

Case Study: Sustainability at Bentley University



Bentley University is one of the nation's leading business schools, dedicated to preparing a new kind of business leader and one with the deep technical skills, the broad global perspective and the high ethical standards required to make a difference in an ever-changing world.

- Waltham, Massachusetts
- 25 majors including Sustainability Sciences
- 4,200 undergraduate/1,000 graduate students
- More than 276 full- and 184 part-time faculty members

At Bentley University, sustainability is everyone's business. This private, not-for-profit institution located in Waltham, Massachusetts is one of the nation's leading business schools. Bentley's curriculum is a unique blend of business, technology, and liberal arts that utilizes an interdisciplinary approach to provide international leadership in business education and research.

Students are encouraged to make the connection between business and environment while emphasizing the need for corporate social responsibility in increasingly transparent global markets. At a time of rapid change, accelerated innovation, intense globalization, and profound demographic shifts, Bentley is prepared to develop a new kind of business leader with deep technical skills, a broad global perspective, and high ethical standards to make a difference in this ever-changing world.

This holistic approach to education ensures that the Bentley community is not only focused on the "profit" aspect of the triple bottom line – instead, they equally consider the social, environmental, and economic impacts of their business and lifestyle decisions. Through their educational, environmental, and social efforts, Bentley has truly created a wholly-integrated, sustainably-minded community that has become a champion for sustainability.



COMMITMENT TO SUSTAINABILITY

Presidents' Climate Commitment

In 2007, Bentley University signed the Presidents' Carbon Commitment (PCC) in order to address the issue of climate change. This commitment recognizes that higher education institutions play unique roles as both role models in their communities and as hubs of research and innovation. Institutions pledge to reduce their greenhouse gas emissions and achieve carbon neutrality. Due to this pledge, Bentley has made capital and operational commitments to reducing emissions, increased support for faculty and student research on sustainability issues, promoted extra-curricular sustainable activities and groups, and supported sustainability teachings in school-wide curriculums. The campus also calculates their annual carbon footprint in order to quantify the effects of their actions on the environment and climate.

Climate Action Plan

From the PCC sprang Bentley's Climate Action Plan: A Plan for Carbon Neutrality. Created in 2010, this document became a roadmap for reaching a 2030 carbon neutrality goal with interim targets along the way. This reduction in emissions accounts for the institution's Scope I, II and III emissions, meaning Bentley aims to neutralize emissions generated on site, by utilities, and indirectly through travel and material production. Though addressing all emission scopes increases the difficulty of attaining their neutrality goal, it also ensures that Bentley's sustainability actions will result in far-reaching positive impacts.

2020 SUSTAINABILITY GOALS

70% Carbon Reduction (Carbon Neutral by 2030)

60% Waste Reduction

15% Water Reduction

5% Single-Passenger Commute Reduction

Bentley plans to meet their carbon neutrality goal through ongoing energy efficiency projects, upgrading building controls for more efficient HVAC operation, investing in on-site renewable energy projects, educating and engaging students, faculty, and staff in energy conservation and sustainability efforts, and purchasing renewable energy via Renewable Energy Certificates (RECs).

Bentley has required **all new construction and major renovation projects to be LEED Silver certified at minimum**. This will drastically increase the efficiency, health, and value of their new building stock while simultaneously providing occupants with productive learning and living spaces. All existing buildings are required to be retrofitted with energy efficient upgrades and low-flow water fixtures. Additionally, they must participate in ongoing waste assessments and green cleaning programs.



Amanda King, Executive Director of Sustainability.

Office of Sustainability

The Bentley Office of Sustainability consists of Executive Director Amanda King and Assistant Director Natalie Hayes. The Office's mission is to present the business case for environmental sustainability and corporate social responsibility and aims to mobilize sustainability leadership by:

- Modeling sustainable operations through balancing environmental resource efficiency, financial stability and societal benefit
- Supporting sustainability teaching in the classroom with opportunities to apply this knowledge to real-world situations
- Partnering with the business community to expand career opportunities in emerging markets

