



Achieving Cost Effective LEED-NC 2.2 Credits with the OptiNet™ Facility Monitoring System

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LEED® and the OptiNet™ System

OptiNet System Overview

The OptiNet Facility Monitoring System networks high performance sensors to continuously evaluate building indoor environmental conditions primarily in order to increase a building's energy efficiency. Knowledge drawn from measurements of carbon monoxide, carbon dioxide, total volatile organic compounds, small particles, temperature and humidity can be used to optimize building



performance, specifically its ventilation effectiveness, energy use, and also enhance indoor environmental quality (IEQ). The system facilitates improved energy performance and indoor environmental quality – the essence of LEED.

The LEED Building Rating System for New Construction (version 2.2) applies to new commercial construction and major renovation projects. Within the system there are three categories for which the OptiNet Facility Monitoring System will enable and generate cost effective LEED credits: Indoor Environmental Quality, Energy and Atmosphere, and Innovation & Design Process.

OptiNet has a direct and primary impact to help generate five to eight LEED credits:

► Indoor Environmental Quality (3 points)

EQ Credit 1: Outdoor Air Delivery Monitoring

EQ Credit 3.2: Construction IAQ Management Plan: Before Occupancy

EQ Credit 7.2: Thermal Comfort: Verification

► Energy and Atmosphere (Potentially 1 to 4 points possible based on application)

EA Credit 1: Optimize Energy Performance

► Innovation and Design Process (ID Credit 1)

Comprehensive IEQ Management System

OptiNet can also assist in earning credits for two additional points:

EA Credit 5: Measurement and Verification (M&V)

IEQ Credit 3.1: Construction IAQ Mgmt Plan: During Construction

Applying OptiNet to Earn Direct LEED Credits

Indoor Environmental Quality

The following credits may be considered for application to OptiNet:

► **EQ Credit 1: Outdoor Air Delivery Monitoring**

The intent of this credit is to provide capacity for ventilation system monitoring to help sustain occupant comfort and well being. This credit requires installation of permanent monitoring systems (carbon dioxide or outdoor air) that provide feedback on ventilation system performance to ensure that such systems maintain design minimum ventilation requirements – primarily to meet the ASHRAE 62.1-2004: Ventilation Standard for Acceptable Indoor Air Quality. For mechanically ventilated spaces, this credit requires monitoring of carbon dioxide concentrations within all densely occupied spaces; and for naturally ventilated spaces, monitoring of carbon dioxide concentrations in all spaces.

OptiNet Performance

OptiNet is a facility wide performance monitoring system that encompasses the industry's first multipoint sensing platform for ventilation and thermal comfort monitoring. Carbon dioxide monitoring is at the core of the OptiNet system for measuring ventilation effectiveness as required by the ASHRAE standard. OptiNet's patented approach using a high quality, stable, multiplexed sensor overcomes the accuracy and maintenance concerns traditionally associated with commercial off the shelf CO₂ sensors.

► **EQ 3.2 Credit: Construction IAQ Management Plan – Before Occupancy**

The intent is to reduce indoor air quality problems resulting from the construction/renovation process in order to help sustain the comfort and well-being of building occupants.

There are two options for meeting the requirements of this credit: one is to perform a building flush-out prior to or during occupancy. The second option is to conduct baseline IAQ testing after construction and prior to occupancy using testing protocols consistent with the U.S. Environmental Protection Agency's (EPA) Compendium of Methods for the Determination of Air Pollutants in Indoor Air. It must be demonstrated that contaminant maximum concentrations for formaldehyde, particulates, total volatile organic compounds (TVOCs), and carbon monoxide are not exceeded. A test for 4-Phenylcyclohexene is required only if carpets and fabrics with styrene butadiene rubber latex backing material are installed as part of the base building system.

OptiNet Performance

The OptiNet system and its array of high performance sensors can easily and quickly determine the concentration levels of most of the parameters identified in this credit. The specific requirements regarding the number of sampling locations / points, breathing zone height, and minimum time period are all achievable using OptiNet's networked system. Documentation of contaminant concentration levels is automatically generated as part of the IEQ parameter sensing. For formaldehyde testing, a handheld

instrument can be separately purchased or rented from Aircuity. Although not commonly needed, if 4-Phenylcyclohexene testing is required, a grab sampling and separate lab analysis of the sample must be performed.

► **EQ Credit 7.2: Thermal Comfort: Verification**

The intent of this credit is to provide for the assessment of thermal comfort over time. To fulfill the requirements, a thermal comfort survey of building occupants must be conducted 6 to 18 months after occupancy in accordance with ASHRAE Standard 55-2004: Thermal Environmental Conditions for Human Occupancy. The Standard defines the criteria for performing a manual survey; it also notes the use of trended data to validate the thermal environment. The LEED NC 2.2 Reference Guide highlights the use of a monitoring system to support the credit:

“Temperature, humidity, and other environmental monitoring systems provide facility operators with objective data to determine if the building space conditions meet the design intent and/or if they are being maintained consistently through the occupied periods”

If survey results indicate that more than 20% of occupants are dissatisfied with thermal comfort in the building, a plan for corrective action must be developed. The plan should include measurement of relevant environmental variables in problem areas in accordance with ASHRAE Standard 55-2004.

