

**Motion: That Academic Council recommend to the Board of Governors the approval of the  
BTech in Sustainable Energy Systems**



**Bachelor of Technology in Sustainable Energy  
Systems  
Faculty of Energy Systems and Nuclear Science**

**February 23, 2018  
R3**



## Table of Contents

1.	INTRODUCTION.....	4
a.	Background .....	4
b.	Student Demand.....	5
c.	Societal Need .....	6
d.	Duplication.....	7
2.	DEGREE REQUIREMENTS .....	9
a.	Program Learning Outcomes.....	9
b.	Admission Requirements .....	12
c.	Program Structure – Program Maps .....	13
d.	Calendar Copy.....	20
3.	RESOURCE REQUIREMENTS .....	21
a.	Faculty Members, Current and New Faculty requirements.....	21
b.	Additional Academic and Non-academic Human Resources .....	22
c.	Student Support Requirements.....	23
d.	Physical Resource Requirements .....	25
4.	BUSINESS PLAN.....	28
a.	Statement of Funding Requirement .....	28
5.	APPENDICES .....	29
A.	Program Maps .....	29
B.	New Course Proposals and Required Course Changes.....	29
C.	Library Report.....	29
D.	Completed Notice Intent .....	29
E.	Course Information Sheets and Course Outlines .....	29
F.	Faculty CVs .....	29
G.	Energy Systems Programs at Ontario Colleges .....	29

## 1. INTRODUCTION

### a. Background

The University of Ontario Institute of Technology (UOIT), established by the University of Ontario Institute of Technology Act, 2002, is founded in technology, the sciences and professional practice. UOIT's vision advances the discovery and application of knowledge that accelerates economic growth, regional development and social innovation and inspires graduates to continue to make an impact on the world, as it is and as it will be. A key mission objective seeks to develop academic and research collaborations with industry and community that stimulate and enhance the region and university at home and abroad.

Energy and environmental science is one of UOIT's four strategic research areas, and integrated with one of the largest challenges currently facing society. As our need for energy continues to grow, so too does the need to mitigate the negative environmental and social impacts of energy supply and use. For example, students graduating today are being called on to double the world's energy supply in their careers (a task that took more than 100 years before them), and to provide this enormous increase in energy supply, while reducing today's carbon emissions by more than 80 percent from 2005 levels.

Indeed, at the current time, in particular, we seem to be on the cusp of making fundamental changes to how we use energy. These changes are facilitated by the development of renewable energy technologies, smart technologies, climate change mitigation policies, and even smart and sustainable communities. Sustainable communities, with a particular focus on energy supply and application, can help overcome many of Ontario's, Canada's and the world's most pressing economic, social and environmental challenges. These ongoing changes in energy technologies and systems will require workers who can enable those changes; workers who are well-versed in various energy technologies, how they are integrated to form complete systems, and how those systems perform economically and environmentally.

The systems perspective is key to making well-informed decisions that meet the goal of improved sustainability. 'Energy systems' can be defined as the technologies, infrastructure and behaviours that connect the flows of materials and energy (fuels and electricity) from natural resources to meet societal wants and needs. As such, achieving the goal of sustainable energy systems requires an interdisciplinary perspective.

UOIT's Faculty of Energy Systems and Nuclear Science (FESNS) actively pursues research in the area of energy systems and their techno-economic and environmental impacts. As an integral part of the University, the mission of the FESNS is to deliver academic programs that prepare graduates for leadership in the energy sector. A compelling case exists for additional well-educated energy practitioners<sup>1</sup>, who are able to adapt to quickly changing conditions, at home and internationally.

A Bachelor of Technology (BTech) in Sustainable Energy Systems program in FESNS will support the mandate of the Faculty and complement its other energy-focused programs. The BTech program will ensure graduates possess a deep familiarity with the technologies associated with energy systems and various technological options, as well as the skills to continually analyse new energy technologies and changes to energy systems, in terms of their techno-economic and environmental performances. Graduates will also possess the business and communication skills that will help them put their technical knowledge to use. Graduates will be well versed in the

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<sup>1</sup> See International Energy Agency for example,  
<https://www.iea.org/policiesandmeasures/renewableenergy/?country=Canada>

strengths and limitations of various energy supply options, which depend on local and regional conditions. Graduates will also develop a thorough understanding of regulatory and political aspects of energy supply.

