# AAON for Green Buildings

LEED®

# What is LEED®?

*"Sustainability" and "green" have recently become terms used within the building industry (and others) to refer to a construction project that has low environmental impact, or boasts highly efficient systems, or even promotes health and wellness among its occupants. But these terms are loosely defined, leaving many asking the question "What makes a green building?"*

*To answer this question, and to define just how "green" a building is, the U.S Green Building Council (USGBC) has developed its Leadership in Energy and Environmental Design (LEED®) accreditation system.*

The LEED rating system offers a way to place quantifiable measures upon building innovations/improvements, and gives discrete guidelines to otherwise loosely defined concepts such as "green" or "sustainable." LEED encourages those collaborating on structural projects: owner, architect, mechanical engineer, electrical engineer, lighting designer, contractor, and others to cooperate in the development of high performance buildings in order to meet minimum energy and consumption targets.

## Why pursue LEED accreditation?

Builders are adopting LEED accreditation in order to create efficient buildings with reduced operational costs and diminished environmental impact, while also maximizing the potential for satisfied and productive building occupants.

## How does LEED accomplish these goals?

LEED offers rating programs for different building project types including new construction, existing buildings, commercial interiors, core and shell projects, homes, neighborhoods, schools, retail, and multiple buildings/campus projects. Each rating program has a number of required prerequisites and available credits in specific categories: sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, and innovation. The level of LEED certification obtained is determined by the number of credits achieved. Four LEED certification levels are available: Certified, Silver, Gold, and Platinum, and each rating program is unique in the number of points required to achieve the levels. For example, LEED for New Construction or LEED-NC requires 26 points for Certified, 33 points for Silver, 39 points for Gold, and 52 points for platinum. A brief overview of the categories and examples of how credits are achieved (LEED-NC) follows. Consult the LEED rating programs (www.usgbc.org) for specific details about each available credit including possible methods to achieve the points.

### *Sustainable sites*

*(14 points possible):*

These credits emphasize the environmental impact of the structure and are impacted by site selection and management. They are earned by minimizing pollution sources, building into an existing urban area, conserving undeveloped land, promoting natural habitats, encouraging methods of alternative transportation, managing stormwater, and diminishing the temperature differences between developed and undeveloped areas.

### *Water efficiency*

*(5 points possible):*

These credits are obtained through conservation of water. They are earned by reducing or eliminating the use of potable water for landscape irrigation, reducing wastewater, and reducing overall water consumption.

### *Energy and Atmosphere*

*(17 points possible):*

This category incorporates two agendas: increasing building energy efficiency and reducing atmospheric impact. Energy credits are achieved by reducing overall energy usage, purchasing and producing renew-

able energy, commissioning building energy systems, and developing long term strategies to evaluate and maintain efficiency. By increasing energy efficiency, the demand for electrical power is lessened, and the use of raw materials required to generate the power is reduced. Green power generation methods such as solar or wind reduce carbon emissions and associated global warming. The credit for minimizing atmospheric impact is achieved by using no refrigerant, or by using a refrigerant that has low ozone depletion and global warming potential.

### *Materials and Resources*

*(13 points possible):*

The majority of credits in this category are gained through reuse and recycling of building materials. Credits are available for: reusing existing building structures, reusing or recycling building materials, and diverting building materials from disposal for recycling or reuse. Credits are also available for using local materials, rapidly renewable materials, and utilizing certified wood products. The local material credits emphasize a reduction in environmental impact from transportation. The use of rapidly renewable materials eases the depletion of non-renewable resources.

### *Indoor Environment Quality*

*(15 points possible):*

This LEED category focuses on the creation and maintenance of a comfortable, occupant-friendly indoor environment with credits for air quality, thermal comfort, and providing daylighting and outdoor views. Indoor air quality credits are obtained by effectively ventilating the indoor space, utilizing low-emitting construction materials (paints, carpets, adhesives), and minimizing the potential for pollutants to infiltrate the occupied space. Thermal comfort credits are obtained by providing temperature controlled working environment and giving a majority of occupants the capability to make adjustments for personal comfort. Daylighting credits are obtained for providing a majority of occupants with natural lighting.

