INTEGRAL GROUP

CBE Livable Buildings Awards 2011

One of the world's first extraordinarily green laboratories, Tahoe Center for Environmental Sciences is the first in Nevada to be rated platinum.

Project Narrative & Images

Tahoe Center for Environmental Sciences

Incline Village, Nevada
University of California, Davis; Sierra Nevada College
Architects: Collaborative Design Studio
Area: 45,000gsf
LEED Certification: Platinum
Energy Savings: 50-60% over ASHRAE 90.1
Water Savings: 70-80% over standard

The new home of the UC Davis Tahoe Environmental Research Center has been named one of only five science laboratories in the world to receive a Platinum LEED Certification from the U.S. Green Building Council. In addition to being one of the world's first extraordinarily green labs, the building is the first in Nevada to be rated platinum and one of only 26 such buildings in the world. It uses 60 percent less energy and 65 percent less potable water than a building of the same function, climate and size designed to current code standards.

This world-class center for environmental research and education is a joint venture between Sierra Nevada College, the University of California at Davis, the Desert Research Institute, and the Rand Corporation. It was conceived from the beginning as an exemplary building that would embody the principles of sustainable design, energy and resource conservation, and the protection of human and environmental health. The building houses intensive laboratories, classrooms, and offices, and uses a variety of innovative mechanical designs, including chilled induction diffusers, low-flow displacement ventilation, radiant floor heating, capstone turbine cogeneration, 30K of BIPV (building integrated photovoltaics), lab exhaust heat recovery, evaporative cooling tower, chilled water storage tanks, direct evaporative cooling in air handlers, and a demonstration solar hot water heater. Plumbing design features include waterless urinals, low flush toilets, and a unique system for collecting and treating rainwater for reuse in toilet flushing, trap primers, and cooling systems. The building has achieved energy savings of 50-60% over ASHRAE 90.1, and 70-80% water savings over traditional systems, and is the first project in the state of Nevada to achieve LEED Platinum certification.

Awards:
ASHRAE Golden Gate Chapter, First Place Category II Institutional Buildings, 2008
University of California, Energy Efficiency Partnership Program Best Practices Award, 2008
US Senate Certificate of Commendation
North Lake Tahoe Chamber of Commerce Positive Environmental Impact Award
Southwest Contractor's Best of 2007, Nevada Awards of Higher Education Project
Environmental Design and Construction Excellence in Design Award, Honorable Mention
Best in the Basin Award for Green Build

The building uses 60 percent less energy and 65 percent less potable water than a building of the same function, climate and size designed to current code standards.

Energy Performance Data

Tahoe Center for Environmental Sciences

LEED Credit EA 1 – Optimize Energy Performance

A. Project Narrative

Tahoe Center for Environmental Sciences performs 58% better than ASHRAE 90.1-20001 Standards requirements using the LEED Energy Cost Budget methodology. This earns 10 LEED points.

The 46,700 square foot, three story structure is an educational building compromising several spaces including classrooms, faculty offices, multipurpose rooms, student rooms and student lounges. It also houses several teaching and research laboratories on the 2nd and the 3rd floor. The construction type is mostly metal frame with walls of R19 batt insulation and roof with R-30 insulation. The HVAC is zoned with one AHU serving the south office/classroom/support spaces and a second air handler dedicated to the north laboratory spaces. Both air handlers supply ventilation only; heating and cooling load are carried by radiant panels or induction diffusers in the spaces. Lighting consists mostly of direct/indirect pendant mounted fluorescent fixtures.

The building was designed to achieve low energy use through a number of mechanisms. The envelope, in particular shading and glass selection, was optimized to eliminate the need for dedicated perimeter zone reheating. The office and laboratory systems have been configured to eliminate reheat entirely as well as cut the supply airflow down to ventilation only. The floorplan was laid out around a central lightwell to maximize the daylighting opportunities[1]. Beyond the large system savings realized through close coordination between the architect and mechanical designers throughout the design, the mechanical systems were also optimized (premium motors, low face velocity air handlers, heat recovery, co-gen with heat recovery, condensing boilers, waterside free cooling with thermal storage, etc.).

Both the budget and design energy cases are modeled in VisualDOE (version 4.0) and hourly analysis performed on DOE2.1E, version 119 using the climatic data for Tahoe City. The energy rates used for both the budget and as-designed cases are based on local utility rates namely; Sierra Pacific GS-2 Demand rate at $0.11 per kWh for electricity, Sierra Pacific NG at $1.02 per therm for natural gas, and CoGen Sierra Pacific NG at $0.96 per therm for the turbine in the proposed building.

[1] In accordance with ASHRAE 90.1 – 1999, no credit is taken for daylighting to spaces daylit via the internal lightwell space.

B. Building Energy Efficiency Measures:

1. High Efficiency Lighting Controls: Average lighting power density for the Tahoe Center for Environmental Sciences is 0.875 w/sf versus 1.16 w/sf allowed by ASHRAE 90.1–1999 standards using the Space by Space method.

2. Lighting Occupant Sensor Controls: The private offices in the office structure use lighting occupant sensor controls to switch off the lighting whenever the offices are unoccupied. This project has adopted a 20% lighting power density credit for occupant sensor controls in private offices as per LEED CIR dated 2/4/2003.

3. Daylighting: Daylighting controls having set point of 50 foot candle illumination are installed for 25% to 45% of lighting fixtures. In addition there is extensive presence of day lighting design, light shelves, light wells, window placement and harvesting controls for perimeter zones.

4. High Efficiency Glazing: The assembly U-value for the fenestration is 0.29 versus 0.57 allowed by ASHRAE standards. The high efficiency glazing used is Solarscreen Low-E (VE) Insulating Glass VE 1-2M with visible transmission of 70%.

5. Cooling Plant: Compressor based cooling has been eliminated. The laboratory is in a very dry climate with a mild cooling season. The ASHRAE 0.1% cooling design condition is 84F at less than 20% RH. The main air handlers supply ventilation air only, tempered to 66F to supply minimal cooling and ensure peak operation of the displacement ventilation system in office spaces. The air is tempered through direct evaporative cooling using the same airless-atomizing humidifiers that provide humidification during the very dry winter season.

Chilled water is provided for zonal loads from 50,000 gallons of thermal storage charged at night, when climate conditions allow for the production of 55F or lower temperature chilled water by a cooling tower – a waterside freecooling economizer that allows for the elimination of a chiller entirely.

Heating loads are far more significant in this climate. The baseline heating load is served by waste heat from a 24 kW (altitude derated capacity) cogeneration turbine. The peak heating load, which is substantial, is met by condensing boilers operating at better than 93.5% efficiency.

6. Office HVAC: The ventilation system is constant volume and provides neutral/cool air at the relatively low rate of 25 cfm/person (outside air rates and schedules are identical between the base and design cases). Air is supplied at 66F in a displacement ventilation configuration, that is low velocity at floor level. The ventilation air provides a significant amount of cooling to high occupant density spaces, some of which are equipped with CO2 sensors to control ventilation rates, but is not controlled to nor intended to carry the primary space conditioning loads.

Heating and cooling are provided by radiant panels or floor slabs. The very dry climate not only allowed for direct evaporative cooling to be used to temper the ventilation air (the air handler has no cooling coil), but combined with the 55F or higher chilled water loop also eliminated condensation concerns. Significant modeling and architectural coordination of shading, window placement, glass type and space configuration combined with appropriate mechanical zoning eliminated the need for any reheat. Indeed, with no cooling coil in the ventilation air handler reheat beyond what is needed for comfort humidification is impossible.

It is expected that the radiant nature of the space conditioning will allow for the use of a wider comfort temperature band, however the energy savings take no credit for this – the temperature schedules between the base case and proposed case are identical.

7. Laboratory HVAC: The laboratory spaces were significantly more challenging, with higher loads, much higher airflow requirements, and tighter temperature requirements. Ventilation is supplied from a single air handler, with cooling tempering to 68F provided by direct evaporative cooling and heating tempering to 55F provided by a hot water coil. The ventilation air control is designed to eliminate simultaneous heating and cooling in the system; with the lowest cooled (via direct evaporation) temperature being 68F, there is no reheat.

