CADMUS

City of Alexandria Green Building Policy Analysis

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Prepared for:

The City of Alexandria

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Table of Contents

Tables

Executive Summary

The City of Alexandria asked Cadmus to evaluate the impacts of changing its Green Building Policy (GBP). Our analysis considers moving from prescriptive to performance-based building requirements. Our team created energy use baselines, energy targets, and the potential incentives to help spur new development. Cadmus also analyzed three strategies to incentivize development of efficient buildings in Alexandria.

1. Scope of Work

1.1. Task 1. Energy Modeling and Cost Analysis of Changing GBP to Site EUI Targets

Cadmus modeled and researched typical site energy use for each of the five building types, including single-family, hotel, restaurant, retail, and multifamily (all detailed in this section). We modeled each type based on typical new construction buildings in Alexandria to estimate its energy use baseline and target with the EnergyPlus engine. Cadmus used energy modeling tools developed by the Department of Energy (DOE) and National Renewable Energy Lab (NREL). OpenStudio is used by energy experts nationwide to create commercial building models, and BEopt is commonly used for modeling residential buildings.[1]

The target energy use intensities (EUIs) were set at 10% lower than the baseline model EUIs. The baseline models were developed to meet the current Virginia energy code. Table 1 summarizes the modeling results, which we rounded down for simplicity. The far-right column shows the modeled EUIs that were achieved with various energy conservation measures (ECMs). The Hotel and Restaurant models were not able to achieve the improved EUI target with conventional energy efficiency because of their high plug and hot water loads. These building types could achieve the improved EUI target by reducing internal loads or electrifying certain equipment.

Table 1. Summary of Modeled Site EUIs and Improved Targets

Building Type	Modeled EUI Baseline (kBtu/sq ft)	Improved EUI Target (kBtu/sq ft - 10% better)	Modeled EUI Achieved (kBtu/sq ft)
Single-Family[a]	35	31	31.8
Hotel	92	83	88.4
Restaurant	305	274	289
Retail	45	40	40.4
Multifamily	42	38	38.5

[a] Cadmus developed the single-family model in BEopt, which uses the EnergyPlus engine.

Developing Future Performance Targets

Cadmus also compared EUIs from the energy model output for each building type to locally benchmarked data on actual use (Table 2). These data come from local benchmarking programs in Maryland, the District of Columbia, and Virginia and can be accessed using the DOE's Building Performance Database (BPD).[2]

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1 DOE. Accessed August 2024. "OpenStudio." https://www.energy.gov/eere/buildings/articles/openstudio NREL. Accessed August 2024. "BEopt: Building Energy Optimization Tool." https://www2.nrel.gov/buildings/beopt

2 DOE. Accessed February 2025. "Building Performance Database." https://bpd.lbl.gov/.

The BPD data was filtered for buildings built after 2010 and in Climate Zone 4A (similar to Baltimore), and each of the four categories had over 1,000 observations. We found that energy use data for multifamily buildings, hotels, retail facilities, and restaurants aligned fairly well between our models and the actual observed energy use data. However, reliable data were not available for single-family home energy use.

Table 2. Modeled and Baseline Building Type EUI's

Building Type	Modeled EUI Baseline (kBtu/sq ft)	Baseline Benchmarked EUI (kBtu/sq ft)
Single-Family	35	NA
Hotel	92	83
Restaurant	305	291
Retail	45	59
Multifamily	42	46

If target site EUIs are needed for additional building types in the future without modeling, we recommend using the following benchmarking approach. After identifying a new building type, use the Building Performance Database to access and filter benchmarking data for that type under the Building Classification tab. To tailor results for Alexandria, filter by location on Maryland, the District of Columbia, and Virginia. If more data points are needed, then expand the geography to Climate Zone 4A (Baltimore, Maryland). If a target for new construction is needed, then limit the Year Built filter to 2010 and later. The selected buildings will represent new construction that uses modern technology and is subject to energy codes.

Once the desired building type and observations are identified, then find the median site EUI for the buildings. Ideally, a collection of hundreds or thousands of observations (building EUIs) is best, and we recommend not drawing conclusions from any data set with fewer than 30 observations.

Estimating Baseline and Incremental Construction Costs

Cadmus also estimated incremental construction costs associated with energy efficiency and electrification upgrades for each building type, which we compared to a regional baseline cost. These findings are detailed below by building type.

To gather information on regional baseline costs, the City of Alexandria surveyed local real estate professionals about their experience with constructing various property types. Cadmus also researched local construction costs using RS Means and other market research. Table 3 summarizes the average costs per square foot (in 2024 U.S. dollars) based on survey responses and researched values. We calculated the incremental costs for each measure using the specific building type's total building area.

Cadmus assumed all baseline estimates included the total cost of construction using standard union labor. We normalized each cost estimate to 2024 U.S. dollars and adjusted national estimates to the City of Alexandria's 2019 City Cost Index (CCI) per RS Means, which was 40% higher than the national

average.[3] While the results were rough estimates (rounded to nearest 10 dollars per square foot) that included wide ranges of uncertainty, they helped to set the baseline for incremental cost comparisons.

Table 3. Summary of Construction Costs in Alexandria

Building Type	Average Cost ($/sq ft)	Survey Responses and Research Data Points
Single-Family	$420	3
Hotel	$280	3
Restaurant	$490	2
Retail	$360	5
Multifamily	$350	4
Commercial Office*	$250	4

*Cadmus did not model offices, but developers provided construction costs. Typical construction costs in Alexandria, Virginia, were provided by local developers. These typical costs were based on observations and building descriptions from six developers across Virginia. We determined cost values by taking the average of the costs provided by developers and found in our regional research.

Detailed explanations and results for each building type are summarized below. ***Error! Reference source not found.*** includes additional information, such as the model inputs, model images, and references.

Single-Family Townhouse

The single-family townhouse modeled baseline adhered to the International Energy Conservation Code (IECC) 2021 and the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) 90.1 2019 codes. The energy-efficient model achieved a 9% reduction, as shown in Table 4, by incorporating the three listed efficiency measures. It was also determined that this building could incorporate air-source heat pumps for space heating, without any of the efficiency measures included, to achieve a reduction of 24% to the EUI. If instead, they chose to install a heat pump water heater, the site would see a reduction of about 15%. The incremental costs, including electrification, for this building type were less than $4 per sq ft, which would be less than a 1% increase over the current construction cost baseline in Alexandria.

- Building size: 1,680 sq ft
- Number of rooms: 3 bedrooms, 2 bathrooms
- Modeled baseline site EUI: 35 kBtu/ sq ft
- EUI with efficiency measure package: 31.8 kBtu/sq ft

[3] RSMeans data. 2019. "RSMeans City Cost Index." https://www.rsmeans.com/rsmeans-city-cost-index.

Table 4. Energy Efficiency and Electrification Measure Information

Measure Type	Measure	Energy Savings	Incremental Cost ($/sq ft)
Efficiency	Install 100% LED Lighting (3% reduction to the lighting power density)	9%	$0.09
Efficiency	Improve insulation in walls, including basement, adding 30% to the overall R-value		$2.53
Efficiency	Improve wall sheathing material, use R-12 Polyisocyanurate board instead of oriented strand board		$0.00
Electrification	Install air-source heat pumps (ASHP) for space heating	24%	-$1.03 to $1.00
Electrification	Install heat pump water heater (HPWH) for domestic hot water	15%	-$0.17

Hotel

The hotel modeled baseline adhered to IECC 2021 and ASHRAE 90.1 2019 codes, and the energy-efficient model did *not* achieve the 10% reduction with energy efficiency measures alone, as shown in Table 5. With the three efficiency measures listed, the site achieved a reduction of about 4%. This shortfall was due to the significant load coming from the water heating and electrical appliances in guest rooms, banquet rooms, kitchens, and laundry spaces.

