University of Toronto

Mapping Sustainability at the University of Toronto Scarborough Campus

Focus on Infrastructure and Initiatives

Harrani Rajasegar (1003536701) & Lotte van Gelderen

EESC34H3

Ana Martinez

April 8, 2020

Abstract

Since 2007, the sustainability office has taken measures to improve sustainability features at the University of Toronto Scarborough Campus. These projects have included both infrastructural changes and additions of sustainable projects within. Both aspects of sustainability have been successful, allowing analysis and suggesting improvements. Contradictingly, the data available to draw connections is limited and in order to develop a clear set of information new opportunities must be considered. Overcoming the challenges of research was done through public domain and documents provided by the University. The future of sustainability is active and well here at the campus. Further, continuous efforts are discussed in context of the entire University and improvements for future endeavours.

Keywords: Sustainability, campus, developments, initiatives, infrastructure

Introduction

According to the UN report of 2010, sustainability is defined as"any action that meets the needs of the present day, that does not compromise the ability of future generations to meet their own needs" (Brundtland Commision, 1987). For many years, this definition has been the foundation of sustainable practices and future imaginations. Right here at the University of Toronto; architects, faculties, and staff have been actively envisioning ways we can adapt to our daily needs without accommodating for the future.

The ongoing changes due to climate change will impact many aspects of the University. "Ongoing teaching and research will further UTSC's contributions to understanding and addressing climate change. In addition to its teaching and research mission, the university must also address climate change from a campus planning perspective" (Masterplan, 2016). The university's response includes reduction and mitigation. Therefore, particular campus operations must be reduced and refined.

Our project focuses on sustainability at the University of Toronto Scarborough Campus. Here at UTSC we contribute to only 8% of GHG emitted amongst the 3 campuses. In order to provide an extensive understanding, we focused on two objectives; the infrastructure and engineering of the building, along with the initiatives on campus. Evidently, some of the newer buildings have sleek technology to improve measures in reducing overall Greenhouse gas emissions. By analyzing the nuances of these buildings, we can better understand how these are impactful choices. From the choices of materials to the placement of them, every decision along the way impacts the use and emissions. The initiatives on campus have been enacted by the Sustainability Office. They're work predominantly encourages, promotes and advocates for sustainable spaces to exist within the campus. In comparison to other UofT campuses, the University of Toronto Scarborough occupies way less physical geography.

Methods

Our action plan for this project focused on gathering quantitative data, as well as detailed descriptions of the direction that UTSC is planning on going when it comes to their campus initiatives. The quantitative data we collected was used to determine the success, and pitfalls, of the target figures UTSC had put in place. We looked particularly at figures that reflected energy consumption, and water resource consumption. These figures are what determine if the initiatives, and infrastructure developments, had a positive or negative impact on UTSC's energy footprint.

The main buildings of focus were as follows: Main Building, Social Sciences, Science Research Building, Environmental & Chemistry, Pan Am Centre, Instructional Centre, and Highland Creek. In order to analyze the buildings we used the University reports and on the public domain. Particularly, the Low Carbon Action Plan 2019 provided details on future endeavours and green initiatives on campus. The UTSC website also held general knowledge on the green changes made. It provided details on the LEED awards and requirements the buildings followed. It was useful to use these sites to draw connections between the structures and changes.

These buildings also contained the following initiatives: the pollinator habitat, eco containers, farmers market, the greenhouse in SRB, geothermal boreholes, solar panels, and the community garden. We also used the UTSC website to acquire information on these resources.

Results and Discussion

According to a 2016 report, there was a reduction in energy consumption by 30% from the implementation of geothermal systems (UTSC, 2016. The small but imminent changes are impacting the overall functioning and usage of the entire system.

When collecting data for the infrastructure of some of UTSCs buildings, we excluded the residence buildings, due to confounding variables. The water resource consumption data was influenced too heavily by the students' variable usage of water throughout the year, as well as the residence hydro being billed differently than the rest of the buildings on campus. We chose to also limit our focus of initiatives to the ones mentioned above. We wanted to limit our initiatives to ones physically found on campus, as opposed to projects that are done based on student involvement (such as the bikeshare, UTSC green courses, and ZipCar). Our decision was due to initiatives like the ones listed are difficult to quantify, and therefore difficult to track annual progress.