Space loads are carried using 'chilled beam' style induction diffusers. The induction diffusers have both a heating and cooling coil. The design of the diffuser draws air over the conditioning coils without the use of an additional fan. The high ventilation rate required for labs provide a high enough volume of induced air to cover the lab loads at the zonal level, essentially providing a fourpipe fancoil in every lab space without the need for a small, inefficient fan.

It should be noted that, in accordance with ASHRAE 90.1 – 1999 requirements, the ventilation rates for the laboratory spaces are the same in the base case and the proposed case. Since the baseline system does not use induction diffusers, this necessitated the modeling of a recirculation VAV system for the base case – a system that is far more efficient than the actual baseline 100% outside air system required by most safety standards and provided in the actual design for this type of laboratory. Actual client savings from use of induction diffusers when compared to a realistic laboratory baseline of a 100% outside air system are significantly higher.

8. Laboratory Exhaust: The laboratories are equipped with a variable volume exhaust system. Considerable consultation between the mechanical designer, laboratory consultants, and laboratory end users allowed an aggressively low air change rate to be used, reducing the condition costs. In addition, in the low-risk teaching labs a nighttime setback to lower the ventilation rate even more when the laboratory is unoccupied has been implemented. Per ASHRAE 90.1-1999, the same ventilation rates and schedules are used for the base case model as for the proposed model so no energy saving credit is taken for these efforts. However, the client has and will realize significant savings, in the form of operating cost and first cost equipment downsizing benefits.

9. Low Face Velocity Rightsized Airhandlers: The air handlers were sized to a face velocity of 300-350 rather than the industry standard of 500 fpm, yielding considerable pressure drop savings. The ductwork was also "oversized," although per ASHRAE 90.1 – 1999 and current LEED CIRs, no credit was taken in the model for low pressure drop oversized ducting. The vast majority of fan energy savings seen in the model are from the much lower flows made possible by the use of radiant and induction diffusers for conditioning.

10. Heat Recovery: A run-around heat recovery loop has been implemented on the laboratory exhaust. The low design heating temperature of 7F combined with the high laboratory ventilation rates made a heat recovery system a very attractive option to trim the peak heating load and downsize the boilers. A runaround loop is used to allow the greatest separation between the supply air intake and the exhaust stacks. A runaround loop, with a variable speed drive on the recirculation pump, also allowed for a high degree of optimization in the frost control methodology, an important benefit when trimming the load on a few peak days is a primary concern.

11. Cogeneration: A 24 kW Capstone turbine is being installed in this project. The heating dominated nature of the climate allows for excellent utilization of the generated heat making this an economical option. The client also appreciates the additional level of power backup provided by the turbine.

12. Photovoltaic: A 32 kW (rated DC power) photovoltaic system is installed on the building, producing an average 60,900 kWh of energy (AC output) annually. This number is 11.3% of the total energy use.

C. Comparison of Budget Design versus Design Energy Case

The table below summarizes the key features of the envelope, mechanical and lighting systems that contribute to the regulated energy savings.

Case Name	ASHRAE 90.1 Add E Base Case	Tahoe Center for Environmental Sciences
Envelope		
Windows	U = 0.57, SHGC = 0.49; VLT = 0.6; Thermally broken Aluminum frames	U = 0.29, SHGC = 0.43, VLT = 0.7; Viracon VE1-2M - High Efficiency Glazing; Thermally broken Aluminum frames
HVAC - Plant		
Thermal Storage	None	Chilled Water Storage
Cooling Source	Air-Cooled Package Unit per LEED EPM baseline requirement	No chiller
Air Heating Source	Boiler, 80% efficiency	Condensing Boiler, 93.5% Efficiency
Reheat Heat Source	Boiler, 80% efficiency	Condensing Boiler, 93.5% Efficiency
Cogen System	none	2 x 12kW turbines with heat recovery: etaE=26%, etaHrec=35%
HVAC - Office Conditioning		
Supply Air Control	Supply air temperature is reset based on warmest zone from 55°F to 65°F	Constant, 66°F
Fan Control	VFD	Constant volume ventilation in majority of areas; occupant controlled diffuser dampers ("residential" style) for personal space control in many areas
Reheat/Perimeter Heating	Reheat Boxes	Radiant Heating and Cooling, no reheat provided.
Cooling and Heating Setpoints	70°F / 78°F	70°F / 78°F
Outdoor Air Rate	15 cfm per person	15 cfm per person
HVAC - Laboratory Ventilation System		
Ventilation Fan System	4.35 in. w.g. supply fan system; 2.0 in. w.g. exhaust fan system. The supply system pressure drop is higher than in the proposed due to the allowance made by the EA C1 CIR response dated 1/20/2004. Proposed system has a face velocity of 330 fpm versus 500 fpm baseline.	2.7 in. w.g. supply fan system; 2.0 in. w.g. exhaust fan system.

Reheat	VAV Reheat System	Reheat *eliminated* through the use of Four-pipe induction units, or "chilled beams," allowing a neutral supply air temperature (modeled as a constant 66°F)
Cooling and Heating Setpoints	Teaching Labs = 70°F /78°F, 55°F setback; Research Labs = 71°F /73°F, 68°F setback	Teaching Labs = 70°F /78°F, 55°F setback; Research Labs = 71°F /73°F, 68°F setback
Outdoor Air Rate	Variable flow, 1 cfm per sf minimum, seasonal fluctuations – ventilation schedule and rate identical to proposed	Variable flow, 1 cfm per sf minimum, seasonal fluctuations
Electrical Systems		
Installed Lighting Density	1.4 W/SF	0.87 W/SF
Lighting Occupant Sensor Controls	None	Occupant sensor controls modeled as 20% reduction in lighting power density.
Lighting Daylighting Controls	None	Daylighting for 25% to 45% of fixtures in at 50 FC illumination set point.
Renewable Energy Systems		
Photovoltaic	None	32 kW (DC) at a 9.5 deg. tilt, oriented South.
Schedules		
Occupancy, Lighting & Equipment	*Offices* – Monday through Friday 8AM to 5PM, Saturday 8AM to 12PM *Classrooms* - Monday through Friday 8AM to 5PM, Saturday 8AM to 12PM *Research Labs* - Monday through Friday 8AM to 5PM, Saturday 8AM to 12PM *Teaching Labs* - Monday through Friday 8AM to 5PM, Saturday 8AM to 12PM	*Offices* – Monday through Friday 8AM to 5PM, Saturday 8AM to 12PM *Classrooms* - Monday through Friday 8AM to 5PM, Saturday 8AM to 12PM *Research Labs* - Monday through Friday 8AM to 5PM, Saturday 8AM to 12PM *Teaching Labs* - Monday through Friday 8AM to 5PM, Saturday 8AM to 12PM
HVAC	Offices – 24hours a day Classrooms - 24hours a day Research Labs - 24hours a day with night set back Teaching Labs - 24hours a day24hours a day with night set back	Offices – 24hours a day Classrooms - 24hours a day Research Labs - 24hours a day with night set back Teaching Labs - 24hours a day24hours a day with night set back

D. ECB Table

Energy Summary by End Use

End Use	Energy Type	Proposed Building		Budget Building		Optimized Energy Performance
		Energy 10^4Btu	Peak 10^4Btu/h	Energy 10^4Btu	Peak 10^4Btu/h	[%]
Lighting	Electricity	292,399	115	652,303	215	45%
Lighting	Co- Gen	41	0.0055	NA	NA	NA
Space Heating	Gas	220	0.1431	619	0.3675	36%
Space Cooling	Electricity	23,126	67	339,068	293	7%
Space Cooling	Co- Gen	4	0.0001	NA	NA	NA
Heat Rejection	Electricity	21,563	19	NA	NA	NA
Heat Rejection	Co- Gen	6	0.0001	NA	NA	NA
Fans/Ventilation	Electricity	295,750	54	1,070,262	130	28%
Fans/Ventilation	Co- Gen	94	0.0136	NA	NA	NA
Pumps	Electricity	25,263	7	50,929	6	50%
Pumps	Co- Gen	8	0.0018	NA	NA	NA
Domestic Hot water - Gas	Gas	19	0.0024	16	0.0021	119%
TOTAL BUILDING CONSUMPTION		**658,495**	**262**	**2,113,197**	**644**	**31%**

