



# ENGINEERS NEWSLETTER

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## LEED® v5 for the HVAC Engineer

The Leadership in Energy and Environmental Design™ (LEED®) green building program is one of the preeminent green building rating systems in the United States and globally. The U.S. Green Building Council® (USGBC) officially released its newest version, LEED v5, in April 2025.<sup>1</sup> After 30 June 2026, all new projects will be required to register under this new version.<sup>2</sup>

For v5, the rating systems were updated to focus on a new set of impact categories: decarbonization, quality of life, and ecological conservation and restoration. While all of the rating systems (New Construction, Core and Shell, Interior Design and Construction, and Building Operations and Maintenance) were updated, this EN provides an overview of the changes to the New Construction (NC) prerequisites and credits (points) that are **most relevant to the HVAC system design engineer**. For specific details, refer to the USGBC web site and the LEED Reference Guide.<sup>3</sup>

Table 1. Energy and Atmosphere Prerequisites (P) and Credits (Points)

LEED v4.1 (NC)	Points	LEED v5 (NC)	Points
		Operational Carbon Projection and Decarbonization Plan	P
Minimum Energy Performance	P	Minimum Energy Efficiency	P
Fundamental Commissioning and Verification	P	Fundamental Commissioning	P
Building-Level Energy Metering	P	Energy Metering and Reporting	P
Fundamental Refrigerant Management	P	Fundamental Refrigerant Management	P
		Electrification	1-5
		Reduce Peak Thermal Loads	1-5
Optimize Energy Performance	1-18	Enhanced Energy Efficiency	1-10
Renewable Energy	1-5	Renewable Energy	1-5
Enhanced Commissioning	2-6	Enhanced Commissioning	1-4
Grid Harmonization	1-2	Grid Interactive	1-2
Enhanced Refrigerant Management	1	Enhanced Refrigerant Management	1-2
Advanced Energy Metering	1		

### Energy and Atmosphere (EA)

Table 1 compares the EA prerequisites and credits between v4.1 and v5.

**Operational Carbon Projection and Decarbonization Plan.** In support of the increased focus on decarbonization, this new prerequisite in v5 is intended to help building owners and design teams understand how current design decisions will impact a project's operational carbon emissions over time. **Operational carbon emissions** are due to the building's energy use for HVAC, lighting, process and plug loads, as well as water use and refrigerant leakage.

Compliance with this prerequisite requires the following:

1. The design team must analyze options to improve efficiency, reduce peak loads, and reduce operational carbon emissions early in the design process. An estimate of the annual site energy use must be submitted to the USGBC.
2. The USGBC will then generate a projection of the project's carbon emissions from energy use, based on current electrical grid data for the specific building location.
3. Finally, the project team must either earn at least four points under the new Electrification credit or create a plan detailing how decarbonization could be achieved over a 25-year period. The goal of this plan is to show the building owner how much less expensive it would be to design for electrification now, rather than to retrofit the building later.

**Minimum Energy Efficiency.** This prerequisite was updated to reference the 2019 (for projects registered before 1 January 2028) and 2022 (for projects registered on or after this date) versions of ASHRAE® Standard 90.1. LEED v5 allows for the use of any compliance path listed in Section 4.2 of the standard, although projects using the 2019 version must also comply with addendum CR, which limits building envelope trade-offs when the performance compliance path is used.

The second change to this prerequisite is that projects using the Performance Rating Method (Appendix G) compliance path must use future source energy in place of energy cost and must use the adjusted Building Performance Factors listed in the v5 rating system.

**Fundamental Commissioning.** In this prerequisite, LEED v5 was modified to cite Standard 90.1 as the basis for commissioning requirements. Commissioning is required for building systems (including HVAC), controls, and the building envelope (or enclosure).

**Energy Metering and Reporting.** In this prerequisite, LEED v5 was modified to cite Standard 90.1 as the basis for energy metering requirements. This includes whole-building metering and sub-metering of specific systems, such as HVAC, refrigeration, and some larger chilled-water plants. Monthly consumption data for each energy source, plus peak electrical demand and on-site renewable energy generation, must be shared with the USGBC for at least five years.