However, when Cadmus paired the efficiency measures with the electrification of space heating or domestic hot water, the 10% target was achieved or exceeded. With electrification of the domestic hot water system we saw a reduction of about 21%, while electrification of the space heating resulted in about a 4% reduction, similar to the efficiency measure package. The incremental costs, including both efficiency and electrification measures, for this building type were less than $3 per sq ft, so that would be just over a 1% increase over the current new construction cost baseline in Alexandria.

- Building size: 122,120 sq ft
- Total number of units: 183
  - Typical room types: Guest rooms, retail space, dining space, and office
  - Major consumers: Faucets and shower heads (1.6 gallons per minute peak combined)
- Modeled baseline site EUI: 92 kBtu/sq ft
- EUI reduction with efficiency measure package: 88.4 kBtu/sq ft

Table 5. Energy Efficiency and Electrification Measure Information

Measure Type	Measure	Energy Savings	Incremental Cost ($/sq ft)
Efficiency	Improve insulation in walls and roof	4%	$2.09
Efficiency	Increase motor and belt efficiencies		$884.73/motor
Efficiency	Increase boiler and chiller efficiencies		$51/unit; >$0.01/sq ft
Electrification	Install ASHP for space heating	4%	-$0.49
Electrification	Install HPWH for domestic hot water	21%	$0.89 to $0.95

Restaurant

The restaurant modeled baseline adhered to IECC 2021 and ASHRAE 90.1 2019 codes, and the energy-efficient model did *not* achieve the 10% reduction with energy efficiency measures alone, as shown in Table 6. With the five efficiency measures listed, the site was able to achieve a reduction of about 5%. This was due to the site having significant load coming from the water heating and cooking equipment.

However, when Cadmus paired the efficiency measures with the electrification of domestic hot water, the 10% target was achieved or exceeded. With electrification of the domestic hot water system we saw a reduction of about 24%, while electrification of the space heating resulted in about an 8% reduction. The total incremental costs for this building type were less than $15 per sq ft, so that would be about a 3% increase over the current construction cost baseline in Alexandria.

- Building size: 5,502 sq ft
- Major consumers: Water systems and kitchen equipment
- Modeled baseline site EUI: 305 kBtu/sq ft
- EUI with efficiency measure package: 289 kBtu/sq ft

Table 6. Energy Efficiency and Electrification Measure Information

Measure Type	Measure	Energy Savings	Incremental Cost ($/sq ft)
Efficiency	Improve insulation in walls and roof	5%	$2.09
Efficiency	Increase motor and belt efficiencies		$884.73/motor
Efficiency	Increase heating and cooling efficiencies		$51/unit; $0.03/sq ft
Efficiency	Increase hot water boiler COP		$0.41
Efficiency	Daylight sensors in the dining area		$5.05
Electrification	Install ASHP for space heating	8%	$3.56 to $6.80
Electrification	Install HPWH for domestic hot water	24%	$0.89 to $0.95

Retail

The retail modeled baseline adhered to IECC 2021 and ASHRAE 90.1 2019 codes, and the energy-efficient model achieved a 10% reduction with efficiency measures shown Table 7. With the four efficiency measures listed, the site was able to achieve a 10% reduction. When looking into electrification, it was determined that a 15% reduction to the EUI can be achieved though electrification of the space heating, while using heat pumps for hot water would result in a reduction of about 7%. The total incremental costs for this building type were less than $3 per square foot, which would be less than a 1% increase over the current construction cost baseline in Alexandria.

- Building size: 24,692 sq ft
  - Water use: 0.25 gallon per minute peak
  - Major consumers: Natural gas equipment
- Modeled baseline site EUI: 45 kBtu/sq ft
- EUI with efficiency measure package: 40.4 kBtu/sq ft

Table 7. Energy Efficiency and Electrification Measure Information

Measure Type	Measure	Energy Savings	Incremental Cost ($/sq ft)
Efficiency	Improve insulation in walls and roof	10%	$2.09
Efficiency	Increase motor and belt efficiencies		$884.73/motor
Efficiency	Lighting controls (10 sensors)		$0.07
Efficiency	Increase gas burner efficiency		$51/unit
Electrification	Install ASHP for space heating	15%	-$0.49
Electrification	Install HPWH for domestic hot water	7%	$0.95

Multifamily Low Rise

The Multifamily modeled baseline adhered to IECC 2021 and ASHRAE 90.1 2019 codes, and the energy-efficient model achieved a 9% reduction with four efficiency measures, as shown Table 8. For this site, it was determined that using a heat pump water heater for domestic hot water would result in a reduction of about 24%, compared to the electrification of space heating, which would result in a reduction of about 7%. The total incremental costs for this building type were less than $10 per square foot, which would be less than a 3% increase over the current construction cost baseline in Alexandria.

- Building size: 33,740 sq ft
  - Total number of units: 39 residential units, 1 office
  - Typical room types: Residential apartments, office
- Cadmus modeled Baseline Site EUI: 42 (kBtu/ sq ft)
- EUI with efficiency measure package: 38.5 kBtu/ sq ft

Table 8. Energy Efficiency and Electrification Measure Information

Measure Type	Measure	Energy Savings	Incremental Cost ($/sq ft)
Efficiency	Improve insulation in walls and roof	9%	$0.70
Efficiency	Increase motor and belt efficiencies		$884.73/motor; $0.63/sq ft
Efficiency	Increase window U-Value and SHGC		$0.73
Efficiency	Increase cooling efficiency		$1.31
Electrification	Install ASHP for space heating	7%	$3.56 to $6.80
Electrification	Install HPWH for domestic hot water	24%	$0.89 to $0.95

1.2. Task 2. Costs for Buildings that Achieve a 20% to 30% Lower EUI: Multifamily Reductions

Multifamily building development is crucial for the City of Alexandria and offers significant potential for energy savings through electrification. Cadmus investigated measure packages that can reduce the baseline energy use by 20% to 30%. To achieve these energy savings, Cadmus determined a combination of efficiency and electrification measures suitable for new buildings through EnergyPlus modeling and state Technical Resource Manual (TRM) calculations.