OptiNet Performance

OptiNet continuously monitors environmental parameters that directly impact occupant thermal comfort as referenced in the ASHRAE standard, specifically temperature and humidity. By automatically measuring and trending thermal comfort conditions and suggesting corrective action when a problem is identified, this information can be used to form the basis of the corrective action plan required by this credit.

Energy and Atmosphere

The following credits may be considered for application to OptiNet:

► **EA Credit 1: Optimize Energy Performance**

Intent of this credit is to achieve increasing levels of energy performance above the prerequisite standard established by ASHRAE / IESNA 90.1-2004, or the local energy codes, provided a minimum defensible equivalency has been established.

OptiNet Performance

The OptiNet system is a facility-wide monitoring system which can integrate with any building management system and is designed to provide sensing/control outputs for improved ventilation performance. As noted in the Indoor Environmental Quality (IEQ) section, OptiNet facilitates monitoring of CO₂ levels to provide feedback on space ventilation performance as defined by ASHRAE 62.1-2004. Additionally, the OptiNet system

can monitor fresh air level levels of the facility’s air handling units. Through the analysis of CO₂ levels and non-human pollutants at both the room and ventilation system level, OptiNet can provide effective Demand Control Ventilation (DCV) strategies to save energy.

Available data suggests that DCV reduces ventilation, heating, and cooling loads by 10% to 30%, and has reduced annual energy costs by \$0.05 to \$1 per square foot (\$0.54 to \$10.75 per m2)¹.

Similarly for laboratory/research facilities, a demand based lab ventilation control approach can dramatically and safely decrease the dilution ventilation rates from 6 to 12 air changes per hour (ACH) to as low as 2 ACH when laboratory air is considered clean. Labs use single-pass air (no recirculation is allowed), and this air is very expensive to condition. The air is filtered, cooled (or heated), pressurized, reheated, delivered to the space, and exhausted. This process is energy intensive. By reducing the demand for airflow, significant amounts of energy can be saved.

New Buildings	Existing Building Renovations	Points
10.5%	3.5%	1
14%	7%	2
17.5%	10.5%	3
21%	14%	4

► **ID Credit 1: Innovation in Design**

The intent is to provide design teams and projects the opportunity to be awarded between 1 and 4 points for exceptional performance above the requirements set by the LEED-NC Green Building Rating System and/or innovative performance in Green Building categories not specifically addressed by the LEED-NC Green Building Rating System.

Comprehensive IEQ Management System

This ID credit relates to implementing an indoor environmental management program that involves both sensing and quantitatively improving a facility’s indoor environmental quality.

The OptiNet System is used in combination with a building management system to implement a real time flush out system by first continuously monitoring key environmental parameters such as carbon monoxide, total volatile organic compounds, dewpoint, and fine particulates, all of which can affect occupant comfort and health. This information is then provided to the building control system to increase outside air ventilation when levels of these indoor air parameters exceed the flush out levels stated in EQ 3.2. Effectively this approach increases outdoor air to above code levels, but only

¹Schell, M., S.C. Turner, and R.O. Shim. 1998. “Application of CO-based, demand-controlled ventilation using ASHRAE Standard 62: optimizing energy use and ventilation.” ASHRAE Transactions 104(2):1213-1225.

when needed. For example, off gassing of new furniture, touch up painting, vacuuming, and other activities that release pollutants will trigger the BMS to instantly increase outside air to flush these contaminants out of the building. Furthermore, outdoor air can also be monitored to shutdown and override economizer operation information when the outdoor air is highly polluted and "not fresh". For example, high levels of nearby traffic pollutants might override the economizers.

Applying OptiNet to assist in earning two additional credits

► EA Credit 5: Measurement & Verification (M&V)

This credit intends to provide ongoing accountability of building energy consumption over time using one of two options for measurement and verification. Either Option D: Calibrated Simulation (Savings Estimation Method 2) or Option B: Energy Conservation Measure Isolation as specified in the *International Performance Measurement & Verification Protocol (IPMVP) Volume III: Concepts and Options for Determining Energy Savings in New Construction, April, 2003*.

OptiNet Performance

Energy savings in new construction is determined by comparing measured or projected post-construction energy use to the projected energy use of a baseline under similar operating conditions. OptiNet, through its ability to measure CO₂ or outside air at the air handling unit and/or the room level, may be used to verify the effectiveness of various energy conservation measures (ECMs).

OptiNet can provide M&V compliance of:

- Air economizer and heat recovery cycles (through monitoring of the AHU)
- Air distribution ventilation air volumes (monitoring of the AHU & space).

► **EQ Credit 3.1: Construction IAQ Management Plan – During Construction**

The intent of this credit is to reduce indoor air quality problems resulting from the construction/renovation process in order to help sustain the comfort and well-being of construction workers and building occupants. The IAQ Management Plan developed and implemented for use during construction must meet or exceed the recommended Control Measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 1995, Chapter 3.

OptiNet Performance

OptiNet's ability to monitor and document indoor air quality levels, specifically particulates (construction dust), VOC's (common to construction materials), carbon monoxide (construction vehicles, forklifts, temporary heat) and humidity levels (mold growth) provides an effective means of validating building IAQ during the construction process. OptiNet is to be included as part of the planned IAQ measurement methodology for source control during construction, and specified as a measurement of the air quality prior to occupancy.

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