HVAC&R ENGINEERING

update

Designing for LEED™ Certification? There is Help Under Your Feet.

Introduction

In recent years, the commercial-building industry has become increasingly interested in the U.S. Green Buildings Council (USGBC) and its Leadership in Energy and Environmental Design™ (LEED) certification program. The interest is often triggered by tax credits, financial incentives, corporate policies, or government mandates.

If a building is being designed with LEED certification as a goal, it is important to know that the HVAC system can be a major contributor toward that goal. In fact, a variable-air-volume underfloor-air-distribution (VAVUFAD) system can garner a significant portion of the LEED points required for building certification.

This HVAC&R Engineering Update will briefly describe the USGBC and its LEED program. It will then explain how a VAVUFAD system, as well as other components of the HVAC system, can accrue LEED points in a variety of categories.

What is the U.S. Green Building Council?

The Council is a national nonprofit organization that was formed in 1993. Its quickly growing membership includes representation from organizations across the building industry.

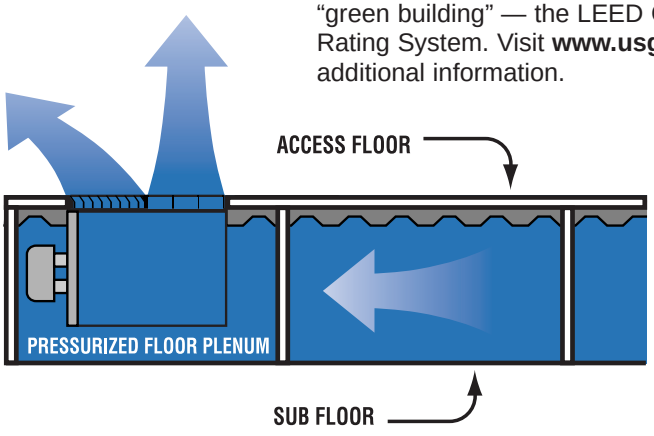
The purpose of the USGBC is to promote buildings that are environmentally responsible, energy efficient, profitable, and healthy places to live and work. This led to the development of a guideline and a "third-party" certification tool for what our industry defines as a "green building" — the LEED Green Building Rating System. Visit **www.usgbc.org** for additional information.

How does a project achieve LEED certification?

When a project is being designed with LEED certification as a goal, the first step involves certain mandatory criteria that must be incorporated into the design before LEED points can be achieved. There are seven of these prerequisites.

The design and construction of the HVAC system is affected by five of the seven prerequisites, as described below:

1. **Minimum Energy Performance** — requirement for the building design to comply with ASHRAE 90.1-1999 (without amendments) or the state/local energy code, whichever is more stringent.
2. **CFC Reduction in HVAC&R Equipment** — requirement for zero use of CFC-based refrigerants.
3. **Fundamental Building-Systems Commissioning** — requirement that commissioning specifications be incorporated into design documents and verify installation.
4. **Minimum IAQ Performance** — requirement for the building design to comply with ASHRAE Standard 62-1999.
5. **Environmental Tobacco-Smoke Control** — requirement that demands zero exposure of non-smokers to tobacco smoke by prohibiting smoking in the building or by providing a designated smoking room that has been tested in accordance with ASHRAE Standard 129-1997.



A variable-air-volume, underfloor-air-distribution system can garner a significant portion of the LEED points required for building certification.

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Once the seven prerequisites are met, then further design concepts and equipment or system choices can be utilized in order to accumulate LEED rating points. The certification levels are detailed below:

Certification Level	Points
Certified	26 – 32
Silver	33 – 38
Gold	39 – 51
Platinum	52 – 69

How do HVAC systems impact LEED certification?

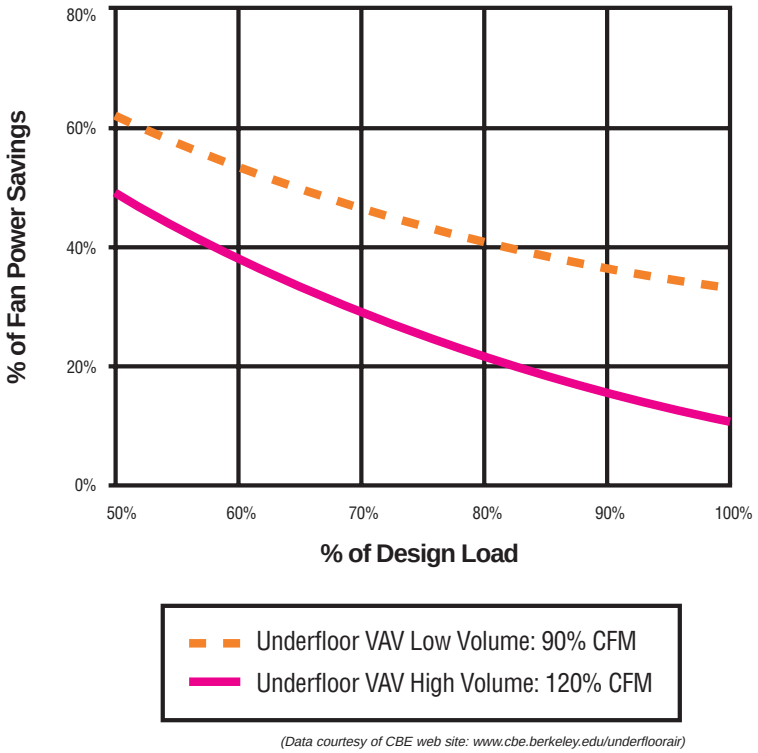
The following is a brief discussion of how the HVAC-system design can influence the LEED certification level of a project. As we will see, the HVAC component which can have the biggest impact is a VAVUFAD system, such as the YORK® FlexSys™ system. And there are other components which can also contribute.

