COLLEGE OF SOUTHERN IDAHO
HEALTH SCIENCE & HUMAN SERVICES

BETTERBRICKS
Bottom line thinking on energy.

INTEGRATED idl DESIGN LAB boise

PROJECT OVERVIEW AND TEAM

OWNER: State of Idaho Division of Public Works, College of Southern Idaho

LOCATION: Twin Falls, ID

BUILDING TYPE: Higher Education

SIZE: 72,270 square feet

COMPLETION DATE: January 2010

UTILITIES: Idaho Power, Intermountain Gas

ARCHITECT: CTA, Inc.

MECHANICAL ENGINEER: CTA

ELECTRICAL ENGINEER: CTA

DESIGN BUILD CONTRACTOR: Starr Corporation

External shading at south façade along east classroom wing

Photo credit: IDL Boise

INTRODUCTION

The Health Sciences and Human Services building was the first structure on the College of Southern Idaho's new 80-acre north campus. The building provides the necessary space to facilitate continued growth of the College's burgeoning healthcare department. This innovative facility includes dedicated spaces for several health technician programs; support spaces and general classrooms, three lecture halls, two computer rooms, simulation and training spaces, and faculty offices. This project was delivered to the State of Idaho's Division of Public Works via a design-build contract with CTA and Starr Corporation. The building's original Request for Qualifications did not dictate any aspects of sustainable design, however, over the course of programming, representatives of the College's Administration and Faculty, the State of Idaho, and the design-build team collectively committed to pursue LEED certification.

The University of Idaho Integrated Design Lab in Boise, part of the BetterBricks Lab Network, aims to facilitate a design process that is focused on design strategies that reduce energy loads and then apply the most energy efficient technologies feasible. This 'integrated design process' relies on strong leadership and collaboration from the architects, engineers, contractors and the owners to ensure that project goals are shared by all, maintained, and critically evaluated throughout the design and construction process. This assumes that tangible goals are established and used to guide the design process. For this project, goals related to general "sustainability" and a "high performance building" led the way, followed by more concrete goals such as "achieve LEED Silver," and later "achieve LEED Gold." Eventually the team set an explicit energy efficiency goal to "keep pace with the milestones of the Architecture 2030 Challenge." For this project, that meant designing a building that was at least 60% better than the 2003 CBECS* baseline data as referenced by Architecture 2030. This baseline was determined to be 83.1 kBTU/SF*YR, so 33.3 kBTU/SF*YR became the operational goal for this building. According to CTA, "The College has a history

> "The College has a history of pursuing very energy conscious selections for various building components, but nothing of such a truly holistic energy efficiency effort had been tackled prior to this project."

*CBECS – Commercial Building Energy Consumption Survey

Photo credit: IDL Boise

View from entrance looking north

of pursuing very energy conscious selections for various building components, but nothing of such a truly holistic energy efficiency effort had been tackled prior to this project." This building sets a new level of expectation for design at the College, one that is high performance from the users' perspective as well as from an energy efficiency perspective.

The Integrated Design Process

There are many aspects that transform a typical linear design process into an interactive and integrated design process. While there are some common themes, each project has an individual story. We asked CTA's architects and engineers, their opinion about how this process was different from previous projects with this particular client and general contractor.

Regarding the Client

"The client made a conscious decision to establish a clear vision of what the building was to be about and what it would say about the College and the State of Idaho. On previous projects their vision has been more program and space oriented. They have always been efficiency minded toward their energy consumption, but they took this project as an opportunity to step up and be a leader for the community regarding energy usage patterns. They recognized the fact that this was to be the first building constructed across the road in the new campus expansion and would set the tone for future campus buildings, systems selection, and be the benchmark of 'how buildings are built at CSI'. Previous projects have been more 'top down' but this time a large user group including students and staff was engaged. They had ample opportunity to voice ideas towards defining the project's vision."

"Critical input was given earlier into process rather than through a traditional cost cutting mind set. Perhaps most importantly, the contractor 'bought in' at an early stage and the project benefitted because of it."