Note: Energy Consumption is listed in units of site energy
10^3 Btu = kWh x 3.413 10^3 Btu = therms / 100

Energy and Cost Summary by Fuel Type

Type	DEC'' Use 10^4Btu	DEC'' Cost [$]	ECB' Use 10^4Btu	ECB' Cost [$]	DEC'' / ECB' Energy %	DEC'' / ECB' Cost %
Electricity	658,101	$21,827	2,112,562	$65,573	31%	33%
Natural Gas	240	$24,609	635	$64,947	38%	38%
Co Gen	154	$14,856	0	$0	NA	NA
Total Nonrenewable	658,495	$61,292	2,113,197	$130,620	31%	47%
Renewable	207,852	$6,882	0	$0	NA	NA
Total including Renewable	866,347	($61,292 - $6,882) **=$54,410**	2,113,197	$130,620 - $0) **=$130,620**	41%	42%

Percent Savings = (ECB' $ - DEC'' $)/ECB' $ = 58.3%

E. Comparison of Measured vs. Modeled Building Performance

Year	Measured vs. Predicted Energy Use (kBtu/sf-yr)
2007	121.9
2008	144.2
2009	154.6
2010	148.5
Modeled	141.1

Project Team

Integral Group (formerly Rumsey Engineers) is the most innovative MEP firm in North America and a leading practitioner of sustainable design. Founded in 1996, Integral Group has five offices nationwide. We are the first in the U.S. to achieve seven LEED platinum buildings. and currently have 13 LEED Platinum Certified projects, as well as several net zero buildings in design. Because we have deep experience with so many highly sustainable projects, we know how to deliver them cost effectively, with elegant yet feasible, value-engineering resistant design solutions that can be executed within standard budgets. Our mission is to transform building practices by creating prominent examples of innovative buildings that are affordable and practical, as well as being significantly more energy and water efficient than standard designs. We have developed complex, innovative research facilities for such clients as: University of California, Davis; University of California, Berkeley; University of California, Santa Cruz; California Institute of Technology; California Polytechnic University; Stanford University; Lawrence Berkeley National Laboratory; National Renewable Energy Laboratory; J. Craig Venter Institute; and Sandia National Laboratories.

Integral Group and **Integrated Design Associates** (IDeAs) have collaborated on the design of over 20 projects achieving the highest sustainability goals, accomplishing LEED Platinum Certification and Net Zero Energy targets, including: University of California, Davis, Tahoe Center for Environmental Sciences ; Caltech Linde + Robinson Lab for Global Environmental Science; California Polytechnic Institute Center for Science & Mathematics; Packard Foundation Headquarters; and J Craig Venter Institute. IDeAs is a California Corporation, established in 1999, and is certified as a Disadvantaged Business Enterprise (DBE). IDeAs will serve as a sub-consultant to Integral Group, providing sustainable electrical systems design services, including power distribution, emergency power systems, fire detection and alarm, public address, master clock, CATV, telephone, and security and data systems. IDeAs is a leader in Net Zero Building Design, with four completed and two in construction, as well as several LEED Platinum Certified projects. IDeAs' specialties include lab facilities, ranging from new research labs to modernizations.. Our long history of working together has resulted in efficient communication and a seamlessly coordinated MEP packages.

Collaborative Design Studio is a multi-faceted architectural firm which also provides environmentally sustainable design, energy efficient design, historic preservation, land planning and interior design services. The ability to creatively design diverse types of buildings and to produce beautiful, valuable and successful projects in a timely and cost-effective manner is our firm strength. By employing experienced and qualified architects and technicians, the firm's staff remains medium in size to maintain personal contact between principals and clients, while also maintaining the capability to provide services effectively and efficiently for projects of varying size, complexity and type.

David Nelson & Associates is a design firm that specializes in sustainable architectural lighting projects. The firm, founded in 2004, is committed to environmentally sensitive and responsible design. DNA provides the highest quality lighting design services that focus on aesthetics, energy efficiency and the integration of electric light with daylight and architecture. Through integrated analysis and modeling, DNA works with other design team specialists to develop environmentally responsible lighting systems that are beautiful, affordable and save energy. The firms is active within the American Institute of Architects' National Committee on the Environment Advisory Group, the International Association of Lighting Designers Sustainable Design Committee ,and the Illuminating Engineering Society of North America's Sustainable Design Recommended Practice Committee. David Nelson & Associates, LLC is currently involved in many noteworthy projects including several net zero and LEED Platinum projects.

Project Team

The team was comprised of some of the top experts in resource efficient and sustainable building and community design in North America. Through an integrated design process,our team evaluated the unique circumstances that affected the project's effectiveness., including site orientation, community context, building materials and MEP system design; thereby, resulting in a project that maximizes user comfort. We worked closely with our clients and end users to achieve and exceed the goals for the project. The team for the project is as follows:

- Owner: UC Davis Architects and Engineers / Bill Starr, Senior Architect
- Mechanical Engineer: Integral Group (formerly Rumsey Engineers), Oakland, California / Peter Rumsey, Managing Director
- Electrical Engineer: Integrated Design Associates, San Jose, California / David Kaneda, President
- Architect: Collaborative Design Studio, Reno, NV / Todd Lankenau, Managing Partner
- Lighting Designer: David Nelson and Associates, Littleton, Colorado / David Nelson, President

Additional Information

UC-Davis Tahoe Center of Environmental Sciences

The Tahoe Center is only the second building in the UC system to achieve LEED Platinum certifiction, LEED's highest level. The facility incorporates innovative energy strategies including active chilled beams, cold water storage, and rooftop photovoltaic shingles.

BEST PRACTICES 2008

Award Category

Best Overall Sustainable Design

Green Features

Active chilled beams

875 photovoltaic shingles on rooftop

Carbon dioxide sensors

Heat-recovery system

High-recycled-content materials

Paints and adhesives with low or no VOCs

Radiant floor heating

Cooling tower and cold water storage

Exterior light shelves

Annual Energy Savings

60% less than ASHRAE Standard 90.1

65% less water use than traditional systems

Size

45,000 ft^2

Cost

$24 million

Completion Date

August 2006

The Tahoe Environmental Research Center of the University of California at Davis is a fitting emblem of education and sustainability, as a leading environmental science research and education center, housed in an energy efficient building. The project has received high honors, in achieving the LEED Platinum certification from the U.S Green Building Council. As such, the center is only the second building in the UC system, and the ninth in the state of California, to be awarded LEED's highest level of certification.

View of Tahoe Center. Photo: Vance Fox

From the exterior, the three-story Tahoe Environmental Research Center (TCES) blends in with its surroundings in Incline Valley, Nevada, clad in stained fiber cement board with a mountain-chalet aesthetic. The 45,000 square-foot facility houses research laboratories for UC Davis, as well as labs, classrooms, offices, public museums and education centers for Sierra Nevada College. The center hosts a variety of activities for multiple audiences—children utilize science curricula, while college students take classes or conduct research. The center also holds public outreach events on topics related to current ecological challenges.

Energy use at the Tahoe Environmental Research Center has been verified to be 60% less than ASHRAE Standard 90.1. Water use in the building has been 65% less than traditional systems. To create an energy-efficient facility, TERC's project team incorporated several innovative systems, including radiant floor heating, evaporative cooling, chilled beams, and underground chilled water storage tanks. In developing this system, the design team faced many challenges during the design process. As UCD senior project manager Bill Starr explains, "Issues emerged in dealing with regulatory limits, using new technology, and building a lab in the Tahoe basin—a setting uncommon to lab buildings."

The project uses "active" chilled beams, a unique technological feature that offers both low investment costs and high efficiency cooling benefits. Active chilled beams move ventilation air through ceiling-mounted diffuser boxes. This in turn induces room air to flow through the coils.

The HVAC system utilizes "free cooling" from chilled water generated at night by a cooling tower. The tower uses 10% of the power consumption of a typical chiller.

