Unlike most colleges that offer a large menu of majors, College of the Atlantic specializes only in human ecology. So, it’s fitting that a college that teaches its 300 students about the interconnections between human and natural systems integrates those principles into its new Kathryn W. Davis Student Village Housing. Because most of the buildings of this coastal campus are large 1800s-era summer cottages, the Bar Harbor, Maine college chose residential-scaled buildings, rather than a large dormitory.

**Zero Fossil Fuels**

Among other sustainable moves, which include operating its own organic produce farm, installing a wind turbine and achieving carbon neutrality since 2007, the college committed in 2002 to achieve campus-wide independence from fossil fuel by 2015. The student village housing, which was designed with this goal in mind, demonstrates the potential energy performance that is possible even in a heating dominated climate (with an annual net energy use intensity of 27 kbtu/ft²·yr) and provides an example of alternative energy sourcing.

Bar Harbor has approximately 7,000 heating degree days and only 300 cooling degree days per year. The owner and design team determined that while air conditioning was not necessary, the space heating and domestic hot water loads would be significant, with heat and hot water about equal, given a super-insulated shell. Predominant strategies involve minimizing heat loss through an efficient building envelope and providing efficient and regionally appropriate heating and hot water systems. Through thoughtful interior planning, exceptional airtightness and use of a biomass-fueled central boiler for heating and hot water, these student houses achieve zero reliance on fossil fuels (the college purchases renewably generated electricity from the local utility).

**BUILDING AT A GLANCE**

<table>
<thead>
<tr>
<th>Name</th>
<th>College of the Atlantic Kathryn W. Davis Student Village Housing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Bar Harbor, Maine (on Mount Desert Island, 100 miles west of Augusta)</td>
</tr>
<tr>
<td>Owner</td>
<td>College of the Atlantic</td>
</tr>
<tr>
<td>Principal Use</td>
<td>Student residence</td>
</tr>
<tr>
<td>Includes</td>
<td>Bedrooms, living , dining and social spaces, laundry</td>
</tr>
<tr>
<td>Employees/Occupants</td>
<td>51 beds</td>
</tr>
<tr>
<td>Occupancy</td>
<td>100%</td>
</tr>
<tr>
<td>Gross Square Footage</td>
<td>20,552 ft²</td>
</tr>
<tr>
<td>Conditioned Space</td>
<td>20,552 ft²</td>
</tr>
<tr>
<td>Total Cost</td>
<td>$4.175 million</td>
</tr>
<tr>
<td>Cost Per Square Foot</td>
<td>$203</td>
</tr>
<tr>
<td>Substantial Completion/Occupancy</td>
<td>2008</td>
</tr>
</tbody>
</table>

**Program**

Students, faculty, staff and trustees, participated in the design process of the student residences, which accommodate 51 students and are

**COLLEGE OF THE ATLANTIC KATHRYN W. DAVIS STUDENT VILLAGE HOUSING**

**CASE STUDY**

**BUILDING ECOLOGY**

**BY BRUCE COLDHAM, FAIA; THOMAS RC HARTMAN, AIA; AND ERIKA ZEKOS, ASSOCIATE AIA**
The college offers one major: human ecology. A human ecological perspective, according to the college, integrates knowledge from all academic disciplines and from personal experience to investigate—and ultimately improve—the relationships between human beings and social and natural communities. The college has no academic departments, but focuses on interdisciplinary education and research. Its curriculum is loosely divided into three main resource areas: arts and design, environmental sciences and human studies. All students design their own majors. The college offered one of the nation’s first sustainable design programs in the 1970s. Students designed and built sustainable buildings over the course of several years.

The college is located in a small building adjacent to the pellet silo. The peaking hyperbolic paraboloidal roof forms the architectural transition from the dominant silo.

A central biomass pellet boiler is housed in this small building adjacent to the pellet silo. The peaking hyperbolic paraboloidal roof forms the architectural transition from the dominant silo.

**Water Conservation**
- Composting toilets
- Rainwater harvesting;

**Daylighting**
- Windows on two sides of every room and projecting bays provide daylight and natural ventilation.

**Individual Controls**
- Operable windows; throughout. Student-controlled thermostats on upper floors.

**Carbon Reduction Strategies**
- Boiler fueled by regionally sourced biomass pellets provide heat and hot water energy to the buildings. The college purchases green, renewable electricity from the local utility.

