By Barbara Horwitz-Bennett, Contributing Writer

Integrated Design

By using an integrated project process, building teams can tap into more innovative solutions, create highly sustainable campus buildings and—ultimately—do more with less.

Charged with delivering adaptable, high-performance campus buildings, more and more design firms are turning to integrated project delivery (IPD) to make it happen.

Unlike a traditional, linear process—where each discipline completes its design and then passes it along to the next party—an integrated approach brings all the players together at the project’s onset to develop the design in a group setting.

“Ideas and synergies can be formed collectively that would never have been formed in our traditional silos,” explains Jeffrey S. Fenimore, AIA, principal, higher education national sector leader, DLR Group, Minneapolis. “In this setting, the combination of ideas and solutions can—when packaged together—create greater benefits and returns than if they were delivered separately.”

On a higher education project, says Fenimore, this could result in multiple benefits: improved classroom flexibility and adaptability; greater classroom utilization; reduced energy consumption; an enhanced student experience; increased interaction among students and faculty; and numerous other intangible benefits.

The idea is to approach the project from a holistic standpoint where the building’s identity is not simply overlaid onto the project at the end of the process, but systematically implemented into the building’s DNA from the beginning, explains Winston Yao, CID, LEED AP BD+C, Associate, LPA Inc. in Irvine, Calif. Furthermore, he says, the interactive planning process creates a sense of ownership for the various parties involved—particularly faculty and students, who ultimately feel as if their opinions really matter.

By engaging in such a high-level dialogue, the full team can benefit from expert perspectives brought by each player. “This dynamic creates an ideal problem-solving platform from a project’s onset,” says Jennifer Mack, vice president, Skanska, Rockville, Md. For example, the construction team can analyze and offer feedback to a project’s proposed design based on a cost and schedule perspective.

These benefits translate into real dollars, says Bill Maclay, AIA, LEED AP, principal, Maclay Architects, Waitsfield, Vt. For instance, by setting energy intensity goals from the onset, the team can efficiently coordinate insulation, downsize HVAC equipment and even target net-zero goals. In fact, with an integrated approach, Maclay reports that he’s typically designing building envelopes at $5 to $10 per sq. ft.

WHY HIGHER ED.?

While integrated design is slowly gaining traction in other market sectors, higher education is a particularly fertile breeding ground, according to Richard Clarke, AIA, lead designer, EYP Architecture & Engineering, New York, because such clients put an emphasis on place-making and have an inclination to think campus-wide, because of their need for adaptability and flexibility.

Educators, adds Fenimore, are “out-of-the-box” thinkers who enjoy listening to a broad array of input and developing new ideas based on the information. “They’re often great collaborators,” he says.

Maclay, who recently published The New Net Zero—a great book on net zero and the IPD process—points out that, for many institutions, making a better world is a significant aspect of their mission. He says they often view their buildings as “living laboratories” that serve as teaching tools. IPD can help enable both goals.

“A less fuzzy factor is the fact that campus buildings are built to last 50 to 100 years,” says Steve Flanagan, AIA, LEED AP BD+C, and a principal with LPA Inc., Irvine, Calif. “Campus architecture is too complex to be created by one individual or even one discipline. It has a very specific function and doesn’t have the luxury of prototype testing,” says Flanagan, who defined the IPD process noted at the top of the page.

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JEFFREY S. FENIMORE, AIA, PRINCIPAL, HIGHER EDUCATION NATIONAL SECTOR LEADER, DLR GROUP, MINNEAPOLIS

“WHAT DOES AN INTEGRATED TEAM LOOK LIKE?”

The manifestation of collaboration between the CLIENT, PLANNERS, PROGRAMMERS, ARCHITECTS, DESIGNERS, LANDSCAPE ARCHITECTS, ENGINEERS and END USERS—all working as one cohesive team throughout various design phases to create a functional and sustainable environment that will enrich the lives of the people who use them.

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In its essence, IPD offers the best value to a client by enabling the team to optimally site and configure the building with a full, holistic understanding of M/E/P and structural system design, including a budget and schedule. With the full team involved from the get-go, a much richer pool of potential design solutions can be tapped.

For example, when designing the University of Wyoming Gateway Center, DLR was interested in cantilevering the second and third floor office areas over the first floor. They also wished to do so without structural support from below. Having the construction manager on board during design allowed the team to concurrently price the proposed structural design with steel suppliers to establish a price point. “With that information available during design, we were able to find middle ground with cost and design. If the project had followed a traditional project delivery method, we would have missed out on this early pricing exercise and the design could have been negatively affected,” says Fenimore.