Table 9. Phase 2. GBP Analysis - Multifamily Measure Packages

Multifamily Measure Package	Measures included	Energy Use Intensity (EUI in kBtu/sq ft)	Percent Reduction from Baseline	Incremental Cost of Measure Package ($/sq ft)
Baseline	New Construction standard per local code	42.00	0%	N/A(average baseline cost of $350)-
Good	Increase roof insulation by 30%, Increase exterior wall insulation by 30%, Improve window's U-Value to 1.2 and Solar Heat Gain Coefficient (SHGC) to 0.25, Increase cooling COP to 4.5, and Increase motor efficiency to 96%	38.50	8%	$3.37 (1%)
Better	All improvements in the Good Package, plus Reduce elevator load by 10%, Install daylight sensors in corridors, Electrify Space Heating	35.70	15%	$9.31 (3.6)
Best	Increase roof insulation by 30%, Increase exterior wall insulation by 30%, Increase motor efficiency to 96%, Electrify Domestic Hot Water with Heat Pump Water Heater	30.98	26%	$2.28 (4.27)

Good: First 10% site energy use reduction target
Better: Second target with fully electrified space heat (includes all measures from "Good" package)
Best: Third target with fully electrified DHW (three efficiency measures + DHW electrification)

1.3. Task 3. Rooftop Photovoltaic Systems for 3% to 5% Building Energy Offset

The rooftops of all the building types will include areas dedicated to amenities, HVAC equipment, and possibly renewable power. Cadmus analyzed the potential sizes and costs of rooftop solar photovoltaic (PV) systems with an annual electricity production goal of 3% to 5% of the building's total energy use. Since energy use in single-family homes is relatively low, we also estimated a larger PV system, which typically makes more financial sense for this building type.

Cadmus based the roof areas for each building type on the energy models for that type. We used NREL's PVWatts calculator and System Advisor Model to model solar PV systems. We assumed building orientations accommodated south-facing PV modules pitched at a 35-degree angle**,** and premium modules were selected. We calculated system costs on a per-watt direct current (DC) basis, with the low estimate at $1.80 and the high estimate at $2.34. Cadmus based these estimates on recent trends for commercial PV system costs and historical information provided by NREL.[4] Table 10 summarizes the full results of our analysis by building type. As shown in the table, most of the building types would still have plenty of space available for mechanical HVAC equipment, amenities for occupants, or potentially a larger PV.

[4] NREL. Accessed February 2025. "Solar Market Research & Analysis." https://www.nrel.gov/solar/market-research-analysis/solar-installed-system-cost.html

Table 10. Phase 2. GBP Analysis - Solar Analysis by Building Type

Building Type	Offset Target	System Size DC (kW)	System Area (sq ft)	Total Available Roof Space (sq ft)	Roof area available for HVAC (sq ft)	Annual Electricity Production (kWh)	Estimated Module Count	Estimated Install Cost (Low: $1.8/W)	Estimated Install Cost (High: $2.34/W)
Single-Family	3%	0.4	21	469	448	530	2	$720	$936
Single-Family	5%	0.7	34	469	435	862	2	$1,170	$1,521
Single-Family (full system)	61%	8.0	411	469	58	10,576	24	$14,400	$18,720
Multifamily	3%	10.0	513	8,435	7,922	13,321	30	$18,000	$23,400
Multifamily	5%	17.0	872	8,435	7,563	22,646	50	$30,600	$39,780
Hotel	3%	75.0	3,845	13,790	9,945	99,911	218	$135,000	$175,500
Hotel	5%	125.0	6,408	13,790	7,382	166,518	365	$225,000	$292,500
Retail	3%	7.5	385	12,345	11,960	9,991	22	$13,500	$17,550
Retail	5%	12.0	616	12,345	11,729	15,986	35	$21,600	$28,080
Restaurant	3%	11.0	564	5,500	4,936	14,654	32	$19,800	$25,740
Restaurant	5%	19.0	974	5,500	4,526	25,311	56	$34,200	$44,460

1.4. Task 4. Comparison of Green Building Incentive Types

Cadmus estimated the impacts of green building tax abatement by first assessing the current value of recently built commercial properties using public records. Next, we applied the City of Alexandria's commercial tax rate to these properties and created scenarios for various building certification levels. We then forecasted the number of developments in the permit pipeline likely to pursue energy-efficient design. Finally, we assembled budget scenarios for the City of Alexandria to consider, showing the impact of the proposed tax abatements on the city budget over the given timeframes.

Scope and Methodology

To help the City of Alexandria evaluate updates to its green building policy, Cadmus investigated four possible developer-facing incentives:

- Tax abatement (special tax rate)
- Bonus density
- One-story increase in building height
- Reduced parking minimums

We investigated each of these incentive scenarios using six straw men developments with the following characteristics:

- Recently built (final occupancy in 2018 or after)
- Some form of green building certification (LEED, ENERGY STAR®)
- Locations in diverse Alexandria neighborhoods (Old Town North, Potomac Yard, Eisenhower East, West End)

- Diverse building types (mixed-use, multifamily mid- and high-rise, office), sizes, and heights
- Publicly available property values and information

Table 11 lists the six developments, with links to their City of Alexandria valuation records and basic data for each building. Note that square footage and number of units align with values in the official record.

Table 11. Straw Men Developments

Name and address of property	Public record	Sq ft (gross building area above grade)	Number of units (if multifamily) and stories	Assessed 2024 building value	Assessed 2024 total value (land + building)
APTA Centennial Center, 3030 Potomac Avenue	https://realestate.alexandriava.gov/detail.php?accountno=60032500	115,000	office; 7 stories	$21,207,800	$26,625,000
Gables Old Town North, 525 Montgomery Street	https://realestate.alexandriava.gov/detail.php?accountno=60035450	272,057	232 units, 8 stories	$90,489,435	$109,878,000
The Point at Eisenhower Square, 2827 Telek Place	https://realestate.alexandriava.gov/detail.php?accountno=60036930	516,508	336 units; 23 stories	$100,650,000	$119,130,000
The Dalton Apartments, 1225 First Street	https://realestate.alexandriava.gov/detail.php?accountno=10961500	258,963	270 units; 6 stories	$76,392,000	$93,942,000
Braddock Gateway, 1100 North Fayette Street	https://realestate.alexandriava.gov/detail.php?accountno=10971540	336,904	370 units; 7 stories	$184,270,000	$231,370,000
Park + Ford, 4401 Ford Avenue	https://realestate.alexandriava.gov/detail.php?accountno=50469920	474,000	222 units; 14 stories	$131,110,000	$159,495,000

Tax Abatement or Special Tax Rate

Background. Several local jurisdictions in the Commonwealth of Virginia offer a 50% tax abatement or a special tax rate incentive for one year for energy-efficient buildings, as defined by municipal code. The abatement is typically applied to the *building* value, not the land and building value of the development, and occurs in the first year after proof of performance. In the case of example jurisdictions such as Charlottesville, this involves proof of green building certification, but this incentive could equally apply to demonstrably low energy use intensity or low carbon construction. Because the abatement depends on documentation of an outcome, it may appear as a risk for some developers. However, if the outcomes are successful, the financial reward is significant, although delayed. An advantage in terms of ease of management (to both developers and the City of Alexandria) is that unlike bonus density or construction of an extra story, the special tax rate would not require that developers put up a financial surety as a guarantee of subsequent performance.

Table 12 lists the abatement amounts for each of the example projects, along with the total revenue that Alexandria would forgo if all six met the city's performance standards. Cadmus used the tax rate

approved by the city in 2024 to calculate these values: $1.135 per $100 of assessed value (in this case, building value).

