

**Building and Construction Sustainability at Colgate University
Colgate University Bicentennial Anniversary**

ENST 390: Community Based Perspectives on Environmental Issues
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Executive Summary

The higher education sector is often referred to as a “living laboratory;” a place where components of sustainability can simultaneously be taught, practiced, studied, invented, produced, and shared. Often, liberal arts colleges such as Colgate University succeed in a few of these areas, but fall short of achieving them all. As Colgate approaches its 2019 goal of carbon neutrality, it is important to assess how principles of sustainability have been prioritized and applied throughout the university’s history. By understanding what has been done well and what needs improvement, effective plans and solutions can be made for the future of Colgate’s sustainability initiatives.

Our group was assigned to focus on sustainability in the context of Colgate’s building design and construction. Our research question is as follows: *How have principles of sustainability have been taken into consideration throughout the history of Colgate’s building design and construction?* We are using case studies of West Hall, James B. Colgate Hall, Lathrop Hall, and Stillman Hall as a way to study buildings that not only span multiple years in terms of construction and renovation, but also buildings that serve multiple purposes (academic, residential, and administrative).

In order to answer our research question, we analyzed documents from the Buildings and Grounds Collection of the Colgate Library’s University Archives Collection. These included construction specifications, relevant correspondence, photographs, and programs from ceremonies, for example. We also conducted interviews with individuals of relevant positions, who provided information concerning how sustainability has evolved and been taken into consideration more recently, over the last ten or so years.

According to Colgate’s Green Building Standards, published in 2015, all new construction and major renovation projects are required to achieve Leadership in Energy and Environmental Design (LEED) Silver certification. Thus, we used a relevant selection of LEED metrics to measure sustainability through our archival research. These LEED metrics applied to the three pillars of sustainability: environmental, economic, and social.

Our findings displayed some interesting, broad trends. Beginning in 1827, there is evidence for a focus on using local materials, primarily stone from the local quarry. In the early 1900s, we begin to see evidence of a desire to blend buildings into the landscape, a desire to use natural light, and a desire to prevent construction-related pollution. In the late 1900s, there is more of a focus on using durable and economically efficient materials, as well as preserving the surrounding landscape and flora throughout the construction process.

In our analysis, we use existing literature to explain why the results we’ve found are

Introduction

As Colgate University is rapidly approaching its bicentennial year, it is also approaching its goal of becoming a carbon neutral campus. Sustainability is becoming an increasingly important focus in the realm of higher education institutions such as Colgate, and it is essential to constantly reevaluate the ways in which campuses encompass sustainability's different facets. With the goal of a carbon neutral campus in mind, it becomes evident just how important the buildings and grounds on Colgate are. Colgate's buildings and ground contribute to over half of the entire university's carbon footprint, therefore making them very important players in the context of Colgate's sustainability efforts. For our group's project, we have set out to discover how sustainable or unsustainable the buildings on our campus are. By studying the history of the buildings selected, we are able to see how sustainability principles have been taken into account throughout the university's history and develop themes and trends based on our findings. In order to achieve a focused and detailed analysis, we narrowed our focus to four specific buildings to use as case studies. The four buildings are West Hall, James B. Colgate Hall, Lathrop Hall, and Stillman Hall. Each of the four buildings experienced construction and/or renovations in a variety of time periods, and each of them serves different functions on the campus. By studying the archival documents and sources of these buildings, we were able to detect and interpret trends and themes throughout time. We were also able to obtain more current information from interviews with key stakeholders in campus sustainability. By using the Leadership in Energy and Environmental Design (LEED) standards to organize and measure our data, we are able to translate it to current sustainability goals and develop future recommendations for the university.

Literature Review

History of Sustainable Construction

The green building movement emerged along with the broader sustainability movement of the 1970s after the US and other nations became aware of the realities of global resource loss and degradation (About the USGBC, n.d). In 1987, the Brundtland Report took place as a result of the World Commission on Environment and Development (Kibert, 2004, p. 498.) The US Green Buildings Council was formed in Washington, D.C. in 1993 (Kibert, 2004, p. 498). In 2007, the Energy Independence and Security act was passed, which provided a specific framework through which to require, regulate, and monitor environmental improvements to construction (Page, 2010, p. 376). Although there were many other conferences and documents released in between those given years, these specific dates provide a general framework through which one can understand the progression of how the sustainability movement has evolved from something extremely abstract and vague to something that can be tangible and regulated.