### *Innovation and Design Process*

*(5 points possible):*

One credit may be obtained in this category if a participant on the project team holds LEED accreditation. The remaining credits are achieved in one of two ways: by significantly exceeding the requirements of the rating system, or alternatively by demonstrating innovation by a method that is not represented currently in the LEED for New Construction Rating System.

*Each rating program has a number of required prerequisites and available credits in specific categories: sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, and innovation.*

## What role do HVAC systems play in earning LEED credits?

While achieving LEED certification requires a total building perspective, the individual building components, such as the HVAC system, are brought into focus through specific credits. By incorporating credits such as those emphasizing energy efficiency, indoor air quality, and thermal comfort, the LEED rating program emphasizes quality and innovation in HVAC system capabilities.

## How does AAON support building green?

It is important that building engineers have the tools available that enable them to meet their LEED credit goals. AAON recognizes the responsibility an equipment manufacturer has in providing those tools, and supports the building construction industry by offering equipment with several innovative standard and optional features that support building "green."

### Alternative Refrigerant

Systems with Hydrochlorofluorocarbon (HCFC) refrigerants such as R-22 have a potential for ozone depletion because they contain chlorine which breaks down ozone molecules in the upper atmosphere and disrupts the absorption of potentially harmful UV-B radiation. Hydrofluorocarbon (HFC) refrigerants such as R-410A, however, have no potential for ozone depletion because they contain no chlorine. As an early proponent of the benefits of alternative refrigerants, AAON has been offering the environmentally responsible refrigerant alternative, R-410A, in commercial air conditioning equipment since 2001.

Another concern surrounding refrigerants is a potential to contribute to global warming. Many refrigerants have a global warming potential, a measure of its direct effect on warming, which occurs with its release into atmosphere. The best means of managing this effect is to minimize system leakage, which begins with the manufacturing process. To that end, equipment manufactured by AAON is pressurized and carefully tested at multiple stages throughout the manufacturing process to find any defects in the refrigerant system before shipment from the factory.

## Indoor Air Quality

There are several ways that HVAC equipment facilitates acceptable indoor air quality, and one of the most important is by providing ventilation. High concentrations of indoor air pollutants such as volatile organic compounds (VOCs) out-gassing from construction materials, cigarette smoke, particles from processes such as printing, dust, and allergens can lead to health concerns for building occupants. Ventilating the indoor space with fresh outdoor air dilutes these harmful contaminants and aids in minimizing health risks. AAON offers many features to handle a variety of various ventilation requirements including: 100% outside air units, economizers, mixed air bypass, return air bypass, power exhaust, sensible and total energy recovery wheels, large capacity cooling coils, and many others. AAON also offers features to ensure that performance is maintained over the life of a ventilating unit such as: hot gas bypass and freeze stats to prevent coil freezing, stainless steel gas heat exchangers, interior cabinet corrosion protection, serviceability features, and polymer e-coated coils.

## Humidity Control

Another important role that HVAC equipment plays in maintaining the quality of indoor air is humidity regulation.

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recommends indoor humidity levels of 30-60% RH because air containing very little moisture is uncomfortable, while air containing too much moisture can lead to potential health risks such as fungal and/or mold growth, and building deterioration. Typical air conditioning installations remove moisture from the ventilating outdoor air by condensing it out of the air, through the transfer of sensible heat, as the air is passed over the evaporator coil and cooled to the dew point. This does not always act as an adequate mechanism for humidity removal. One option that AAON offers to handle excessive humidity is a high capacity cooling coil. Since the saturation vapor pressure of water decreases with decreasing temperature, the moisture in the air condenses on the cooling coil as the air passes through the coil. Thus, the additional rows of a high capacity cooling coil allow for more dehumidification than a standard cooling coil.

In some applications, situations can arise where the space cooling load is low, and the space temperature setpoint is satisfied without the supply air being cooled to the dew point to remove moisture. This can result in a space humidity that is greater than desired. For such situations, a reheat dehumidification strategy is implemented. When the temperature setpoint of the space is satisfied, but the humidistat setpoint is not satisfied, the system will continue to operate, cooling the ventilation air to promote condensation, and then reheating the air so as not to overcool the space. The AAON hot gas reheat system uses modulating valves so that a controlled, precise amount of reheat is applied. This allows both space temperature and humidity to be satisfied, and uncomfortable temperature swings, typical of on/off reheat systems, are avoided.

