UNIVERSITY OF TORONTO

OFFICE OF THE GOVERNING COUNCIL

FOR RECOMMENDATION **PUBLIC** **OPEN SESSION**

TO: Planning & Budget Committee

SPONSOR: Professor Scott Mabury, Vice-President, Operations and Real Estate Partnerships

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PRESENTER: Christine Burke, Assistant Vice-President, University Planning

CONTACT INFO: 416-978-5515, christine.e.burke@utoronto.ca

DATE: February 11, 2021 for February 22, 2021

AGENDA ITEM: 5

ITEM IDENTIFICATION:

Capital Project: *Report of the Project Planning Committee for the Wallberg Building 'Sustainability Lab'*

JURISDICTIONAL INFORMATION:

Pursuant to section 4.2.3. of the Committee's terms of Reference, "…the Committee considers reports of project planning committees and recommends to the Academic Board approval in principle of projects (i.e. space plan, site, overall cost and sources of funds)."

Under the Policy on Capital Planning and Capital Projects, "…Capital projects over $5 million and up to $20 million will be considered by the Planning and Budget Committee for projects at the St. George campus and by the respective Campus Affairs Committees and Campus Councils for projects at University of Toronto Mississauga and University of Toronto Scarborough and recommended to the Academic Board for consideration. It is expected that such projects will be placed on the Board's consent agenda and be confirmed by the Executive Committee of the Governing Council. Execution of such projects is approved by the Business Board."

GOVERNANCE PATH:

A. Project Planning Report
1. **Planning and Budget [for recommendation] (February 22, 2021)**
2. Academic Board [for approval] (March 11, 2021)
3. Executive Committee [for confirmation] (March 25, 2021)

B. Execution of the Project:
1. Business Board [for approval] (March 17, 2021)

PREVIOUS ACTION TAKEN:

On January 17, 2017, the Capital Project and Space Allocation Executive Committee (CaPS Executive) approved the Terms of Reference proposing a Project Planning Committee to proceed with the planning for the Wallberg Building 'Sustainability Lab'.

At its meeting of April 6, 2018, the CaPS Executive Committee approved funds to be made available to engage consultants to the end of Construction Drawings for Wallberg Building 'Sustainability Lab'. Baird Sampson Neuert Architects Inc. were the selected proponents in October 2018.

HIGHLIGHTS:

The University of Toronto's (U of T), Faculty of Applied Science and Engineering (FASE), Department of Chemical Engineering and Applied Chemistry (ChemE), propose to support sustainable research by building the 'Sustainability Lab', a lab inclusive to many sustainable research platforms at the Wallberg Building—The Wallberg Building, 184-200 College Street, is flanked by St George Street and King's College Road and is one of the gateways into the St George campus. The Sustainability Lab will be a one-storey addition on Wallberg's 4th floor (3rd floor roof), and will contain an open wet lab, an open graduate student research office with collaboration space and an exterior rooftop lab, to facilitate the testing and integration of technologies in real climate conditions. The Sustainability Lab will train U of T graduate students to be the next generation of researchers, policy makers and practicing engineers to develop innovative solutions with high commercialization potential, and create academic research cross-collaborations with government and industry. Housing under one roof various sustainable platforms, researchers and partners will help position the University of Toronto as a leader in innovative sustainable solutions and technologies.

The Sustainability Lab will be dynamic and multi-disciplinary, with research that focuses on a broad array of energy challenges, touching on: energy capture, storage, conversion and integration. At FASE, over 50 faculty members look at devices and technologies including: photovoltaics, fuel cells, batteries, wind energy, hydro energy, biofuels, demand management, grid optimization, and other topics. The Sustainability Lab will provide opportunities for the Faculty of Applied Science and Engineering to enrich the graduate student experience through collaboration and innovation of climate change technologies, while aspiring to become both a campus "Test Bed" and research immersive "Living Lab".

The Department of Chemical Engineering and Applied Chemistry's (ChemE) academic vison statement highlights the strong link between "big" global issues in sustainability and the chemical engineering discipline. ChemE believes that the world is on an unsustainable track and the efficient use of energy resources is becoming an increasingly important global issue. This department is one of the most research-intensive chemical engineering departments in North America, with an outstanding international reputation for innovative research addressing sustainability energy, materials, and other topics. "Sustainable Energy" is one of eight Research Clusters which consolidates the diverse energy related expertise with over twenty-one Principal Investigators (PIs)(twenty PIs from ChemE and one PI from the Department of Mechanical and Industrial Engineering (MIE)) covering evolving areas such as biofuels, photovoltaics, fuel cells, energy recovery, and the environmental impact of energy production.

The proposed Sustainability Lab will support sustainable research that will help address the Department of Chemical Engineering's Strategic Plan as articulated in the Department's 2015/16 Self-Study, External Review and Response— the five strategic initiatives from the Plan are below:

1. Initiate large, multi-researcher/multi-disciplinary collaborative programs;
2. Create a modern, chemical engineering curriculum;
3. Elevate teaching excellence, effectiveness and impact;
4. Catalyze the synergy of external networks without internal capability for societal and economic impact; and
5. Reorganize and streamline administration and support systems, to drive overall space and organizational effectiveness.

The Sustainable Research cluster of PIs aforementioned above will help bolster these initiatives through wet lab space dedicated to sustainability research across FASE and beyond. The Sustainable Lab will support multiple research teams doing multi-disciplinary research; graduate and undergraduate students opportunities to interact and innovate across disciplines; development of sustainable technologies that can be tested prior to commercialization; and, to provide space that will enhance collaboration with industry and government partners. FASE also offers through the Institute of Sustainable Energy (ISE) an Emphasis in Sustainable Energy Systems, to complement degree pathways for MEng, MASc and PhD degrees, as well as an undergraduate engineering minor in Sustainable Energy. Through intra- and inter-departmental research collaborations and institutes, the Sustainability Lab will be able to enrich cross-fertilization of various climate change platforms to expand research tools for graduates.

Overarching Design Objectives:

1. Effective, flexible research environment. Facilitate and promote multi-disciplinary collaboration;
2. LEED Gold certification targeted. A high performance, low energy building exemplar for sustainable labs;
3. Standalone systems. Performance metering. "*Living Lab*";
4. Containment Level 2 ready;
5. Campus gateway; and
6. Net Zero 'ready' (potential future geothermal project).

The Sustainability Lab will employ the following sustainable design strategies: energy efficient lighting, low-flow fume filtered fume hoods, high efficiency thermal envelope, comprehensive and integrated building automation system, high efficiency energy recovery ventilation system, flexible planning with modular furniture, and an extensive roof top energy generation with solar PV arrays. The Wallberg building is oriented with its long direction running on an east-west axis gaining enormous solar exposure. The orientation and exposure to the South would strategically allow for some of the sustainable design strategies listed above, notably energy efficient lighting (maximizing passive daylight) and rooftop energy generation into the grid (net metering). This proposed climate change incubator is an opportunity to not only support sustainable research but also become a potential infrastructural vehicle to implement, test, measure and inform facility and equipment efficiency (inputs/outputs) in real time, providing feedback information to other related operating projects or developments across the St George campus.