The project has been noted as the first lab to use "active" chilled beams, also known as induction diffusers.

This strategy made it possible to eliminate reheat while reducing the HVAC energy for the building by 57%. In addition, other strategies were an integral part of the success of the chilled beam. This includes storing cooled water from the cooling tower in underground tanks, which is then circulated through the chilled beam system when needed.

2008 BEST PRACTICES

Additional Awards

LEED-NC Platinum

Contacts

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Team

Architect: Lundahl and Associates

Contractor: Turner Construction Company

Mechanical Engineer: Rumsey Engineers

Electrical Engineer: Integrated Design Associates (IDeAs)

Structural Engineer: John A. Martin & Associates of Nevada

Lighting Designer: David Nelson & Associates

Acoustical Consultant: McKay Conant Brook

Laboratory Consultant: Research Facilities Design

LEED Consultant: Architectural Energy Corporation

More Information

johnmuir.ucdavis.edu/featurettes/tces-platinum.html

www.news.ucdavis.edu/search/news_detail.lasso?id=8309

cms.ashrae.biz/files/20081016_rumsey.pdf

In addition, the project boasts excellent water efficiency. Waterless urinals and low flush toilets use 50% less water than normal fixtures. A snowmelt and rainwater catchment system captures water for toilet flushing use. After filtration and UV treatment of the water, it is used once to flush toilets, thus conserving onsite water. However, an unexpected issue arose with the rainwater used in toilets. When the pine trees around the building release their yellow pollen, some of the color remains in the roof water after filtration, causing visitors to repeatedly flush the toilets. Signage has been added to inform visitors that the color poses no sanitary problem.

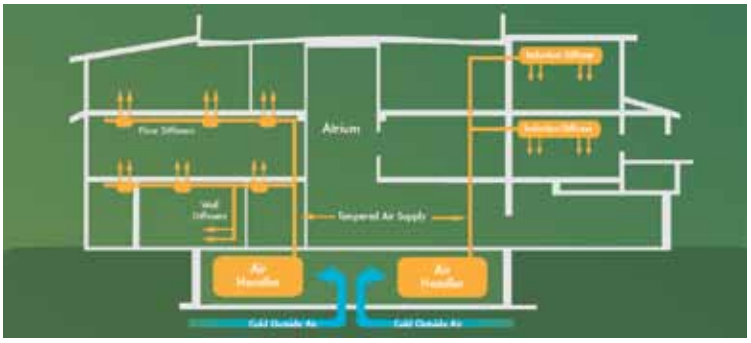

Diagram showing air supply, including the use induction diffusers. Image: UC Davis.

The central atrium is an area where sunlight potential is maximized through architectural strategies. Private areas within the center, including offices, are connected to a central, open sky-lit atrium, so that the spaces are visually comfortable even with minimal electric lighting. Exterior light shelves bring daylight into rooms and corridors surrounding the central atrium. On the roof top, 875 photovoltaic shingles generate approximately 10 percent of the electricity used in the building. Rooms also contain carbon dioxide sensors that can automatically increase the ventilation of outside air. Heat recovery was also implemented to reclaim the heat of the exhaust stream to pre-heat the outside air going to the laboratory air handler unit.

The project team also included several materials and products containing recycled industrial by-products. For example, wall insulation by Soft Touch includes pre-consumer fabric scraps. The structural concrete contains 25% fly ash, a by-product of coal combustion in power plants. The center's sound-absorbing panels are made of recycled newspapers, while both steel and carpet contain a high-recycled content and low emission rate. The project team also specified paints and adhesive with low or no VOCs. In addition, over 85% of construction debris was recycled.

LESSONS LEARNED

Bill Starr, senior project manager of the UC Davis Architects & Engineers, recommends that selecting the right team is essential to doing innovative work. In this project, with the amount of technology and strategies implemented, he emphasizes the importance of right-sizing the equipment to provide good energy and cost-outcomes. Joe Wenisch of Rumsey Engineers remarks that the early stages of the project were challenging, as the team was developing ideas while working with a large team of consultants and contractors. Mr. Starr mentions the importance of aiming beyond the minimum goal by targeting everything that can be done within the budget, pushing the team to become creative. He also learned that focusing on a few key technologies allowed for a more cost-effective and functional design.

- Mangala Gopal

Best Practices is written and produced by the Green Building Research Center, at the University of California, Berkeley.

The Best Practices Competition showcases successful projects on UC and CSU campuses to assist campuses in achieving energy efficiency and sustainability goals. Funding for *Best Practices* is provided by the UC/CSU/IOU Energy Efficiency Partnership.

LEED Version 2

How to Interpret this Report

Purpose The Leadership in Energy and Environmental Design (LEED) Rating System was designed by the US Green Building Council to encourage and facilitate the development of more sustainable buildings. The Tahoe Center for Environmental Sciences project was evaluated according to this system and the Final Rating is totaled below.

Environmental Categories The report is organized into five environmental categories as defined by LEED including: Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources and Indoor Environmental Quality. The category of Innovation and Design Process is also included.

LEED Prerequisites Prerequisites must be achieved. Non-compliant prerequisites must be resolved before a certification can be awarded.

LEED Credits The environmental categories are subdivided into the established LEED credits, which are based on desired performance goals within each category. An assessment of whether the credit is earned, pending, or rejected is made and a narrative describes the basis for the assessment.

Achieved 56 The applicant has provided the mandatory documentation which supports the achievement of the credit requirements, achieving the associated points. Currently the project has scored the adjacent points in this category.

Denied 2 The applicant has applied for a point in a particular credit, but has misinterpreted the credit intent or cannot substantiate meeting the requirements. Currently the project has the adjacent points in this category.

Rating Final Rating is Platinum

Official LEED v2 Scores: Certified: 26-32 Silver Rating: 33-38 Gold Rating: 39-51 Platinum Rating: 52 +

A - Achieved
D - Denied

A	D		
10	1	**Sustainable Sites**	**Possible Points 14**

0	Erosion & Sedimentation Control	Prerequisite 1-Version 2.1

Preliminary Review: The signed LEED Letter Template declares that the local Best Management Practices meet or exceed the EPA BMPs. Measures include erosion control fencing, storm drain inlet protection, mulching, an infiltration basin and pre-treatment controls for stormwater runoff, protection, parking barriers, and preservation of natural vegetation, re-vegetation, watering for dust control and slope stabilization measures. Supporting documentation includes an erosion and sedimentation BMP Plan and details, along with photographs of measures implemented during construction activities.

1	Site Selection	Credit 1-Version 2.1

Preliminary Review: The signed LEED Letter Template declares that the site does not meet any of the prohibited criteria.

Not Attempting	Urban Redevelopment	Credit 2-Version 2.1

Preliminary Review: No Comments.

Not Attempting	Brownfield Redevelopment	Credit 3-Version 2.1

Preliminary Review: No Comments.

1	Alternative Transportation, Public Transportation Access	Credit 4.1-Version 2.1

Preliminary Review: The signed LEED Letter Template declares that there are at least two public bus lines or campus shuttle buses usable by building occupants within a ¼ mile of the project site. A scaled site map has been provided, depicting the project location and three bus stops located within ¼ mile of the project site, along with a copy of a bus route served by the mass transit system (TART). Also, a narrative explains that a campus van/shuttle service is provided to students, faculty and staff.

1	Alternative Transportation, Bicycle Storage & Changing Rooms	Credit 4.2-Version 2.1

Preliminary Review: The signed LEED Letter Template declares that 7 bicycle stalls and one shower are provided within 200 yards of the project for 131 occupants. Supporting documentation includes a partial floor plan and a site drawing indicating the bicycle storage area (bicycle rack) and shower locations, along with a bicycle rack cut sheet and submittal approval/invoice.

1	Alternative Transportation, Alternative Fuel Refueling Stations	Credit 4.3-Version 2.1

Preliminary Review: The signed LEED Letter Template declares that four alternative fuel refueling stations are provided for 3.70% of the total on-site vehicle parking capacity of 108 spaces. Supporting documentation includes specifications, installation and operating instructions for a FMQ-10 FuelMaker CNG refueling station capable of serving four alternative fuel vehicles at the building, partial site drawings depicting the location of the refueling equipment, and details of the piping for this equipment. A parking plan of the adjacent lot is provided in the documentation submitted for SSc4.4.