## Air Filtration

An HVAC system also provides air filtration as a means of controlling particulate contamination. Proper filtration is an essential step to creating a healthy indoor atmosphere through removal of dust, spores, and other pollutants from both the ventilation air and the recirculated space air. A key element to adequate filtration is filter selection. Most filters are rated according to the MERV (minimum efficiency reporting value) scale, which assigns a number from 1 to 16 according to the filter's efficiency at trapping particles from 0.3 microns up to 10 microns in diameter. As the MERV rating increases, so does the ability of the filter to trap very fine particles. High MERV filters (MERV 13 through MERV 16) are extremely efficient and are regularly specified in applications such as hospital patient facilities and designated indoor smoking areas where airborne particle contamination must be kept very low. For spaces such as surgery centers or clean rooms that necessitate the strictest environmental quality, and require filtration efficiencies greater than offered by common filters, highly efficient HEPA filters are available. HEPA filters provide the maximum arrestance for particles less than 0.3 microns in diameter. AAON offers a variety of filtration options, including HEPA filters and high MERV rated filters, to meet diverse building requirements. Careful consideration of the filtration needs of individual spaces is urged. Selecting filters that are too permeable for potential pollutants may not adequately purify the air. On the other hand, highly efficient filters require greater fan static pressures and may require larger supply motors.

## Equipment Service

An additional means of promoting indoor air quality is to keep HVAC equipment clean and well maintained. AAON incorporates several features into its products in order to make cleaning and servicing equipment easier. One such feature is the high performance foam composite panel construction. The paneling provides several advantages over comparable fiberglass insulated construction: it is more structurally rigid, provides a metal interior liner that is easier to clean, and does not provide a porous surface that easily harbors dirt and mold. Other features that improve cleanability and deter mold growth are: double sloped stainless steel drain pans to encourage drainage and minimize corrosion,

***« Signature Centre, Denver, CO***
*Certified LEED Platinum, HVAC system includes AAON RL Series Rooftop Units and LL Series Chiller*

internal coating with corrosion resistant paint, and raised, removable coils. AAON also makes its equipment easily accessible with hinged door access and half turn lockable handles.

## Energy Recovery

When dedicating HVAC equipment to ventilation applications, it is also important to consider energy recovery. Exhausting conditioned air from the space while conditioning fresh outside air can require more energy usage and cost more than recirculating the return air, without an effective means of energy recovery. To address that need, AAON offers total and sensible energy recovery wheels and heat pipe heat exchangers.

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The energy recovery wheel consists of a rotating media coated with a silica gel desiccant that transfers sensible (sensible and latent for total energy recovery wheels) load from the outside air to the exhaust air to precondition the entering air and reduce required cooling and heating. These energy recovery devices can dramatically increase unit energy efficiency and cooling capacity, allowing for the selection of smaller tonnage units to satisfy the same load as a unit not equipped with energy recovery. The total energy recovery wheel can be particularly effective at reducing space humidity (especially at part load conditions) and mitigating discrepancy between the latent load of the space and the latent capacity of a cooling unit.

The heat pipe heat exchanger is an energy recovery device that AAON can incorporate into custom built equipment. It transfers sensible heat from the supply air to the exhaust air as with the sensible recovery wheel, but unlike the energy recovery wheel, the heat pipe performs this function with no moving parts. It is constructed of several refrigerant tubes, partially filled with refrigerant. The tubes consist of an evaporator section where warm outside air is passed over the condensed liquid refrigerant to vaporize it, and a condenser section where the refrigerant vapor is condensed as heat is transferred to the exhaust air. As with the energy recovery wheel, this device can reduce the amount of energy required to effectively cool the space, and increase unit capacity.