The utilities and infrastructure of the buildings will efficiently, and reliably run, without negatively impacting the quality of the campus. Water conservation efforts (due to renewed infrastructure aimed at maximizing water usage efficiency) will minimize water usage. The

neutralized, and on-site stormwater management features will maximize retention and treatment to further increase sustainability (Master Plan, 2016).

In a sustainability assessment report written by Sala, Ciuffo & Nijkamp, we witness the importance of sustainable approaches. This report highlights by using a combination of ontology, epistemology and methodology, we can frame and integrate changes. These changes allow decision-makers and policy-makers to decide what actions to take (Sala, Ciuffo, & Nijkamp, 2015). Specifically, the university should gear towards the sustainability assessment as a practice. The multidisciplinary approach includes environmental, economic and social factors together. Ultimately, the sustainability assessment allows us to plan and contribute to sustainable development.

Infrastructure and Buildings

Science Wing: Amongst the Science Wing many building and facility changes are being made.

- Change in heating plans: UTSC Science Building on the South Campus that currently provides an installed rated capacity of 1,115 kW for heating and supplanting natural gas-based heating (Low Carbon Action Plan). According to the Low Carbon Action Plan, they are looking to convert the entire campuses heating system. Beginning with the Science Wing they are converting "campus building heating systems from steam to hot water" (Low Carbon Action Plan, 2019).

- Outdoor Air System: The Science Wing is known as a laboratory intensive space. In order to meet the demands of operation via utilities, the space requires high ventilation and airways compared to other spaces. These laboratories tend to work with volatile substances and toxins that require such ventilation. However the original air handling units operated on original steam heating coils. Now, replaced with higher efficiency hot water coils. "The new air handling units have also been configured to take advantage of unique existing dual duct infrastructure to provide an innovative control system that supplies dedicated outdoor air to spaces served according to varying occupancy and fresh air requirements" (Low Carbon Action Plan, 2019).

- Infrastructure & Utilities: A central heating and cooling plant provides most of the HVAC needs for all of the academic buildings, ensuring efficiency, reliability and ability to retrofit for new technologies (Masterplan, 2016).

*Humanities Wing (*HW): Along with the change in heating from steam to hot water, the Humanities wing will include some new technologies to reduce greenhouse gas emissions. This includes "the installation of high-efficiency boilers and ground source heat pumps" (Low Carbon Action Plan, 2019).

Science Research Building (SRB): Infrastructure: Designed by Moriyama & Teshima Architects to encourage interdisciplinary approaches to the physical, environmental and life sciences, the innovative plans establish research clusters in an open-concept setting for maximum collaboration.

Environmental & Chemistry (EV): Sustainable features include geothermal boreholes, an Earth Tube system to supply 100 per cent fresh air to the administrative wing, unique fritted glazing to minimize solar heat gain, all LED lighting fixtures and a high performance curtain wall. Geothermal Boreholes are a ground source heat pump borehole representing a closed loop system which comprises a set of polyethene pipes that are vertically inserted into the ground and which circulate water to and from the geothermal heat pump. The Earth Tube Systems are a passive technology that enables the transfer of ground source energy to heat or cool ventilation air. They are standard concrete tubes that run underground and precondition the temperature of incoming air before it enters the building. They reduce the energy required to heat or cool the building. The building also encompasses materials low in Volatile Organic Compounds (VOCs) for the construction of the interio. As well the roof is designed to recycle rainwater by funneling it to large underground cisterns to be used in irrigating the surrounding landscape during dryer months

Panam Centre: This is one of the newer buildings with extensive features. It includes 1,854 solar panels on roof & 666 over the field house = basically generate 10-15% of power to run the building. Nearly, 40 percent of heating and 99 percent of the cooling in the facility is supported by a geothermal field. A green roof covers 30 percent of the roof area, approximately 60,000 square feet. Along with the installation of LED lighting throughout the building. which consumes 80 percent less energy than incandescent, and about 35 per cent less than fluorescent. Also, there are three underground cisterns installed to collect rainwater for landscape irrigation. TPASC has netted other awards as well. PCL Construction was awarded the 2015 Ontario General Contractors Association award for Best Project Built in Ontario and earlier this year, PCL accepted the Best of the Best Large Project Achievement Award from the Toronto Construction Association (University of Toronto, 2015)

Instructional Center (IC): This building is equipped with state-of-the-art digital technology; a high-tech trading floor with double-monitor workstations and an LCD stock ticker; and a microprocessor lab. Also has been awarded with the LEED Silver–certified, the building features green roofs and solar panels on the rooftop. The IC is supported by a $35 million investment by the Government of Canada. The sustainable features include 23,700 square feet (2,200 square metres) of rooftop solar panels as well as a green roof covering the auditorium. Exterior sun shades minimize glare and solar heat gain, high thermal performance double-glazed

insulated fritted glass, a unitized curtain wall system and operable awning windows (University of Toronto).