**Fundamental Refrigerant Management.**

This prerequisite was modified in v5 to focus primarily on the Global Warming Potential (GWP) of a refrigerant. Use of HCFC refrigerants is not allowed and the project team must complete an inventory of all refrigerant-containing equipment (indicating the type, quantity, and GWP of refrigerant used). If a refrigerant GWP exceeds 700, the team must develop a list of alternative equipment options that have a refrigerant GWP  $\leq 700$ . Finally, for systems that are field-assembled (i.e., connected by field-installed refrigerant piping), a leak test, vacuum test, and pressure test must be conducted prior to charging the system.

**Electrification (1-5 points).** This new credit encourages building designs that do not burn fuel on site, thereby reducing carbon emissions from the site. This is commonly achieved by “electrifying” systems that have traditionally used on-site fuel combustion, such as space heating, service water heating (SWH), cooking, and other processes.

- **Option 1:** Five points can be earned by designing the building to operate entirely without on-site combustion. To prevent sacrificing efficiency too much, and to manage peak demand on the electrical grid, the combined weighted-average efficiency of all space heating and SWH equipment must be  $\geq 1.8$  COP. Some equipment is allowed to be excluded from this calculation.
- **Option 2:** Alternatively, up to four points can be earned by largely avoiding on-site combustion in the following systems.
  - Two points can be earned by designing space heating systems to operate without on-site combustion, except for when outdoor temperatures are  $\leq 20^\circ\text{F}$ . If the project is in climate zone 3 through 8, the combined weighted-average efficiency of all space heating equipment must be  $\geq 1.8$  COP. Supplemental or auxiliary heating equipment that only operates when it is  $\leq 20^\circ\text{F}$  outside can be excluded from this calculation.
  - One point can be earned by designing the SWH system to operate without on-site combustion, except for when outdoor temperatures are  $\leq 20^\circ\text{F}$ . If total SWH capacity is  $> 34,000$  Btu/hr, the combined weighted-average efficiency of all SWH equipment must be  $\geq 1.8$  COP. Supplemental or auxiliary heating equipment that only operates when it is  $\leq 20^\circ\text{F}$  outside and point-of-use water heaters that comply with Standard 90.1 criteria can be excluded from this calculation.

- One point can be earned by designing cooking, laundry, process equipment, and non-emergency on-site power generation to operate without on-site combustion. Process heating equipment that is designed to operate when outdoor temperatures are  $\leq 20^\circ\text{F}$  is exempt.

**Reduce Peak Thermal Loads (1-5 points).**

This new credit seeks to minimize peak demand on the electrical grid, which is especially important in an electrified building.

- **Balanced Ventilation and Infiltration:** One point can be earned by designing the ventilation (intake) and exhaust airflows within 10 percent of each other (verified by a testing, adjusting, and balancing report), and by conducting an air leakage test to demonstrate that infiltration does not exceed a specified threshold.
- **Ventilation Energy Recovery:** One point can be earned by equipping each “fan system supplying outdoor air” with an exhaust-air energy recovery device that has an enthalpy recovery ratio  $\geq 70$  percent or a sensible heat recovery ratio  $\geq 75$  percent. Fan systems that supply (in aggregate) less than 15 percent of the project’s total outdoor airflow can be excluded.
- **Peak Thermal Load Reductions:** Up to three points can be earned by reducing the peak heating and peak cooling loads to below a specified threshold, using strategies such as better insulation, improved window performance, lower internal heat gains, or exhaust-air energy recovery.

**Enhanced Energy Efficiency (1-10 points).**

This credit was also updated to reference the 2019 and 2022 versions of Standard 90.1.

- **Option 1 (Prescriptive Path):** Up to seven points can be earned by using the protocol in Section 11 of Standard 90.1-2022 to earn eligible “Additional Efficiency Requirements” credits. Examples include Heating Performance Improvement (H02), Cooling Performance Improvement (H03), Ground-Source Heat Pump (H05), DOAS/Fan Controls (H06), and Guideline 36 Sequences (H07). Additional points can be earned by using one or more approaches to reduce energy used for plug and process loads.
- **Option 2 (Energy Simulation):** Alternatively, up to ten points can be earned by using Appendix G of Standard 90.1 to compare the proposed building to a baseline building model. Projects using this option must use future source energy in place of energy cost and must use the adjusted Building Performance Factors listed in the v5 rating system. Points are earned based on the percentage reduction in future source energy use.