## Comfort

An important requirement for any HVAC system is that it provides a comfortable environment in addition to maintaining indoor air quality. The latest AAON innovation, the Digital Precise Air Control (D-PAC™) system, is engineered to satisfy both requirements by providing cooling and dehumidification under any load conditions. The system incorporates a Digital Scroll™ Compressor that has the capability to accommodate changing load conditions via capacity modulation. It can vary the amount of refrigerant flowing through the system, from 10% of its capacity, up to full refrigerant flow. This gives the Digital Scroll™ compressor the ability to precisely match load conditions and provide a superior level of comfort than is offered by single or multi-step compressors.

In addition to the Digital Scroll™ Compressor, the D-PAC system also utilizes return air bypass. The return air bypass feature provides an energy efficient means to control humidity at low latent loads. It consists of an economizer for ventilation, a return air damper that allows return air to pass through the evaporator coil, and a bypass damper to allow return air around the evaporator. Up to 50% of return air may be bypassed around the coil, allowing dehumidification of the mixed return and outside air which is then reheated by the bypassed return air.

To provide the optimal level of humidity control at higher latent loads, the D-PAC additionally includes a modulating hot gas reheat system. With the ability to vary the refrigerant flow to the reheat coil, the modulating hot gas reheat system provides the capability to compensate for excessive moisture, and maintain controlled humidity. By incorporating all three components, Digital Scroll™ compressor, return air bypass, and modulating hot gas reheat, the D-PAC system will efficiently and accurately maintain a comfortable environment under all conditions.

To maximize the efficiency of the D-PAC system, a total energy recovery wheel can be coupled with the system to precondition the air and further conserve energy. The D-PAC system eliminates the uncomfortable temperature swings that can accompany on/off control schemes, and difficulties in managing humidity (particularly at part load conditions) while maintaining efficiency by only providing the necessary capacity for precision cooling.

## Energy Efficiency

Minimizing the energy required to operate a building is another important LEED objective to which an HVAC system can significantly contribute. Many of the same features that AAON provides to enhance indoor air quality, responsibly manage refrigerant, and improve occupant comfort also offer energy savings. Features such as energy recovery wheels, R-410A refrigerant, Digital Scroll™ Compressor technology, economizers, and programmable control schemes with time of day scheduling increase system efficiencies and reduce operational costs.

AAON also offers condensing section alternatives to consider when optimizing building efficiency. One such option is an AAON Evaporative-Cooled Condenser. The AAON Evaporative-Cooled condenser can provide 20 to 40% savings over air-cooled condensers, and provides at least 22% water savings when compared with other evaporative-cooled condenser designs by incorporating a de-superheating coil above the wetted section. The de-superheating coil sensibly removes heat from the refrigerant, reducing condenser coil temperature and maintaining heat transfer effectiveness by limiting scale formation and fouling of the coil surface. Another option is a water-cooled condenser featuring either brazed plate or shell and tube heat exchangers. Water provides a better coefficient of heat transfer than air, and as a result, the water-cooled system can reduce required compressor capacity by up to 20%. These condenser options are available on AAON rooftop units, split system condensing units, and chillers.

A feature AAON offers on custom products to minimize energy consumption is direct evaporative cooling. The evaporative cooler (commonly known as a swamp cooler) uses wetted pads or misters to introduce water into the air stream, causing the air to approach saturated conditions, and causing the dry bulb temperature of the air to approach wet bulb temperature. This is a particularly effective technique for environments with hot, dry ambient air. With only the blower motors and small water pumps consuming electricity, it also uses significantly less energy than some alternative air conditioning solutions. This system does not incorporate refrigerants of any kind, so it has no potential for ozone depletion.

Some of the options AAON offers facilitate emerging energy efficient technologies such as low leaving air temperature systems, underfloor air distribution, and chilled beams.

Low leaving air temperature systems supply air between 45°F and 50°F to the space. Because the leaving air temperature is reduced from the standard 55°F, the supply air flow rate is reduced, therefore providing the same amount of cooling with a lesser volume of air. Smaller volumes of air require lower static pressure capabilities which reduces fan energy usage. The reduction in air supplied results in decreased coil face velocity, smaller ductwork, smaller supply fan motors, and better dehumidification. Thus compared to a traditional system, ductwork installation is cheaper, fan energy usage and noise are reduced, and the space temperature setpoint can be set to a higher temperature and still maintain comfort in the space because of the additional dehumidification. AAON units have been utilized in many low leaving air temperature applications.

