



University of Virginia BUILDING ENERGY PERFORMANCE REQUIREMENTS

Summary

The University of Virginia Building Energy Performance Requirements outline UVA’s energy performance requirements for all new construction and major renovations projects. This document outlines maximum allowable building energy use metrics, methodologies for calculation, and rationale for their development. The energy requirements presented herein were developed to meet the requirements outlined in the UVA Green Building Standards (i.e., UVA Facility Design Guidelines, Appendix G). The [UVA Building Energy Modeling and Reporting Standards](#) provide additional information on expectations for developing project-specific energy performance estimates.

Unless otherwise stated, building energy consumption and associated metrics are based on the U.S. Department of Energy’s building *Site Energy* definition. For consistency, this means each building will be evaluated based on the hypothetical on-site building energy meter, including but not limited to electricity, chilled water, hot water, steam, and natural gas. Any upstream losses or efficiency gains shall not be accounted. **Note: This definition can differ from LEED energy modeling requirements.** The design team is responsible for reporting energy metrics within the appropriate context. **On-site energy production (e.g., solar PV) shall not count towards the building energy performance requirement.**

Building Type	UVA Maximum Building Energy Performance Requirement
Academic	47
Residential	37
Multi-Use	51
Research	130
Inpatient	229
Outpatient	130

*all energy requirements are expressed as energy use intensities (EUIs) based on annual energy consumption per building area (kBtu / ft² / year).

For more information, including updates, visit:

<https://sustainability.virginia.edu/resources/uva-building-energy-performance-requirements>

Development and Methodology

1. BUILDING TYPOLOGIES

The University of Virginia (UVA) has collated the variety of University owned and/or operated buildings into six major building types as outlined below.

- **Academic** – any facility with predominantly classroom, library, meeting, and/or office space.
- **Residential** – dormitories, multifamily residential and hotel type buildings.
- **Multi-Use** – high intensity-of-use spaces, such as gymnasiums, athletic facilities, and dining halls.
- **Research** – Facilities with significant laboratory type space.
- **Healthcare – Inpatient** – Inpatient and other intensive use hospital facilities.
- **Healthcare – Outpatient** – Outpatient and clinical healthcare facilities.

Each project's energy performance requirement will be determined based on the aforementioned building types. The intent is that vast majority of all existing and future UVA buildings should be appropriately represented within these categories. Where buildings have multiple, distinctly different programming typologies, up to three building types can be selected. The final energy performance requirement may be prorated per building type based on gross area, provided each building type makes up at least 20% of the total building area. Building renovations need only include areas being substantially renovated as part of the project scope.

2. BUILDING ENERGY PERFORMANCE BENCHMARKS

UVA conducted a University-wide building energy performance analysis in 2019 to benchmark the University's existing building stock and inform the development of subsequent energy performance requirements. As part of this exercise, a diverse subset of well-performing, existing buildings within each typology was selected as a benchmark. These existing building benchmarks are provided in *Table 2* below. Additional information is provided in Appendix A.

3. BUILDING ENERGY PERFORMANCE REQUIREMENTS

Building energy performance requirements were developed by reducing the existing building energy benchmark for each building type by 25%. The resulting energy performance requirements represent the maximum energy use intensity (EUI) allowable for each building type - as outlined in *Table 2*.

Table 2. UVA energy performance benchmarks for existing buildings and new building requirements

Building Type	UVA Existing Buildings Benchmark	UVA Maximum Building Energy Performance Requirement
Academic	62	47
Residential	50	37
Multi-Use	68	51
Research	173	130
Inpatient	305	229
Outpatient	173	130

*all energy requirements are expressed as energy use intensities (EUIs) based on annual energy consumption per building area (kBtu / ft² / year).