Highland Creek (HL): This building is the newest addition to the campus, compromised with active design and innovative design. Some of the features include the storm water filtration system, aerodynamic window installations, water efficient systems, bioretention, and the inclusion of the ravine.

- Storm water filtration system: "The retrofit was designed to capture stormwater and convey it to the bioretention areas and dry pond. These practices have been implemented to improve the quality and reduce the quantity of runoff discharged into Highland Creek" (University of Toronto, 2018). This design allows the excess water to be put to great use, reducing the overall consumption.

- Dry pond: A dry pond was constructed in the centre of the bus loop to receive all flows from the curb inlets around the bus loop, as well as overflows from two of the bioretention areas. It provides stormwater runoff attenuation and infiltration and improves water quality by providing an opportunity for sediment deposition, filtration and pollutant uptake by plants.

- Bioretention: Along the perimeter of the parking lots on the east and south sides, two bioretention areas discharge overflows to the sewer system which in turn discharges to Highland Creek. The remaining two bio retention areas located within traffic islands in the visitor parking lot and curb inlets around the bus loop convey excess flows into a dry pond.

- Maintenance and Upkeep: Moreover, the maintenance and upkeep of these areas on campus do not require major maintenance. Since the function is effective and well, the maintenance can focus on other activities such as wedding, removal trash and debris. (UofT case study, 2016)

Initiatives on Campus

Farmer's Market (HW): Established in 2010, UTSC begins hosting weekly Farmer's Markets from June through October to promote sustainability and buying local. Vendors from the Greater Toronto Area sell fresh fruits, vegetables, baked goods, cheese, honey and much more. Through sustainable-food production practices, all vendors produce locally grown farm products within Ontario and the GTA.

Pollinator Habitats (Social Sciences): This pollinator habitat consists of four beehives. Brian Hamlin, is the beekeeper partnered with the sustainability office to host bee and pollination workshops, as well as apiary tours. This part of the "Regenesis" project, which is in partnership with York university, and other UofT campuses

Rooftop Greenhouse (SRB): The Science Research Building was commissioned in 2009 and houses six plant biology faculty and their laboratories in an open concept building design. The building features a microscopy suite, tissue culture facility, a darkroom, radioisotopes labs, a plant growth facility, coldrooms, an NMR facility and conference and seminar rooms. The open-concept design facilitates interactions amongst students and faculty, fostering collaborative relationships and technology transfer.

Community Garden (IC): This community garden consists of over 40 community allotment gardens, with ability to be rented out. It was built in the summer of 2016, spearheaded by the DPES (Department of Physical and Environmental Sciences), as well as the sustainability office. This initiative reflects the UN sustainable development goal #2 (zero hunger), #3 (good health and well-being), #11 (sustainable cities and communities), and #15 (life on land). The food harvested (tomatoes, corn, squash, cucumbers, nasturtium, herbs (sage, rosemary, mint), kale, and peppers) are utilized in the farmers market for free samples, for the food discussions cafe, and for the health campus event

Conclusion

When looking at what drives the success of sustainability endeavors, looking at the causes of failure of environmental policy seems applicable. The majority of policy failure is caused by structural causes (economic, social, environmental, etc), implementation, and knowledge scope. Applying these policy failure causes into our model aided us in analysing why the initiatives at UTSC are effective. We attempted to analyse the data we collected, and the initiatives and infrastructure goals, to see the likelihood of success. The most applicable cause of failure for us, given the data we collected, was that of implementation, and knowledge scope. As an example: the pollinator habitat is led by a specialized beekeeper, who has a wide scope of background knowledge surrounding bee pollination, and bee habitats. This initiative is properly run because of this knowledge, being able to integrate both bee livelihoods and wellbeing, as well as student involvement. This transmissibility of knowledge from beekeeper to student, and the impact the knowledge has on the bees' livelihoods, was only possible because the beekeeper has knowledge pertaining to the importance of beekeeping on the sustainability of UTSCs environment. Without this scope, this initiative has a high failure rate. The greenhouse and the community garden are very similar, with biologists, geneticists, and botanists all working together in making these initiatives as successful as possible. The competence of those in charge

of implementation was reflected in many of the initiatives, again such as the greenhouse, community garden, and pollinator habitat, but also the infrastructure. The geothermal boreholes in the Environmental & Chemistry building, and the solar panels atop the pan am center, and instructional center, could not have been done without proper guidance from professionals who knew what they were doing.