BTech graduates will emerge ready for long careers in the continually changing energy field, whether in energy-focused technical, policy or project management positions. They are expected to work in fields such as energy auditing, wind energy, solar energy, smart (and micro) grids, building management, and government. Experiential learning opportunities will further prepare students for these positions. Work placement/internship opportunities will be available for BTech students. They will also have the advantage of studying in a Teaching City<sup>2</sup>, where there may be opportunities for them to not only explore urban issues, but to implement potential improvements. Further, BTech graduates will be well placed to pursue graduate studies in engineering, science or the social sciences.

The BTech program lends itself well to international collaborations, as emerging technologies and the challenges facing energy systems are common globally. By collaborating with institutions like the Beijing Polytechnic Institute the program will produce leaders for China in sustainable energy systems. This fits well with UOIT's growing international mandate.

Several professors with skills in the energy sector already have courses developed in sustainable or renewable energy systems. The BTech supports a key FESNS priority to ensure retention of an integrated energy systems mix in the faculty.

#### b. Student Demand

Three broad pools of students are anticipated: general offering (starting at first year); bridge option (students arriving from Canadian colleges); and international students (entering either at first year, or through a bridge). The programs are expected to appeal to students who enjoy science and math, but are looking for a broader education than is offered by engineering programs. Incoming students will have strong technical skills, so that they can learn how energy technologies operate, but also strong interests in the business, regulatory/political and environmental sides of energy systems, including areas such as project management and public relations.

When the program opens in September 2019, 20 students are expected (19 from Canadian high schools), increasing in 2020 to approximately 30 students per year (27 domestic). These students would attend four years. Transfers to other program offerings would be possible, e.g. energy systems engineering, nuclear engineering, physics.

The bridge option facilitates Canadian students entering the full program from Canadian colleges. A three-year advanced diploma from an Ontario college in Mechanical or Chemical Engineering Technology, for example, would be a good background for the BTech program. Students would complete three bridge courses, and then proceed into the final two years of the BTech program, with a slightly modified curriculum to ensure all learning outcomes are met. Some Ontario colleges offer more energy-specific programs, such as Energy Systems Engineering Technology, and Sustainable Energy and Building Technology (see Appendix G). The bridge option has been designed based on the more common Mechanical and Chemical Engineering diplomas, which importantly are offered by the co-located Durham College. However, the energy-specific programs offered by other colleges in the Greater Toronto Area would be natural feeders, as well. If a significant number of graduates from these programs apply to the BTech, tailored bridge options

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<sup>2</sup> <https://www.oshawa.ca/business-and-investment/teaching-city.asp>

can be developed; initially, applicants will be assessed on a case-by-case basis. Approximately 10 bridge students per year are anticipated from Canadian colleges.

The initial international offering of the program is likely for students from the Beijing Polytechnic Institute (BPI) with whom UOIT has a Memorandum of Understanding. BPI will recruit students from high school specifically for this program and train them for 2 years in Beijing. For long-range planning purposes, the Beijing Municipal government will fund students (> 30/a) from China to come to UOIT to obtain their BTech degree. An additional number of students from other areas in China are also expected (also returning to China upon graduation). The first international student bridge offering will have approximately 15 students. We hope to build appropriately within the overall UOIT international student plans. If the University grows sufficiently, other countries would be canvassed, making the total international student potential intake approximately 100 students, of course subject to the University plans (roughly 60% from China, 25% rest of Asia, and 15% rest of world).

Table 1. Projected enrolment by year of operation and program year.

YEAR OF OPERATION	Yr1	Yr 2	Yr 3	Yr 4	Yr5	Yr6	Yr7	TOTAL ENROLMENT	Maturity
2019	20	0	25	0	0	0	0	45	
2020	30	16	25	25	0	0	0	96	
2021	30	24	40	25	0	0	0	119	
2022	30	24	46	40	0	0	0	140	
2023	30	24	46	46	0	0	0	146	146
2024	30	24	46	46	0	0	0	146	146

### c. Societal Need

A recent report by ECO Canada<sup>3</sup> explored “Careers in Energy”. Listed below are three example careers from that report in which graduates from this program may be employed. Importantly, our graduates will have the skills that will enable them to adapt as energy systems, and the energy sector, continue to change.