There are multiple issues of sustainability that can be directly applied to building design and construction. Buildings deplete a vast amount of resources in the US; using 68% of all consumed electricity, releasing 38% of CO2 emissions, and absorbing 12% of all water resources (Page, 2010, p. 374). In general, construction projects in the US produce around 2.5 pounds of solid waste for every square foot of completed floor space (Ried, 2008, p. 5), which is around the weight of a liter of water per square foot. It is shown that the US construction industry has used about 90% of all of the raw materials

Working Definition of Sustainability

In order to fully understand and critique the sustainability of Colgate University's past, present, and future building construction and design practices, it is essential to establish a working definition of sustainability in the relevant context. The most commonly used definition of sustainability originated in the Brundtland report of 1987, and is as follows: "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Theis and Tompkin, 2012, p. 6). There are three main facets of this definition, those being the environmental, economic, and social components of sustainability. The environmental component involves factors such as the impact on land, waste, and renewable energy, for example. The social component consists of how humans are impacted, and preservation of culture and functions that influence human knowledge and health. The economic component is primarily concerned with how financial capital is moved around in the involved processes, how skills of commerce and other relevant skillsets are promoted and continued, among other things (Theis and Tompkin, 2012, p. 7). In the context of sustainable building design and construction, these three pillars can be applied to provide a more specific definition of sustainability as it relates to the topic. The environmental component of sustainable buildings often involves energy and water use that is not excessive, preservation of the natural land and using local and environmentally friendly resources (Kibert, 2004, p. 491-2). The social component can consist of the health effects of the buildings, the way the building is utilized, and the choice and regulations around the construction workers and their rights. The economic component for buildings is primarily the way in which financial costs of using more sustainable practices compare to less sustainable practices, both in the immediate time frame and over longer time periods. Based on all of these definitions, our working definition of sustainable building design and construction is: Construction and design that avoids environmental degradation, promotes economically efficient building practices, and allows for the continuation of culture and maintenance of good health.

Methods

Overview

The aim of our research project was to answer the following question: How has Colgate, throughout its 200 years, taken principles of sustainability into consideration for the university's building design and construction? We approached our project utilizing case studies of James B. Colgate Hall, Lathrop Hall, Stillman Hall, and West Hall.

In order to do this, we first selected the four university buildings, then conducted archival research focusing specifically on each building. We critically examined our findings utilizing the Leadership in Energy and Environmental Design (LEED) rating system criteria. Finally, we conducted two interviews with key stakeholders on Colgate's campus to gather more information about discussion of sustainability across campus, both generally and specifically for buildings.

Building Selection

In order to obtain a wide range of evidence with which to answer our research question, we chose four buildings that spanned different time periods and different

(Colgate University Green Building Standards, 2015, p. 13). Also, the criteria for LEED building design and construction is very thorough and we feel it adequately addresses the three pillars of our definition of sustainability.

Table 1 below displays the five general categories of sustainability criteria that we created, and how they fit into the three pillars. The environmental pillar is split into three categories, while the social and economic pillars are their own categories. Table 2 displays the subsections of each category, each of which is a separate criterion from the LEED v4 metrics.

Table 1: Division of Broad Categories

Environmental	Social	Economic
-Assimilation into/Preservation of Surrounding Natural Landscape -Choice and Sourcing of Materials -Energy, Electricity, Water Use	Social Pillar	Economic Pillar

Table 2: Broad Categories in Subsections of LEED v4 Metrics

Assimilation into/Preservation of Surrounding Natural Landscape	Energy, Electricity, Water Use	Choice and
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Lifecycle Impact Reduction: This metric promotes adaptable buildings, and encourages materials that are durable and long lasting.

Quality Views: This LEED metric aims to increase the connection between the individuals within the building and the environment outside of the building.

Indoor Air Quality: This LEED metric encourages high air quality in the building after

Results

LEED v4 Metrics: Sensitive Land Protection, Protect or Restore Habitat

In the initial specifications for the construction of Lathrop in 1906, there was a mention that the contractor should remove the trees, but no mention of what they should do with the trees once they were removed, implying that the trees were simply disposed of. In 1930, West Hall was repaired due to fire damage and the specifications required that “Care must be taken not to disturb the ivy on the outside of building, and properly protect the grounds. Keep the premises broom clean” (Specifications for Repairing Damage by Fire, 1930). This focus increases in the 1964 specifications for the renovations of James B. Colgate Hall, which require the contractor to “Remove complete all trees, shrubs and stumps from area to be covered by building. Remove without injury to trunks, interfering

The 1906 specifications for Lathrop said that the underpinning of the building was to be made of local quarry stone. The 1927 specifications for the construction of Stillman required that the “stone for exterior walls.... Will be obtained from the University quarry” (Chambers, 1927). Also, sand for the construction “was to be procured from Boonville, NY” (W. B. Chambers, 1927). Although the archives of James B Colgate Hall don’t have an explicit mention of local quarry stone, the 1889 image of the building’s construction highlights the use of stone, and it can only be presumed that the building would use the same stone as the other buildings. However, it is iumed that the building

This is a current-day image of the quarry, taken from the Colgate website. It has not been used for a long time, as evident by how overgrown it appears to be. Despite this, it was most certainly an interruption in the landscape and continues to be today.
(Daniels, M.)