Recommendations

The primary recommendation for the University of Toronto Scarborough Campus, is to grow within. Even though the sustainability office has existed since 2007, there are still more efficient operations that could take place. The first step is towards relocating funding and providing resources for the sustainability office. In order to continue improving emissions and green technology, a platform with these resources will be beneficial. As witnessed, many numerical data and figures that would've assisted our comparison is nonexistent. Even though the numbers are available, it is not readable by an average student. By providing the sustainability office with funds and support, one can focus on these reports and putting together the data. It's also important to note, the person should understand the campus, student, and commuter lifestyles. This data will be useful for not only students, but enhance our understanding of the campuses across.

A small, but useful idea is to promote and bring awareness about these initiatives across campus. One popular method is to use social media and Facebook posts to engage content with students and staff. As well, the Television screens places all over Highland Creek and Bladen Wing can encourage students to partake too.

On a larger scale, the improvements and changes the University is taking includes a 30% reduction of greenhouse gases by 2030, these rates would match the levels from 1990 (CDM-StGeorge, 2019). This report explicitly made for the St. George campus states the projects and describes the targets and measures needed to achieve success. A report similar to this would be beneficial in analyzing and contributing to change at the Scarborough Campus as well. For example the Greenhouse Gas Campus Retrofits Program (GGRP), has 15 ongoing projects with $34 million investment to reduce GHGs. Overall, these investments are an initial cost but once implemented can be a long term practice. These projections should be echoed at the Scarborough campus.

Furthermore, innovative projects such as the Waste Heat Recovery converys waste heat to hot water. These plans are being implemented to current steam-heated buildings, which are also seen at UTSC. This is the next step the campus can take to improve GHG.

These operations and overall changes can be achieved. The future of green living is a lot closer than we think. It is now in our hands to locate funds and plan for the upcoming ventures.

References

Bradburn, J. (2016). Introducing UTSC's Environmental Science & Chemistry Building. *Torontoist.* Retrieved from https://torontoist.com/2016/01/introducing-utscs-environmental-science-chemistry-building/

CDM St-George Plan. (2019). Energy Conservation and Demand Management Plan. *University of Toronto.* Retrieved from http://www.fs.utoronto.ca/wp-content/uploads/2019/06/2019-06-28_St.-George-CDM-Plan_V.1_O.Reg_.-507-18.pdf

Low-Carbon Action Plan. (2019). Retrieved from http://www.fs.utoronto.ca/sustainability-office/publications/low-carbon-action-plan

Sala, S., Ciuffo, B. & Nijkamp, P. (2015). A systemic framework for sustainability assessment. *Ecological Economics.* pp. 314-325. Doi: 10.1016/j.ecolecon.2015.09.015.

Saporta, R. (2019). Energy Conservation and Demand Management Plan. St. George Campus. Retrieved from http://www.fs.utoronto.ca/wp-content/uploads/2019/06/2019-06-28_St.-George-CDM-Plan_V.1_O.Reg_.-507-18.pdf

University of Toronto Scarborough New Buildings and Centres. (n.d.). Retrieved from https://www.utsc.utoronto.ca/aboutus/toronto-pan-am-sports-centre

University of Toronto Scarborough Sustainability. (n.d.). Retrieved from https://www.utsc.utoronto.ca/sustainability/initiatives

Urban Toronto. (2015). U of T: UTSC Environmental Science and Chemistry. Retrieved from https://urbantoronto.ca/database/projects/u-t-utsc-environmental-science-and-chemistry

UTSC Facilities Management Staff. (2014). 2014 Energy Conservation & Demand Management Plan. pp. 1-6. Retrieved from https://www.utsc.utoronto.ca/~facmgmt/pdf/2014%20UTSC%20CDM%20Plan.pdf