The Sustainability Lab space program will provide an additional 437 net assignable square metres (nasm), 667 gsm, and provide the following spaces:

- 1 Open Research Office for graduate students;
- 1 Open Research Lab, Wet; and

- 1 Exterior Research Roof top Lab.

City of Toronto's Committee of Adjustment approved minor variances on June 2020, and the anticipated construction start date is April 2021 with occupancy targeted in July 2022.

Schedule

Proposed Project Milestones:

100% Construction Documents	January 2021
Building Permit Application	January 2021
CaPS Executive Meeting (Cycle 4)	January 2021
Executive Committee (Cycle 4 Full approval)	March 2021
Tender and Award	March – May 2021
Mobilization Start	May 2021
Substantial Performance	Aug 2022
Occupancy	Aug 2022

FINANCIAL IMPLICATIONS

Discussion of overall costs and sources of funds can be found in the *in camera* document for this project.

RECOMMENDATIONS:

Be It Recommended:

THAT the *Report of the Project Planning Committee for the University of Toronto Wallberg Building 'Sustainability Lab',* dated January 14, 2021, be approved in principle; and,

THAT the project totaling 437 net assignable square metres (nasm) (667 gross square metres (gsm)), be approved in principle, to be funded by Faculty of Applied Science and Engineering Divisional Reserves and Chemical Engineering and Applied Chemistry Departmental Reserves.

DOCUMENTATION PROVIDED:

- SEE Item 5 re *Report of the Project Planning Committee for the Wallberg Building 'Sustainability Lab',* dated January 14, 2021

Report of the Project Planning Committee for
University of Toronto
Wallberg Building 'Sustainability Lab'

January 14, 2021

Office of University Planning, University Planning, Design and Construction
Department of Chemical Engineering and Applied Chemistry, Faculty of Applied Science & Engineering

I. Executive Summary

The University of Toronto's (U of T), Faculty of Applied Science and Engineering (FASE), Department of Chemical Engineering and Applied Chemistry (ChemE), propose to support sustainable research by building the 'Sustainability Lab', a lab inclusive to many sustainable research platforms at the Wallberg Building—The Wallberg Building, 184-200 College Street, is flanked by St George Street and King's College Road and is one of the gateways into the St George campus. The Sustainability Lab will be a one-storey addition on Wallberg's 4th floor (3rd floor roof), and will contain an open wet lab, an open graduate student research office with collaboration space and an exterior rooftop lab, to facilitate the testing and integration of technologies in real climate conditions. The Sustainability Lab will train U of T graduate students to be the next generation of researchers, policy makers and practicing engineers to develop innovative solutions with high commercialization potential, and create academic research cross-collaborations with government and industry. Housing under one roof various sustainable platforms, researchers and partners will help position the University of Toronto as a leader in innovative sustainable solutions and technologies.

The Sustainability Lab will be dynamic and multi-disciplinary, with research that focuses on a broad array of energy challenges, touching on: energy capture, storage, conversion and integration. At FASE, over 50 faculty members look at devices and technologies including: photovoltaics, fuel cells, batteries, wind energy, hydro energy, biofuels, demand management, grid optimization, and other topics. The Sustainability Lab will provide opportunities for the Faculty of Applied Science and Engineering to enrich the graduate student experience through collaboration and innovation of climate change technologies, while aspiring to become both a campus "Test Bed" and research immersive "Living Lab".

The Department of Chemical Engineering and Applied Chemistry's (ChemE) academic vison statement highlights the strong link between "big" global issues in sustainability and the chemical engineering discipline. ChemE believes that the world is on an unsustainable track and the efficient use of energy resources is becoming an increasingly important global issue. This department is one of the most research-intensive chemical engineering departments in North America, with an outstanding international reputation for innovative research addressing sustainability energy, materials, and other topics. "Sustainable Energy" is one of eight Research Clusters which consolidates the diverse energy related expertise with over twenty-one Principal Investigators (PIs)(twenty PIs from ChemE and one PI from the Department of Mechanical and Industrial Engineering (MIE)) covering evolving areas such as biofuels, photovoltaics, fuel cells, energy recovery, and the environmental impact of energy production.

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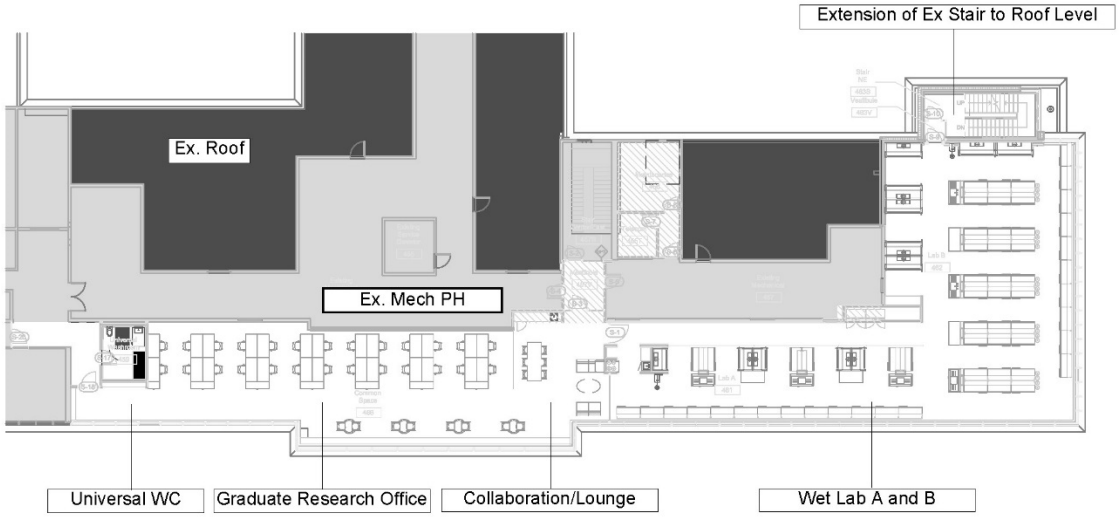
Proposed Sustainability Lab, Southeast corner of Wallberg Building at College St and King's College Road



Proposed 4th floor part plan, east wing of Wallberg Building

Proposed Open Research Office and Collaboration space for Graduate Students

Proposed Open Research Lab, Wet

II. Project Background

Existing Space

The Department of Chemical Engineering & Applied Chemistry (ChemE) is primarily housed at the Wallberg Building, followed by the Haultain Building and the Bahen Centre for Information Technology (Table 2.0). As per the fall 2016 University space inventory, almost half of the Department of ChemE space types are dedicated Research Labs followed by Class Labs (Table 2.1). Note: the existing space inventory, FTE count and COU Analysis is from the 2017-2018 academic year. Space update: ChemE no longer has space at the Terrance Donnelly Centre for Cellular & Bimolecular Research and the some ACE Classrooms space within Wallberg has been removed and converted into other types of spaces due to Myhal CEIE project.