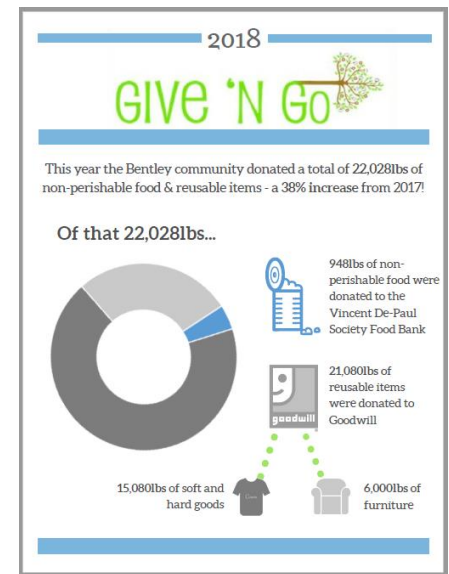
The Office of Sustainability has created several task forces which engage critical members of the Bentley community. These task forces include Recycling and Waste Reduction, Transportation, Energy, and Faculty and Staff Eco Representatives. The Office and task forces ensure that sustainability measures are being implemented effectively across campus and that new, innovative solutions are being developed to help meet Bentley's ambitious sustainability goals.

The Office of Sustainability's mission is strategically aligned with the university's goal of a holistic business education to make environmental and social considerations essential to all forward-looking business leaders.

Waste

The Bentley campus uses single stream recycling and has installed 150 recycling dumpsters to increase recycling capacity. Previously, trash and recycling were collected by separate entities, but they are now both handled by the resource management vendor. There are also e-waste stations for batteries, cell phones, hand held electronics, and printer cartridges.

Through Bentley's year-round Office Swap program, the campus community can exchange office items through an online platform instead of sending them to a landfill. In addition, Give 'N Go is a sustainable move-out program where students can claim left-over items or donate them as they move into or out of the dorms. In 2018, the Give N' Go program donated 22,000 lbs of non-perishable food and reusable items to local charities.



Bentley has an extensive compost program; pre-consumer food scraps are collected at each of the university's three campus kitchens and post-consumer food scraps are collected from catering operations. Food waste is sent to a local anaerobic digester where methane is captured for use as biogas. Kitchen grease containers are collected and recycled by Cape Cod Biofuels to create biodiesel. They then send their biodiesel to Loud Fuels which blends it with their home heating oil. 100% of the biodiesel remains in Massachusetts to heat local homes.

A majority of the leftover prepared food from dining halls and catering is donated to people in need through the non-profit Food for Free. Initiated in 2017, this program helped the school donate 8,900 lbs of food in its first year.

"I worked to implement reusable takeout containers in our cafeterias. We presented to the dean of students and he loved it. Many people asked why we hadn't done it before. Starting in 2018, Bentley will test out use of recyclable containers in one of their dining halls." – Taylor Cori, President of Bentley's Students for Sustainable Business

Water

Bentley is currently working to install low-flow bathroom fixtures across campus. Most residence halls have low-flow faucets and shower heads. Residents also have access to dual flush toilets that use 0.9 GPF for liquids and 1.6 GPF for solids.

There are 55 water bottle filling stations across campus. This has drastically reduced the campus sales of plastic water bottles as well as the amount of discarded plastic.

Energy

Fifty percent (50%) of Bentley University's annual greenhouse gas emissions are from campus building operations. Bentley utilizes two networked building energy management systems (EMS) to troubleshoot equipment failures, manage building schedules, adjust temperature set points, and track trends in energy usage.



Dana Athletic Center.

Photo courtesy of Bentley University

The majority of the lighting at Bentley is high efficiency LEDs or CFLs with occupancy sensors. All exterior lighting is LED and saves the university \$100,000 annually (a 584,000 kW reduction). The university has minimized light trespass onto neighboring properties by emphasizing downlighting.

In 2009, a 3,000 square foot solar thermal wall was erected on the Dana Athletic Center. The solar wall is made of perforated metal and is installed several inches from the exterior wall of the building to create an air cavity. This wall is directly connected to the Dana Center's HVAC system. During the day the wall is heated by the sun's rays. When the HVAC system calls for outside air it is pulled through the perforations in the wall and heated by the warm metal. This pre-heated air rises up the wall's air cavity and enters into the HVAC system where it provides the building with warm air, reducing energy use and heating costs.