**Local Materials**
- The project used locally sourced wood for framing. An additional space, shared by the college community, that functions as meeting space, game room or laundry room. No basements were included on this rocky, coastal site.

The six houses are similar in plan and form, based on an efficient module that serves to constrain costs and establish a repetitive rhythm on the site. Projecting bays invite daylight and provide intimate interior reading nooks. Each duplex has a covered porch and a common space that connects the two houses. To further reduce the impression of the three-story buildings, the upper level is created as an attic space with a steep (and lower) roof.

**Energy at a Glance**
- Annual Energy Use: 26.9 kBtu/ft²
- Electricity (Renewable (Wind) Energy
  Purchased from Grid): 10.4 kBtu/ft²
- Regionally Sourced Biomass Pellets: 16.5 kBtu/ft²
- Annual Source Energy: 5.3 kBtu/ft²
- Heating Degree Days (base 65°F): 7285 (2011)
- Cooling Degree Days (base 65°F): 304 (2011)
- Average Operating Hours per Week: 168
- Energy Savings vs. CBECS 2003 Lodging: 71%

**Full Energy Picture**
- The Davis Student Village, which includes the six student houses and Deering Common Community Center, is served by an on-site wood pellet fired boiler. To understand total site use energy, use energy losses at the boiler and in the underground piping must be incorporated. Deering Common is 9,000 ft² and includes a kitchen, lounge, dining and meeting space, offices, project spaces and a small health clinic. It operates at an average of 98 hours a week, with an annual EU of 37 kBtu/ft². The following total EU for the student housing and Deering Common includes energy losses at the boiler plant and in the underground piping.

**Site Energy Savings vs. CBECS 2003 Lodging/Dormitory 54%**

**Water at a Glance**
- Annual Water Use: 185,616 gallons

**Sources:** College of the Atlantic and the Sierra Club

*Note: Data is from meters and includes all six houses.*

**System Distribution**
- Precinsulated and jacketed polyethylene underground piping carries hot water from the boiler’s 425 gal-

**Annual Total**
- 62,824
- 338,380

*Monthly breakdown of data not available for August–October.*

*Emissions have been converted to carbon.

**Electricity**
- Heat and Hot Water

---

John Rivers

---

Sam Coplon
The rocky site precluded basements, but allowed for the first floor of each building to have hydronic radiant heating in the slab on grade. Dramatically reducing the heating load with a high performance thermal envelope allowed a minimal increase in the size of the ventilation ducts to also provide the heating to the upper two floors. A traditional envelope would require larger heating ducts than needed for ventilation only or perhaps a separate hydronic distribution system. Instead, the design team added a small heating coil fed from the boiler loop in the ventilation system each of the floors is its own zone, which was intended to allow the students to maintain their own comfort level.

The air barrier was achieved by taping the seams of the exterior roof and wall sheathing panels with a tenacious self-adhesive tape. (See detail on Page 49.)

The low emission, fully automatic, modulating pressure rated, ASME rated boiler provides heating for all of the newly constructed buildings and Deering Common Community Center.

BOILER SYSTEM DESIGN

- **Wood Pellets:** Delivery -> Storage
- Boiler
- Heat exchanger
- Storage tank for DHW with electric backup for summer periods when the pellet boiler is off and allows a single house to be occupied while others are not — during summer programs, for example.

**BUILDING ENVELOPE**

**Roof**
- Type: Asphalt shingles over 5/8 in. sheathing with 14 in. I-Joists at 19.2 o.c., air sealed at the sheathing, cavities filled with dense-pack cellulose
- Overall R-value: R-45

**Walls**
- Type: Double stud wall, 11.5 in. thick, 2x6 load bearing exterior wall with 2x4 interior stud wall. Cavity filled with cellulose, air sealed exterior OSB with primer and tape
- Glazing Percentage: <10%
- Overall R-value: R-40

**Basement/Foundation**
- Slab Edge Insulation R-value: R-15
- Under Slab Insulation R-value: R-15

**Windows**
- Effective U-factor for Assembly: 0.19
- (Whole window)
- Solar Heat Gain Coefficient (SHGC): 0.28
- Visual Transmittance: 0.41

**Location**
- Latitude: 44˚ North
- Orientation: Various orientations
DEERING COMMON COMMUNITY CENTER

Deering Common Community Center, housed in renovated an oceanfront 19th century large summer cottage serves as the campus “living room.” It is served by the same biomass pellet central boiler plant that provides heat and hot water to the Davis Student Village Housing. The renovation, designed by Stewart Brecher Architects, was completed in 2008.