Table 2.0 - ChemE, NASM by Building

Building Name	Area NASMS	%
Bahen Centre for Information Technology	67.32	1%
Haultain Building	197.98	2%
Wallberg Building	8,264.39	92%
Terrance Donnelly Centre for Cellular & Bimolecular Research	432.31	5%
Total Area NASMS	8,835.17	100%

Table 2.1 - ChemE, NASM by COU Category

COU Space Subcategory	COU Subcategory Description	Area NASMS	%
1.0	Classrooms	51.78	1%
2.1	Class Labs	1,117.94	13%
2.2	Unscheduled Class Lab	0.00	0%
2.3	Lab Support	164.63	2%
3.1	Research Labs	4,451.20	50%
3.2	Research Lab Support	360.13	4%
4.1	Faculty Offices	731.60	8%
4.2	Research Appointments	182.43	2%
4.3	Grad Student Offices	786.69	9%
4.4	Administrative Offices	279.75	3%
4.5	Office Support Space	484.95	5%
11.1	Non-Library Study Space	36.98	0%
14.1	Student Office and Support Space	8.86	0%
14.3	Recreational Facilities and Service	178.23	2%
Total		**8,835.17**	**100%**

Within Wallberg Building are the following groups: Faculty of Applied Science and Engineering (FASE) Departments [Dean's Office, Department of ChemE, Department of Materials Science & Engineering (MSE) and Electrical & Computer Engineering (ECE)] and Central Academic & Campus Events (ACE) Classrooms (Table 2.2).

Table 2.2 - NASM, by Department/Occupant at Wallberg

Department/Occupant	Area NASM	% of Total NASM
UPD&C-ACE Classroom Inventory	**820.16**	8%
Faculty of Applied Science & Engineering:		
Chemical Engineering & Applied Chemistry, Dept of	8,137.56	76%
Deans Office Applied Science & Engineering	375.31	3%
Electrical & Computer Engineering, Rogers Dept of	129.84	1%
Materials Science & Engineering, Dept of	1,327.07	12%
Faculty of Applied Science & Engineering Total	**9,969.78**	
Total NASM	**10,789.94**	**100%**
Non Assignable Space	4,805.82	
Gross Area	18,043.20	
Gross-to-NASM Ratio	1.7	

Occupant Profile

The breakdown of Full Time Equivalent (FTE) for the Department of ChemE is shown at two academic year intervals: Fall 2016-2017 and 2021-2022 (Table 2.3). FTE for faculty, staff and students are used as input measures in the Council of Ontario Universities (COU) space formula to generate a benchmark requirement for facilities as described in the next section, Space Requirements.

Table 2.3 ChemE Full Time Equivalent FTE input measures

Staff Category	Existing FTE 2016-2017	Projected FTE 2021-2022
Academic		
FTE Faculty-Tenured Stream	26.49	31.49
FTE Faculty-Teaching Stream	3.00	3.00
FTE Faculty-Non-Tenured Stream	4.00	1.00
Total Academic	**33.49**	**35.49**
Research		
FTE PDF's	47.00	56.00
FTE Research Associates	19.00	23.00
FTE Non-academic staff (research)	38.00	45.00
Total Research	**104.00**	**124.00**
Undergraduates		
Undergraduate Students	**545.00**	**546.32**
Graduates		
FTE Grad/PhD Students	**251.00**	**300.00**
Departmental Administrative & Support Staff		
FTE Non-academic	**18.00**	**21.00**
Total FTE	**951.49**	**1,026.81**

The Sustainability Lab will be research lab space for Graduate Students. The following ChemE graduate degrees are offered: Master of Engineering (MEng), Research Degrees (MASc and PhD). The Department and Faculty have seen increases in the MEng program of study and there is generally a shift towards more PhD students vs MASc. There is growing interest from students in 'making a difference' in the world. Within that climate change and hence sustainable energy is of major interest given the key role of chemical and biochemical systems. Within the sustainability area, areas of particular interest include solar-based technologies, biofuels, waste to energy and developing biological and chemical manufacturing processes using renewable materials. There is also interest from students in improving our environment, beyond sustainable energy, including air pollutants, wastewater and soil remediation and linking the environment and health.

III. Project Description

a) Vision Statement

The University of Toronto's (U of T), Faculty of Applied Science and Engineering (FASE), Department of Chemical Engineering and Applied Chemistry (ChemE), propose to support sustainable research by building the 'Sustainability Lab', a lab inclusive to many sustainable research platforms at the Wallberg Building—The Wallberg Building, 184-200 College Street, is flanked by St George Street and King's College Road and is one of the gateways into the St George campus. The Sustainability Lab will be a one-storey addition on Wallberg's 4th floor (3rd floor roof), and will contain an open wet lab, an open graduate student research office with collaboration space and an exterior rooftop lab, to facilitate the testing and integration of technologies in real climate conditions. The Sustainability Lab will train U of T graduate students to be the next generation of researchers, policy makers and practicing engineers to develop innovative solutions with high commercialization potential, and create academic research cross-collaborations with government and industry. Housing under one roof various sustainable platforms, researchers and partners will help position the University of Toronto as a leader in innovative sustainable solutions and technologies.

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Enriching the Graduate Student Experience

The addition of graduate student research space is critical for FASE and ChemE, as research space has been underaccommodated for some time. In 2009, FASE commissioned a report to review existing space and needs. The outcome of the report points to a shortfall of space across various space categories. The space shortfall was calculated at 5,000 NASM, but realistically 11,500 NASM, "based on the needs of a leading edge research intensive University and calibrated with respect to space requirements expected by the Faculty and 2008/2009 enrollments."[1] Since that time, additional projects have been added to the Faculty's inventory through addition/renovation. As such, the approximate shortfall is estimated to be approximately 2,211 NASM (Table 3.0). The 2009 FASE report, "Divisional Space Review and Development of a Masterplan", lists two recommendations: 1. That any academic expansion should include graduate research laboratory facilities and; 2. There is a need to, "consolidate more shared research support facilities which can service and support research across all engineering units…boost collaboration and provide the users with expansive research tools that simply cannot be accommodated and afforded in individual laboratories."[2] The report responded

[1] Divisional Space Review and Development of a Master Plan, by the Faculty of Applied Science and Engineering, August 2009
[2] Ibid

to the need to align space with rising enrollment, as in 2008-2009, enrollment increased 25%. Comparatively in academic year 2016-2017, enrollment increased by 954 students since 2008 (Chart 3.0) – a 67% increase in enrollment.

Recommendations 1 & 2 aforementioned above are addressed through the Sustainability Lab. The Sustainability Lab addition will add approximately 437 NASM of dedicated graduate research space to bolster multidisciplinary activities and provide a training ground for the next generation of researchers in sustainability. Though the labs will be managed by ChemE, the vision is that the facility is a collaboratory to encourage cross-collaboration across all FASE departments as well as foster external relations with Industry and Government. The proposed Sustainability Lab will promote multidisciplinary research under one roof to allow sustainable initiatives across FASE to grow and galvanize (refer to Timeline 3.0). The proposed facility will provide a research-intensive environment and incubator, which has the potential to generate various graduate student experiential learning outcomes, such as:

- Hands-on Training through direct connection through PIs and Industry;
- Exposure to energy policy, initiatives and energy economics expertise through external relations with Industry and Government research partnerships;
- Experience in entrepreneurship, innovation and commercialization through ideation and testing (ChemE has to date filed 46 invention disclosures and 7 licenses);
- Delivery of new device efficiencies to make clean-tech prototype technologies robust and low cost; and
- Advancement of research through researcher and student exposures to a broader range of technologies, multiplying opportunities for multidisciplinary research.