**Renewable Energy (1-5 points).** Similar to v4.1, this credit in v5 offers points for using various levels of on-site and/or off-site renewable energy.

**Enhanced Commissioning (1-4 points).**

Two points can be earned by complying with ASHRAE® Standard 202-2024 for commissioning the HVAC, electrical, plumbing, control, data center, process, building monitoring, and renewable energy systems. An additional point is available for commissioning the building enclosure, including air leakage testing, water penetration testing, and infrared imaging.

Up to two points can be earned by implementing a monitoring-based commissioning plan that includes a remotely-accessible software platform that has the functionality to perform smart analytics and visually present all metered data. This allows the building operator to identify problems and issues when they occur, enabling the building to continue performing at a high level.

**Grid Interactive (1-2 points).** This credit awards points for implementing strategies that help improve grid reliability and decarbonization.

- **Energy Storage:** Up to two points can be earned by providing on-site thermal or electric storage that is capable of storing energy during off-peak periods and using this stored energy during on-peak periods. Examples include ice storage, chilled-water storage, and hot-water storage.
- **Demand Response:** One point is available by enrolling in a demand response contract with a qualified provider, such as the electric utility.
- **Automated Demand-Side Management:** One point can be earned by installing a control system that can automatically shed electricity demand, commonly initiated by a signal from the electric utility.
- **Power Resilience:** One point is available if on-site renewables and energy storage are sufficient to operate all “critical equipment” in the building independently from the grid for at least three days.

**Enhanced Refrigerant Management**

**(1-2 points).** Like the prerequisite, this credit was modified in v5 to focus on lowering refrigerant GWP. Points can be earned if the total weighted-average GWP in all new equipment is less than a specified threshold. The GWP benchmark for HVAC equipment is 700, so one point is earned if the weighted-average GWP is  $\leq 560$  (80 percent of the benchmark) and two points are earned if the weighted-average GWP is  $\leq 350$  (50 percent of the benchmark).

One point can be earned by using design and installation strategies and operational practices that limit refrigerant leakage. This may include avoiding (or minimizing) the use of field-installed refrigerant piping, using brazed or press-type fittings for piping, installing automatic leak detection systems, tracking refrigerant charge and leakage rates, and repairing leaks immediately.

## Indoor Environmental Quality (EQ)

Table 2 compares the EQ prerequisites and credits between v4.1 and v5.

**Construction Management.** Now a required prerequisite, this was formerly an optional credit in v4.1. Among its requirements is to use proper filtration if permanently installed HVAC equipment is operated during construction. Filtration media must be replaced after all construction activities have been completed and prior to test and balance.

**Fundamental Air Quality.** This prerequisite was renamed and updated to reference the 2022 version of ASHRAE® Standard 62.1. The project must meet all requirements listed in sections 4 through 6 of the standard, which means complying with more than just the ventilation rates. (Healthcare spaces must meet all the requirements in sections 6 through 10 of ASHRAE® Standard 170-2021.) LEED v5 allows for the use of either the Ventilation Rate Procedure (VRP), the IAQ Procedure (IAQP), or the Natural Ventilation Procedure. As in the previous version, each mechanical ventilation system with intake flow > 1000 cfm must be equipped with an outdoor airflow measurement device.

The second change to this prerequisite is that it now requires each “central HVAC system that supplies outdoor air and/or recirculated air to regularly occupied spaces” to be equipped with a MERV 13 filter. In v4.1, this was an option in the Enhanced IAQ Strategies credit.

**Enhanced Air Quality (1 point).** This credit was simplified into two options, depending on which procedure was used to comply with the Fundamental Air Quality prerequisite.

- **Option 1:** If the VRP was used, one point can be earned if the breathing zone ventilation rates are at least 15 percent higher than Standard 62.1 (or 30 percent higher for an additional “exemplary performance” point) for at least 95 percent of all regularly occupied spaces.
- **Option 2:** If the IAQP was used, one point can be earned if ventilation rates are determined using more stringent design limits for ozone (10 ppb), formaldehyde (20 µg/m³), and PM2.5 particulate matter (10 µg/m³).