The first floor includes a student lounge and café. The offices of student life staff, the nurse and counselors are on the upper floors, as are the meditation room, student organization meeting space, and the music practice room. Deering Common also houses the school’s graduate program.

The cottage, formerly known as Sea Urchins, was built in 1886 for Burton and Constance Cary Harrison (Rotch and Tilden architects). Both of the Harrisons played prominent roles in the Confederacy during the Civil War. Burton Harrison served as Jefferson Davis’ private secretary and later practiced law. Constance Cary Harrison sewed an early prototype of the Confederate flag and later became a novelist.

Sources: College of the Atlantic, http://tinyurl.com/cg9qenb

Building Envelope

Efficient systems alone could not achieve the zero fossil fuel mandate. The building design is key to reducing demand on mechanical systems and electricity used for lighting. Building enclosures were designed, detailed, constructed, repeatedly tested and verified to achieve a peak load of 8 Btu/h ft² with R-40 walls, R-45 roof plane and R-5 windows.

Wall construction is double-framed, 12 in. thick and filled with dense packed cellulose insulation. Wood framing is locally sourced. Cellulose insulation follows the 14 in. deep I-joisted, unvented roof planes. Windows are triple glazed fiber-glass casements or awnings with low-e glazing. The exterior finish is fiber cement siding and trim with rain screen venting.

Roof planes are 14 in. I-joists. Large roof overhangs, which serve as a “rain hat” and shelter the walls from wind-driven rain, were detailed for prefabrication and attachment after the primary air sealing was completed. Photovoltaic panels were not installed due to existing tree canopy and cost, but roofs were sized, cleared, and oriented for future PV installation.

The buildings are slab on grade. Thermal mass coupling to the interior is provided through R-15 under-slab 3 in. expanded polystyrene (EPS) type IX rigid insulation. The foundation has a slag-derived cement substitute in footings and foundation walls and in the floor slab.

For air sealing, the exterior sheathing was taped with a tenacious self-adhesive tape over a continuous self-adhesive tape over a contact adhesive primer on the OSB. Construction documents included separate air sealing sheets showing the critical details in color, and these were carefully reviewed with the construction team prior to assembly.

To form the air barrier, the sheathing was primed and then the self-adhesive tape was pressure applied (rolled) to achieve a durable attachment.

Numerous air and theatrical fog tests on the buildings during construction demonstrated the effectiveness of taping all exterior sheathing joints and sealing gaps at material connections. The final blower door numbers resulted in an air tightness standard of 0.77 ACH50, or 0.08 cfm50/ft² of shell area. The goal of 1 ACH 50 was exceeded, but the building’s air tightness is just short of the Passive Haus Standard of 0.6 ACH50.

Water

Interior water use is reduced by using low flow faucets and showerheads and is further reduced by using composting toilets on upper floors. (Composting toilets cannot be used on the first floor since there is no basement.) Total water use, including irrigation, is just 10 gallons of water per person, per day. The composting toilets alone save 340,000 gallons of water annually. Liquid end product (LEP) from all of the houses was designed to be collected in a central underground tank.

Solid waste goes into the composting units on the first floor of each house. Composted material is harvested every few years and the nutrients in the LEP and compost can be added back to the soil when properly handled, turning waste into nutrients.

Originally, maintenance of the composting, pumping the LEP within the tank and turning the crank that mixes the composting material was assigned to students, but maintenance staff has taken over this task. Despite the unfamiliarity of composting toilets to most students, no complaints have been reported to the architects.

In addition, drain water from the showers serves as an energy source. Heat is captured from the shower water and is returned to help pre-heat incoming DHW.

Sustainable Community

Strategies for creating a healthy environment for the students include using no-VOC materials, providing ventilation directly to all spaces and ensuring that cleaning supplies are also low VOC and environmentally appropriate. Green cleaning policies were already well established at the College of the Atlantic.