An Energy Efficient Campus "Test Bed" and Research Immersive "Living Lab"

The proposed Sustainability Lab at the Wallberg Building provides for multiple opportunities for the Faculty of Applied Science and Engineering and the University of Toronto. Wallberg's location is in close proximity to other engineering buildings and sits on the southern edge of the St. George campus on College Street, two blocks away from the Ontario Legislature building and the Discovery District—Toronto's hotspot for entrepreneurship and innovation. Despite its advantageous location, Wallberg is inefficient due to its vintage (constructed in 1949), and faces a couple of challenges. The first challenge is inflexible/non- adaptable space. The second challenge is Wallberg is almost 52% lab dedicated space (ChemE only) which relies heavily on infrastructure (Table 2.3). Additionally, Wallberg's energy use and carbon emissions are one of the highest on campus. In 2019, Wallberg completed a significant HVAC infrastructure upgrade, where existing fume hoods remained in-place, but all HVAC infrastructure, including rooftop units and ductwork, were upgraded[3]. This HVAC project was funded by the Post-Secondary Institutions Strategic Investment Fund (SIF), and is helping to make Wallberg more energy efficient and environmentally friendly. In 2016-2017 Wallberg's electrical use was 295 kWh/gsm with equivalent GHG at approximately 80 tonnes/gsm for thermal and electrical energy[4]—putting Wallberg under the top ten buildings on St George Campus. Other energy efficient upgrades include a building wide window replacement (also SIF

[3] Eventually the existing fume hoods will be replaced in order to take advantage of the new venting infrastructure to both reduce energy and allow for more hood space.
[4] Thermal is very weather dependent as a warmer year could result in approximately 1,442 tonnes/ghg

funded) in summer of 2017, supplanting original single pane glass windows with low-e argon gas double glazed window units. It is anticipated that these investments will help to reduce energy intensity and carbon emissions for the Wallberg Building.

Building upon the success of these infrastructure projects, the Sustainability Lab will employ the following sustainable design strategies: energy efficient lighting, low-flow fume filtered fume hoods, high efficiency thermal envelope, comprehensive and integrated building automation system, high efficiency energy recovery ventilation system, flexible planning with modular furniture, and an extensive roof top energy generation with solar PV arrays. The Wallberg building is oriented with its long direction running on an east-west axis gaining enormous solar exposure. The orientation and exposure to the South would strategically allow for some of the sustainable design strategies listed above, notably energy efficient lighting (maximizing passive daylight) and rooftop energy generation into the grid (net metering). This proposed climate change incubator is an opportunity to not only support sustainable research but also become a potential infrastructural vehicle to implement, test, measure and inform facility and equipment efficiency (inputs/outputs) in real time, providing feedback information to other related operating projects or developments across the St George campus.

The Sustainability Lab will become part of a greater campus initiative to help meet larger campus goals related with climate change by partnering with the University's Facilities & Services and Environmental Health Services to target the integration of energy efficient systems, on-site energy generation, and efficient building envelope to contribute to a cleaner and healthier campus. Currently, one of the University of Toronto's eight new sustainability initiatives was the creation of the Committee on the Environment, Climate Change and Sustainability (CECCS). The mandate of the CECCS is to identify ways to advance the University's contributions to meet the challenges of climate change and sustainability with a particular focus on research and innovation, teaching and University operations. One of the activities the Committee will pursue is opportunities to use the U of T campus as a 'Test Bed' for environmental and sustainability research and best practices[5]. The proposed Sustainability Lab has great potential to be a "Test Bed", working with the campus Sustainability framework while also striving to be a "Living Lab". A "Living Lab" provides real-life context to research and innovation processes within a public-private-people-partnership, involving academics, students, professional staff and external stakeholders[6] (i.e. industry and government). Coupled with a proposed exterior roof top laboratory, the Sustainability Lab provides space for multidisciplinary collaboration between research and industry and government in real time weather conditions.

[5] "Annual Report 2017: Sustainability Yearbook", by the University of Toronto's Committee on the Environment, Climate Change, and Sustainability, 2017

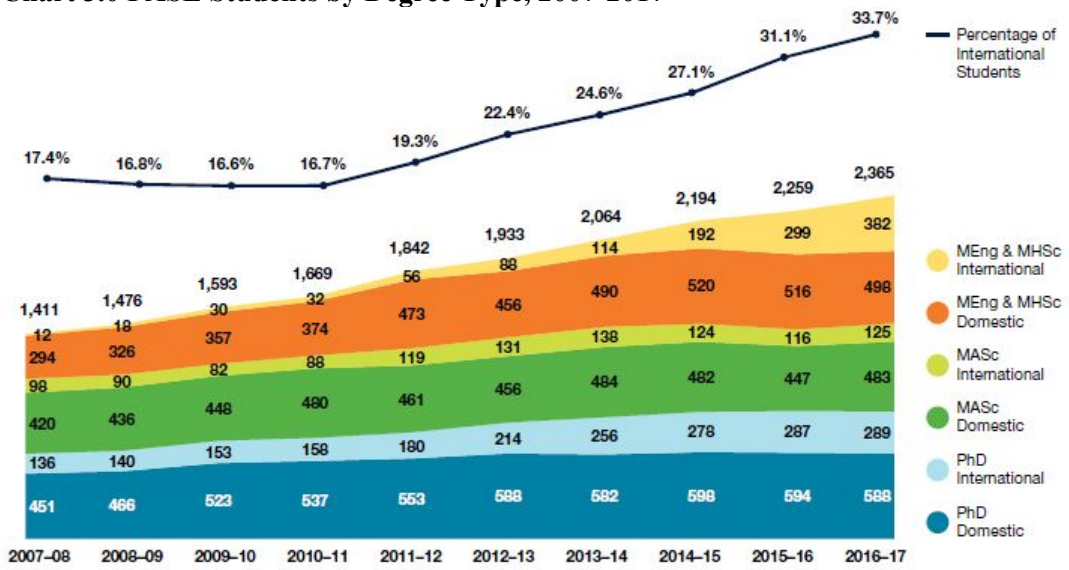
[6] "A Revolution for Post-16 Education - Part 1: A Case for the Living Lab" by M Hassan Waheed, Environmental Association for Universities and Colleges (EAUC), 2017

Table 3.0 Faculty of Applied Science & Engineering – Estimated Shortfall of Space in NASM

2009 Shortfall from Divisional Space Report	**-11,500 NASMS**
FASE Projects since 2009:	**Additional Assignable**
The Microsatellite Science and Technology Centre MSTC, UTIAS, Downsview Campus	+1,115 NASMS
BioZone Addition at Wallberg Building, St George Campus	+279 NASMS
Civil Engineering Interdisciplinary Design Studios at Lassonde Mining Building, St George Campus	+632 NASMS
Centre for Innovation and Entrepreneurship CEIE, St George Campus*	+7,513 NASMS
Total FASE Projects since 2009	**+9,289 NASMS**
2017 Adjusted Shortfall	**-2,211 NASMS**

*CEIE projected completion Spring 2018. The figure noted above does not include the adjustment of instructional space between FASE and ACE.