Regarding the Construction Delivery Process

"We had direct access to the individual at Starr Corporation (Design/Builder), a seasoned builder who was empowered as the decision maker from their end. He was an effective resource throughout the design process and made a sizeable contribution to the overall design. We have partnered with this contractor in the past but this time communication started earlier and was more in depth. Critical input was given earlier early into the process rather than through a traditional cost cutting mind set. Perhaps most importantly, the contractor 'bought in' at an early stage and the project benefitted because of it."

Regarding Energy Efficiency and Goal Setting

"The story of goal setting on this project was a long and interesting process, which nearing completion of the project, seemed to take on a new light. In the original request for proposals from the Division of Public Works (DPW), there was only a reference to the availability of geothermal and something to the effect of 'an opportunity for a high performing building'. There were no real performance benchmarks set in the formal program. There was a historical expectation about how buildings get designed and built at the College, but that was, and still is, a pretty unmeasured benchmark against Architecture 2030, ASHRAE, CBECS and the like. After we were selected, in early September 2007, members of the college staff and students began to talk about the project being 'green'. Discussions of the project shifted to it being LEED certified. In October 2007, there was commitment that the project would be LEED Certified with the hopes of reaching the Silver certification. By February 2008, there was commitment by all to try and achieve LEED Gold. This was an interesting development in the project because at the onset, 3rd party verification was not on the table. With this momentum, energy efficiency goals were set and we were determined to keep pace with the Architecture 2030 Challenge."


Photo credit: IDL Boise

View of computer lab adjacent to main vertical circulation space

STRATEGIES AND FEATURES

Saving Tax Payer Dollars:

- Minimizing energy use and operating cost
    - Quality daylighting and integrated electric lighting controls
    - Architectural solar shading
    - Increased insulation and high performance glazing
    - Direct Digital Control system
    - Geothermal heat exchange system
    - Variable frequency drive fans and pumps
    - Water to water heat pumps
    - Demand control ventilation with heat recovery

Visual Comfort and Preference

- Use daylight as the primary light source
    - Use high floor to ceiling heights to increase window daylight penetration
    - Daylighting monitors through corridor into back side of classrooms
    - Light wells between floors provide daylighting to ground level
    - Minimized visual contrast with light colored interior finishes
    - Solar control at perimeter angled to block low angle sun and redirect it to the ceiling
- Supplement daylight with high performance electric lighting and controls
    - High efficiency indirect lighting
    - Daylight sensing photo-controlled dimming and occupancy sensors

Thermal Comfort and Air Quality

- Reduce loads to allow alternative cooling systems
    - Building orientation elongated in east west axis
    - Glazing concentrated on North and South exposure with extensive shading at the south
    - Demand controlled ventilation
    - Optimized glazing specifications to orientation
    - Utilized local 90° F (once used) geothermal campus water loop for heating

Water

- Minimize water consumption
    - Reduction of sod from typical campus practice, replaced with native and adaptive plantings
    - Parking areas feed heavily landscaped bio-swales and retention ponds
    - Irrigation water supplied is a municipal non-potable source
    - 34% potable water use reduction with low flow fixtures (Under Baseline EPA 1992)
    - Worked with state plumbing code officials to allow waterless urinals

ENERGY AND FINANCIAL ANALYSIS

- **Project Construction Budget:** $20,560,000
- **Building Cost / Square Feet:** $250
- **Utility Incentive:** Idaho Power incentives for lighting and load control measures, $35,224
- **Grants:** The College is pursuing a federal grant for a photovoltaic roof top system

Photo credit: IDL Boise

View of south façade at faculty offices in west wing

Energy Analysis

- **Energy Cost:** $79,843 (baseline) $37,797 annually (47% savings)
- **Energy Use Index:** 77.6kbtu/sf (typical Idaho educational) 73.8kbtu/sf (baseline) 34.5kbtu/sf (predicted)
- **Lighting:** 329,000 kWh (baseline) 164,000 kWh (50% savings)
- **Space Heating:** 399,000 kWh (baseline) 75,000 kWh (81% savings)
- **Space Cooling:** 110,000 kWh (baseline) 45,000 kWh (59% savings)
- **Pumps:** 11,000 kWh (baseline) 28,000 kWh (40% penalty)
- **Fans:** 137,000 kWh (baseline) 91,000 kWh (34% savings)
- **Misc. Equip:** 300,000 kWh (baseline) 215,000 kWh (29% savings)
- **Carbon Offset:** 6.228 lbs/sf CO_2 reduction, 60% reduction (meets 2010 Architecture 2030 Challenge)
- **TOTAL ENERGY USE:** 618,000 kWh