A dedicated service door provides service access for the composting toilet in the densely consolidated utility space. The liquid end product drains to the central accumulating tank seen at bottom.

An axonometric drawing shows the dense consolidation of building services in the 6 ft × 12 ft first floor mechanical space. The design team executed a complete 3-D model of all components, including pumps, ducts and piping, to understand the sequence in the system coordination of component installation and service requirements.
comfort standards. These programmatic goals took priority over strict energy performance.

**Landscape**

Located within an existing complex of historic shoreline residences, the design of the new student village was further constrained by encircling wetlands and a 75 ft setback from a perennial stream. The design team’s choice to create a dense cluster of new and existing buildings around a pedestrian spine created a north-south campus link in an otherwise disconnected campus, as well as a series of landscaped outdoor rooms. Porches spill out to these naturally furnished outdoor spaces and invite students outside to gather on the rocks on the rare warm day.

The landscaping design, using trap rock gravel for walkways instead of paved surfaces, reduces impervious surfaces by 8%. Offsite runoff is directed into landscaped infiltration areas that surround the individual building courtyards. These catchment areas minimize off-site flows and promote infiltration and recharge into the electrical energy, total water and total domestic hot water. Residents initially read and tabulated the various meters to record consumption data from each house. The intention was to establish awareness of energy consumption and a friendly sense of competition between the houses.

A significant variation in the houses’ use of heat and hot water has been observed, thermostats set in the high 70s (˚F), for example. This level of control over thermal comfort may be an asset from the student perspective, but does not contribute to optimal energy performance.

The design team did push for simpler zoning of the heating system: one thermostat for the common space and one for both floors above, to moderate the variation that individual controls might give. The college, however, was committed to more fine-grained zoning. The administration wanted to be mindful of international students, some from tropical climates, who might be uncomfortable in Bar Harbor’s deep cold.

In addition, the college, devoted to the study of human ecology, wanted students to grow and benefit from the conversations and negotiations inevitably arising from different small bedrooms on the upper floors benefit from the single-story link, which provides separation between the units and allows upper stories to be ventilated and daylit from all sides in a way that a large unified building would not. Artificial lighting is mostly linear and compact fluorescent fixtures with LED under-cabinet lights. The design team developed a custom light fixture for the bedrooms so the task light could be relocated by facilities staff depending on the room layout.

Stairwell lighting is controlled by occupancy sensors. The efficient lighting and controls contribute to a lighting power density of 0.3 watts/ft².

First floor community spaces include kitchen and dining areas, which have integrated recycling and composting systems. Entry air locks for each house preserve comfort in the small, populated living spaces.

Data tracked for each house includes total thermal energy, total water and total domestic hot water. Residents initially read and tabulated the various meters to record consumption data from each house. The intention was to establish awareness of energy consumption and a friendly sense of competition between the houses.

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Energy Performance
Since 2009 data has been manually gathered from Btu meters on the incoming heating loop and electrical submeters in each building. The data indicates general trends in energy consumption among the six houses, but year to year variations in hot water and heating energy indicate the impact of occupant behavior.

While the house meters indicate the energy used by each house, they do not account for system losses that occur at the pellet-fired boiler and in the underground piping. To determine the total energy produced, the project team started with the total amount of pellets consumed by the boiler in 2011.

Heat and Hot Water from Pellet-Fired Boiler. The total area of the project is 29,500 ft² and includes the six student houses in Davis Student Village and Deering Common, which was renovated by another design team and connected to the common boiler plant. In 2011

the student housing and Deering Commons used 59.5 tons of pellets for heat and hot water. At 16,000 kBTU/ton of pellets, annual consumption is 952,000 kBTU.

The student housing is 70% of the project area, and the following metrics are based on the total project.