Corporate Energy Professionals: “...work at all levels of an organization to manage energy usage, maintain positive stakeholder relationships, and improve energy performance”. According to ECO Canada<sup>3</sup>, “in the past 2 years” 53% of studied employers were hiring Business Development and Marketing Managers, in this category, while 60% intended to hire further into this position “in the near future” (emphasis removed).

Building Operators and Managers<sup>3</sup>: “...coordinate property management, develop building operating procedures, and improve building systems to save energy and costs”. According to ECO Canada<sup>3</sup>, “in the past 2 years: 45% of employers had vacancies for Green Building Project Managers...and in the future: 62% of employers expect to hire more staff for this specific role” (emphasis removed).

Renewable Energy Professionals<sup>3</sup>: “...support the development and implementation of renewable energy facilities, systems and equipment”. According to ECO Canada<sup>3</sup>, “in the past 2 years” 65% of studied employers were hiring Renewable Power Project Managers, while 55% intended to hire further into this position “in the future” (emphasis removed).

<sup>3</sup>ECO Canada. 2013. Careers in Energy, Current Job Trends & Future Growth. Environmental Sub-Sector Profiling Series. Available at: <http://www.eco.ca/reports/careers-in-energy-current-job-trends-and-future-growth/>

Graduates with robust technical and business skills in the energy sector are in demand. Low-carbon, renewable and integrated energy systems are in particular demand. So too energy conservation, adaptability and resiliency skills are needed. UOIT's existing Energy Systems Engineering program provides compelling evidence as the program has one of Ontario's highest levels of sector-employment by graduates.

BTech graduates are expected to be employed in large companies, and emerging small energy companies, and to start their own firms. BPI and the Beijing government specifically indicated a strong need for technically qualified people in sustainable energy technologies with systems approaches.

The UOIT FESNS retained Academica Group to conduct a Degree Program Feasibility Study, B.Tech in Chemical/Environmental Engineering (Phase 1 – January 2015; Phase 2 – March 2016). The study focused on the need for such a program, its relationship with accredited engineering programs (professional engineer and engineering technologist), and likely sources of potential students. Survey respondents (students) were particularly interested in Co-op/internship opportunities and the most compelling aspect of a potential program was potential employment.

d. Duplication

Carleton University has a Sustainable and Renewable Energy Engineering program that competes directly with UOIT's Energy Systems Engineering program. This is an engineering accredited program and therefore not a direct competitor for the BTech degree program.

McMaster University has a BTech program. Originally this program did not include energy. They recently added the Energy Engineering Technologies program, demonstrating the sector's increasing popularity. Their BTech is combined with Mohawk College. This program is slightly different than the one proposed as it is presented mainly as a bridge program with Mohawk College (the majority of students are from the College).

Queen's University, and the Universities of Toronto and Waterloo have similar energy research institutes, however these mainly focus on research, and not on Bachelor student-level programming (employment focussed).

Several colleges provide Energy Systems Engineering Technologist programs, however some of these have been discontinued (e.g. St. Lawrence College) as there is not a direct fit with a trade (overseen by Ontario Colleges of Trades). These college programs are anticipated to be an important source of potential students for the UOIT BTech (those wanting a broader education in energy systems while maintain a focus on employment).

There are several programs similar to the one proposed here in Ontario (within Ontario and Canada-wide). This program is however unique through its concentration on sustainable and emerging technologies. Further, an energy 'systems approach' is proposed where students are adept at discrete technologies, e.g. wind or solar, as well as understanding how 'the pieces fit together' with a more holistic (and sustainable) outcome.

<b>Institution:</b> McMaster University
<b>Program Name and Credential:</b> BTech as a stand-alone degree; recently added Energy Engineering Technologies program.

**Program Description:** McMaster University has a BTech. program. Originally launched in 2013. Energy Engineering Technologies recently added. The BTech is combined with Mohawk College. As per the McMaster University web site:

“The four-year Bachelor of Technology program has been designed for students who learn best by doing. It provides a balance of university-level course study and practical experience by applying classroom knowledge and theory to real-life situations.”