DLR also benefitted from the construction manager’s early involvement when it came to sorting through cladding options, before ultimately selecting a fiber cement rain screen system as the best value. The recent design of Chemeketa Community College’s Health Science Complex in Salem, Ore., also demonstrates how integrated design can help transfer function and construction costs into other systems. According to Jon Wiener, AIA, principal, SRG Partnership, Portland, traditional, linear project delivery would have limited funding for the M/E/P systems to just HVAC system; an integrated process, however, helped the team transfer a good portion of those funds to a high-performance curtain wall that included horizontal window shading devices, automatic operable windows and control systems.

SRG has also been able to benefit from integrated design through the firm’s long-term relationship with the University of Oregon’s Energy Studies in Buildings Laboratory (ESBL). “Instead of a one-way flow of information from university researchers to design practitioners, participants experience a rich, two-way exchange,” explains Wiener. “ESBL joins the design team, contributes to the proposal and is already advocating for the building’s fundamental form and organization prior to the project’s start. During design, discussions focus on the problem rather than the project, and ESBL continues to test options and issue reports to reach outstanding results.”
CONCEPTS STICK

An example of the SRG/ESBL collaboration is a daylighting innovation called “cones of light,” as created inside Portland Community College’s southeast campus library. The cones stretch between floors, allowing daylight to permeate the building. “The space between the bars allows some light to filter through, while the bars themselves bounce the remaining light to the floor below,” says Wiener. “The cones are visible through the entire structure; it creates a wonderful airy quality and adds significantly to the character of the space.”

The reality, however, is that this feature added space, and therefore construction costs to the building. A traditional project delivery approach would not tolerate such a strategy says Wiener; yet the integrated process allowed the owner to more holistically recognize its value and role in the overall performance and quality of the design.

COLLABORATION RESULTS

As showcased in the design of Portland Community College’s new library on their southeast campus, a unique daylight harvesting reflector enables daylighting to reach between the floors and provides a path for natural ventilation. Called “cones of light,” this innovative strategy emerged from an integrated project process and a collaborative relationship between SRG Partnership and the University of Oregon’s Energy Studies in Buildings Laboratory.

CONES OF LIGHT

Size: 1 in. wide metal bars spaced 1 in. apart
Daylighting: Allows daylight to permeate the building from top to bottom
Ventilation: Path for natural ventilation

THE INTEGRATED PROCESS:

ARCHITECT
SRG Partnership

OWNER
University of Oregon’s Energy Studies in Buildings Laboratory

PROJECT: Portland Community College, Southeast Campus Library, Portland, Ore.

COLLABORATION: Find a way to keep a critical architectural/daylighting initiative from being a budgetary victim.

RESULTS: Early discussions and conveying a holistic understanding of the project’s goals, allowed the design team to convey the value of the idea and its role in the overall performance and quality of the design. The result was a “cone of light.”

Photo courtesy: Lincoln Barbour/SRG Partnership
A big proponent of the integrated process, LPA has been implementing this approach for years, including its recent work at California State University Northridge’s 138,000-sq.-ft. Student Recreation Center, which beats the state’s stringent Title 24’s energy baseline by 40% thanks to its displacement ventilation system, skylights and tight, well-coordinated M/E/P infrastructure.

From day one, the team, which, most importantly, included the end users—the students—collaborated on the design of the building. “The goal was to minimize infrastructure cost and unusable ancillary space typically found in the truss spaces of large-span structures,” explains Flanagan. Emerging from this integrated process, according to Erik Ring, P.E., LEED Fellow, and a principal with LPA, was the idea to stack the large volume gymnasium spaces onto the upper level. This way, Ring says, HVAC air distribution is closely integrated with the structural trusses, and supply is delivered via a thermal displacement ventilation strategy. The results: improved comfort, better IAQ and less ductwork.

**PROJECT:** California State University Northridge’s Student Recreation Center

**COLLABORATION:** LPA’s integrated team brainstormed on programming, structural and mechanical strategies to lower overall costs.

**RESULTS:** By stacking the large volume gym spaces onto the upper level, HVAC equipment and supply, via displaced ventilation, was closely integrated with structural trusses resulting in improved comfort, better IAQ, and less ductwork.

**THE INTEGRATED PROCESS:**

ARCHITECT

ENGINEERS

END USER

LPA

LPA

Students

**Access to daylight and views through self-shading tilted glass wall**

**Tripod structural system minimizes steel, yet maximizes strength in extreme seismic zone**

**Displacement ventilation supply at bleacher risers minimizes energy consumption and maximizes occupant comfort**

**Displacement ventilation with ductless return in vented ceiling**

**Skylights eliminate need for artificial lights during daylight hours in majority of building**
Another major tenet of integrated design is selecting building systems that can serve multiple purposes, thereby eliminating redundant systems, trimming down construction costs and cutting down on waste. For example, a cast-in-place concrete structure plays multiple roles at Coastline Community College's Learning Center in Newport Beach, Calif. The system provides a striking architectural form, a durable floor and wall finish and an exposed thermal mass, which enables a large central public space to be passively conditioned.