The EUI calculation assumes that the buildings perform at the same efficiency for heating and hot water at 32.2 kBtu/ft²·yr. This is based upon the pellet delivery directly applied to the square footage. The Btu meters that measure heating and hot water

TABLE 1 STUDENT VILLAGE, DEERING COMMON NET EUI’S

<table>
<thead>
<tr>
<th>TABLE 1 STUDENT VILLAGE, DEERING COMMON NET EUI’S</th>
<th>Energy Consumed</th>
<th>Percent of Energy Used/Lost</th>
<th>Square Footage</th>
<th>Net EUI*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Davis Student Village</td>
<td>551 MMBtu</td>
<td>44%</td>
<td>20,500 ft²</td>
<td>27 kBtu/ft²·yr</td>
</tr>
<tr>
<td>Deering Common</td>
<td>334 MMBtu</td>
<td>26%</td>
<td>9,000 ft²</td>
<td>37 kBtu/ft²·yr</td>
</tr>
<tr>
<td>Underground Piping</td>
<td>95 MMBtu</td>
<td>8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boiler Plant**</td>
<td>276 MMBtu</td>
<td>22%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Net consumption not including energy lost at boiler plant or in underground piping.
** Based on what remains from energy inputs unaccounted for by submeters or calculations. The boiler itself is rated at 85% efficient, but the overall boiler plant appears to be approximately 75% efficient.

<table>
<thead>
<tr>
<th>2011 ENERGY, WATER USE BY HOUSE</th>
<th>Electricity kBtu</th>
<th>Heat and DHW kBtu</th>
<th>Total Water Gallons</th>
<th>DHW Gallons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inner North</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>House A</td>
<td>29,415</td>
<td>65,773</td>
<td>30,803</td>
<td>13,750</td>
</tr>
<tr>
<td>House B</td>
<td>26,498</td>
<td>61,844</td>
<td>37,063</td>
<td>12,730</td>
</tr>
<tr>
<td>Laundry</td>
<td>14,672</td>
<td></td>
<td></td>
<td>2,240</td>
</tr>
<tr>
<td>Inner South</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>House A</td>
<td>36,867</td>
<td>23,987</td>
<td>35,163</td>
<td>18,210</td>
</tr>
<tr>
<td>House B</td>
<td>37,266</td>
<td>63,684</td>
<td>27,160</td>
<td>26,750</td>
</tr>
<tr>
<td>Seminar Room</td>
<td>887</td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>Outer South</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>House A</td>
<td>26,699</td>
<td>55,484</td>
<td>29,247</td>
<td>15,120</td>
</tr>
<tr>
<td>House B</td>
<td>40,316</td>
<td>67,608</td>
<td>26,180</td>
<td>13,400</td>
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<tr>
<td>Game Room</td>
<td>1,733</td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>Total</td>
<td>214,352</td>
<td>338,380</td>
<td>185,616</td>
<td>102,200</td>
</tr>
</tbody>
</table>

* Included in house data. Data from house meters.

Project Costs
The total project cost including Deering Commons was $6,533,000. The total site work and landscaping was $510,000 and the central heating plant including building, underground piping and equipment was $220,000. The student housing net cost not including landscaping and central heating plant is $4,175,000 or $203/ft². The total student housing project cost $221/ft².

Energy Performance
Since 2009 data has been manually gathered from Btu meters on the incoming heating loop and electrical submeters in each building. The data indicates general trends in energy consumption among the six houses, but year to year variations in hot water and heating energy indicate the impact of occupant behavior.

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<td>Davis Student Village</td>
<td>551 MMBtu</td>
<td>44%</td>
<td>20,500 ft²</td>
<td>27 kBtu/ft²·yr</td>
</tr>
<tr>
<td>Deering Common</td>
<td>334 MMBtu</td>
<td>26%</td>
<td>9,000 ft²</td>
<td>37 kBtu/ft²·yr</td>
</tr>
<tr>
<td>Underground Piping</td>
<td>95 MMBtu</td>
<td>8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boiler Plant**</td>
<td>276 MMBtu</td>
<td>22%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Net consumption not including energy lost at boiler plant or in underground piping.
** Based on what remains from energy inputs unaccounted for by submeters or calculations. The boiler itself is rated at 85% efficient, but the overall boiler plant appears to be approximately 75% efficient.