A - Achieved
D - Denied

A	D		
1		Alternative Transportation, Parking Capacity	Credit 4.4-Version 2.1

Preliminary Review: The signed LEED Letter Template declares that the parking capacity for the project does not exceed the minimum zoning requirements, and seven preferred carpool parking spaces are provided for 10.69% of building occupants. Supporting documentation includes a site plan drawing depicting the location of the carpool parking spaces with designation via pavement painting, a copy of the college carpooling program, a copy of the local zoning requirements, and supporting calculations.

1		Reduced Site Disturbance, Protect or Restore Open Space	Credit 5.1-Version 2.1

Preliminary Review: The signed LEED Letter Template declares that site disturbance has been limited to the required thresholds. A site plan drawing depicting the limits of construction disturbance demonstrates achievement.

1		Reduced Site Disturbance, Development Footprint	Credit 5.2-Version 2.1

Preliminary Review: The signed LEED Letter Template declares that open space exceeds local zoning requirements by 25%. A copy of the local zoning requirements and supporting calculations have been provided. Additional supporting documentation includes a site plan depicting open space and a copy of a letter from the college declaring that the open space will be preserved for the life of the building. However, the submitted site plan and calculations exclude the parking lot.

TECHNICAL ADVICE: Please provide revised site plan drawings and calculations for this credit that utilize the same defined site area used for all other credits. In other words, the total site area defined for this credit must be utilized consistently across all other LEED credits.

Final Review Additional documentation consists of a revised site plan that includes the parking lot, thereby utilizing the same defined site area used for all other credits in the calculations of compliant open space.

1		Stormwater Management, Rate and Quantity	Credit 6.1-Version 2.1

Preliminary Review: The signed LEED Letter Template declares that the post-development 1.5 year, 24 hour peak discharge rate and quantity do not exceed pre-development conditions, based upon a declaration that the site's existing pre-development imperviousness was less than or equal to 50%. Supporting calculations and a narrative have been provided in the form of the project's "Drainage Report", demonstrating compliance via an infiltration pond that retains and infiltrates 100% of the runoff from a 1.5 year, 24-hour storm event.

1		Stormwater Management, Treatment	Credit 6.2-Version 2.1

Preliminary Review: The signed LEED Letter Template has been submitted along with a narrative explanation that the local standard for stormwater treatment is more stringent than the EPA standard, and that the local standard has been followed. Supporting documentation in the form of the project's "Drainage Report", demonstrate compliance via pre-treatment devices (oil/water separators and sediment traps) and an infiltration pond that infiltrates and treats 100% of the runoff from a 1.5 year, 24-hour storm event.

1		Landscape & Exterior Design to Reduce Heat Islands, Non-Roof Surfaces	Credit 7.1-Version 2.1

Preliminary Review: The signed LEED Letter Template declares that a minimum of 30% of non-roof impervious surface areas will be shaded within five years, and/or constructed with light-colored/high albedo materials. Supporting documentation includes a site plan depicting paved areas and shaded areas, along with calculations utilizing a weighted average methodology, in accordance with SSc7.1 CIR Ruling dated 12/5/2001, to demonstrate compliance.

A - Achieved
D - Denied

A	D			
Not Attempting		Landscape & Exterior Design to Reduce Heat Islands, Roof Surfaces		Credit 7.2-Version 2.1

Preliminary Review: No Comments.

	1	Light Pollution Reduction	Credit 8-Version 2.1

Preliminary Review: The signed LEED Letter Template declares that the project's exterior lighting has been designed according to the IESNA RP-33, as required by this credit. Supporting documentation includes a photometric site plan, lighting fixture cut sheets, and building sections. However, the photometric site plan appears to indicate light trespass beyond the campus property boundary to the south, but the site boundary is not clearly identified, and it could not be verified whether or not the fixture generating the light trespass was associated with the project's scope of work or construction contract. Also, compliance with the requirements for parking lots could not be verified.

TECHNICAL ADVICE: Please provide a revised photometric site plan (at a larger legible scale) that clearly depicts the project's site and campus boundaries. This photometric site plan should include point-by-point illuminance level calculations across the site (on a 10' grid) that extend 10 feet beyond the property line and/or site boundary lines and indicate the average footcandle (fc) value for the site. Please provide "line of sight illuminance" calculations (as described on pages 75-76 of the LEED-NC V2.1 Reference Guide) for all locations where horizontal fc values exceed zero at the site (campus) boundary and/or property line, demonstrating that calculated "line of site illuminance" values comply with the limits indicated in Table 1 on page 70 of the LEED-NC V2.1 Reference Guide. Additionally, please provide the Environmental Zone designation for the site. Please note that it appears, from the submitted documentation, that the project likely is located in Zone E1 or E2, since Zone E4 (High Ambient Brightness Environmental Zone) is reserved exclusively for night-life entertainment districts in major city centers, and Zone E3 is defined as high density residential/commercial urban areas. Also, please provide another photometric plan for the project's parking lot, indicating average/minimum and maximum/minimum footcandle ratios in the parking lot area only in order to demonstrate compliance with the IESNA reference standard (IESNA RP-20 for parking lots, as referenced by IESNA RP-33).

Requirements: Meet or provide lower light levels and uniformity ratios than those recommended by the Illuminating Engineering Society of North America (IESNA) Recommended Practice Manual: Lighting for Exterior Environments (RP-33-99). Design exterior lighting such that all exterior luminaires with more than 1000 initial lamp lumens are shielded and all luminaires with more than 3500 initial lamp lumens meet the Full Cutoff IESNA Classification. The maximum candela value of all interior lighting shall fall within the building (not out through windows) and the maximum candela value of all exterior lighting shall fall within the property. Any luminaire within a distance of 2.5 times its mounting height from the property boundary shall have shielding such that no light from that luminaire crosses the property boundary.

Submittals: Provide the LEED Letter Template, signed by an appropriate party, declaring that the credit requirements have been met.

Final Review: Additional documentation includes a revised photometric site plan that depicts point-by-point illuminance level calculations extending 10 feet beyond the germane property line along Country Club Drive. Horizontal fc values exceed zero only at the roadway entrance where safety issues exist, therefore the minimum illuminance levels indicated here are acceptable. The remaining LEED boundaries border on adjacent campus property, and thereby, in this case, can be exempted from potential light trespass, in accordance with SSc8 CIR Ruling dated 6/15/2004. However, a second submitted photometric plan for the project's parking lot indicates average/minimum and maximum/minimum footcandle ratios of 9.6:1 and 50:1, respectively, in the parking lot area. Both of these uniformity ratios significantly exceed (in one case by 2.5 times and the other by nearly double) the recommended illuminance values of the IESNA reference standard (table 1 of IESNA RP-20 for parking lots, as referenced by IESNA RP-33).

A - Achieved
D - Denied

A	D		
5		**Water Efficiency**	**Possible Points 5**
1		Water Efficient Landscaping, Reduce by 50%	Credit 1.1-Version 2.1
		Preliminary Review: The signed LEED Letter Template declares that the project's landscape design uses native and drought-tolerant plantings that do not require a permanent irrigation system. A narrative describing the plant species, the watering protocol, and the use of a flexible temporary HDPE irrigation system for their establishment period that is scheduled for removal within two years has been provided.	
1		Water Efficient Landscaping, No Potable Use or No Irrigation	Credit 1.2-Version 2.1
		Preliminary Review: See WEc1.1.	
1		Innovative Wastewater Technologies	Credit 2-Version 2.1
		Preliminary Review: The signed LEED Letter Template, calculations, and a narrative demonstrate that municipally provided potable water for sewage conveyance is reduced by 69.72%. Strategies include harvesting rainwater and using low flow fixtures. Supporting documentation includes detail drawings of the project's rainwater harvesting system components and cut sheets of dual flush toilets and waterfree urinals.	
1		Water Use Reduction, 20% Reduction	Credit 3.1-Version 2.1
		Preliminary Review: The signed LEED Letter Template and calculations have been provided demonstrating that water use has been reduced by 65.23% through the use of rainwater harvesting, dual flush water closets, waterless urinals, and low-flow lavatories, kitchen sink faucets and showers. Supporting documentation includes fixture cut sheets verifying flow rates.	
1		Water Use Reduction, 30% Reduction	Credit 3.2-Version 2.1
		Preliminary Review: See WEc3.1.	