**Occupant Experience (1-7 points).** Several credits from v4.1 have been combined into this single credit for v5. While most of the strategies are in the purview of the architect, the following two apply to the HVAC engineer.

- **Thermal Environment:** One point can be earned by designing occupied spaces to meet the requirements of ASHRAE® Standard 55-2023. This involves considering thermal conditions that adjust with changing seasons, overcooling during non-temperate seasons, and occupant tasks that require varying levels of movement.
- **Sound Environment:** One point can be earned by defining the acoustic criteria for each indoor and outdoor space, and using design strategies to meet those acoustic expectations. An additional point can be earned by using calculations, modeling, and/or measurements to demonstrate that all classrooms and learning spaces, and at least 75 percent of other occupied spaces, meet the defined acoustic criteria.

**Resilient Spaces (1-2 points).** This new credit focuses on strategies intended to protect occupants from events that can temporarily compromise indoor environment quality.

- One point can be earned by designing the HVAC system to protect occupants from smoke due to nearby wildfires or prescribed burns, as described in ASHRAE® Guideline 44-2024.

- One point can be earned by designing the HVAC system to operate in “infection risk management mode” that provides the minimum equivalent clean airflow rates outlined in ASHRAE® Standard 241-2023.
- Up to two points can be earned by using thermal modeling to demonstrate that the building can maintain “thermally habitable conditions” during a two-day power outage. One point is earned for modeling extreme heat conditions and one point for extreme cold conditions.
- Up to two points can be earned based on the percentage of regularly occupied spaces that have operable windows meeting the size and location requirements of the Natural Ventilation Procedure (Section 6.4) of Standard 62.1. One point is earned for 50 percent or two points for 75 percent.

**Air Quality Testing and Monitoring (1-2 points).** This credit was renamed and the option to perform a building flush-out was removed in v5. The requirements for preoccupancy air testing (up to two points) remain largely unchanged, with added details on the duration of testing and the number of measurement points. A new option (one point) was added for using permanently installed air quality monitors that report temperature, relative humidity, CO<sub>2</sub>, particulate matter (PM<sub>2.5</sub>), and total volatile organic compounds (TVOC).

**Table 2. Indoor Environmental Quality Prerequisites (P) and Credits (Points)**

LEED v4.1 (NC)	Points	LEED v5 (NC)	Points
		Construction Management	P
Minimum IAQ Performance	P	Fundamental Air Quality	P
Environmental Tobacco Smoke Control	P	No Smoking or Vehicle Idling	P
Enhanced IAQ Strategies	1-2	Enhanced Air Quality	1
Thermal Comfort	1	Occupant Experience	1-7
Interior Lighting	1-2		
Daylight	1-3		
Quality Views	1		
Acoustic Performance	1		
		Accessibility and Inclusion	1
		Resilient Spaces	1-2
IAQ Assessment	1-2	Air Quality Testing and Monitoring	1-2
Construction IAQ Management Plan	1		
Low-Emitting Materials	1-3	* Moved to MR section in v5	

## Water Efficiency (WE)

Table 3 compares the WE prerequisites and credits between v4.1 and v5.

**Minimum Water Efficiency.** As with v4.1, this prerequisite prohibits once-through cooling with potable water for heat rejection equipment and requires makeup water metering, conductivity controllers, overflow alarms, and efficient drift eliminators for cooling towers and evaporative condensers.

### Water Metering and Leak Detection

**(1 point).** This credit was expanded in v5 to include two options.

- **Option 1 (Submeters):** Similar to v4.1, this point can be earned by installing permanent water meters on a defined list of water-using subsystems, including makeup water for chilled-water or process-water systems.
- **Option 2 (Leak Detection Sensors):** Alternatively, a new option for earning this point was added in v5, which involves installing permanent water flow meters or sensors to detect leaks from various subsystems.

### Enhanced Water Efficiency (1-8 points).

Several credits from v4.1 have been combined into this single credit for v5. While most of the strategies are in the purview of the plumbing designer, two may apply to the HVAC engineer.