Table 12. Sample Development's Abatement Information

Name and address of property	Assessed 2024 building value	Tax (rate of $1.135 per $100 of assessed building value)	50% building value tax abatement for one year
APTA Centennial Center, 3030 Potomac Avenue	$21,207,800	$240,708.53	$120,354.27
Gables Old Town North, 525 Montgomery Street	$90,489,435	$1,027,055.09	$513,527.54
The Point at Eisenhower Square, 2827 Telek Place	$100,650,000	$1,142,377.50	$571,188.75
The Dalton Apartments, 1225 First Street	$76,392,000	$867,049.20	$433,524.60
Braddock Gateway, 1100 North Fayette Street	$184,270,000	$2,091,464.50	$1,045,732.25
Park + Ford, 4401 Ford Avenue	$131,110,000	$1,488,098.50	$744,049.25
TOTAL tax and tax abatement		**$6,856,753.32**	**$3,428,376.66**

Bonus Density

Background. For over 20 years, the City of Alexandria's neighbor, Arlington County, has made bonus density its primary green building incentive. Arlington County bases its award on proof of green building certification, against which developers must offer financial securities. While Table 13 illustrates the benefits to the City of Alexandria in terms of increased property taxes resulting from increased square footage, Arlington County's proof of concept demonstrates that the financial advantages to developers are an even stronger pull.

The following example project, Braddock Gateway, illustrates the strength of bonus density as an incentive for developers when given the opportunity to include additional square footage. Braddock Gateway's rental website advertises studios of 438 sq ft renting at $2,110 per month. If allowed to build an additional 23,055 sq ft (.25 FAR bonus density), this could translate into roughly 52 additional units at an additional $109,720 per month or $1,316,640 per year. At the .35 FAR bonus density level, with as many as 73 additional units, additional rent could be $154,030 per month or $1,848,360 per year.

Table 13 summarizes Cadmus' bonus density calculations for all of the example projects. Please note that because Gables Old Town North's lot size is listed as "0" in the public record (perhaps because it does not own the land it occupies), we did not include it in these calculations.

Table 13. Sample Development's Bonus Density Calculations

Name and address of property	Lot size, square feet	Added sq ft for .25 FAR	Added sq ft for .35 FAR	Building value	Building value per sq ft above grade	Added value at .25 FAR	Added value at .35 FAR	Assumed total assessed value (land+building) with added building value at .25 FAR	Additional annual tax collected based on increased sq ft at .25 FAR	Assumed total assessed value (land+building) with added building value at .35 FAR	Additional annual tax collected based on increased sq ft at .35 FAR
APTA Centennial Center, 3030 Potomac Avenue	19,890	**4,973**	**6,962**	$21,207,800	$184.42	$917,006.83	$1,283,809.56	$27,542,006.83	$10,408.03	$27,908,809.56	$14,571.24
Gables Old Town North,525 Montgo-mery Street	0	**0**	**0**	$90,489,435	$332.61	$0.00	$0.00	$109,878,000.00	$0.00	$109,878,000.00	$0.00
The Point at Eisenhower Square, 2827 Telek Place	145,873	**36,468**	**51,056**	$100,650,000	$194.87	$7,106,432.74	$9,949,005.84	$126,236,432.74	$80,658.01	$129,079,005.84	$112,921.22
The Dalton Apartments, 1225 First Street	43,462	**10,866**	**15,212**	$76,392,000	$294.99	$3,205,235.02	$4,487,329.03	$97,147,235.02	$36,379.42	$98,429,329.03	$50,931.18
Braddock Gateway, 1100 North Fayette Street	92,221	**23,055**	**32,277**	$184,270,000	$546.95	$12,610,093.43	$17,654,130.80	$243,980,093.43	$143,124.56	$249,024,130.80	$200,374.38
Park + Ford, 4401 Ford Avenue	160,099	**40,025**	**56,035**	$131,110,00	$276.60	$11,070,980.95	$15,499,373.34	$170,565,980.95	$125,655.63	$174,994,373.34	$175,917.89
Additional annual total tax collected									**$396,225.65**		**$554,715.91**

Construction of One Additional Story

Background. The advantages of adding one additional story to developers are similar to those of bonus density: added square footage and the ability to build and profit from an entire floor of additional units. However, the height increase may be controversial and even problematic for neighbors. Added height will also impact Alexandria's urban ecosystem in terms of sunlight, wind and ventilation, bird-friendly construction, and more.

Table 14 summarizes the results of Cadmus' analysis of adding one additional story for our example developments. In most cases, we determined the number of stories above grade by looking at visual images of the developments from Google Street View. We then divided the total above-ground square footage by the number of stories to calculate the square footage of each story.

Table 14. Sample Development's with an Additional Story

Name and address of property	Square footage (gross building area above grade)	Number of units (if multifamily) and stories	Assessed 2024 total value (land + building)	Added sq ft for extra story	Assessed 2024 building value	Building value per sq ft above grade	Added value for extra story	Assumed total assessed value (land+buidling) with added building value for extra story	Additional annual tax collected based on increased sq ft
APTA Centennial Center, 3030 Potomac Avenue	115,000	7 stories	$26,625,000	**16,429**	$21,207,800	$184.42	$3,029,685.71	$29,654,685.71	$34,386.93
Gables Old Town North, 525 Montgomery Street	272,057	232 units, 8 stories	$109,878,000	**34,007**	$90,489,435	$332.61	$11,311,179.38	$121,189,179.38	$128,381.89
The Point at Eisenhower Square, 2827 Telek Place	516,508	336 units; 23 stories	$119,130,000	**22,457**	$100,650,000	$194.87	$4,376,086.96	$123,506,086.96	$49,668.59
The Dalton Apartments, 1225 First Street	258,963	270 units; 6 stories	$93,942,000	**43,161**	$76,392,000	$294.99	$12,732,000.00	$106,674,000.00	$144,508.20
Braddock Gateway, 1100 North Fayette Street	336,904	370 units; 7 stories	$231,370,000	**48,129**	$184,270,000	$546.95	$26,324,285.71	$257,694,285.71	$298,780.64
Park + Ford, 4401 Ford Avenue	474,000	222 units; 14 stories	$159,495,000	**33,857**	$131,110,000	$276.60	$9,365,000.00	$168,860,000.00	$106,292.75
ADDITIONAL TAX PER YEAR									**$762,019.00**

Reduced Parking Minimums

Background. The push to reduce or eliminate parking minimums has become a full-fledged national "parking reform" movement, with advocates tying parking oversupply to traffic congestion, environmental harm, and housing unaffordability. Consider that the cost to build a single off-street, under-grade (not electric-vehicle-ready) parking space in New York City is now estimated at $150,00.[5] Developers pass these costs on to tenants in the form of increased rent. The extent to which local jurisdictions may be able to lift parking mandates depends on factors such as availability and proximity of local public transit, urban walkability, nearness of services such as grocery stores and schools, and the relationship of housing location to employment. It also depends on politics, wealth, status connected with car ownership, and the city's ability to manage street infrastructure and on-street parking rules.

Because construction of new surface parking in an increasingly dense and land-scarce urban region is rare, Cadmus assumed that new parking areas would be underground or garage parking, with an estimated cost of $85,000 per space. We based this regional cost figure on the median value in the range of $70,000 to $100,000, as cited in a 20204 Montgomery County press release summarizing public testimony in support of lifting parking minimums.[6] The savings of avoided parking space construction would accrue to developers; we did not monetize the environmental and social benefits to the City of Alexandria and its neighborhoods. For multifamily buildings, Alexandria parking minimums are tied to the number of bedrooms per dwelling unit. Since this information was not publicly available for the example projects, Cadmus assumed that 20% of the total number of units in a development were two bedrooms and 80% were one bedroom. (Alexandria defines studios and one-bedroom units as one-bedroom equivalents.) We also assumed that all example multifamily projects would be eligible for a 50% reduction of the parking minimum. Table 15 summarizes the results of our analysis.