A - Achieved
D - Denied

A	D		
15	1	Energy & Atmosphere	Possible Points 17
0		Fundamental Building Systems Commissioning	Prerequisite 1-Version 2.1
		Preliminary Review: The signed LEED Letter Template declares that the required commissioning (Cx) activities have been completed or are under contract. Supporting documentation includes copies of the project's mechanical systems basis of design narrative, commissioning specs, and commissioning plan.	
0		Minimum Energy Performance	Prerequisite 2-Version 2.1
		Preliminary Review: The signed LEED Letter Template declares that the project complies with ASHRAE 90.1-1999.	
0		CFC Reduction in HVAC&R Equipment	Prerequisite 3-Version 2.1
		Preliminary Review: The signed LEED Letter Template declares that the project's HVAC&R systems do not contain CFC-based refrigerants.	

A - Achieved
D - Denied

A	D		
2		Optimize Energy Performance, 20% New /10% Existing	Credit 1.1-Version 2.1

Preliminary Review: The signed LEED Letter Template, summary tables, and energy modeling output demonstrate a 58.3% savings between the design case and the budget case based on ASHRAE 90.1-1999. Energy efficiency measures include reduced lighting power density, occupancy sensors, daylighting controls, high efficiency glazing, displacement ventilation, evaporative cooling, a microturbine, demand controlled ventilation, thermal storage, waterside economizer, condensing boilers, chilled beams, variable volume lab hood exhaust, heat recovery and a photovoltaic array. The variety of energy efficiency measures applied to the project certainly pose modeling challenges. Additional details are needed to evaluate the modeling results.

TECHNICAL ADVICE:

1. Please provide a detailed description of the modeling methodology for the following technologies: evaporative cooling, microturbines (check the modeling procedures for consistency with the CHP modeling Guidelines available on the USGBC web site), displacement ventilation system, chilled beams, and any other technology which has not been modeled directly by the software that required a "workaround" or other software to determine savings.

2. The comparative table and narrative compare center of glass U-Value in the proposed building to the whole unit U-Value in the budget building. Please confirm that the whole unit values have been used in both models. If not, please revise the modeling results.

3. Demand controlled ventilation is mentioned for the office areas. This measure must be modeled separately under Section 11.5 Exceptional Calculation Methods. Please provide a separate modeling run, a narrative explanation of the modeling procedure, and subtract the savings from the DEC like renewable energy on the ECB Table.

4. According to 90.1 Section 11.4.3j, the proposed and budget building must be within 50 hours of unmet loads. The budget building shows 1.2% outside throttling range (105 hours) while the proposed building shows 2.8% (245 hours). These values must be within 50 hours. Please revise the models so that they are in compliance.

Final Review According to 90.1 Section 11.4.3j, "Unmet load hours for the proposed design shall not differ from unmet load hours for the budget building design by more than 50 hours." We interpret this to refer to the entire building not each system within it. In most cases, but not all, the percentage of hours outside throttling range can be translated to the total number of hours, assuming that the systems are attempting to maintain set conditions for every hour of the year (not that they are running for every hour of the year). The 1% contained on the sample documentation is not an acceptable value to use for your submission. The information contained in the sample is for illustrative purposes only and is not a source of official interpretation regarding the enforcement of the EAc1 requirements. Projects should be within 0.6% (~52 hours) for their model to qualify. However, since this model is very close (0.7%), deals with difficult to model systems, and the change would not likely affect the number of points awarded, credit achievement can be confirmed.

2		Optimize Energy Performance, 30% New /20% Existing	Credit 1.2-Version 2.1

Preliminary Review: See EAc1.1.

TECHNICAL ADVICE: See EAc1.1.

Final Review See EAc1.1.

2		Optimize Energy Performance, 40% New /30% Existing	Credit 1.3-Version 2.1

Preliminary Review: See EAc1.1.

TECHNICAL ADVICE: See EAc1.1.

Final Review See EAc1.1.

A - Achieved
D - Denied

A	D		
2		Optimize Energy Performance, 50% New /40% Existing	Credit 1.4-Version 2.1
		Preliminary Review: See EAc1.1.	
		TECHNICAL ADVICE: See EAc1.1.	
Final Review		See EAc1.1.	
2		Optimize Energy Performance, 60% New /50% Existing	Credit 1.5-Version 2.1
		Preliminary Review: See EAc1.1.	
		TECHNICAL ADVICE: See EAc1.1.	
Final Review		See EAc1.1.	
1		Renewable Energy, 5% Contribution	Credit 2.1-Version 2.1
		Preliminary Review: The signed LEED Letter Template declares that 10.1% of the building's regulated energy cost is provided by on-site renewable energy. A narrative describing the project's photovoltaic array and calculations demonstrate achievement.	
1		Renewable Energy, 10% Contribution	Credit 2.2-Version 2.1
		Preliminary Review: See EAc2.1.	
Not Attempting		Renewable Energy, 20% Contribution	Credit 2.3-Version 2.1
		Preliminary Review: No Comments.	
1		Additional Commissioning	Credit 3-Version 2.1
		Preliminary Review: The signed LEED Letter Template declares that the required commissioning (Cx) activities have been completed or are under contract. Supporting documentation includes copies of three sets of DD and CD reviews with substantive comments.	
1		Ozone Protection	Credit 4-Version 2.1
		Preliminary Review: The signed LEED Letter Template declares that the project's HVAC&R systems do not contain HCFCs or Halons.	

A - Achieved
D - Denied

A	D		
	1	Measurement & Verification	Credit 5-Version 2.1

Preliminary Review: The signed LEED Letter Template declares that metering equipment has been installed for all appropriate systems. An M&V Plan, following Option D, also has been provided, but the submitted Plan does not adequately address the verification of savings. The Plan thoroughly covers the gathering of data to be used to calibrate the model. However, the purpose of calibrating the model is to reconcile this with the building's utility bills. Accordingly, adjustments to modeling input, such as weather data and schedules, are absolutely necessary to the calibration effort. The Plan, as written, is essentially a modeling exercise and will not result in a verification of actual savings.

TECHNICAL ADVICE: Please provide a revised M&V Plan which calibrates the model to the actual utility bills. In order to comply with credit requirements of Option D, the M&V Plan must contain a detailed description of the following: the prediction of savings through the energy model and water calculations, the gathering of data to verify the inputs into the models (this includes sub-metering, surveys, etc), the modeling calibration procedures, the procedure to reconcile the modeling results with utility bills, the creation of an adjusted baseline, and a action plan if the savings are not achieved.

Requirements: Install continuous metering equipment for the following end-uses: Lighting systems and controls Constant and variable motor loads Variable frequency drive (VFD) operation Chiller efficiency at variable loads (kW/ton) Cooling load Air and water economizer and heat recovery cycles Air distribution static pressures and ventilation air volumes Boiler efficiencies Building-related process energy systems and equipment Indoor water risers and outdoor irrigation systems Develop a Measurement and Verification plan that incorporates the monitoring information from the above end-uses and is consistent with Option B, C or D of the 2001 International Performance Measurement & Verification Protocol (IPMVP) Volume I: Concepts and Options for Determining Energy and Water Savings.

Submittals: Provide the LEED Letter Template, signed by the licensed engineer or other responsible party, indicating that metering equipment has been installed for each end-use and declaring the option to be followed under IPMVP version 2001. Provide a copy of the M&V plan following IPMVP, 2001 version, including an executive summary.

Final Review: A narrative has been provided to address the preliminary review comments. The M&V Plan has not been modified, as requested.