Besides using local materials, there was also clearly a desire to use top quality durable materials. This may have been prompted by the fires that occurred in a few of the buildings including West and James B Colgate, both of which required hefty renovations.

throughout the years based on the human needs that it was meant to fulfill. This type of adaptability is important, as it is much more sustainable and cost efficient to renovate and reset buildings than it is to break down a building and create a completely new one for a different use. There was definitely an awareness of this, at least in the 1972 renovation of Lathrop, as an individual who spoke at the event said that “It is not possible to say what facilities will be desired in another 65 years, for equipment will change and educational styles may differ substantially from those of today, but in planning the remodeling every effort was made to build in flexibility for accommodating later needs” (Rededication and Renovation of Lathrop Hall, 1972.) There wasn’t any explicit information on the economic pillar in the archival resources for James B. Colgate Hall, but it should be noted that it has been used as a library, an administration, and an admissions building. There were likely structural changes that needed to take place for these shifts to happen, but the building looks relatively similar today compared to how it did at initial construction, indicating that it was also flexible and adaptable. West Hall also looks very similar today, although it has primarily been used as a residence hall (exempting its first few years of existence when it was one of the only buildings on the entire campus). The building originally contained a chapel that was transformed into student rooms in 1867. “Extensive Renovations have obliterated all traces of the original interior but externally the building is the same as it was in 1827” (Williams, 1969, p. 33). In an interview with one stakeholder, we discussed this exact issue and how it is coming into light currently:

“This campus is pretty old, and our buildings weren’t really designed, some of them are not being used for what some of them were originally designed for. For instance in some of the lab buildings, we are going back through that cycle now. I think Wynn Hall in particular they’re looking at the mechanical side of the systems to upgrade and change some of the parameters, obviously windows and things like that we’re looking at changing out, but there is obviously a cost to everything you do, you take the money and try to plan smarter for what you do next time” (Interviewed Stakeholder, 2017).

cases covering how exactly landscaping should be carried out. For instance, in the 1964

Analysis

Timeline of Larger Sustainability Trends Between 1827-2000

From our research in the archives as well as our understanding of Colgate's current environmental approaches, it seems reasonable to infer that many of Colgate's seemingly sustainable practices throughout its history of building design and construction have been motivated by a concern for aesthetics. This prioritization of aesthetics is

Again, from the information provided in the archives, we are unable to know for certain the primary concerns that motivated regulations such as these. Figure 2 (in Results) depicts the original site of James B. Colgate Hall during construction preparation, and shows tall grasses in the surrounding area which could indicate a desire to keep the surrounding area as similar to its natural state as possible.

Further emphasis on aesthetics can be found in the desire to blend the buildings into the natural surroundings and existing built environment. The university's desire to blend the buildings into the natural surroundings simultaneously contributed to the use of local materials. West Hall, Lathrop Hall, and Stillman Hall were all constructed from gray limestone acquired from the local quarry. The exact rationale for use of stone from the quarry is not stated but convenience of location of and access to the quarry as well as a desire for the buildings to reflect the region's natural environment seem probable. It is uncertain whether environmental sustainability reasons (ex. Native to the environment and minimized emissions due to transport distance) for using local stone over other material were considered in the decision. Specific evidence from Lathrop's specifications indicate a desire for the building to fit into the built environment seamlessly, "The exterior walls of the building, except as otherwise shown or specified are to be of rubble work of local quarry stone similar to that in Alumni Hall" (Harding and Seaver, 1906), and "Granite is to be of a warm color to harmonize with the limestone used in the building". Local wood has also been used and continues to be used in buildings on campus. Two common types include red oak and white pine, both explicitly used in the construction of Lathrop (1906) and Stillman (1927). Both red oak and white pine are flourishing, native species of New York state. It can be presumed that the prevalence of such trees throughout the state allowed for the cost of the material to be affordable, if not inexpensive for the university to invest in. It seems reasonable to determine that the university was primarily concerned with the cost of the material and not with the environmental impact of the wood as there is no indication of consideration for utilizing recycled wood, and thus deforestation was a direct result. As we learned from the Director of Sustainability, the university is now placing greater focus on utilizing recycled materials in construction and renovation projects, "If you look at our two newest buildings, we did use a lot of recycled materials, post-consumer content. Trudy has a lot of wood in it, a lot of wood that is repurposed wood. I just think that that's better for forests, for recycling so you're not using virgin materials or products" (Director of Sustainability, 2017).