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[5] Openplans.org. March 2023. *Lifting Parking Mandates in New York City*. https://static1.squarespace.com/static/5e71380706dc865d40a6f93c/t/6414c8fb08a2bf368b41ca51/1679084194164/Parking+Mandates_whitepaper_OpenPlans.pdf

[6] Montgomery County Council. March 5, 2024. Press Release. "Council Enacts Zoning Measure to Eliminate Parking Requirements and Promote Housing Near Transit Hubs." https://www2.montgomerycountymd.gov/mcgportalapps/Press_Detail.aspx?Item_ID=44870

Table 15. Sample Development's with Reduced Parking Minimums

Name and address of property	Square footage (gross building area above grade)	Number of units (if multi-family)	Number of bed-rooms (see assump-tions in text)	Parking now required (.8 spaces per bedroom)	Reduced parking scenario (for MF, half [.4] of required minimum)	Number of avoided spaces	Savings to developers, in dollars ($85,000 per avoided space)	Office calculation of .25 spaces per 1000 sq ft of building area	Savings to developers, in dollars ($85,000 per avoided space)
APTA Centennial Center, 3030 Potomac Avenue	115,000						N/A	115 spaces required: 25% reduction = 29 avoided spaces	**$2,465,000**
Gables Old Town North, 525 Montgomery Street	272,057	232 units	271	217	108	109	**$9,265,000**		N/A
The Point at Eisenhower Square, 2827 Telek Place	516,508	336 units	403	322	161	161	**$13,685,000**		N/A
The Dalton Apartments, 1225 First Street	258,963	270 units	324	259	130	129	**$10,965,000**		N/A
Braddock Gateway, 1100 North Fayette Street	336,904	370 units	444	355	178	177	**$15,045,000**		N/A
Park + Ford, 4401 Ford Avenue	474,000	222 units	266	213	106	107	**$9,095,000**		N/A

Utility

Dominion Energy is the electricity utility serving the City of Alexandria. Dominion Energy actively provides various incentives related to green building, clean energy, and electrification policies, as summarized below.[7]

Technical Assistance/Assessments

Income and Age Qualifying Energy Efficiency Program. Qualifying customers receive a free site visit including a custom energy assessment report and installation of energy-saving products.

Home Energy Assessment Program. Residential customers receive a home energy assessment from qualified contractors who perform the assessment and recommend improvements. They receive a customized report containing cost-effective options and recommendations to help them reduce their energy usage. Recommended measures include installing lighting, hot water appliances, efficient faucets and aerators, and cool roofs; tuning up and upgrading heat pumps; and sealing and insulating ducts.

EnergyShare. In addition to energy bill payment assistance, qualifying customers can receive free weatherization services and educational tips to help reduce their energy usage by making lasting energy-saving improvements.

Small Business Improvement Enhanced Program. This program provides on-site energy assessment of customer's facilities. Qualifying customers can receive incentives for making energy efficiency improvements identified during the assessment.

Commercial Equipment Distributors: EE Midstream Program. Qualifying customers can upgrade their business with ENERGY STAR-rated products, like food service appliances and more efficient heating and air conditioning.

New Construction Program. Qualifying customers receive customized recommendations and incentives for installing energy-efficient measures in new construction projects. Eligible buildings include small and medium offices, stand-alone retail shops, and outpatient healthcare facilities.

Multifamily Program. Property owners and managers receive an on-site energy assessment of common areas and tenant units and a follow-up report identifying and quantifying savings opportunities, estimated project costs, and available incentives.

Rebates/Financial Incentives

Commercial Lighting Systems and Controls Program. Participating customers may receive a rebate from Dominion Energy Virginia by upgrading lighting or installing new energy-efficient lighting and controls.

Non-Residential Office Energy Management System Efficiency Program. Participating customers may receive a rebate from Dominion Energy Virginia by recommissioning improvements made to their

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[7] Virginia Energy Sense. Accessed February 2025. "Incentives and Rebates." https://www.virginiaenergysense.org/incentives-and-rebates/

office's energy management system. Program measures available include scheduling lighting, heating, and air conditioning equipment, setting a different temperature at night, and resetting the chiller condenser air temperature.

Distributed Generation Program. Participating customers receive an incentive to use their on-site backup generation to reduce the use of electricity when electrical demand is high. Customers operate their on-site backup generation to supply some or all of their electrical needs during load control events for up to 120 hours per year.

Appliance Rebates. Rebates are available for the following ENERGY STAR–certified appliances:

- Refrigerator ($50)
- Freezer ($50)
- Clothes washer ($50)
- Electric clothes dryer ($100)
- Dehumidifier ($25)
- Room air purifier ($50)
- Dishwasher ($50)

Appliance Recycling. Dominion Energy offers a $20 rebate for recycling an old refrigerator or freezer.

EnergyShare. In addition to energy bill payment assistance, qualifying customers receive free weatherization services and educational tips to help reduce their energy usage and lower their bills by making lasting energy-saving improvements.

Small Business Improvement Enhanced Program. This program provides customers with an energy assessment of their facility and incentives for making energy efficiency improvements identified during the assessment.

Agriculture Program. Eligible Dominion Energy customers receive rebates for high-efficiency agricultural equipment, lighting, etc. Participants also have access to Dominion Energy's network of equipment vendors and contractors associated with the agricultural industry.

Existing Building Automation and Controls Program. Eligible customers receive rebates for making recommissioning improvements to their facility's energy management system.

Data Server Room Program. This program is designed to conserve energy in data server rooms at dedicated data center buildings, offices, hospitals and health care buildings, private universities, manufacturing facilities, large industrial facilities, colocation data centers, cloud-based data centers, modular data centers, etc.. The program offers rebates to eligible Dominion Energy Virginia customers for installing high-efficiency computer room air conditioner or computer room air handler units, a high-efficiency power supply, space temperature set point adjustment, lighting occupancy sensors, etc.

Healthcare Energy Solutions Program. This program provides incentives for efficient technologies used in healthcare facilities, including indoor lighting, outdoor lighting, cooling, ventilation, refrigeration, vending machines, cooking equipment, and motors.

New Construction Program. Eligible customers receive customized recommendations and incentives for implementing energy-efficient measures in their new construction project. Eligible buildings include small and medium offices, stand-alone retail shops, and outpatient healthcare facilities.

Hotel and Lodging Energy Solutions Program. This program provides incentives for efficient technologies used in hotels, motels, and dormitories, including indoor lighting, outdoor lighting, cooling, ventilation, refrigeration, vending machines, cooking equipment, and motors.

Prescriptive Enhanced Program Bundle. Qualifying customers receive a rebate for improvements made to ductwork, HVAC system, kitchen appliances, and refrigeration systems.

Federal

Financial Incentives

Fannie Mae Green Financing Loan Program. This program offers mortgage financing to apartment buildings and cooperatives (with five or more units) to finance energy and water-efficiency improvements. Its green financing programs include Green Rewards and beneficial pricing for loans secured by a property with an eligible Green Building Certification.