The primary purpose of an M&V effort is to verify actual energy savings. Option D requires that the energy model "must be 'calibrated' so that it predicts an energy use and demand pattern that reasonably matches actual utility consumption and demand data from either a base year or a post-retrofit year." This language is taken directly from the IPMVP: Volume 1, January 2001 on page 31.

Further, Option D can be used to assess the performance of individual systems if they can be isolated. This facility has numerous, interactive EEMs that would not possibly enable their isolation.

The item in Table 1, quoted from the v2.1 Reference Guide, needs to be considered within the full explanation of Option D in the IPMVP. Calibration to end use metering is appropriate if the EEMs can be isolated. Regarding the point raised in the second paragraph of the project team's response, while the IPMVP was originally written for retrofits, it routinely is applied to new construction and the savings based on 12 months of actual utility billing data. Once the energy model has been calibrated and reconciled with the utility bills (to within an acceptable tolerance), a new budget model is created from the calibrated model. The difference between the two models is the verified savings. The budget building is not calibrated; rather, the original budget model is discarded, and the new budget model is used for the calculation of actual savings based on post-retrofit data.

The IPMVP further states that actual weather data should be used where it varies from the average year weather data used in the original simulation, and the Plan explicitly states that weather data will not be modified in the calibration.

The M&V Plan, as outlined, will really result only in a more accurate predictor of savings than the original model, but it will not serve to determine actual energy savings according to the IPMVP, thereby not meeting the intent of the credit to provide "ongoing accountability and optimization of building energy and water consumption performance over time."

A - Achieved
D - Denied

A	D		
1		Green Power	Credit 6-Version 2.1

Preliminary Review: The signed LEED Letter Template declares that 50% of the building's regulated electric usage is supplied by renewable power that meets the definition of Green-e. A copy of the project's two-year electricity purchase contract from Sterling Planet has been provided. The total quantity of this purchase is 642,000 kWh. It is unclear from the modeling results submitted for EAc1, though, what has been included in the regulated electrical usage. This usage should include the electrical consumption by the building (including the electricity generated by the microturbine) minus the non-regulated electrical loads.

TECHNICAL ADVICE: Please provide a narrative explanation of what has been included in the regulated electric usage and utilized as the basis for this purchase. Keep in mind that a change in the modeling results could change the quantity required for this purchase.

Final Review A narrative has been provided which addressed the basis for the green power purchase. Calculations demonstrate a purchase in excess of 100% of the regulated electrical use.

A - Achieved
D - Denied

A	D		
7		**Materials & Resources**	**Possible Points 13**
0		Storage & Collection of Recyclables Preliminary Review: The signed LEED Letter Template indicates that appropriate facilities for recycling have been provided. Recycling areas are indicated on a submitted partial floor plan, and a narrative explaining the College's recycling program also is included.	Prerequisite 1-Version 2.1
Not Attempting		Building Reuse, Maintain 75% of Existing Shell Preliminary Review: No Comments.	Credit 1.1-Version 2.1
Not Attempting		Building Reuse, Maintain 100% of Shell Preliminary Review: No Comments.	Credit 1.2-Version 2.1
Not Attempting		Building Reuse, Maintain 100% Shell and 50% Non-Shell Preliminary Review: No Comments.	Credit 1.3-Version 2.1
1		Construction Waste Management, Divert 50% Preliminary Review: The signed LEED Letter Template declares that 86.52% of project construction waste was diverted from landfill disposal. Supporting documentation includes a copy of the project's Construction Waste Management Plan, the project's waste disposal summary log, waste hauling invoices, and recycling facility receipts.	Credit 2.1-Version 2.1
1		Construction Waste Management, Divert 75% Preliminary Review: See MRc2.1.	Credit 2.2-Version 2.1
Not Attempting		Resource Reuse, Specify 5% Preliminary Review: No Comments.	Credit 3.1-Version 2.1
Not Attempting		Resource Reuse, Specify 10% Preliminary Review: No Comments.	Credit 3.2-Version 2.1
1		Recycled Content, Specify 5% Preliminary Review: The signed LEED Letter Template and supporting calculations declare that the project has achieved a combined recycled content value of 25.83% of the total materials by cost. Supporting documentation includes an expanded spreadsheet listing of the project's materials and their recycled content, along with product data indicating post-consumer and/or post-industrial recycled content and invoices documenting product costs for the materials listed in the spreadsheet.	Credit 4.1-Version 2.1
1		Recycled Content, Specify 10% Preliminary Review: See MRc4.1.	Credit 4.2-Version 2.1

A - Achieved
D - Denied

A	D		
1		Local/Regional Materials, 20% Manufactured Regionally	Credit 5.1-Version 2.1

Preliminary Review: The signed LEED Letter Template and supporting calculations declare that 46.29% of the total project's materials by cost were manufactured within 500 miles of the project site. Supporting documentation includes an expanded spreadsheet listing of the project's materials and their manufacturing location, along with invoices from manufacturers verifying the location of manufacture and product costs for the materials listed in the spreadsheet.

1	Local/Regional Materials, 50% Extracted Regionally	Credit 5.2-Version 2.1

Preliminary Review: The signed LEED Letter Template and supporting calculations declare that 33.38% of the total project's materials by cost were manufactured using raw materials harvested within 500 miles of the project site. Supporting documentation includes an expanded spreadsheet listing of the project's materials, their manufacturing location, their extraction/harvesting/recovery location, and the distances to these locations, along with invoices and manufacturer's documentation verifying the extraction location, manufacturing location, and product costs for the materials listed in the spreadsheet.

Not Attempting	Rapidly Renewable Materials	Credit 6-Version 2.1

Preliminary Review: No Comments.

1	Certified Wood	Credit 7-Version 2.1

Preliminary Review: The signed LEED Letter Template declares that 51.81% of wood-based materials are certified in accordance with FSC Principles and Criteria. Supporting documentation includes an expanded spreadsheet listing of the project's wood materials and their costs, along with vendors' FSC Certification numbers and chain-of-custody certificates. However, the $18,600 value for the project's Marshfield laminate veneer wood doors has been excluded from the calculations of the total cost of all wood-based products, but it should be included. Also, the $3,228 value for the project's wheatboard has been included in the cost of all wood-based products, but should be excluded. Revising the calculations accordingly results in the project's total cost for wood-based materials equating to $158,330; therefore, only 46.78% of the project's wood-based products are FSC Certified.

Final Review Additional documentation includes a narrative clarifying that the value listed in the spreadsheet calculations for Marshfield laminate veneer wood doors refers solely to the value of the veneer for these doors, which is comprised of plastic laminate, as evidenced by project submittals. Accordingly, once the wheatboard is excluded from the calculations, the project has achieved 53% of its wood-based products that are FSC Certified.