“The Bachelor of Technology program offers a fresh approach to education for the dynamic world of engineering. Promoting “Learning In 3D,” we incorporate Theory, Practice and Experience in our education. Our students go beyond learning from a textbook – they learn from “hands on” experience through lectures, labs and work experience.”

From Wikipedia: “The joint McMaster-Mohawk Bachelor of Technology program offers four-year bachelor-degree programs in engineering technology, including process automation technology, biotechnology and automotive and vehicle technology, as well as degree-completion programs in civil engineering infrastructure technology, computing and information technology, energy engineering technology and manufacturing engineering technology.”

**Similarities and Differences:** McMaster’s program is the only energy focussed Bachelor of Technology in Ontario. The program is jointly offered by McMaster and Mohawk College. Key areas of focus are automotive, biotechnology, and software and manufacturing. A new focus is Energy Engineering Technologies was added in 2015. The energy technologies program focusses mainly on specific technologies. UOIT’s ‘systems approach’ to energy is unique in a bachelor’s program. UOIT also has deep expertise in nuclear, hydrogen and geothermal, as well as integration with new home construction in Durham Region (net zero buildings).

**Links:** <http://future.mcmaster.ca/programs/btech/>

**Institution:** Carleton University

**Program Name and Credential:** BEng, Sustainable and Renewable Energy Engineering

**Program Description:** Carleton University has a Sustainable and Renewable Energy Engineering program that competes directly with UOIT’s (now closed) Energy Systems Engineering program. This is an accredited engineering program and is not a direct competitor for the proposed BTech degree. From the website: “Sustainable and Renewable Energy Engineering (SuRE) is a professional discipline concerned with the design, development, implementation, and improvement of the methods and systems used to generate and distribute energy from sustainable and renewable sources.”

**Similarities and Differences:** The program is presented here since it reflects well the shift in many schools on renewables and ‘sustainable’ energy engineering (as captured also in the proposed BTech). UOIT’s BTech is underpinned with low-carbon energy provision (including nuclear and hydrogen). Students get a deep understanding of life cycle assessment and a systems approach.

**Links:** <https://admissions.carleton.ca/programs/sustainable-and-renewable-energy-engineering/>

## 2. DEGREE REQUIREMENTS

### a. Program Learning Outcomes

*\*For both the BTech (Hons) and BTech – Bridge*

Degree Level Expectation	Learning Outcome	How the program instructional design & elements support the attainment of student learning outcomes	Method of assessment: How are you planning to measure the learning outcome stated in column 2
1) Depth and Breadth of Knowledge	<ul style="list-style-type: none"> <li>• <i>Apply knowledge of natural sciences and engineering fundamentals, such as mathematics, physics, fluid mechanics, heat transfer, electric circuits and instrumentation to identify, formulate, analyse and solve problems.</i></li> <li>• <i>Apply knowledge specific to the energy field to identify, analyse and solve problems. This knowledge relates to alternative and conventional energy technologies (solar, wind, nuclear, hydroelectric), integrated energy systems, etc.</i></li> </ul>	<p>Introduced <i>Fundamental courses, e.g., MATH 1000U, PHY 1010U, ENSY 1110U</i></p> <p>Developed <i>Program-specific technical courses, as well as courses covering environmental, economic and social implications of energy systems e.g., ENSY 3830U, ENSY 3730U, ENVS 1000U, SSCI 1470U, BUSI 1700U</i></p> <p>Applied <i>Upper year courses focused more specifically on applied problem solving e.g., ENSY 4610U, ENSY 4600U</i></p>	<p>Introduced <i>Assignments (problem sets), Quizzes, Midterms, Final exams</i></p> <p>Developed <i>Assignments (problem sets), Quizzes, Midterms, Final exams, Major projects</i></p> <p>Applied <i>Major/Thesis projects</i></p>