According to LPA’s Ring, this approach eliminated some HVAC system equipment, as well as finish interior materials, reducing costs by while enhancing the energy efficiency, aesthetics and durability of the facility.

DLR has also had success by instituting a more versatile envelope. At the aforementioned Gateway Center at the University of Wyoming, by opting for a fiber cement rainscreen, DLR was able to promote water drainage, therefore allowing the envelope to dry better by directing moisture to the outside of the wall assembly by force of gravity. Taking into account Laramie’s considerable change in weather conditions, the rainscreen system helps reduce hot and cold air, as well as thermal movement through the wall, thereby reducing energy costs, says Fenimore. At the same time, not only was fiber cement a durable and cost-effective cladding system, it’s also fairly lightweight, so ultimately, it reduced the building’s overall dead load.

Creative HVAC strategies such as this, and at CSUN, are exciting to SRG’s Wiener, in that many “sustainably” designed projects try to take advantage of passive ventilation and cooling in a small portion of their buildings, but still end up conditioning the majority of their spaces. With integrated design efforts such as these, he says, it’s not inconceivable to eliminate mechanical cooling in its entirety.
“Integrated design is much easier said than done. IPD propels an architect into a leadership role. Not all architects or their consultants are prepared to accept this added risk.”

JON WIENER, SRG PARTNERSHIP
NET ZERO NOW
For the net-zero University of Vermont George D. Aiken Center, an integrated design process enabled the team to reduce energy consumption by 63% by tightening up the envelope with R-5 glazing, R-32 walls and an R-54 roof.

Coupled with an on-site PV system, the building’s energy use intensity is just 24 kBTU/sq. ft.-yr.

Photo courtesy: Jim Westphalen/Maclay Architects.
Image courtesy: Maclay Architects

9 in. rigid insulation over existing roof deck
Lighting with daylight sensing controls

THE INTEGRATED PROCESS:

ARCHITECT
Maclay Architects
OWNER
University of Vermont

PROJECT: University of Vermont George D. Aiken Center

COLLABORATION: Transform the center into a ‘Living Building’ in honor of retired UVM professor John Todd, who invented the technology behind the Eco-Machine wastewater treatment system.

RESULTS: Upon winning a design competition, Maclay created a plan based on a model of a living organism within an ecosystem. This included the installation of an Eco-Machine, plus extensive envelope improvements that significantly increased window openings and the performance requirements of the windows and envelope. It was also envisioned to be a learning laboratory and a space that would bring people together and engage its occupants.
Existing buildings, too, can benefit from IPD and make good retrofit candidates. Such was the case at the University of Vermont’s George D. Aiken Center. According to Maclay, the net zero project (pictured above and opposite) is among the most energy efficient renovations in American higher education. It features plenty of daylight in a formerly dark building, as well as a high-performance envelope/ HVAC system that reduced the building’s load by 63%. More on it and general principles of net zero design, which has IPD at its core, can be found in Maclay’s The New Net Zero, by Chelsea Green Publishing.

SPEED BUMPS
While in Maclay’s estimation IPD is expanding “by leaps and bounds,” it is a new way of doing things and wide-scale adoption is going to take time. “There is not always an easy solution and it requires design professionals to work in a more collaborative manner, which is not always the easiest thing for some to do,” adds Fenimore.

In addition, he says, it requires a significant, up-front investment of time and this can concern some clients who are used to the traditional fee allocation that places the largest expense during the construction drawing phase. It may also be difficult, according to Macks, for owners’ representatives to explain to their organizations why work is not being procured in a lump-sum approach with up-front cost certainty.

Furthermore, architects must be prepared to manage the full process, including risk and resistance. “The architect must be confident, knowledgeable and passionate about the integrated approach to overcome any resistance,” observes Wiener. For example, he adds that the integrated process can affect the way traditional design guidelines, such as ASHRAE, are implemented. “Patience is essential to delay immediate time-based decision making in favor of an all-inclusive approach that gives every discipline an equal voice and opportunity to affect the outcome,” points out Glenn Carels, FAIA, and a principal with LPA. “This approach requires trust that a better holistic solution, ultimately, takes less time and effort to realize.”

It’s about empowering all building team members with an equal voice, concludes Fenimore. “Communicating to all participants and involving them in the process will generate better ideas and establish a broad base of ownership for both the process and the resulting solutions,” he says.