- **Optimize Process Water Use:** Unchanged from v4.1, up to two points can be earned by either minimizing cooling tower makeup water used for blowdown, increasing cooling tower water efficiency beyond a baseline defined by Appendix G in Standard 90.1, or by using alternative water to meet a percentage of the process water demand.
- **Water Reuse:** New in v5, one point can be earned by designing a water supply system that will allow for the future supply of reclaimed or alternative water sources to one subsystem (such as makeup water for cooling towers or boilers). Or two points can be earned by implementing such a system now, using reclaimed or alternative water from the site or supplied by a municipality.

Table 3. Water Efficiency Prerequisites (P) and Credits (Points)

LEED v4.1 (NC)	Points	LEED v5 (NC)	Points
Building-Level Water Metering	P	Water Metering and Reporting	P
Outdoor Water Use Reduction	P	Minimum Water Efficiency	P
Indoor Water Use Reduction	P		
Water Metering	1	Water Metering and Leak Detection	1
Outdoor Water Use Reduction	1-2	Enhanced Water Efficiency	1-8
Indoor Water Use Reduction	1-6		
Optimize Process Water Use	1-2		

## Materials and Resources (MR)

Table 4 compares the MR prerequisites and credits between v4.1 and v5.

### Quantify and Assess Embodied Carbon.

In support of the increased focus on decarbonization, this new prerequisite in v5 is intended to help building owners and design teams understand how current design decisions will impact a project's **embodied carbon emissions**. Embodied carbon emissions occur from the extraction, manufacturing, transportation, installation, maintenance and disposal of building materials.

In v5, however, the scope of this prerequisite is limited to only the structure, enclosure, and hardscape materials. This includes asphalt, concrete, masonry, structural steel, insulation, aluminum extrusions, structural wood and composites, cladding, and glass. Components of the HVAC system are not included in this assessment.

### Reduce Embodied Carbon (1-6 points).

This new credit awards points for using materials with less embodied carbon, either by conducting a whole-building life-cycle assessment or by submitting data from Environmental Product Declarations (EPDs). However, like the prerequisite, the scope of this credit in v5 is limited to only the structure, enclosure, and hardscape materials.

**Low-Emitting Materials (1-2 points).** In v5, this credit was moved from the EQ section to the MR section. Like in previous versions, this credit awards points for using products that emit only low levels of chemical contaminants. However, some products are excluded from this credit, such as HVAC (including ductwork), plumbing, electrical, and communications systems.

Table 4. Materials and Resources Prerequisites (P) and Credits (Points)

LEED v4.1 (NC)	Points	LEED v5 (NC)	Points
Storage and Collection of Recyclables	P	Planning for Zero Waste Operations	P
		Quantify and Assess Embodied Carbon	P
Building Life-Cycle Impact Reduction	1-5	Building and Materials Reuse	1-3
		Reduce Embodied Carbon	1-6
		Low-Emitting Materials	1-2
Environmental Product Declarations	1-2	Building Product Selection and Procurement	1-5
Sourcing of Raw Materials	1-2		
Material Ingredients	1-2		
Construction and Demolition Waste Management	1-2	Construction and Demolition Waste Diversion	1-2

### Building Product Selection and Procurement (1-5 points).

This credit awards points for selecting interior and enclosure materials that are environmentally, economically, or socially preferable—as demonstrated by a third-party product certification, ecolabel, declaration, or standard. The list of eligible product categories includes paints and coatings, adhesives and sealants, flooring, walls, ceilings, insulation, furniture, composite wood, and plumbing fixtures.

However, a **pilot credit** (“Multi-Attribute Mechanical and Electrical and Plumbing Products”) was recently published which adds mechanical, electrical, and plumbing (MEP) products to this list of eligible product categories.<sup>4</sup> This pilot credit awards points for installing MEP products that demonstrate beneficial impacts in the Climate Health attribute, plus at least one other attribute (Human Health, Ecosystem Health, Social Health and Equity, or Circular Economy).

- **General MEP Products:** One point can be earned by installing at least ten MEP products, from at least three manufacturers, that demonstrate multi-attribute criteria.
- **Targeted MEP Products:** One point can be earned by installing at least five “targeted” MEP products, from at least three manufacturers, that demonstrate multi-attribute criteria. The list of “targeted” products includes terminal units, air-handling units, heat exchangers, ductwork, and others.