Energy-Efficient Mortgages. Homeowners can receive energy-efficient mortgages to either fund energy efficiency improvements to existing homes, including renewable energy technologies or to increase their home buying power with the purchase of a new energy-efficient home. The U.S. federal government insures these loans through Federal Housing Authority or Veterans Affairs programs.

Weatherization Assistance Program (WAP). Through WAP, the U.S. DOE issues grants to states, territories, and some Indian tribes to increase the energy efficiency of low-income homes in their jurisdictions. The DOE and state governments do not issue grants directly to low-income families or perform the retrofits. States, territories, and Indian governments contract with local governments and nonprofit agencies that provide the weatherization services. Low-income homes that qualify for the program will receive free weatherization based on the needs of the home and the rules in the state.

Residential Energy Conservation Subsidy Exclusion. According to Section 136 of the U.S. Code, energy conservation subsidies provided to customers by public utilities are non-taxable. This exclusion does not apply to electricity-generating systems registered as "qualifying facilities" under the Public Utility Regulatory Policies Act of 1978. If a taxpayer claims federal tax credits or deductions for the energy conservation property, the investment basis for the purpose of claiming the deduction or tax credit must be reduced by the value of the energy conservation subsidy (i.e., a taxpayer cannot claim a tax credit for an expense that the taxpayer ultimately did not pay).

Residential Renewable Energy Tax Credit. A taxpayer may claim a credit for a renewable energy system that serves a dwelling unit that is owned and used as a residence by the taxpayer. Expenditures with respect to the equipment are treated as made when the installation is completed. If the installation is at a new home, the "placed in service" date is the date of occupancy by the homeowner. Expenditures include labor costs for on-site preparation, assembly or original system installation, and piping or wiring to interconnect a system to the home.

U.S. Department of Energy Loan Guarantee Program. Under Section 1703, DOE is authorized to issue loan guarantees for projects with high technology risks that "avoid, reduce or sequester air pollutants or anthropogenic emissions of greenhouse gases; and employ new or significantly improved technologies as compared to commercial technologies in service in the United States at the time the guarantee is issued."

Low Income Home Energy Assistance Program (LIHEAP). The LIHEAP provides resources to aid families with energy costs. This assistance helps in managing costs associated with home energy bills, energy crises, weatherization, and energy-related minor home repairs.

Business Energy Investment Tax Credit (ITC). The ITC offers a 6% to 30% tax credit depending on status of the project and labor factors and other bonus tax credits depending on domestic content percentage and communities served by renewable energy development.

Renewable Electricity Production Tax Credit. – This tax credit is a per kilowatt-hour tax credit for electricity generated by qualified energy resources and sold by the taxpayer to an unrelated person during the taxable year. The length of the credit is 10 years after the date the facility is placed in service.

Energy-Efficient Commercial Buildings Tax Deduction. This tax deduction is available to owners of qualified commercial buildings and designers of buildings that achieve at least 25% overall energy savings compared to an ASHRAE Reference Standard 90.1 model.

Residential Energy Efficiency Tax Credit. Property owners may receive tax credits for energy efficiency improvements. Tax credits vary depending on when the building was built (before or after January 1, 2023).

Energy-Efficient New Homes Tax Credit for Home Builders. Homes builders can receive tax credits for energy efficiency upgrades. Tax credits vary depending on when the building was built (homes constructed or acquired before or after January 1, 2023).[8]

[8] NC Clean Energy Technology Center. Accessed February 2025. “Programs.” https://programs.dsireusa.org/system/program?zipcode=20598

State

Regulation

Virginia Solar Rights. According to state law, community associations in Virginia generally may not prohibit a homeowner from installing or using a solar energy collection device on their property.

Virginia Solar Easements. The Virginia Solar Easements Act of 1978 allows property owners to create binding solar easements for the purpose of protecting and maintaining proper access to sunlight.

Net Metering. Net metering in Virginia is available on a first-come, first-served basis until the rated generating capacity owned and operated by customer-generators reaches 1% of an electric distribution company's adjusted Virginia peak-load forecast for the previous year. Net metering is available to customers of investor-owned utilities.

Shared Solar Program. In April 2021, the General Assembly enacted Chapter 532 (HB 1855) during special session I. The chapters authorize the shared solar program in the service territory of Dominion Energy Virginia with an aggregate capacity maximum of 150 MW.

Multi-Family Shared Solar Program. In April 2020, the Virginia General Assembly enacted Chapters 1187 (SB 710), 1188 (HB 572), 1188 (HB 1184), 1239 (HB 1647) of the 2020 Virginia Acts of Assembly. The chapters authorize a Multi-Family Shared Solar program in the service territories of Dominion Energy Virginia and Old Dominion Power. System size is limited to 3 MW, up to 5 MW cumulative for systems on contiguous locations owned by the same entity.

Commercial Solar Property Tax Exemption. The following property tax exemptions for solar facilities are available in Virginia: (1) 100% property tax exemption for the assessed value of equipment and facilities used in projects equaling 20 MW or less that serve a public institution of higher education or private college or projects equaling 5 MW or less, (2) 80% property tax exemption for the assessed value of equipment and facilities used in other projects over 5 MW and less than 150 MW. The exemption for projects greater than 20 MW shall not apply to projects upon which the construction begins after January 1, 2024.

Rebates/Financial Incentives

Income Tax Deduction for Energy-Efficient Products. Virginia taxpayers may deduct from their taxable personal income an amount equal to 20% of the sales taxes paid for certain energy-efficient equipment. The maximum incentive is $500.

Sales Tax Exemption for Energy-Efficient Products. Virginia allows sales tax exemption for dishwashers, clothes washers, air conditioners, ceiling fans, light bulbs, dehumidifiers, programmable thermostats, and refrigerators that reach federal ENERGY STAR standards. To qualify for the incentive, the products must meet or go beyond the federal ENERGY STAR or the Environmental Protection Agency's WaterSense standard, be $2,500 or less per product, and be purchased for noncommercial or personal use.

Small Business and Nonprofit Loan Program. In April 2014, H.B. 864 mandated that the Virginia Small Business Financing Authority provide funding for wind and solar projects to small businesses and nonprofits.

Energy Project and Equipment Financing. In March 2011, H.B. 2389 added renewable energy to the list of eligible projects which the Virginia Resources Authority can provide funding assistance to local governments in Virginia.

VirginiaSAVES Green Community Loan Program. This program provides low-cost financing to private commercial and industrial, nonprofits, and local governments for a wide range of energy efficiency and renewable energy projects in the state. The program works with third-party funding sources to provide funding for projects. The program is administered by CleanSource Capital, LLC.[9]

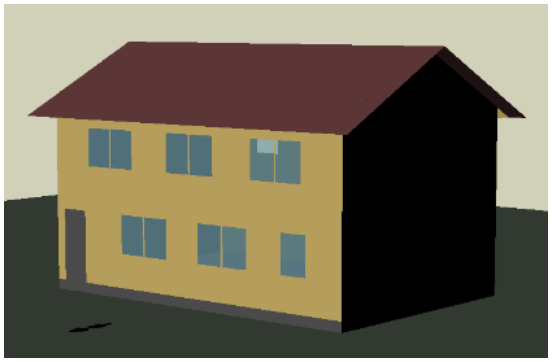
[9] NC Clean Energy Technology Center. Accessed February 2025. "Programs." https://programs.dsireusa.org/system/program?zipcode=20598

Appendix – modeling and cost estimate details

This appendix gives further detail and information on the energy modeling and cost estimation process. Calculations and references are organization by building type. A table at the end of this section shows all the EnergyPlus modeling inputs.