Each year Bentley University invests a portion of its savings from energy efficiency projects into Green-e certified wind renewable energy certificates (RECs). The REC purchase guarantees that 25 MWs (the amount of electricity that Bentley uses per year on average) is generated by a domestic wind farm and used by the national electricity grid. This offsets the university's Scope II purchased electricity emissions. Bentley also purchased 3,337 MT of CO₂e offsets from a landfill methane gas capture project in Massachusetts. This purchase is used to offset the GHGs generated from Scope III emissions such as faculty air travel and student study abroad air travel.

Green Cleaning

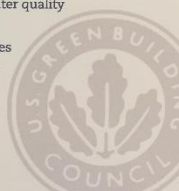
Bentley's green cleaning goals aim to minimize the exposure of building occupants to potentially hazardous chemicals through greener cleaning products and techniques. Almost all cleaning products are Green Seal Certified, and all vacuum cleaners met the rigorous testing requirements of Green Label Plus.

Wetlands

The Bentley Brook runs through Bentley's main campus and flows into the wetlands located on the university's south campus. The brook is an important stormwater feature on campus, acting as a channel for water during major rain events. The wetlands located on Bentley's south campus help to prevent the campus from flooding during heavy rain events by absorbing runoff. The wetlands also provides critical habitat for plants and animals. As the campus is also close to a state-protected river front and other areas that provide ecosystem services to the surrounding community, there are many environmental considerations to take into account during campus development. The campus is both actively protecting these sensitive sites while simultaneously educating the campus community about their importance.

KEEP IT WILD

The wetlands visible through this window are a protected natural habitat that provides valuable ecosystem services to the Bentley campus environment. They help to manage rainfall runoff, enhance groundwater recharge, and assist in regulating water quality in nearby Chester Brook, which flows into the Charles River. These wetland areas were carefully protected during construction of this building.



STUDENTS

Business and voluntary commitments are leading the way in global greenhouse gas reductions. By fusing the arts and sciences in the curriculum, Bentley aims to teach students that sustainability is a smart business decision. By offering two courses of study where sustainability science is paired with business majors, through supporting academic research on sustainability, and creating a living lab for students to assess campus energy, water, and emissions data, Bentley has transformed into a community of sustainably-minded business leaders. Students can now find sustainability topics in almost all courses taught at the university and can enroll in specialty business sustainability classes like “sustainable financial investing.”



Photo courtesy of Rebecca Bishop, Bentley University.



Photo courtesy of Rebecca Bishop, Bentley University.

The robust diversity, inclusion, and affordability programs for staff and students ensures that this educational experience is available to people across all walks of life. The DeLongchamp Family Endowed Fund supports undergraduate professional and extra-curricular activities associated with the triple bottom line. The fund allows students to explore opportunities that might otherwise be out of reach including attending conferences, networking events, taking an unpaid or a limited paid internship, or creating a research or public awareness sustainability campaign.

Students and staff also enjoy the benefits of a free shuttle service, carpool and vanpool programs, a fully electric golf cart fleet for facilities staff, and bicycling amenities such as commuter showers and fix-it stations.

“Once Students for Sustainable Business understood the student view [on sustainability] we began to push the business pillar as well. We talked about how businesses benefit from recycling and waste reduction efforts, how investing in sustainable companies is a profitable venture, and about how students can seek out companies with values like their own. We began to push the business angle to attract students to a different side of sustainability - and once we did that, the people and planet aspects followed naturally.”
-- Taylor Cori, President of Bentley’s Students for Sustainable Business

BENTLEY ARENA

The Bentley Arena is among the first collegiate ice arenas in the country to receive a LEED Platinum certification. It is also the first LEED certified building on Bentley's campus and has quickly become a symbol of the university's sustainability ambitions. Designed by Architectural Resources Cambridge and built by Suffolk Construction, this 76,000 square foot arena demonstrates how a space type ubiquitously recognized as highly inefficient can be built sustainably.



Photo by Rebecca Bishop. Courtesy of Bentley University.

Ice arenas are generally extremely inefficient as they consume a large amount of energy to meet the demands of ice making, heating for occupant comfort, and dehumidification due to ice evaporation. Developing such an arena would make it difficult for Bentley to realize their ambitious carbon neutrality goals unless it was built sustainably. That's where LEED came in.