Chart 3.0 FASE Students by Degree Type, 2007-2017



Timeline 3.0 FASE Sustainable Initiatives since 2011

2011 –BioZone, a centre of applied bioscience and bioengineering at Wallberg;
2012 – Centre for Research in Sustainable Aviation (CRSA) at the Institute for Aerospace Studies;
2013 – Institute for Sustainable Energy (ISE), a multidisciplinary centre designed to bring together researchers, students, and teachers from across the university, together with partners from industry and government, with the goal of increasing energy efficiency and reducing the environmental impact of energy use and conversion[7];
2022 – Future Sustainability Lab at Wallberg

[7] The Institute of Sustainable Energy (ISE) has no physical laboratory research space. However, administration space for ISE is accommodated at the Myhal Centre for Engineering Innovation and Entrepreneurship building.

b) Statement of Academic Plan

"*Through leading edge research and education, we integrate chemistry, biology and engineering to drive solutions to global challenges in energy, the environment and health*"

The Department of Chemical Engineering and Applied Chemistry's (ChemE) academic vison statement highlights the strong link between "big" global issues in sustainability and the chemical engineering discipline. ChemE believes that the world is on an unsustainable track and the efficient use of energy resources is becoming an increasingly important global issue. This department is one of the most research-intensive chemical engineering departments in North America, with an outstanding international reputation for innovative research addressing sustainability energy, materials, and other topics. "Sustainable Energy" is one of eight Research Clusters which consolidates the diverse energy related expertise with over twenty-one Principal Investigators (PIs)(twenty PIs from ChemE and one PI from the Department of Mechanical and Industrial Engineering (MIE)) covering evolving areas such as biofuels, photovoltaics, fuel cells, energy recovery, and the environmental impact of energy production.

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4. Catalyze the synergy of external networks without internal capability for societal and economic impact; and
5. Reorganize and streamline administration and support systems, to drive overall space and organizational effectiveness.

The Sustainable Research cluster of PIs aforementioned above will help bolster these initiatives through wet lab space dedicated to sustainability research across FASE and beyond. The Sustainable Lab will support multiple research teams doing multi-disciplinary research; graduate and undergraduate students opportunities to interact and innovate across disciplines; development of sustainable technologies that can be tested prior to commercialization; and, to provide space that will enhance collaboration with industry and government partners. FASE also offers through the Institute of Sustainable Energy (ISE) an Emphasis in Sustainable Energy Systems, to complement degree pathways for MEng, MASc and PhD degrees, as well as an undergraduate engineering minor in Sustainable Energy. Through intra- and inter-departmental research collaborations and institutes, the Sustainability Lab will be able to enrich cross-fertilization of various climate change platforms to expand research tools for graduates. Some potential examples of graduate student activities and learning outcomes associated with the Sustainability Lab are below.

Graduate Lab Activities (examples):

- Study fabrication and manufacturing methodologies for emerging non-carbon based energy; prototype devices and systems including energy generation, conservation, and storage;
- Integrate and test prototype-scale devices into energy systems;
- Interdisciplinary training – intersection of energy for example, photovoltaics and biofuels;
- Interdisciplinary cross connection across various FASE sustainable research platforms;
- Test prototype-scale devices in the ambient environment prefaced by the testing of the devices under controlled environmental conditions;

- Provide a location where budding student entrepreneurs in the “Hatchery” can test their technologies; and
- Study the relationship between lab infrastructure (fume hoods and ventilation), energy use, carbon footprint and air quality.

Graduate Learning Outcomes (examples):

- Hands-on training, will provide graduates with skills and experience;
- Fabrication and testing devices provides a flexible toolkit for future energy professionals to approach device challenges with a broad perspective;
- Opportunity to work and interact with industry partners;
- Develop innovative solutions with high commercialization potential and help create cross-collaborations with government and industry; and
- Advance carbon-free energy devices that have a considerable impact on Canada’s carbon reduction efforts, as well as health and energy security concerns.

The contribution of these anticipated research activities and outcomes places the University of Toronto, Faculty of Applied Science and Engineering, and Department of Chemical Engineering and Applied Chemistry at the forefront of emerging multidisciplinary studies in sustainable energy research.

c) Space Requirements, Program and Functional Plan

Space Requirements

The space requirements for ChemE were generated based on examination of existing and projected space and FTE. To understand long-term space needs, Table 3.1 also shows anticipated FTE growth in 2020-2021 with area remaining as-is and then with proposed Sustainability Lab NASM. The Sustainability Lab will be graduate student research space, falling under COU Category 3.0 space. Note: space requirements shown in Table 3.1 are generated based on 2013 COU Space Standards – COU input measures are used by all Ontario postsecondary institutions for this purpose.

The comparison between actual inventory “I” and COU generated “G” suggests that the Department of Chemical Engineering and Applied Chemistry is overall slightly underaccommodated at 75% COU in academic year 2016-2017. The underaccommodation increases to 66% COU in 2020-2021 with anticipated FTE growth and no additional space. Similarly, Graduate Research Labs (COU Category 3.0) space shows slight underaccommodation at 84% COU in 2016-2017, decreasing to 71% COU in 2020-2021 with anticipated FTE growth. With the new net footprint of the Sustainability Lab (~430 NASM), accommodation in Graduate Research Lab space improves to 78% COU. ChemE Graduate Research Lab space, as per COU standards, is under accommodated compared to the St. George campus average, which sits at 89% COU as per the 2016-207 COU Submission.

Table 3.1 Space Requirements As Measured by COU Space Standards for ChemE

		2016-2017					2020-2021 Anticipated Growth					2020-2021 Anticpated Growth + Sustainability Lab	
COU Cat		FTE Input Measure	2013 COU Space Factor	COU Generated Space "G" NASM	Actual Inventory "I" NASM	% I / G	FTE Input Measure	2013 COU Space Factor	COU Generated Space "G" NASM	Actual Inventory "I" NASM	% I / G	Proposed Inventory "I" NASM	% I / G
TEACHING/RESEARCH/ACADEMIC SUPPORT													
1.0	CLASSROOMS												
	Total FTE Students	796.00	1.11	**883.56**	**51.78**	**6%**	846.32	1.11	**939.42**	**51.78**	**6%**	**51.78**	**6%**
2.0	CLASS LABS												
	Lab Contact Hours W	1,963.00	0.8	1,570.40	1,282.57		1,963.00	0.8	1,570.40	1,282.57		1,282.57	
	Total Class Lab	1,963.00		**1,570.40**	**1,282.57**	**82%**	1,963.00		**1,570.40**	**1,282.57**	**82%**	**1,282.57**	**82%**
3.0	RESEARCH LABS												
	Research Disciplines B	191.99	30.0	5,759.70	4,811.33		224.99	30.0	6,749.70	4,811.33		5,241.33	
	Total Research	191.99		**5,759.70**	**4,811.33**	**84%**	224.99		**6,749.70**	**4,811.33**	**71%**	**5,241.33**	**78%**
4.0	OFFICE - ACADEMIC												
4.1	Total FTE Faculty	33.49	12.0	401.88	731.60	182%	35.49	12.0	425.88	731.60	172%	731.60	172%
4.2	Research Appointments (PDF, RAssoc.)	66.00	12.0	792.00	182.43	23%	79.00	12.0	948.00	182.43	19%	182.43	19%
4.3	Total FTE Grads (Masters & PhD)	251.00	3.0	753.00	786.69	104%	300.00	3.0	900.00	786.69	87%	786.69	87%
4.4	Total FTE Non-Acd Staff	18.00	12.0	216.00	279.75	130%	21.00	12.0	252.00	279.75	111%	279.75	111%
4.5	Office Service	2,162.88	0.25	540.72	484.95	90%	2,525.88	0.25	631.47	484.95	77%	484.95	77%
	Total Academic Office			**2,703.60**	**2,465.42**	**91%**			**3,157.35**	**2,465.42**	**78%**	**2,465.42**	**78%**
STUDY SPACE													
5.0/11.0	STUDY SPACE												
5.5/11.1	**Study Space**	796.00	0.6	477.60	36.98		846.32	0.6	507.79	36.98		36.98	
	Total Study Space			**477.60**	**36.98**	**8%**			**507.79**	**36.98**	**7%**	**36.98**	**7%**
SUB-TOTAL: TEACHING/RESEARCH/ACADEMIC/STUDY SPACE				**11,394.86**	**8,648.08**	**76%**			**12,924.66**	**8,648.08**	**67%**	**9,078.08**	**70%**
STUDENT ACTIVITY SPACE													
	STUDENT ACTIVITY SPACE												
	Total FTE Students	796.00	0.5	398.00	187.09		846.32	0.5	423.16	187.09		187.09	
SUB-TOTAL: OTHER SPACE				**398.00**	**187.09**	**47%**			**423.16**	**187.09**	**44%**	**187.09**	**44%**
OVERALL TOTAL NASM				**11,792.86**	**8,835.17**	**75%**			**13,347.82**	**8,835.17**	**66%**	**9,265.17**	**69%**
COU Shortfall					-2,957.70					-4,512.65		-4,082.65	