2) Knowledge of Methodologies	<ul style="list-style-type: none"> <li>• Utilise common and advanced software tools for data collection and management, and for the analysis and solution of problems.</li> <li>• Work safely, responsibly and effectively in the construction/assembly of laboratory components, collection of data, and operation of equipment.</li> <li>• Formulate a systems-level approach to solving problems.</li> <li>• Apply well-established methods for the techno-economic and environmental assessment of energy systems</li> </ul>	<p>Introduced Fundamental courses e.g., ENGR 3200U, CSCI 1040U, ENGR 2140U Courses with lab components e.g., ENSY 1110U, ENSY 2220U</p> <p>Developed Upper year courses e.g., ENGR 3750U, ENSY 3730U Risk-specific course, ENGR 4660U</p> <p>Applied Fourth-year and capstone courses e.g., ENSY 4700U, ENSY 4600U, ENSY 4610U</p>	<p>Introduced Assignments (problem sets), Quizzes, Midterms, Final exams, Lab reports, Safety quizzes</p> <p>Developed Assignments (problem sets), Quizzes, Midterms, Final exams, Lab reports, Safety assessments</p> <p>Applied Development of safe operating procedures; design of experiments to collect data, Projects (including thesis)</p>
3) Application of knowledge	<ul style="list-style-type: none"> <li>• Develop solutions to energy-related problems, while recognizing the systems-level implications of their decisions from technical, environmental, social and economic perspectives.</li> <li>• Combine fundamental knowledge, analytical skills, and specialized knowledge to develop and/or evaluate a solution to an energy problem.</li> </ul>	<p>Introduced ENSY 1000U</p> <p>Developed Program-specific technical courses e.g., ENSY 2410U, ENSY 2330U, ENSY 3730U Courses focusing on environmental, economic and social elements e.g., ENVS 1000U, SSCI 1470U, BUSI 1700U</p> <p>Applied ENSY 3600U, ENSY 4600U</p>	<p>Introduced Assignments, Exam</p> <p>Developed Assignments, projects and exams; start with one or two elements and add in more over time, until most complete picture emerges at Applied stage</p> <p>Applied Major/thesis projects</p>
4) Communication Skills	<ul style="list-style-type: none"> <li>• Communicate effectively in written, spoken and visual form with members of a multi-disciplinary team, and with members of the general public.</li> <li>• Use various web-based communications and social media to convey specialist knowledge to stakeholders</li> </ul>	<p>Introduced COMM 1050U, ENGR 3200U</p> <p>Developed COMM 1311U, COMM 2310U Lower year tech courses with communication component e.g., lab reports in ENSY 2220U</p> <p>Applied Upper year courses with communication components</p>	<p>Introduced Assignments</p> <p>Developed Projects, lab reports</p> <p>Applied Major/thesis projects</p>

		e.g., ENSY 3600U, ENSY 4600U	
5) Awareness of Limits of knowledge	<ul style="list-style-type: none"> <li>• <i>Perform an uncertainty analysis and assess margins of safety.</i></li> <li>• <i>Recognize the limits to their own knowledge and expertise.</i></li> </ul>	<p>Introduced <i>Lower year courses with a lab component e.g., ENSY 1110U, ENSY 2220U</i></p> <p>Developed <i>ENGR 3750U, NUCL 3740U, ENSY 4700U</i></p> <p>Applied <i>Capstone projects ENSY 3600U, ENSY 4600U</i></p>	<p>Introduced <i>Lab reports</i></p> <p>Developed <i>Assignments (problem sets), Projects</i></p> <p>Applied <i>Major projects</i></p>
6) Autonomy and professional capacity	<ul style="list-style-type: none"> <li>• <i>Collaborate with peers and colleagues in other disciplines to develop and communicate a solution to a problem.</i></li> <li>• <i>Demonstrate academic integrity in their work</i></li> <li>• <i>Describe the social, cultural, ethical, environmental, safety and economic consequences of technical decisions, especially as they apply to the many uses of energy technologies, in local, national and global contexts;</i></li> <li>• <i>Recall the principles and key provisions of regulatory frameworks related to different energy systems, and apply them in their work</i></li> <li>• <i>Evaluate the performance of new, emerging technologies, and apply strategies available for life-long learning</i></li> <li>• <i>Demonstrate an understanding of the management and business practices relevant to the energy industry, including the importance of quality management and quality assurance</i></li> </ul>	<p>Introduced <i>BUSI 2620U, ENSY 1000U, ENSY 2410U</i></p> <p>Developed <i>ENVS 1000U, BUSI 1700U, SSCI 1470U, Tech specific courses</i></p> <p>Applied <i>Tech specific courses e.g., ENSY 2330U, ENSY 3830U, ENSY 3730U, ENSY 4600U, ENSY 4700U, ENSY 4610U</i></p>	<p>Introduced <i>Assignments</i></p> <p>Developed <i>Projects</i></p> <p>Applied <i>Major/thesis projects</i></p>