A - Achieved
D - Denied

A	D		
14		**Indoor Environmental Quality**	**Possible Points 15**
0		Minimum IAQ Performance — Prerequisite 1-Version 2.1 Preliminary Review: The signed LEED Letter Template has been provided declaring that the requirements of ASHRAE 62-1999 have been met. Documentation describing the ventilation rate procedure calculations has been provided.	
0		Environmental Tobacco Smoke (ETS) Control — Prerequisite 2-Version 2.1 Preliminary Review: The signed LEED Letter Template has been provided declaring that no smoking is allowed in the building and outdoor smoking areas are located away from operable windows and entryways. Supporting documentation includes a site plan depicting the location of the designated smoking area and a copy of the college's smoking policy.	
1		Carbon Dioxide (CO2) Monitoring — Credit 1-Version 2.1 Preliminary Review: The signed LEED Letter Template declares that a CO2 monitoring system has been installed. A narrative and calculations are provided indicating that the sensors are placed in each zone with differential set points ranging from 500 to 650 ppm above ambient, which was calculated based on 20 to 30 cfm/person, depending upon type of use. Supporting documentation includes cut sheets of the CO2 sensors and HVAC floor plans depicting sensor locations.	
1		Increase Ventilation Effectiveness — Credit 2-Version 2.1 Preliminary Review: The signed LEED Letter Template with the completed Ventilation Effectiveness Table declares that the design achieves an air-change effectiveness of 0.9 or greater in each mechanically ventilated zone, as determined by ASHRAE 129-1997. A submitted narrative describes the project's displacement ventilation system via floor diffusers in offices/classrooms and via low wall-mounted diffusers for the mixing system in laboratories. Supporting documentation includes ventilation effectiveness tables, ADPI calculations, floor plan and section drawings depicting air flow patterns in typical spaces, specifications for diffusers and grilles, and air diffuser cut sheets, and diffuser performance data.	
1		Construction IAQ Management Plan, During Construction — Credit 3.1-Version 2.1 Preliminary Review: The signed LEED Letter Template declares that a construction IAQ plan was followed and implemented, that filters with a MERV 13 rating were installed during construction, and that filters with a MERV 13 rating were installed after construction. Supporting documentation includes a copy of the project's Construction IAQ Management Plan, photographs and descriptions of the SMACNA approaches followed, a sample copy of an IAQ Management tracking Log, and product data for the filtration media.	
1		Construction IAQ Management Plan, Before Occupancy — Credit 3.2-Version 2.1 Preliminary Review: The signed LEED Letter Template declares that a two week building flush out was conducted with 100% outside air from 8/12/2006 – 9/11/2006. A brief narrative is provided, describing the use of MERV 13 filters and compliance with the air change requirements described in EQc3.2 CIR dated 9/8/2004.	
1		Low-Emitting Materials, Adhesives & Sealants — Credit 4.1-Version 2.1 Preliminary Review: The signed LEED Letter Template declares the use of compliant adhesives and sealants. A list of all interior field-applied adhesives and sealants utilized for the project has been provided, along with manufacturer's product data indicating compliant VOC levels for each listed product.	

A - Achieved
D - Denied

A	D		
1		Low-Emitting Materials, Paints	Credit 4.2-Version 2.1

Preliminary Review: The signed LEED Letter Template declares that all paints, including topcoats and primers, meet the VOC requirements of Green Seal. A list of all interior field-applied paints and coatings, including primers, utilized for the project has been provided, along with manufacturer's product data indicating compliant VOC levels for each listed product.

1		Low-Emitting Materials, Carpet	Credit 4.3-Version 2.1

Preliminary Review: The signed LEED Letter Template declares that the project uses carpeting that complies with the CRI Green Label Program. A list of all carpet systems used in the project has been provided, along with manufacturer's product data indicating that all carpet products meet the CRI Green Label IAQ Test Program requirements.

1		Low-Emitting Materials, Composite Wood	Credit 4.4-Version 2.1

Preliminary Review: The signed LEED Letter Template declares that all composite wood and agrifiber products used in the project do not contain added urea-formaldehyde. A list of composite wood products has been provided, along with manufacturer's product data indicating that all listed products contain no added urea formaldehyde resins.

1		Indoor Chemical and Pollutant Source Control	Credit 5-Version 2.1

Preliminary Review: The signed LEED Letter Template declares that the requirements of the credit have been met. Supporting documentation includes a narrative that describes compliant copy rooms, along with a permanent entryway system cut sheet, a floor plan indicating the location of these walk-off systems, floor plans depicting chemical use spaces, drawings indicating compliant partition types, and a copy of an email describing plumbing disposal capabilities in lab spaces.

1		Controllability of Systems, Perimeter	Credit 6.1-Version 2.1

Preliminary Review: The signed LEED Letter Template and calculations have been provided declaring that all regularly occupied perimeter spaces have been provided with operable windows and lighting controls as required by this credit. Supporting documentation includes a narrative, Lighting floor plans depicting controls, floor plans indicating the 15' offset line, and a summary spreadsheet of all spaces that tabulates their perimeter/non-perimeter status, their area, operable windows, and the number of controls provided.

1		Controllability of Systems, Non-perimeter	Credit 6.2-Version 2.1

Preliminary Review: The signed LEED Letter Template and calculations have been provided declaring that all regularly occupied non-perimeter spaces have been provided with airflow, ventilation, and lighting controls as required by this credit. Supporting documentation includes a narrative, HVAC and Lighting floor plans depicting controls, floor plans indicating the 15' offset line, and a summary spreadsheet of all spaces that tabulates their perimeter/non-perimeter status, their area, and the number of controls provided.

1		Thermal Comfort, Compliance with ASHRAE 55-1992	Credit 7.1-Version 2.1

Preliminary Review: No signed LEED Letter Template has been provided. However, the information on temperature and humidity control ranges required by the letter template has been provided for all thermally controlled zones in a submitted Thermal Comfort Table spreadsheet, demonstrating compliance.

A - Achieved
D - Denied

A	D		
1		Thermal Comfort, Permanent Monitoring System	Credit 7.2-Version 2.1

Preliminary Review: No signed LEED Letter Template has been provided. Submitted HVAC floor plans indicate the locations of thermostats.

TECHNICAL ADVICE: Please provide the required signed LEED Letter Template declaring that a permanent temperature and humidity monitoring system that operates during all seasons has been installed in accordance with credit requirements. Please provide drawings, specifications and cut sheets highlighting the installed permanent temperature and humidity monitoring system. Include a narrative describing measurement points (trending or logging data) and operator interface. Also, please provide an excerpt from the commissioning specifications indicating that these controls are covered in the scope of work for EAp1.

Final Review A signed LEED Letter Template has been provided, declaring a permanent temperature and humidity monitoring system that operates during all seasons has been installed in accordance with credit requirements. Additional documentation includes HVAC floor plan drawings and cut sheets highlighting the installed permanent temperature and humidity monitoring system components, along with excerpts from the commissioning specifications indicating that these controls are covered in the scope of work for EAp1. Operator interface information is provided in the documentation submitted for EAc5. It should be noted that contrary to the submitted narrative, documentation of operator interface is required to earn this credit; otherwise, it cannot be demonstrated that the monitoring system is "configured to provide operators control over thermal comfort performance" and system effectiveness, as described in the credit requirements.

1		Daylight and Views, Daylight 75% of Spaces	Credit 8.1-Version 2.1

Preliminary Review: The signed LEED Letter Template, drawings, and calculations declare that 91.9% of critical visual task areas have direct access to views of the outdoors.

Not Attempting		Daylight and Views, Views for 90% of Spaces	Credit 8.2-Version 2.1

Preliminary Review: No Comments.

A - Achieved
D - Denied

A	D		
5		Innovation & Design Process	Possible Points: 5
1		Exemplary Performance for MRc4	Credit 1.1-Version 2.1
		Preliminary Review: The signed LEED Letter Template and supporting calculations submitted for MRc4 indicate that the project has achieved a combined recycled content value of 25.83% of the total materials by cost, which demonstrates that more than the next incremental threshold of 15% was achieved.	
1		Exemplary Performance for MRc5.1	Credit 1.2-Version 2.1
		Preliminary Review: The signed LEED Letter Template and supporting calculations submitted for MRc5.1 indicate that at least 46.29% of the total project's materials were manufactured within 500 miles of the project site, which demonstrates that more than double the credit threshold was achieved.	
1		Exemplary Performance for EAc6	Credit 1.3-Version 2.1
		Preliminary Review: The project team seeks an innovation credit for exemplary performance relative to EAc6, by providing green power for 100% of the building's regulated electric usage. Achievement is pending the submission of supplemental documentation requested in the comments for EAc6.	
		TECHNICAL ADVICE: See EAc6.	
Final Review		The project team seeks an innovation credit for exemplary performance relative to EAc6, by providing green power for 100% of the building's regulated electric usage, which is demonstrated by the documentation submitted for EAc6.	
1		Exemplary Performance for WEc3	Credit 1.4-Version 2.1
		Preliminary Review: The Letter Template calculations and supporting documentation submitted for WEc3 demonstrate a 65.23% potable water use reduction, thereby earning exemplary performance by achieving the next incremental threshold of at least 40% water use reduction.	
1		LEED™ Accredited Professional	Credit 2-Version 2.1
		Preliminary Review: The signed LEED Letter Template declares that the project's LEED Consultant, Sally (Sarah) Blair, served as the project's LEED Accredited Professional and as a principal participant of the project team. A copy of her LEED Accredited Professional Certificate has been provided.	

Contact Information

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