In terms of energy use, efficiency and conservation, Colgate has somewhat maintained a concern for energy efficiency/natural energy and conservation since the early years. Prior to electricity, students utilized wood or coal in their stoves to heat their rooms, which they had to supply for themselves. While this saved the university money, there are several environmental consequences to utilizing coal and also implications depending on the students' sourcing of the wood, as well as health impacts to burning coal and wood indoors. "Using coal and other mineral solid fuels for home heating will usually result in higher emissions of both local air pollutants (such as particles and sulphur dioxide) and carbon dioxide (the greenhouse gas) than an equivalent natural gas-fired system, and therefore coal-fired heating will normally have a higher environmental impact than gas" (Environmental Protection UK, 2017). Though there is less environmental impact due to the burning of wood, the manufacturing of and transport of

wood fuel products leads to deforestation and produces carbon emissions. In later years it became clear that the university was eager to incorporate more natural lighting into their constructions. The construction of Lathrop in 1906 included the installation of a large skylight window, in the two-story room intended to be a museum. Motivations for installing the skylight were likely centered around aesthetics, so the museum could be better lit throughout the day, and economics as the museum would likely be lit for the entirety of the day incorporating natural lighting would help to reduce the amount of electricity needed to light it during daylight hours. The utilization of skylights was also referred to in the renovations of West in 1930, which indicated that the original construction of West also included skylights. The implementation of skylights at this point in history was likely motivated by the quality of lighting prior to electricity and provided by electricity at the time as well as the cost of electricity. Another reference to energy usage in the archives was seen in dormitory regulations from 1936 indicating a concern for conserving energy usage in the dorms most likely to save on expenses. Economic concerns also motivated the requirement to take extreme caution during excavation to avoid electrical, water, and telephone lines as severing such lines would pose costly losses due to cost of loss of water and re-installment fees.

It is evident that intentional implementation of and focus on the environmental pillar of building design and construction practices was not present in Colgate's history until the turn of the century. In the school's present-day construction projects, the mindset has changed: we are shifting to valuing utilizing durable materials that minimize environmental impact over the initial costs. This can actually be seen after the 1971 renovation of Lathrop when there seemed to be an awareness of the both economic and social value of constructing buildings that are adaptable and will be beneficial to future generations. The utilization of environmentally responsible materials is also economically responsible for the university as they are also more durable, "They replaced James C. Colgate last year with something that isn't slate but it is an equivalent and it is expensive but it will be here for our great grandchildren" (Interviewed stakeholder, 2017). Yet, costs have still had a heavy influence over the decisions Colgate has made in terms of buildings and is detrimental for becoming more sustainable. We learned from one interviewee, who said that in the construction of the Ho Science Center, there was a conscious decision to not have the building LEED certified due to the cost of doing so. "The part about buildings that I think has been a shift for Colgate is we spend a lot of time focusing on the cost of the initial construction, which is generally about 1-2% of the cost of a building. I have to keep reminding people of that. Because, [Ho] is an expensive building. We will end up spending 5-10% more just on maintenance and energy costs. Its way more expensive to operate a building than it is to build it" (Interviewed stakeholder)

of the surrounding landscape, the effort put into maximizing economic efficiency or the desire to incorporate aesthetically pleasing views, it is clear that sustainability has been given physical form in Colgate's history through building construction and design. However, there is still a lot of room to grow in this regard. We have come up with a few recommendations for the future that may assist the university with achieving goals of sustainability and, ultimately, carbon neutrality.

Recommendations

Our first recommendation concerns the fact that Colgate is no longer growing at the exponential rates that it was in its earlier years. In the early to mid-1900s, the student population at Colgate was steadily increasing very quickly due to innovations in

sustainability of buildings, in terms of how they maintain or degrade the health of students, faculty, and employees.

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Appendix 1: Certificate of Informed Consent

Overview and Procedure: We are a group of students from Colgate University working on a project concerning the history of sustainability in Colgate's building design and agriculture. We would like to ask you some questions concerning this topic. The interview will take 20-30 minutes of your time.

Risks and Benefits: Your participation in this project is low risk, as none of the questions should be too personal. We cannot offer compensation in the interview, but recognition of your name and the information with which you provide us will be included in our final report.

Confidentiality:

1. Please tell us a bit about your job, how long you've worked at Colgate, and which types of positions you held prior to coming to Colgate.
2. Have you seen Colgate's approach to sustainability change during your time here?
3. How often does sustainability come up in your conversations in the professional setting? In which form does it manifest itself?
4. Relative to how other universities have progressed in terms of green building design, where does Colgate stand?
5. Do you think Colgate addresses all three pillars of sustainability in building construction and design?
6. What are some sustainability initiatives at Colgate that have succeeded? Are there any that have failed?
7. Does building sustainable green buildings inconvenience the process at all?