Space Program

The proposed Sustainability Lab is a research cluster comprised of Graduate Student Research Office space, an open Wet Lab and an Exterior Research Rooftop Lab to house sustainable research to create a community focused on sustainability research

Table 3.2 – Detailed Space Program for Sustainability Lab

Sustainability Lab Program Element	Room Count	Total NASM
Open Research Office, 26 Graduates	1	92.78
Open Research Lab, Wet, 26 Graduates	1	273.03
Research Subtotal		**365.81**
Exterior Research Office	1	5.95
Exterior Research Rooftop Lab*		(99.16)
Exterior Research Subtotal		**5.95**
Open Kitchenette		13.49
Open Collaboration/Lounge		52.08
Collaboration subtotal		**65.57**
Total Sustainability Lab NASM	**3**	**437.33**
GSM		667
GSM-to-NASM ratio		1.53

*Exterior Research Rooftop Lab has been excluded from the Total NASM and the Gross Area as it is a non-conditioned space. Only Exterior Research Office is included in the Total NASM and Gross. The number of occupants working in Research Cluster C will fluctuate and be transient. The exterior lab will not have any resident occupants, as the primary function of the lab will be research monitoring and recording of real-time conditions on devices/prototypes, the majority which can happen remotely, with some intermittent in-person monitoring.

Functional Plan

Overarching Design Objectives:

1. Effective, flexible research environment. Facilitate and promote multi-disciplinary collaboration;
2. LEED Gold certification targeted. A high performance, low energy building exemplar for sustainable labs;
3. Standalone systems. Performance metering. "*Living Lab*";
4. Containment Level 2 ready;
5. Campus gateway; and
6. Explore opportunities to realize Net Zero (future pathway).

Description of Space Program Elements

Open Research Office
The Research Office is an open, flexible workplace environment to support the various graduate research activities within a collaborative setting. The research office will include flexible 26 open workstations, collaborative group tables, and a kitchenette.

Open Research Lab
The Research Lab is one open wet lab, complete with modular benching, services fed from above, and below to accommodate dynamic research needs. The Research lab will contain twelve fume hoods. Six of which are low face velocity ducted fume hoods with self-closing design (40fpm design basis). The remaining six are filtered, ducted fume hoods to reduce energy demands to ventilation. The ratio of fume hoods to graduate students is intensive (1 fume hood to 2 graduate students), in order to allow for a broad array of experimentation to occur. The design of the layout has provided designate areas primed for future renovation to accommodate research equipment for specific research projects and funding opportunities, while other areas (sinks, fume hoods) are fixed.

Exterior Research Lab and Office
The Exterior Lab is a flexible platform to support research activities requiring exposure to outdoor conditions. Types of rooftop research activities will include: testing and systems integration of clean energy devices, growing algae, wind and solar power generation, housing of a laboratory weather station, and more. The addition of an exterior lab will provide real-time Canadian environmental data along with controlled lab conditions, providing meaningful assessment of robustness in commercialization.

- The location of the roof top laboratory on the north portion of the east wing will minimize shadow impact to maximize testing of solar cells and other devices/technologies contingent on solar and/or wind exposure.
- Work environment includes:
    - enclosed stairwell access
    - continuous safety guard surrounding lab work area that functions to also allow fastening of various devices to be exposed on the rooftop
    - floating floor surface that is slip resistant and protects actual rooftop membrane
    - service wall that provides: power, water, argon, nitrogen, compressed air and outdoor safety lights

Collaboration Space
These designated areas with group tables will support and encourage collaboration and exchange while simultaneously unifying the labs and offices thematically through the interior design. The kitchenette will help support the graduate research students and any lab staff.

d) Building Considerations & Sustainability

Standards of Construction

Levels of Finish/Quality

- Mid-Range quality for 4th floor addition (Interior and Exterior)
- Standard quality for Research Cluster C (Lab C and Research Office C Interior)

Building Characteristics and Massing

The Sustainability Lab will be a 1-storey addition and fill out the remainder of the roof of the Wallberg Building on the southeastern side. The Sustainability Lab aligns with the previous two rooftop additions in elevation. The two previous rooftop additions are clad in metal panel and characterized by a continuous window strip with a sunshade. The Sustainability Lab addition maintains the elevational datums, but departs in materiality in order to meet some of the sustainable performance goals discussed throughout this report.

Publicly visible, the proposed design of the rooftop addition will:

- Signal visibility of the Sustainability Lab to the street through the finned articulation of the glazed addition and continuous photovoltaic (PV) array canopy overhead;
- Minimize visibility of mechanical equipment from street view through the PV array canopy;
- be coplanar with the previous 1992 and 2012 additions and will tie into the existing fourth floor with use of similar cladding, proportions and materiality and remain within the maximum height permitted;
- meet performance target of 55% below ASHRAE 90.1, 2013 and
- attain LEED Gold V4 certification (Gold anticipated)

Consistent with the project's sustainability mandate and response to its campus location, the proposed design elevates a rooftop PV solar array to convey the importance of sustainability at this important campus and city threshold. The PV solar array canopy will be an infrastructural third façade that signals to the public that U of T is leading the development of multidisciplinary solutions to the complex problem of sustainability.

During Implementation phase, Consultants confirmed that existing structure capacity roof was designed to accept a floor live load (75 psf) and was reviewed against the proposed one-storey addition.