The LEED rating system is organized into five environmental categories: Sustainable Sites, Water Efficiency, Energy & Atmosphere, Indoor Air Quality, and Material & Resources. A VAVUFAD system can accumulate points in three of these categories.

Energy & Atmosphere

The first of the environmental categories that the HVAC-system design can impact is Energy & Atmosphere. It is also the category which has the greatest number of potential points.

Figure 1: Fan-Power Savings of VAVUFAD System vs. Overhead VAV System



(Data courtesy of CBE web site: www.cbe.berkeley.edu/underfloorair)

Optimized Energy Performance (1 – 10 points)

This category requires a reduction in the building energy consumption beyond the levels specified in ASHRAE 90.1. By using the Energy Cost Budget (ECB) Compliance Form, the amount of energy cost reduction can be calculated and referenced to the table below for LEED rating points.

Energy Cost Budget Reduction

New Bldgs.	Existing Bldgs.	Points
15%	5%	1
20%	10%	2
25%	15%	3
30%	20%	4
35%	25%	5
40%	30%	6
45%	35%	7
50%	40%	8
55%	45%	9
60%	50%	10

According to the Center for the Built Environment (CBE) located at the University of California, a VAVUFAD system can have significant fan-power savings when compared to an overhead VAV system. As shown in Figure 1, from the CBE web site, the average fan-power savings can range from 25 to 50%, depending upon the amount of CFM required.

Additionally, by using higher-temperature supply air (63˚F), additional hours of free cooling are realized, reducing the central-plant energy consumption as well.

The choice of refrigeration equipment can also impact LEED points. YORK centrifugal and screw chillers have excellent design and off-design efficiencies. The off-design efficiencies far exceed the minimum requirements of ASHRAE 90.1. A YORK centrifugal chiller equipped with an OptiSpeed™ variable-speed drive (VSD) can exceed ASHRAE 90.1 efficiency levels by as much as 30%.

YORK also has a line of packaged rooftop units whose energy-efficiencies meet and exceed ASHRAE 90.1. These rooftop units can be supplied with a VSD on the supply fan to greatly enhance the off-design performance.

The resultant energy savings will vary from building to building. However, with an energy-efficient building design and HVAC system, it is conservatively estimated that 1 to 4 LEED points are possible.

Ozone Depletion (1 point)

This requirement dictates that the building's HVAC equipment not contain HCFC refrigerants. Thus HCFC-22 or HCFC-123 do not comply and are not eligible for achieving this rating point. In order to attain this credit, equipment should use HFC-134a, HFC-407C, or HFC-410A. The equipment must still comply with ASHRAE 90.1.

YORK has one of the broadest equipment offerings utilizing HFC refrigerants and that also comply with ASHRAE 90.1. These include water-cooled centrifugal and screw chillers, air-cooled screw chillers and rooftop units.

Materials & Resources

This is the second of the environmental categories that the HVAC-system design can impact. The most effective way to reduce this environmental impact is to reuse existing buildings and materials.

Recycled Content (1 – 2 points)

This item provides incentive for the use of materials containing recycled content. One point applies if the materials with recycled content are such that the post-consumer recycled portion constitutes at least 5% of the total value of materials in the project or combined post-consumer and post-industrial recycled content constitute at least 10%. An additional point is available if the above percentages are 10% and 20% respectively. This credit excludes MEP (mechanical, electrical, plumbing) in version 2.1. However, if the design incorporates VAVUFAD, then the raised access floor contributes by using recycled steel panels with fly-ash fill.

Regional Material (1 point)

This item provides incentive for the use of materials that are manufactured locally, thereby reducing the environmental impacts resulting from their transportation. Specify that 20% of building materials be manufactured within a radius of 500 miles. MEP is excluded, but the raised access floors required for VAVUFAD may contribute.