LESSONS LEARNED

Process

- **Collaborative integrated design process.** Through the integrated design approach, the design team was able to convey the benefit of specific design opportunities which differed from existing campus trends. Early integration of civil engineers and landscape architects with the design team guided the focus of building location, resource proximity, traffic hierarchy, and reinforced the importance of place-making throughout the project, resulting in the successful integration of the design with the Twin Falls community.

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Load Reduction Measures

- **Daylight harvesting.** Special attention was paid to the overall programmatic layout to provide comfortable diffuse daylight to as many critical visual task spaces as possible. Extensive daylighting modeling was conducted in coordination with the University of Idaho – Integrated Design Lab in Boise. Specifically, modeling of the primary academic spaces helped to inform architectural decisions related the primary building section. The modeling results also informed interior spatial design and configuration and electric lighting design and lighting control sequences.

- **Iterative modeling.** Initial modeling in the early phases of design included exploring several ways to site the building, orientation of the buildings footprint and geometry. Several investigations of the building circulation and how it relates to the internal program as well as to the campus and future campus building sites were considered. The eQuest (http://www.doe2.com/eQUEST/) energy modeling software proved to be a valuable tool for the analysis of this building during design stages. The program was used in the early stages to check the energy impacts of design decisions. The team was able to make informed decisions concerning the amount of glazing to use on the building and the effect of the glazing on daylighting versus the effect on the building heating and cooling loads. The analysis resulted in the optimal design of building overhangs and spandrel panels to limit the summer heat gain while still contributing to the building's exterior character. Ultimately, five different glazing types with three different tints are used in the building to assure the optimal mix of daylighting benefits while limiting solar gain. Fixed horizontal and vertical shading devices were optimized according to daily and seasonal sun patterns in order to minimize glare and reduce both the summer peak and total building cooling load.

- **Heating.** Geothermal water at 90°F that is rejected from heating systems of other campus buildings is used as the primary heat source through water-to-water heat pumps. This strategy provided the most significant single measure savings from the baseline model, with a savings of 81% on heating energy.
- **Cooling.** The cooling system uses a variable air volume with fresh air provided through a separate, dedicated outdoor-air system (DOAS). The DOAS allows enhanced quantities of fresh air to be precisely delivered to occupied spaces while unoccupied areas are maintained with a minimum of energy use. The flow of fresh air is triggered to occupied spaces by the same occupancy sensors that control the room lighting. Air handling systems use efficient fan-wall technology to effectively control intake air quantities, at lower fan speeds.
- **Envelope.** Glazing types and overhangs were examined and specifically selected for each exposure as dictated by the analysis. Glazing specifications were differentiated based upon their primary purpose for either views or to provide daylight. Building insulation was optimized for the climate, occupancy patterns, and building type.

Money Savers

- **Design-Build process.** This project is unusual as it was being delivered under a Design-Build contract with the State of Idaho. This highly collaborative delivery method involved more effort up front from both the facilities team and the contractors, leading to a relatively smooth construction process with few costly change orders.
- **Modeling more efficient systems.** With the mechanical team involved early and the use of eQuest energy modeling software, CTA was able to test more options for systems to discover which would achieve the most cost effective reduction in operational energy use.

CONTACTS AND RESOURCES

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INTEGRATED DESIGN LAB | BOISE:
www.idlboise.com
208.429.0220

IDAHO POWER:
www.idahopower.com
208.345.6677

STARR CORPORATION:
www.starrcorporation.com
208.733.5695

BETTERBRICKS:
www.betterbricks.com

Photo credit: IDL Boise

East wing corridor looking east, displayed during painting process with clearstory covered in plastic as well as classroom relights.