Overall, electrification incremental costs have a wide range depending on technology and property type. For simplicity, $5.50/sf was used as an estimate for the air source heat pump (ASHP) upgrade, and $0.95/sf was used for the heat pump water heater (HPWH) upgrades

1. Single Family
    a. Lighting Fixtures – RS Means
        i. 10” diameter, 36W LED = 503.09
        ii. Fluorescent, interior, 32W and 40W = 242.11
        iii. Baseline is 40% LED
            1. 503.09(0.4) + 242.11(0.6) = 346.50
            2. 503.09-346.5 = $156.59 / 1680 = $0.09/sf
    b. Insulation and Heat pumps - NREL Energy Efficiency Tool - https://remdb.nrel.gov/
        i. Insulation – Cost per square foot of wall area = $1.20 with 3,500 sq ft of wall and 1680 sq ft of floor area.
        ii. Heat pumps – basic heat pump cost is $3,400 per installation compared to $1,800 for basic furnace, so that is approximately $1.00 per square foot in incremental cost
    c. Wall sheathing – costs for OSB and R-12 polyiso board vary by less than $0.02
    d. Heat pumps for heating and domestica hot water – BuildingDecarbCostStudy.pdf
        i. “Cost Study of the Building Decarbonization Code.” *New Buildings Institute*, Apr. 2022, newbuildings.org/wp-content/uploads/2022/04/BuildingDecarbCostStudy.pdf.

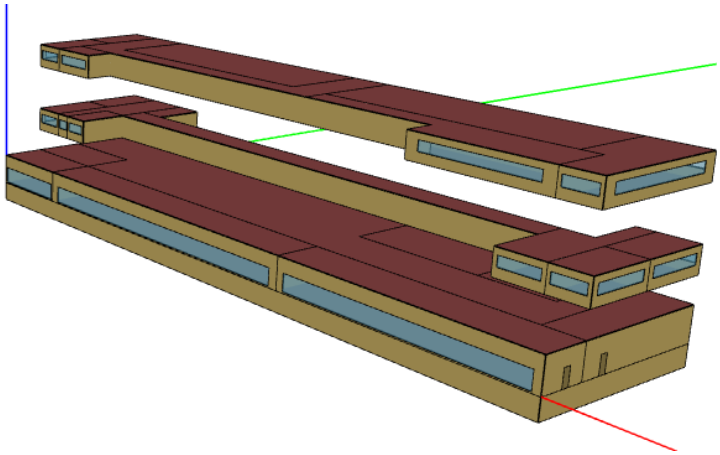


2. Hotel
    a. Incremental Costs
        i. Assume (1) chiller, (1) boiler, and (2) fan motors are upgraded
        ii. $884.73 * 2 = 1769.46 (/ 122120 = $0.01 / sq ft)
        iii. 51 * 2 = 102 (/ 122120 = $0.00 / sq ft)
    b. Heat pump for space heat - BuildingDecarbCostStudy.pdf

i. "Cost Study of the Building Decarbonization Code." *New Buildings Institute*, Apr. 2022, newbuildings.org/wp-content/uploads/2022/04/BuildingDecarbCostStudy.pdf.

c. Insulation – RS Means
   i. Blanket insulation for walls R13, 11" wide
      1. (2.5" thick R10.9 fiberglass = 4.30/sf)
   ii. Motor and Belt Efficiencies
      1. Baseline 5 HP motor = $368.64
      2. Drip proof, premium efficiency 5 HP motor = $1,253.37
         a. 1253-368= $884.73 / 122120 = $0.007244/sf
   iii. Heating and Cooling Efficiencies
      1. 3 T air cooled = $6,007.38
      2. 3 T water cooled = $6,057.88
         a. $50.50 per unit

d. NYSERDA's Building of Excellence program data: https://www.nyserda.ny.gov/All-Programs/Multifamily-Buildings-of-Excellence/Winners/Resources
   i. Incremental costs before incentives for all-electric DHW systems range from even to $7.76 per sq ft, the median was $0.00 and the average was $0.95



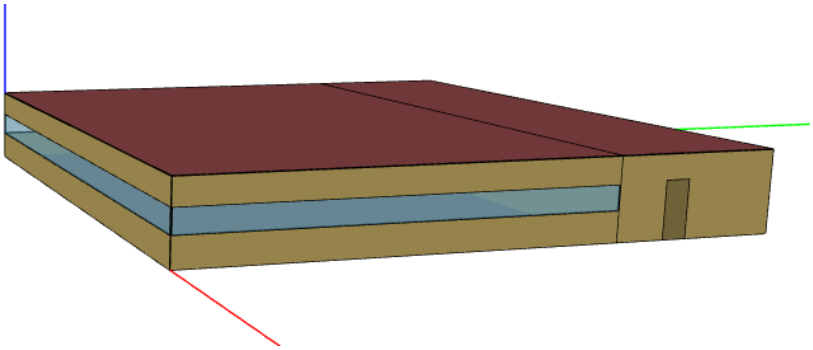
3. Restaurant
   a. Incremental Costs
      i. Assume upgrades are made in both the Kitchen and Dining Zones
         1. 884.73 * 2 = 1769.46 (/ 5502 = $0.32 / sq ft)
         2. 51 * 2 = 102 (/ 5502 = $0.02 / sq ft)
   b. RS Means
      i. Blanket insulation for walls R13, 11" wide
         1. (2.5" thick R10.9 fiberglass = 4.30/sf)
      ii. Daylight sensors, manual control = $278 per sensor
      iii. Motor and Belt Efficiencies
         1. Baseline 5 HP motor = $368.64

2. Drip proof, premium efficiency 5 HP motor = $1,253.37
    a. 1253-368= $884.73 / 5502 = $0.16/sf

iv. Hot water boiler
1. 85 MBH (84%) = 3814.63
2. 94 MBH (95%) = 6052.78
    a. 2238.15 / 5502 = $0.4067

v. Heating and Cooling Efficiencies
1. 3 T air cooled = $6,007.38
2. 3 T water cooled = $6,057.88
    a. $50.50 per unit

c. NYSERDA's Building of Excellence program data: https://www.nyserda.ny.gov/All-Programs/Multifamily-Buildings-of-Excellence/Winners/Resources
    i. Incremental costs before incentives for all-electric HVAC range from $0.03 to $17.19 per sq ft, the median was $1.05 and the average was $3.56
    ii. Incremental costs before incentives for all-electric DHW systems range from even to $7.76 per sq ft, the median was $0.00 and the average was $0.95



4. Retail
    a. Incremental Costs
        i. Assume upgrades are made in all 4 Zones
            1. 884.73 * 4 = 3538.92 (/ 24692 = $0.14 / sq ft)
            2. 51 * 4 = 204 (/ 24692 = $0.01 / sq ft)
    b. Heat pump for space heat - BuildingDecarbCostStudy.pdf
        i. "Cost Study of the Building Decarbonization Code." *New Buildings Institute*, Apr. 2022, newbuildings.org/wp-content/uploads/2022/04/BuildingDecarbCostStudy.pdf.
    c. RS Means
        i. Blanket insulation for walls R13, 11" wide
            1. (2.5" thick R10.9 fiberglass = 4.30/sq ft)
        ii. Occupancy sensor, passive infrared = 177.62 ea
        iii. Motor and Belt Efficiencies
            1. Baseline 5 HP motor = $368.64
            2. Drip proof, premium efficiency 5 HP motor = $1,253.37