Elevators

The existing freight and service elevators are accessible from the corridor where BioZone is located. The original passenger and service elevator is old and will require an elevator audit to confirm any repairs or upgrade. Elevators currently do not have fob access. Fob access will be installed at the corridors or individual rooms and secured during non-public hours.

Accessibility

Currently Wallberg does not have any accessible entrances. Barrier free accessibility is available via the Pratt Building. The Sustainability Lab addition will be barrier-free including the open Research Lab, which includes provisions for two barrier-free fume hood.

Personal Safety and Security

The Sustainability Lab area will be secure and accessible via fob system. Currently there is public access to the 1st – 4th floors. Access to the 4th floor is semi-restricted and will requires fob access for hours outside of 9am-5pm. Similar to BioZone, the Sustainability Lab will require fob access outside these hours including the corridors connecting all the labs and offices.

Sustainability Design and Energy Conservation

The U of T Policy Statement of Energy Efficiency (Policy) requirements for new buildings, effective January 1, 2018, updated with the April 1, 2019 Energy Performance & Modelling Standard require that all new buildings shall have an energy use index at a minimum, 40% better than that calculated using ASHRAE 90.1 – 2013, Appendix G "Performance Rating Method". In addition, the Project Consultant Team shall present energy modelling in conformance with the April 1, 2019 Standard for consideration by the U of T Implementation Committee.

ASHRAE provides Standards for all components within buildings – HVAC, windows, lighting, modeling, envelope, ventilation and reviewed by industry experts. It allows for prescriptive and performance based compliance paths to meet the minimum energy use. Toronto Green Development Standards (TGDS), OBC** and LEED use ASHRAE 90.1 to define energy efficiency targets. Consultants shall submit to U of T for approval the benchmark building used for energy modelling.

Building energy performance modeling during the design of a new building shall serve several purposes. The primary objective is to inform design decisions in a way that guides the designs toward the University's goals of sustainable energy efficiency, reduced carbon footprint and optimal long-term building performance and comfort of its occupants. It is recognized that the detail and resolution of the performance assessment through modeling will refine as the design progresses from concept through design development to tendering and then on-going measurement and verification.

Energy modeling coupled with Life Cycle Cost Analyses (LCA) will serve as tools throughout design to evaluate design options and make appropriate choices that support the University of Toronto's pursuit of sustainable reduced energy use and lower carbon footprint with long-term comfort.

At each design phase, the consultant team is expected to submit the energy model with EUI (Energy Use Intensity) metrics to test the energy performance for alignment with U of T Policy and standards. See Appendix 5 for U of T's Energy Modeling Guidelines.

Integration of environmentally sustainable principles into buildings, transportation options and landscapes, across all categories (materials, indoor air quality, water use and waste reduction) in addition to energy, is a high priority for the University. In accordance with City criteria, all new buildings shall be designed to meet the Toronto Green Development Standard Version 3, Tier 1, at a minimum with design and costing options to be provided to the U of T Implementation committee to achieve at TGS Tier 2 rating.

Since the project does not trigger Site Plan Control, the project is not required to meet the requirements for the City of Toronto Green Roof Bylaw No. 583-2009, Chapter 492.

The Sustainability Lab is designed to meet the Toronto Green Standard (TGS v3), Tier 1 and is projected to obtain LEED v4 Canada NC Gold certification. Currently, modelling of the energy performance put the proposed design to 55% below ASHRAE, 15% better than standard. This will significantly reduce the building's operating costs over its lifetime. Other Sustainable design features are:

- Building Dashboard – illustrate and make available energy and sustainability metrics for public and educational value
- Smart metering – all energy/resource loads will be metered for comprehensive Mechanical & Electrical and use in curricula
- Reduction of fume hood energy by 50% or more
    - 6 auto-closing fume hoods, low-flow (40 fpm design basis) and 6 filtered hoods to reduce energy demands to ventilation
- Day-lighting maximized and lab benches to have integrated task lighting. Reduction of lighting power densities (±0.6 W/sf). All lighting will be LED.
    - exterior lights to be dark sky compliant and controlled to reduce by minimum 50% between 11pm and 6am.
- Dedicated Outside Air and ventilation strategy:
    - The lab is primarily cooling load driven, then exhaust driven (fume hood and fire code), and finally ventilation/ACH driven. Office areas separated from experimental areas and ventilation rates minimized.
    - Dedicated outside air and natural ventilation allowed in non-lab spaces.
- Air-to-Water heat pump distribution exchange, maximizing use of low temp heating/high temp cooling creating optimal conditions for high efficiency heat pumps, chillers and boilers
- Chilled beams will provide heating and cooling
- Provide for all (structural, electrical, etc.) provisions for tie-in for solar energy generation (net metered, ballasted system preferred)
- Highly insulated walls and roof and roof to be cool roof with low albedo
- Solar Photovoltaic (PV) array on roof beside the Exterior Research Lab, annual production estimated to be 102 MWh
- Provide space and services for recyclables, organics, waste and attention to lab waste
- High efficiency plumbing fixtures – target 50% reduction in potable water use
- Recirculation pumps for domestic hot water in washrooms and at lab benches
- Target the following environmental footprint:
    - Greenhouse Gas Intensity (GHGI) - 26 kg of Co2 equiv./m2. (18 kg/m2 for thermal + 8 kg/m2 for electrical. Does not include the reduction of site GHG due to electrical generation by a PV system)
    - Thermal Energy Demand Intensity (TEDI) - 100 ekWh/m2. The annual heating energy demand for space conditioning and conditioning of ventilation air.
    - Total Energy Use Intensity (TEUI) - 300 ekWh/m2. The sum of all energy used on site (i.e. Electricity, natural gas, district heat), minus all renewable energy generated on site and divided by the modelled floor area (includes TEDI value above)
- Zero Carbon pathway ready as separate project to link to campus geothermal

Signage and Donor Recognition

Faculty of Applied Science and Engineering's Advancement is seeking donor interest and defining opportunities for donor recognition within the project. The wall closest to the suite entrance to the Sustainability Lab has been earmarked for a potential donor wall while remaining areas will have typical U of T signage.

Non-Assignable Spaces

The non-assignable spaces included in the scope of work are areas such as corridors, stairs, mechanical service rooms, janitor closets, corridors, mechanical stacks, washrooms, etc. These aspects in the building program are normally accommodated within the gross-to-nasm factor of approximately 2.0.

- Stair extension from 3rd to 4th floor
- Corridors and vestibules
- Waste alcoves – located along corridors to accommodate waste warriors, laboratory glass and plastic recycling bins
- 1 Universal Washroom has been added

Mechanical/Electrical and Data

Please refer to the University of Toronto St. George Campus Design Standards for information on mechanical, electrical and data design standards as well as commissioning information, http://www.fs.utoronto.ca/.

Wireless connectivity will be provided throughout the addition.

Any additional fume stacks/venting/strobic fans must consider that the Exterior Lab will have some transient occupants on the rooftop.

Refer to Sustainability Design and Energy Conservation for more information on the proposed Mechanical and Electrical design.

Environmental Health and Safety

The University of Toronto's Environmental Health and Safety office provides a broad range of health and safety services to the University community and whose responsibility it is to ensure environmentally responsible, safe and healthy work, research and study environments on campus. All lab design to comply with University of Toronto EHS Laboratory Design Standard available at: https://ehs.utoronto.ca/

Facilities & Services (F&S) have Ministry of Environment (MOE) agreements in place. Review of the proposed design/modelling is in progress.