Bentley's original plan was to pursue LEED Silver certification. Through the team's joint efforts and passion to create a truly sustainable building, they were soon surpassing their earlier goals and on their way to Gold certification. Approximately three quarters of the way through the design process, the team discovered they could potentially reach LEED Platinum if they acquired a few more points. By changing the school shuttle schedule to provide service to the arena every half hour instead of on the hour, the arena obtained the highly-valued Platinum certification.

LEED Facts	
for LEED BD+C: New Construction (v2009)	
Certification awarded Apr 2018	
Platinum	85
Sustainable sites	22/26
Water efficiency	8/10
Energy & atmosphere	31/35
Material & resources	6/14
Indoor environmental quality	9/23
Innovation	6/6
Regional priority credits	3/4

BENTLEY UNIVERSITY GREEN AWARDS

Association for the Advancement of Sustainability in Higher Education (AASHE) Sustainability Tracking, Assessment, and Rating System STARS Gold rating

Named one of the most environmentally responsible colleges in the country by the Princeton Review

Won the US EPA's 2014-15 College and University Green Power Challenge for using more green power than any other school in the Northeast-10 Conference

Bronze Bicycle Friendly University by the League of American Bicyclists

"The architects were perfectly aligned with the university's sustainability goals throughout the entire design and construction process. This shared vision and teamwork was critical to our LEED success." – Amanda King, Executive Director of the Office of Sustainability

Exterior Integration

The arena was built on top of previously developed tennis courts and did not utilize any extra undeveloped land. The plaza area consists of permeable pavers and extensive vegetation, both of which have drastically increased water infiltration compared to the once-impermeable tennis courts. Stormwater from the roof is directed to a settling basin which flows first into the water table and then to the surrounding wetlands.

The wetlands were protected throughout development and educational signage about the ecosystem services they provide is displayed inside the arena.

Exterior vegetation consists of adapted, native, and drought tolerant plants that do not require additional irrigation.



The native plants outside the arena do not require irrigation. Photo by Vanessa Goh.

Efficient Lighting

One of the surprising features about the arena is the massive amount of transparent and translucent glazing. Typically, ice arenas are windowless to prohibit heat intrusion and diminish the glare on the ice. However, the Bentley Arena's windows have been positioned to reduce glare during the hockey season and are also highly insulated, allowing for plenty of natural light to fill the arena during the day while preventing heat gain. At night, LED light fills the arena and occupancy sensors ensure lights are turned off in areas with intermittent traffic.



Photo by Rebecca Bishop courtesy of Bentley University.

An unexpected benefit from the LED lights came from the reduced thermal emittance. As LEDs run at much cooler temperatures than conventional lighting, they are less likely to contribute to the melting of arena ice. "When we told our Arena Operations Manager about the LED lighting he was excited about not having to fight the heat of inefficient lights in his efforts to maintain the proper temperature for the ice sheet," says Amanda King, Executive Director of the Office of Sustainability.

The project team was offered over \$80,000 in utility incentives from the local utilities Eversource and National Grid for their energy efficiency measures.

Ice Creation and Energy

Ice for the arena is created annually during the winter and spring hockey season. The arena platform consists of a large concrete slab with five miles of underground pipe. Highly efficient chillers pump a cold antifreeze (glycol) through the pipes for three days in order to cool the slab. Water is then hand-sprayed over the slab to create the ice. The ice is continually maintained throughout the season by two electric Zambonis which decreases the amount of exhaust inhaled by workers and visitors.



Electric Zamboni. Photo by Rebecca Bishop courtesy of Bentley University.



Chillers. Photo by Rebecca Bishop courtesy of Bentley University.

An insulated floor can be placed over the ice so that the university can host events such as concerts, career fairs, lectures, and alumni gatherings. There are 1,917 fixed seats for hockey, plus standing room for 400 to 500; it can welcome 3,400 for a concert and 750 to 1,000 people for lectures or other events. This transformational ability, along with multiple all-gender bathrooms, increases the inclusivity of the building as well as decreases the amount of separate programming spaces needed for events.