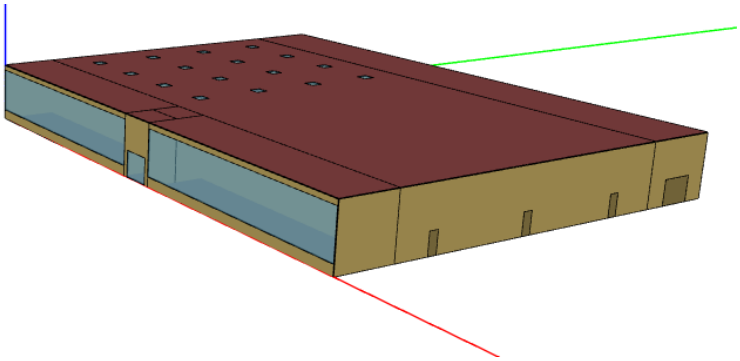
a. 1253-368= $884.73 / 24692 = $0.358/sf

iv. Heating and Cooling Efficiencies

1. 3 T air cooled = $6,007.38
2. 3 T water cooled = $6,057.88
    a. $50.50 per unit

d. DHW Electrification NYSERDA's Building of Excellence program data: https://www.nyserda.ny.gov/All-Programs/Multifamily-Buildings-of-Excellence/Winners/Resources

i. Incremental costs before incentives for all-electric DHW systems range from even to $7.76 per sq ft, the median was $0.00 and the average was $0.95



5. Multifamily

a. Incremental Costs

i. Assume upgrades are made in all 24 Zones, representing each space type

1. 884.73 * 24 = 21233.52 (/ 33740 = $0.63 / sq ft)

b. Microsoft PowerPoint - NEEA_Partner_Webinar-20170720

i. "Building Innovation - Multifamily." *New Buildings Institute*, 16 Mar. 2016, newbuildings.org/wp-content/uploads/2017/08/NEEA_Partner_Webinar-20170720.pdf.

ii. Incremental cost of installing cold climate heat pump in Boston was $6.80

c. Guide to Energy-Efficient Windows

i. "Guide to Energy-Efficient Windows." *U.S. Department of Energy*, Oct. 2010, www.energy.gov/sites/prod/files/guide_to_energy_efficient_windows.pdf.

d. NREL Energy Efficiency - EE Measures Database: https://remdb.nrel.gov/

e. NYSERDA's Building of Excellence program data: https://www.nyserda.ny.gov/All-Programs/Multifamily-Buildings-of-Excellence/Winners/Resources

i. Incremental costs before incentives for all-electric HVAC range from $0.03 to $17.19 per sq ft, the median was $1.05 and the average was $3.56

ii. Incremental costs before incentives for all-electric DHW systems range from even to $7.76 per sq ft, the median was $0.00 and the average was $0.95

f. Motor and Belt Efficiencies

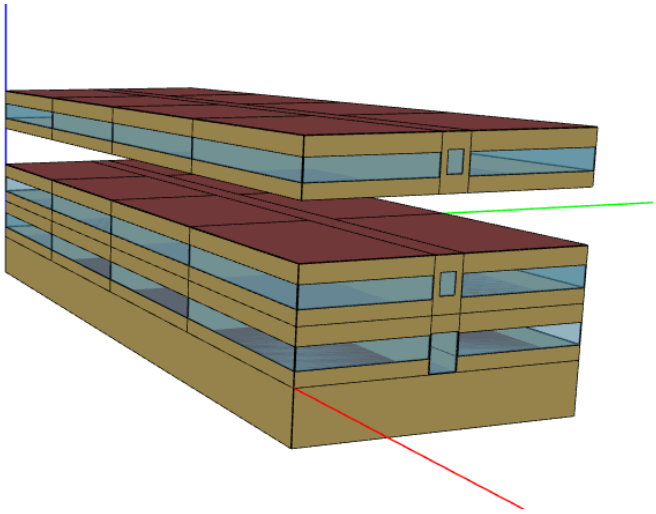
i. Baseline 5 HP motor = $368.64

ii. Drip proof, premium efficiency 5 heat pump motor = $1,253.37

1. 1253-368= $884.73 / motor

g. Elevator Improvement
    i. Average cost for standard elevator = $97,500
    ii. Average cost of efficient elevator = $110,500
        1. Difference of $13,000 = Incremental cost of $0.39/sf

h. Daylight Sensors
    i. 16 sensors, 4 per corridor on 4 floors @ ~$100 each
    ii. $1,600 total gives and incremental cost of $0.05/sf



Building Simulation Model Inputs					
Type Index	1	2	3	4	5
Building Type	Single Family Homes (townhome)	Multifamily Low Rise (1-4 Stories)	Hotel	Retail	Restaurants
Baseline Code	IECC 2021/ASHRAE 90.1 2019				
Vintage	New Construction				
Weather File (CZ4)	Washington-DC-Reagan-AP VA USA TMY3				
Number of floors (Above Grade)	2	4	4	1	1
Spaces	3 Bedrooms, 2 Bathrooms	39 Units, 1 Office	183 Guest rooms, Retail, Dinning, Office	Retail Space, Point of Sale	Kitchen, Dinning
Total Building Sq. Ft.	1,680	33,740	122,120	24,692	5,502
HVAC	Central AC and Gas-fired furnace	Split AC (with gas heating)	VAV with Reheat plus DOAS with ERV in guest rooms (Includes Economizer)	Unitary AC with gas heating coil	Unitary AC with gas heating coil
Hot water (DHW)	Storage Water Heater, Gas	Electric Water Heater	Storage Water Heater, Gas	Storage Water Heater, Gas	Storage Water Heater, Gas
Heating Efficiency (AFUE)	0.8	0.8	0.8	0.8	0.8
Cooling System Efficiency (SEER/EER/COP)	SEER 14	SEER 14	SEER 14	SEER 14	SEER 14
Heating Set Point (F)	70	70	70	70	70
Cooling Set Point (F)	73	73	73	73	73
Wall Construction (exterior)	Insulated Wood Framed(R-20)	Insulated Wood Framed(R-20)	Insulated Metal Building Wall (R-13.89)	Insulated Exterior Mass Wall (R-9.62)	Insulated Steel Framed (R-15.63)
Roof Construction	Insulated Attic (R-60)	IEAD Roof (R-31.25)	IEAD Roof (R-31.25)	IEAD Roof (R-31.25)	IEAD Roof (R-31.25)
Foundation Construction	Unconditioned Basement (Whole Wall- R10)	Unconditioned Basement (Whole Wall-R10)	Unconditioned Basement	Slab on Grade (F-Factor 0.52 Btu/hr.ft.R)	Slab on Grade (F-Factor 0.52 Btu/hr.ft.R)
Model Window to wall ratio	20%	40%	27%	20%	18%
Window (U-Factor / SHGC)	0.3U / 0.4 SHGC	0.36U / 0.36 SHGC	0.36U / 0.36 SHGC	0.36U / 0.36 SHGC	0.36U / 0.36 SHGC