Ductless fume hoods filter the air before circulating it back into the room help with energy efficiency as it reduces conditioning loads through minimizing the exhaust rate. With both ductless and ducted fume hoods, air monitoring to be factored and coordinated in Implementation phase. Fume hoods are

to be designed to work in together with the HVAC design, and vice versa to reduce fume hood leakage. Testing to ensure no contamination and commissioning of equipment required. Equipment is to be either Energy star rated or U of T approved.

Lab A and B will be designed as Biosafety Level 2 'ready'

e) Site Considerations

Site Context

The Wallberg Building, 184-200 College Street, is flanked by St George Street and King's College Road and is one of the gateways into the St George campus. The Sustainability Lab rooftop addition and its signature PV array will be visible to the general public along on the southern edge of the St George Campus.

Zoning Regulations

The in-force zoning by-law is 438-86, zoned Q, Mixed-Use Districts permits class A laboratory, research and development institutes, and offices. The in-force zoning by-law has an approved envelope of 23m for portions of the roof area to be constructed on the existing Wallberg Building within the zoning envelope. The current building is approximately 18.63m to grade to top of mechanical roof. The height of the proposed addition is within the allowable height. However, the proposed Sustainability Lab require minor variances to amend the in-force Zoning By-law 438-86: 1. To construct a building envelope outside the permitted building envelope, shown in Map 16 (see next page); and, 2. To increase area over the allowable Non-Residential Gross Floor Area. Application to Committee of Adjustment (COA) was in late 2019 and the City of Toronto's Committee of Adjustment approved the minor variances in June 2020.

184-200 College Street, Site 16, is included in the 2011 University of Toronto St George Master Plan. The Sustainability Lab is a minor addition, not contemplated in the 2011 U of T Master Plan, and does not impede future redevelopment of the block.

In September 2016, the University submitted an application to the City to amend the Official Plan, to adopt a new Secondary Plan for the St. George Campus area. The plan, once enacted, will replace the existing 1997 University of Toronto Secondary Plan. The Draft Secondary Plan and companion Urban Design Guidelines reflect the objectives and vision of the 2011 Master Plan. The Draft Secondary Plan application maintains the intersection of King's College Road and College Street as a gateway to the campus and the key view from College Street looking north to University College. Gateways have been identified at locations where higher volumes of people are generally entering campus or gathering, and where institutional presence of the University should be enhanced.

Landscape and Public Realm

The proposed Wallberg addition will have no impact to the public realm at grade. No landscaping is proposed as part of the Sustainability Lab upper-level addition project. Any potential impacts with existing trees must be coordinated with U of T and follow City of Toronto's Municipal Code Tree By-law and apply for required tree permits and approvals.

Site Access and Servicing

The site is adjacent to the TTC College and Spadina Streetcar routes and the Queen's Park Subway station in close proximity to the site. The building is accessible via accessible ramp through the D.L. Pratt Building and elevator. The main labs and graduate spaces of the addition will have elevator access. Loading and service vehicles have access from the north side of the Wallberg Building with access from St. George Street.

Heritage Status

Formerly referred to as the Chemistry Building, the building was constructed from 1946 to 1949 following the World War and was used for the Chemical Engineering Department. The building was designed to allow for a rooftop addition. Following the initial build, the Pulp and Paper Centre addition was built on the 4th floor in 1992, followed by the BioZone rooftop addition in 2012. Both rooftop additions were constructed to allow to provide more research and laboratory space.

ERA Architects prepared a Cultural Heritage Resource Assessment (CHRA) of the campus, as a supporting document to the University's Secondary Plan application. The Wallberg Building is not recommended for listing in the CHRA. Currently, the building is not included on the City of Toronto's Heritage Register.

Note: The Wallberg lot address also includes Cumberland house (33 St George Street is the convenience address) which is listed heritage. However, the municipal address for the Wallberg Building remains 184 College Street as it was originally addressed in 1973.

Designated Substances

The University of Toronto will investigate and identify designated substances and other site-specific hazardous materials present within the project area as per appropriate regulations and the Ontario Occupational Health and Safety Act.

f) Campus Infrastructure Considerations

Utilities (electrical capacity, water, gas, steam lines)

Electrical

Electrical systems for Wallberg are old and beyond serviceable life with the exception of the main Hydrovolt substation which was upgraded recently. Medium power voltage is supplied from Toronto Hydro.

- A new 347/600V switchboard is provided in the existing substation electrical room.
- A minimum of 25% space will be provided in each new panel board for S-Lab, for future loads.

Emergency power is supplied from MSB can only be assigned to life safety use and not continuous emergency power. Continuous emergency power is not required for this project.

When planning the layout of rooms, allow for a minimum of 1 metre clearance (1.5m in the corridors) from all electrical equipment, including electrical panels and disconnect switches. All data communications racks and telephone equipment shall be installed in a room separate from the electrical room.

Steam

The Walberg building is currently heated using steam via existing pipe from MSB from the Central Plant. Currently a four-inch diameter pipe services Walberg also providing for the Pratt and Engineering Annex buildings. The current pipe steam capacity at 100 feet per second is 13,850 lbs / hour at 200 psig as compared to an intermittent maximum demand of 12,200 lb/hr. Based on the assumption the current building renovations will reduce the building thermal load, the building has additional thermal capacity up to the intermittent maximum demand of 13,850 lbs/hour @200 psig.

Cooling will come from the existing ten-inch diameter pipe from Medical Sciences Building MSB - this line has a lot of spare capacity. Note that during the winter months the main chilled water supply to the building from Medical Sciences Building MSB is not available.

g) Secondary Effects

- Impact on Existing Occupants
  - As the addition is net new space, there should be minimal impact on existing space other than the eastern wing of the third floor where the ceiling will need to be accessed to add/modify services for the fourth floor. Access to the ceiling space can be limited to off-hours or weekends in order to minimize disruption to occupants in other areas of the building. Most of the existing spaces on the third floor are Faculty offices and Research Lab space.
- Partial Demolition of the Existing Mechanical Penthouse
  - The addition will sit south of the existing mechanical service space. In order to make the addition accessible, existing mechanical services will be relocated and reworked to suit the proposed addition. Three areas of Mechanical space are affected and have been reviewed by Facilities and Services. These three areas will be reconfigured to rework some existing ductwork to accommodate the Sustainability Lab. In particular, Mechanical Room 456 will be renovated/split into two spaces to create a Maintenance room (456) and a Telecom room (455T). In addition, to allow for sufficient exiting, a vestibule has been carved out of the Mechanical penthouse corridor.
- Construction Staging
  - Locations of Construction staging and access to be considered prior to tender, as there is not much available space adjacent to the subject site. Tree protection will be required as per City of Toronto Municipal Code.

h) Schedule

Proposed Project Milestones:

100% Construction Documents	January 2021
Building Permit Application	January 2021
CaPS Executive Meeting (Cycle 4)	January 2021
Executive Committee (Cycle 4 Full approval)	March 2021
Tender and Award	March – May 2021
Mobilization Start	May 2021
Substantial Performance	Aug 2022
Occupancy	Aug 2022


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