<table>
<thead>
<tr>
<th>2011 ENERGY, WATER USE BY HOUSE</th>
<th>Electricity kBtu</th>
<th>Heat and DHW kBtu</th>
<th>Total Water Gallons</th>
<th>DHW Gallons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inner North</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>House A</td>
<td>29,415</td>
<td>65,773</td>
<td>30,803</td>
<td>13,750</td>
</tr>
<tr>
<td>House B</td>
<td>26,498</td>
<td>61,844</td>
<td>37,063</td>
<td>12,730</td>
</tr>
<tr>
<td>Laundry</td>
<td>14,672</td>
<td></td>
<td></td>
<td>2,240</td>
</tr>
<tr>
<td>Inner South</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>House A</td>
<td>36,867</td>
<td>23,987</td>
<td>35,163</td>
<td>18,210</td>
</tr>
<tr>
<td>House B</td>
<td>37,266</td>
<td>63,684</td>
<td>27,160</td>
<td>26,750</td>
</tr>
<tr>
<td>Seminar Room</td>
<td>887</td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>Outer South</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>House A</td>
<td>26,699</td>
<td>55,484</td>
<td>29,247</td>
<td>15,120</td>
</tr>
<tr>
<td>House B</td>
<td>40,316</td>
<td>67,608</td>
<td>26,180</td>
<td>13,400</td>
</tr>
<tr>
<td>Game Room</td>
<td>1,733</td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>Total</td>
<td>214,352</td>
<td>338,380</td>
<td>185,616</td>
<td>102,200</td>
</tr>
</tbody>
</table>

* Included in house data. Data from house meters.
Electricity. The project is connected to an electrical transformer system that serves several other buildings beyond the project, so utility data is not available. Electricity use is based on the submeters within the six student houses, which was averaged over the entire project area. The total electrical use is 306,800 kBtu, or 10.4 kBtu/ft²·yr.

Determine EUIs for Deering and Student Housing. Based upon the Btu meter and electrical submeter readings at each of the six student houses and Deering Common, the total EUI was allocated as indicated in Table 1.

Conclusion

The Davis Student Village demonstrates the potential energy savings that can be achieved despite a challenging climate. By using regionally sourced biomass, the college avoids the purchase of 6,800 gallons of oil annually. This student village is meeting the college’s zero fossil fuel goal, while also providing a living example for students who care deeply about the sustainability of their built and natural environments.

LESSONS LEARNED

Add Better Insulation Under the Slab. More rigid foam insulation under the slab would have created a better envelope. In 2006, the design team thought they had chosen a lot of insulation. After working on subsequent projects, however, they would increase the amount of insulation on a project in design today.

LEP Collection Tank Unnecessary. Liquid end product doesn’t collect in the underground tank. This is a result of eliminating water consumption with the composting toilets located on the upper two stories of the residence houses. The urine component is volatized/evaporated through the ventilation stack, producing an insufficient amount of excess liquid to accumulate.

Better Manage Temperature Control. The owners requested student control over temperature in each of the upper floors. Upper stories could have been zoned together to provide more consistency across the buildings, with a centrally located thermostat on each second floor. According to the meter readings, had all six student houses used heat and hot water at the rate of the lowest consuming house, the heat and hot water energy use would have been reduced by nearly half.

Establish Redundant Protocols for Data Collection. The design team thought that the manual meter reading system would provide a reliable basis for understanding the buildings’ performance (and one that would engage the occupants and maintenance staff in a constructive feedback process). But it seems this plan was overly optimistic, and it has taken considerable effort over the years to obtain good data, and then question it.

Manual Reading (Even with Facilities Staff Oversight) of 30 Individual Meters was Not Adequate to Provide a Reliable Data Stream. With current Web-based digital technology, the team would design data collection differently. In this educational environment the design team and college still feel that it is important to include the students in the reading process. Digital access to online monitoring has its drawbacks as well, such as losing data with power loss or the exclusive dependence on a controls contractor to provide access to this information. A redundant system that includes remote access and visual meter-reading on site would increase the likelihood of reliable reporting and would provide the option of checking the information via both methods.

Site Energy Use Intensity (EUI). Adding the heat, hot water and electricity together results in a combined gross site EUI of 42.6 kBtu/ft²·yr or 1,256 MMBtu. The Commercial Buildings Energy Consumption Survey (CBECS) Weighted Mean Energy Use Intensity for Lodging is 94 kBtu/ft²·yr, and the project is performing 54% better compared to CBECS.

Determining EUIs for Deering and Student Housing. Based upon the Btu meter and electrical submeter readings at each of the six student houses and Deering Common, the total EUI was allocated as indicated in Table 1.

About the Authors

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