The project team was challenged to develop creative solutions in order to reduce energy demand from the ice-making process. In response to this charge, the mechanical engineers developed a state-of-the-art heat reclamation loop that absorbs waste heat from the chillers to pre-heat the building's hot water, showers, radiant floor heating system, and to melt the extra ice removed by the Zambonis. This process reduces the building's need for natural gas for heating purposes and helps to save valuable operating dollars.

The facility uses 44% less power than a standard ice arena, saving Bentley 50% on energy costs. Efficient technologies include: LED lighting, occupant motion sensors, and radiant floor heating.

Materials and Resources

Fifty percent (50%) of wood used on the project was sourced from forests with certified sustainable forestry practices such as Forest Stewardship Council certifications. Ten percent (10%) of construction and finish materials were locally sourced, decreasing the amount of emissions used for transport. Twenty percent (20%) of construction and finish materials contain recycled content and 75% of total waste generated from construction was recycled.

Recycling bins are located throughout the arena as well as compost bins for the concessions kitchen. The bathrooms utilize highly efficient electric hand dryers to reduce paper towel waste.



Photo by Rebecca Bishop courtesy of Bentley University



Sustainability Education

As Bentley is home to a popular Division 1 Hockey Team, the arena experiences its fair share of foot traffic during the hockey season. To better educate the hundreds of fans that pass through its doors, the project team constructed an educational “LEED Wall” in the main entrance lobby for visitors to easily learn about the sustainability features of the arena. Other strategically-placed educational signs offer a self-guided tour on specific LEED features and their impacts.

Photo by Rebecca Bishop courtesy of Bentley University.

1,400 solar panels cover 70% of the arena’s roof. These panels produce 625,000 kwh of electricity and meet 40% of the arena’s electricity needs. In Massachusetts, snowy and cloudy days are viewed by many as deterrents from installing solar panels. However, the purposeful building orientation and south/southeastern roof slope as well as the lack of shading greatly improves solar electricity generation. Even accounting for all historical weather data and potential overcast conditions, the solar system will still meet almost half of the arena’s electricity needs. This is also in part due to the energy efficiency of the building which has reduced overall electricity demand. This solar array, along with the arena’s other energy efficiency measures, helped the project team earn all eligible points in the LEED Energy and Atmosphere category.

Rooftop Solar



Solar PV roof. Photo by Rebecca Bishop courtesy of Bentley University

Living Laboratory



Photo by Rebecca Bishop courtesy of Bentley University

The arena also serves as a living laboratory for students and faculty alike. English and media studies students work with the video production team and in the press booth during events. Natural and applied science students analyze arena data on energy, water, and solar production. Math and sports management students will be able to evaluate statistics from arena information in the near future. All of these students are able to engage with a sustainable LEED building and realize its benefits through the lens of their specific discipline. The living lab process helps students practically apply their sustainability knowledge and develop a more environmentally-friendly campus community.

“Think of a marketing student analyzing customer data, a natural and applied sciences student gathering energy usage information or a math student crunching player stats at a game. The arena is meant to be a live learning laboratory that consistently adds to students’ academic experience in addition to the social one.” - Wiley Davi, Associate Dean of Arts and Sciences

Water Efficiency

Water bottle filling stations are located around the arena while bathrooms contain low-flow faucets, dual flush toilets, and hybrid waterless urinals. The hybrid waterless urinals installed are new to the market and incorporate a valve internal to the fixture that flushes one-gallon of water into the sewer pipe every 72 hours. This technology is meant to combat reports of urine crystallization in sewer pipes associated with waterless urinals. Even with single-gallon flush every 72 hours, the urinals use significantly less water than conventional models. Overall, the facility uses 48% less water than a standard ice arena.



Waterless urinals. Photo: Vanessa Goh.

Surrounding Community

As the arena is located close to a residential area, it was developed with outside community considerations in mind. The arena was built with acoustical finishes and materials that reduce sound transmission to the exterior. “The neighbors even commented that they could not hear any noise from one of our largest concerts held at the arena,” says King. The project team was also conscious of light trespass and designed their exterior lighting to minimize uplight, backlight, and glare to the surrounding area.