In a departure from v4.1, an EPD alone is no longer sufficient documentation for this credit. A product-specific (Type III) EPD only demonstrates the Climate Health attribute, so additional documentation (such as a recycled content declaration, which demonstrates the Circular Economy attribute) will be needed from the manufacturer to satisfy the “multi-attribute” requirement of this pilot credit.

## EPDs from Trane

An Environmental Product Declaration (EPD) is a standardized, third-party-verified document that reports a product's environmental footprint across its life stages. It quantifies product environmental footprint data across the entire life cycle (upstream production and distribution, product use, and end of life), making it easier for engineers to compare products or model sustainability outcomes.

Trane® can provide EPD documentation for several of our most-specified products, and we are actively adding more. Find published EPDs on the product-specific pages of [www.trane.com](http://www.trane.com), or ask your local Trane expert.

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## Summary

Most of the changes implemented in LEED v5 are intended to put more emphasis on decarbonization, quality of life, and ecological conservation and restoration. While this *Engineers Newsletter* focused on the New Construction rating system, similar changes were also made to the Core and Shell, Interior Design and Construction, and Building Operations and Maintenance rating systems. For specific details, refer to the USGBC web site and the LEED Reference Guide.<sup>3</sup>

With the release of v5, the USGBC stated their intent to begin a five-year development cycle, so the next version of LEED may be released as soon as 2030.<sup>5</sup>

By John Murphy, applications engineer, LEED AP® BD+C, Trane. You can find this and previous issues of the *Engineers Newsletter* at [www.trane.com/EN](http://www.trane.com/EN). To comment, send e-mail to [ENL@trane.com](mailto:ENL@trane.com).

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## References

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- [2] U.S. Green Building Council web site, “LEED Certification Deadlines”: [www.usgbc.org/tools/leed-certification/deadlines](http://www.usgbc.org/tools/leed-certification/deadlines)
- [3] U.S. Green Building Council, LEED v5 Reference Guide: [www.usgbc.org/leed/v5](http://www.usgbc.org/leed/v5)
- [4] U.S. Green Building Council LEED v5 credit library, “Multi-Attribute Mechanical and Electrical and Plumbing Products”: <https://www.usgbc.org/credits/new-construction-core-and-shell-commercial-interiors/v5/mrpc185?return=%2Fcredits%2FNew%20Construction%2Fv5>
- [5] U.S. Green Building Council web site, “LEED v5”: [www.usgbc.org/leed/v5](http://www.usgbc.org/leed/v5)



## Learn more on how Trane is leading the industry in building decarbonization strategies.

- Visit [www.trane.com/decarbonization](http://www.trane.com/decarbonization)
- [HVAC Industry Update on Refrigerants](#)
- [Trane Engineers Newsletter](#) "Introduction to Decarbonization"
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### MARCH

Trends in Geothermal Systems and Ground Loops. Geothermal HVAC systems can offer premium performance, but often at a premium cost. New technologies have extended the use of geothermal to larger applications, while broadening its use in smaller applications. This ENL will discuss various geothermal system configurations.

### MAY

Modern VAV Solutions: Control Optimization and Electrification. This program explores the latest in variable air volume (VAV) systems. We will provide an overview of multiple-zone VAV systems, focusing on key components and system operation. System optimization strategies such as fan-pressure optimization, discharge air temperature reset, and demand controlled ventilation to enhance efficiency and comfort will be discussed. Electrification of heat and technological advancements, like connected controls and AI will be highlighted. Finally, a case study will demonstrate how optimization can save a significant amount of energy and money.

### SEPTEMBER

High Temperature Heating Solutions. High temperature hot water is required for some applications, even if it is less efficient than low temperature hot water. This program will cover technologies and designs that enable high temperature heating solutions, including compressors, plant layout, and system operation.

### NOVEMBER

Economizing: Evaluating Efficiency and Practicality in Modern HVAC Systems. With the focus of energy efficiency and sustainability, economizing remains a critical topic in modern HVAC systems. This program will discuss types of economizers, including relevant standard and guideline requirements. It will also discuss practical applications and examine scenarios where economizing is bypassed to recover or store heat effectively.

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