Appendices

Appendix A. DEVELOPING EXISTING BUILDING ENERGY BENCHMARKS

Building energy performance benchmarks for each building type were identified through the development of a building energy performance database. UVA tracks the energy consumption of over 550 owned and leased spaces. The primary use of each of these buildings was identified and sorted into one of the six building typologies described. Unique and non-applicable building types (e.g., modular and temporary buildings, parking garages, storage areas, etc) were removed from the dataset, as were buildings without a connection to UVA's district utilities (medium or low temperature hot water, steam, and/or chilled water). Average annual energy consumption for each building was compiled for the five-year period from 2014 through the end of 2018 and the average energy use intensity (in kBtu/ft²/year) was calculated. The top 10% of buildings (based on lowest EUI) were identified and used to calculate the subsequent UVA Existing Building Energy Benchmark as presented in *Tables 2 and 3*. For buildings types with at least 50 samples, the average EUI of the top 10% of buildings was designated the benchmark. For buildings types with 10 to 50 samples, the 10th percentile EUI was calculated and designated the energy benchmark. With only three building samples, the inpatient building benchmark was set equal to the best performing building.

Appendix B. ENERGY REQUIREMENTS FOR STAND-ALONE BUILDINGS

The existing building energy benchmarks described above were developed based on the subset of UVA buildings connected to district heating and cooling utilities. As such, energy requirements based on these benchmarks are most relevant to buildings connected to UVA district utilities. Any 'stand-alone' buildings that are not to be connected to UVA district utilities, therefore, will be required to meet an alternative energy requirement. In developing requirements for stand-alone buildings, a stand-alone building energy factor multiplier was developed. This multiplier accounts for the varied use of electrical, heating, and cooling energy in UVA buildings and the campus-level efficiency factor associated with each energy end use. Stand-alone buildings area assumed to produce all heating and cooling on-site, such that the building energy meters would be upstream of any heating or cooling equipment (e.g., heat pumps, chillers, etc.).

The stand-alone building factor developed by identifying the average proportional use of electricity, district cooling, district heating, and natural gas heating for each building type. Equivalent stand-alone site energy was then calculated by removing the efficiency and loss effects of central district heating and cooling. The UVA average district plant efficiencies of 435% for chilled water and 82% for low and medium temperature hot water and steam were used for this calculation. An average 82% efficiency factor for natural gas combustion was assumed for buildings with on-site natural gas. This analysis resulted in a UVA-specific stand-alone building energy performance conversion factor of 0.81. This factor shall be multiplied by the UVA Maximum Building Energy Performance Requirement from *Table 2* to develop the appropriate Maximum Building Energy Performance Requirement for a stand-alone building. The resulting stand-alone energy performance requirements are presented in *Table 3*.

Table 3. UVA energy performance requirements for new stand-alone buildings

Building Type	UVA Maximum Building Energy Performance Requirement for Stand-Alone Buildings
Academic	38
Residential	30
Multi-Use	41
Research	105
Inpatient	185
Outpatient	105

*all energy requirements are expressed as energy use intensities (EUIs) based on annual energy consumption per building area (kBtu / ft² / year).

Appendix C. EXCLUDED BUILDING PROGRAMMING

The following building functions can be excluded from the energy requirements described herein:

- Magnetic Resonance Imaging (MRI) rooms
- Clean rooms (ISO classes 1-6 per ISO 14644-1)
- Single-family residential

Where these building programs exist within a larger building, the prorated energy use and area of the excluded building function may be removed from the encompassing building’s energy performance requirement. The presence of an excluded building function does not preclude the larger building from the energy performance requirements discussed herein – only the prorated, excluded portion.

Appendix D. GUIDANCE FOR LEED DISTRICT ENERGY MODELING

Projects engaging in LEED energy modeling may opt to model buildings connected to district energy systems via any of the three paths proposed in LEED v4 EA Prerequisite: Minimum Energy Performance Option 1. Additional information and default assumptions for projects following ‘*Path 2. Full DES Performance Accounting*’ or ‘*Path 3 Streamlined DES Modeling*’ are provided in the [UVA Building Energy Modeling and Reporting Standards](#).