Photo by Rebecca Bishop courtesy of Bentley University

The Icing on the Cake

The sustainable design, construction, and operation of the Bentley Arena has cut its carbon footprint in half. Though pursuing LEED certification was daunting at first, the team discovered that the results spoke for themselves. “We let the data do the talking,” says King, “The performance metrics became the convincing factors. We demonstrated that the LEED measures improved building performance and would save money over time.”

Because of this, LEED skeptics slowly became sustainability advocates throughout the arena development. At the beginning of the project, the arena was allocated a \$45 million budget which did not account for LEED costs. By the time construction was finished, the project was LEED Platinum and came in just under budget.

The arena became a proof point for campus sustainability measures – if the campus can meet high energy demands efficiently, make smart financial decisions, and build a model sustainable ice arena, what can’t they accomplish?

“The biggest win is not only the sustainable space but the minds that were changed throughout the process. We now have many more champions of sustainability.” – Amanda King, Executive Director, Office of Sustainability

THE FUTURE

The campus has started a \$250,000 Green Revolving Fund for energy efficiency projects on campus.

Creating a LEED Platinum ice arena kick-started the campus's LEED goals with a bang. The arena became a prime example of how LEED could be successful across disciplines and meet the needs of a variety of stakeholders. Though Bentley's administration was encouraged to continue with their sustainability goals after the arena's success, there are still large challenges that must be overcome in order to effectively address campus sustainability.

The high density of Bentley's campus has increased its efficiency as it uses less land and energy per student.



Photo by Rebecca Bishop courtesy of Bentley University.

However, this means there is little room for renewable energy installations. Bentley will first focus on energy efficiency upgrades before turning to solar roofing systems and off-site renewable Power Purchase Agreements in the future.

The regional grid is increasing its renewable energy mix which aids in reducing Bentley's Scope II emissions. However, the campus is not well connected to the outside community by public transit and many students and staff travel in single-passenger vehicles which increases the difficulty of reducing Scope III emissions. Bentley is currently planning to increase transportation options such as shuttles, carpool servicing, and biking amenities. Bentley also plans to collaborate with the City of Waltham on their [Complete Streets Policy](#) and bike-sharing program to improve campus and community connectivity.



Photo by Rebecca Bishop courtesy of Bentley University

As there is currently no new construction planned on campus, Bentley is looking into LEED Operations and Maintenance (O+M) certifications. "Technology changes so quickly; what was not feasible a few years ago is easily achievable now," says King. "LEED O+M can be more easily achieved due to enhanced technology and market changes partially driven by LEED and v4."

LESSONS LEARNED



Photo by Rebecca Bishop courtesy of Bentley University

Integrating sustainability throughout Bentley's campus has been a challenge for the two-person team at the Office of Sustainability. Amanda King quickly learned that taking responsibility for campus-wide sustainability was not the most effective way to produce results. "To really create a change, everyone must own their sustainability goals," says King. "You have to give people the responsibility to make their own sustainability decisions. You have to be sensitive to their habits and inspire them to be more conscious of their actions. And you have to be okay if they fail. The fact that you gave them the responsibility to fail in the first place is what matters."

Ensuring that sustainability was instilled as part of campus culture instead of requiring it as a top-down measure was not an easy task. "Patience is key," says King, "If you push too hard and too fast, you risk losing people. You have to be open-minded, meet people where they are and be willing to negotiate. You will get much farther by listening to people rather than demanding something from them."

King's patience has paid off. The campus has won multiple awards in sustainability and is pursuing ambitious strategies to meet their carbon neutrality goals. "Climate change is such a large and looming threat, it's a tough burden to bear," says King. However, with an army of sustainability champions now at her back, King will no longer have to face the fight alone.

"Sometimes working in sustainability can be discouraging. There are people who truly don't care, and people who care but won't act. I've found that all you need is a small group of passionate people to make a difference. Keep your head up, focus on the end goal, and you will get there one small victory at a time." - Taylor Cori, President of Bentley's Students for Sustainable Business



Photo by Rebecca Bishop courtesy of Bentley University

Learn More

Bentley University: <https://www.bentley.edu>

Sustainability at Bentley: www.bentley.edu/offices/sustainability

LEED: www.usgbc.org/leed