Indoor Environmental Quality

This is the third of the environmental categories that the HVAC-system design can impact. As highlighted in the prerequisites, the HVAC system must meet the minimum requirements of ASHRAE 62-1999 and have an acceptable Environmental Tobacco Smoke (ETS) control policy. In addition, there are several opportunities to capture additional points through utilizing an VAVUFAD design and additional building-control concepts.

High-efficiency refrigeration equipment that use HFC refrigerants, such as the YORK MAXE™ chiller (left) and the YORK Eco²™ rooftop unit (below), can earn LEED points in several categories.

Carbon Dioxide (CO_2) Monitoring (1 point)

This control option requires a permanent CO_2 monitoring system that provides feedback on space-ventilation performance. Using monitoring devices in the space to limit the CO_2 levels (to a maximum setpoint of 530 ppm above outdoor levels) allows the building to recognize the inherent capability of a VAVUFAD system to efficiently distribute fresh air to the occupied space. This provides better Indoor Air Quality (IAQ) by allowing more outside air to reach occupants in comparison to traditional overhead systems. Alternatively, one can reduce the outside-air requirement by as much as 30% to achieve the same ventilation requirement as an overhead system, following ASHRAE 129-1997 guidelines for measuring air-change effectiveness.

Increased Ventilation Effectiveness (1 point)

This concept details the need for the effective delivery and mixing of fresh air to support the health, safety, and comfort of building occupants. This is achieved by designing ventilation systems that result in an air-change effectiveness (E) greater than or equal to 0.9, as determined by ASHRAE 129-1997 and tested in accordance with this standard. However, if an VAVUFAD system is incorporated, then this system is assigned an E value greater than 0.9 and testing is therefore not required to earn this certification point.

Construction IAQ Plan (1 point)

The objective of this item is to prevent IAQ problems resulting from the construction/renovation process. First, develop and implement an IAQ Management Plan for the construction and preoccupancy phases of the building. By designing a VAVUFAD system, construction IAQ is a very important aspect of plenum integrity and cleanliness, and therefore is usually part of the design documentation as standard best practices.

Second, specify that all air-handling equipment be shrink-wrapped prior to shipment, to prevent the intrusion of contaminants during transportation and installation.

Controllability of Systems (1 – 2 points)

With this item, the intent is to provide a high level of individual occupant control of thermal, ventilation, and lighting systems to support optimum health, productivity, and comfort conditions. Providing controls for 50% of individuals in the non-perimeter regularly occupied space for airflow, temperature, and lighting contributes one (1) point. This can be economically achieved through task lighting and the use of a VAVUFAD system.

Thermal Comfort (1 – 2 points)

This design consideration results in a thermally comfortable environment that supports the productive and healthy performance of building occupants by complying with ASHRAE 55-1992. With its patented Convection Enhanced Ventilation (CEV) technology, a YORK FlexSys VAVUFAD system complies with this standard. By installing a permanent temperature-and-humidity-monitoring system, an additional point is available. VAVUFAD systems use this as a standard and thus achieve the additional point.

Low-Emitting Materials (1 point)

The intent of this constraint is to reduce the quantity of indoor-air contaminants by minimizing the volatile organic compounds (VOCs) content of adhesives and sealants used in the construction process.

This is impacted in an VAVUFAD system by the raised-floor system. For example, a Tate™ access floor/carpet system does not use adhesives that emit VOCs. This can help contribute to design compliance and result in a possible award of one (1) point.

Daylight and Views (1 – 2 points)

With a properly designed VAVUFAD system, ceiling supply and return ductwork are not required. This not only saves costs, but also allows for the elimination of a drop ceiling to conceal this ductwork. The designer then has more flexibility in the height of exterior windows to achieve a minimum Daylight Factor of 2% and/or ensure more occupants (requires 90%) have a direct line of sight to the outdoors.

Summary of Potential LEED Points

Optimized energy performance	1 – 4 points
Recycled content	1 – 2 points
Regional materials	1 point
Carbon dioxide monitoring	1 point
Increased ventilation effectiveness	1 point
Construction IAQ Management Plan	1 point
Controllability of systems	1 point
Thermal comfort	1 – 2 points
Low-emitting materials	1 point
Daylight and views	1 – 2 points
Potential Contribution	**10 – 16 points**

Conclusion

In 1998, the USGBC launched the LEED Pilot Program that resulted in 12 certified projects. By the end of 2001, 250 projects had been registered and 40 had been certified. Below are projections for the near future:

2005: 5,000 projects registered
1,000 projects certified

2010: LEED captures 15% of the commercial new-construction market

Building owners and designers interested in securing LEED certification for their project should definitely examine the HVAC-system design. YORK products, particularly the FlexSys VAVUFAD system, offer a variety of techniques to acquire a significant number of LEED points. For more information, contact your nearest YORK office.

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Form 130.15-PM1 (0603)