2: Annual Utility Costs, 2030

Figure 3: 15-year net present value results



Older Office Building Energy and Cost Breakdown (cont.)

- Original thermal EUI: 28.7 kBTU/SF
- Post-retrofit thermal EUI: 8.4 kBTU/SF (71 percent reduction) including envelope upgrades.
- Caveats on envelope upgrades:
  - To improve the building envelope, air sealing may be the most suitable option for this case and other historic and/or brick buildings.
  - ComStock currently does not model the impact of air sealing in its energy model. Below, we show the impact of installing exterior wall insulation as a proxy to estimate energy savings.
  - Given the brick walls, it is likely not feasible or cost-effective to add exterior wall insulation to this building.

Figure 1: EUI results

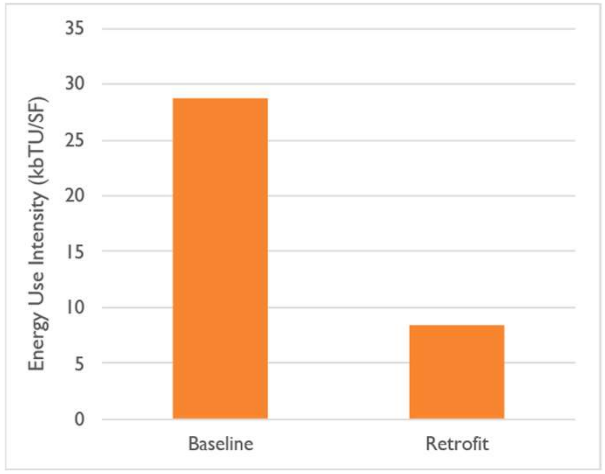


Figure 2: Annual Utility Costs, 2030