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The underfloor air distributions system supplies conditioned air at floor level to cool the occupied space and displace warmer air. This system does not rely on 55 °F supply air mixing with room air to create a comfortable condition in the space as with traditional overhead distribution. Instead, conditioned air is supplied at warmer temperatures (typically 62°F to 68°F) and at low velocities directly to the occupied zone, requiring less energy input than traditional systems. An AAON

| AAON Green Building Features | |
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| **Feature** | **AAON Product Line Availability*** |
| Environmentally Friendly R-410A refrigerant | • All AAON refrigerant equipped products including:<br>• Large Commercial Rooftops<br>• Light Commercial Rooftops<br>• Chillers<br>• Large Commercial Condensing Units<br>• Light Commercial Condensing Units |
| Dedicated Ventilation unit (100% outside air) | • Large Commercial Rooftops<br>• Light Commercial Rooftops<br>• Commercial Air Handlers |
| High MERV or HEPA Filtration | • Large Commercial Rooftops<br>• Light Commercial Rooftops<br>• Commercial Air Handlers |
| High Efficiency Evaporative-Cooled Condenser | • Large Commercial Rooftops<br>• Chillers<br>• Large Commercial Condensing Units |
| Composite Foam Panel Construction | • Large Commercial Rooftops<br>• Light Commercial Rooftops<br>• Commercial Air Handlers<br>• Large Commercial Condensing Units<br>• Chillers |
| Energy Recovery: Heat Wheels, Fixed Plate Heat Exchanger | • Large Commercial Rooftops<br>• Light Commercial Rooftops<br>• Commercial Air Handlers |
| D-PAC™ precise comfort system | • Large Commercial Rooftops<br>• Light Commercial Rooftops<br>• Commercial Air Handlers |
| Modulating Hot Gas Reheat for Humidity Control | • Large Commercial Rooftops<br>• Light Commercial Rooftops<br>• Commercial Air Handlers<br>• Light Commercial Condensing Units<br>• Large Commercial Condensing Units |
| Corrosion Resistant Interior | • Large Commercial Rooftops<br>• Light Commercial Rooftops<br>• Commercial Air Handlers |
| VFD Controlled Condenser Fans | • Large Commercial Rooftops<br>• Chillers<br>• Large Commercial Condensing Units |
| Carbon Dioxide Sensor (Controls) | • Available for all products |
| Outside Air Monitoring Sensor (Controls) | • Large Commercial Rooftops<br>• Light Commercial Rooftops<br>• Commercial Air Handlers |
| Time of Day Scheduling, Optimized Building Performance, Inter-operable controller capable of integration into most building automation systems (Controls) | • Large Commercial Rooftops<br>• Light Commercial Rooftops<br>• Commercial Air Handlers<br>• Large Commercial Condensing Units |

*** In addition to the products listed, the AAON custom division can build equipment to include any of these features as well as many other customer specified features that are not listed.**

unit incorporating return air bypass lends itself naturally to this application by its ability to provide the higher leaving air temperatures, while maintaining the space relative humidity.

Chilled beams circulate chilled water at ceiling level to provide comfort. Warm air rises to the ceiling level to be cooled by the beams and then descends to displace the warmer air in the occupied zone. An AAON LL Series chiller can be mounted outside to provide the chilled water, and outfitted with an evaporative-cooled condenser for energy efficient operation. An AAON 100% outside air unit can be applied in coordination with the chilled beam system to provide enhanced ventilation, and the addition of an AAON outdoor boiler system provides a complete heating/cooling solution.

## AAON for green buildings

Building green is not just to benefit the environment as the name may suggest. Improving the quality of people's lives and reducing monthly costs are also ideas central to the program. With these advantages, it is not difficult to understand why LEED certification is becoming so popular, and more building teams are specifying equipment with features that will earn credits.

By offering a wide variety of green features and options, AAON is ready to meet the needs of customers with LEED objectives. Whether building teams are just looking to reduce long term monthly expenses, or pursuing LEED platinum certification, they can look to AAON to provide HVAC system solutions for green buildings.

Contact your local AAON sales representative for more information about building green with AAON.