Of the above program-level learning outcomes, the ability of BTech graduates to complete techno-economic and environmental assessments of both existing and emerging energy systems, is key. The methods and need for such assessments is introduced to students early, in ENSY 1000U. These skills are then developed (applied at previous level and expanded) through the program's Technology Courses (e.g., ENSY 3730U, ENSY 3840U). The "final" application of and test of students' abilities to complete these assessments will come through their thesis projects, ENSY

3600U and ENSY 4600U. Students' ability to undertake these assessments for existing and emerging technologies will be a key indicator that they are prepared to enable the small and large changes occurring in energy systems.

The plans for documenting and demonstrating the level of student performance have been designed specifically to be consistent with the degree level expectations (DLEs). The program-level learning outcomes are based on the DLEs and onto these were mapped appropriate courses and methods of assessment.

The program will be externally reviewed during cyclical reviews, and assessed on an ongoing basis through indicators such as student grades, retention, and yearly course evaluations. Classes and assessment practices as outlined in the proposal will be closely monitored on an ongoing basis through the FESNS Energy Systems Program Curriculum Committee. We will also monitor closely the career success of our students upon completion.

All students are also required to complete a culminating thesis project. The projects completed by students will allow them to demonstrate that they have achieved the overall program learning outcomes that have been aligned with the DLEs. The outcomes of the thesis project will be closely monitored to ensure that the courses in the program are preparing students for success in this culminating project. As well, students enrolled in the four-year program complete a third-year thesis project. While this is primarily intended to emphasise the importance of integrating various technologies and concepts in energy systems, it also provides an earlier opportunity to assess how well program learning outcomes are being achieved.

#### b. Admission Requirements

Admission to the Bachelor of Technology in Sustainable Energy Systems program is expected to be competitive. The specific average or standing required for admission will vary from year to year. Students will be selected by taking into consideration a wide range of criteria including school marks, distribution of subjects taken, and performance in subjects relevant to the academic program. Possession of the minimum requirements will not guarantee acceptance. Preference will be given to applicants with the best qualifications.

Current Ontario secondary school students must complete the Ontario Secondary School Diploma (OSSD) with six 4U or 4M credits including English (ENG4U) with a minimum average of 60 per cent, Advanced Functions (MHF4U), Calculus and Vectors (MCV4U), Chemistry (SCH4U), and Physics (SPH4U). In addition, a combined minimum 70 per cent average in math and science courses is required, with no grade below 60 per cent.

Graduates from a three-year Ontario college advanced diploma (or equivalent) program in one of the following: Chemical Engineering Technologist, or Mechanical Engineering Technologist, with a minimum overall B- average (minimum 70% or 2.7 GPA on a 4.3 scale), will be considered for admission to UOIT's Sustainable Energy Systems Bridge program. Graduates of two- or three-year Ontario college programs in other disciplines should contact UOIT to determine their admission eligibility for this program.

All other applicants should refer to the Admissions section of the current UOIT calendar for the requirements for their specific category of admission.

### c. Program Structure – Program Maps

#### **Program details and degree requirements – BTech (Hons)**

To be eligible for an honours Bachelor of Technology degree in Sustainable Energy Systems, students must successfully complete 120 credit hours, including all courses outlined in the following program map.

Although reasonable efforts will be made to adhere to the following program map, course requirements and term offerings may change. The most up-to-date list of course offerings will be available on the faculty website at [nuclear.uoit.ca](http://nuclear.uoit.ca).

#### **Year 1**

##### Semester 1

- MATH 1000U – Introductory Calculus
- PHY 1010U – Physics I
- ENSY 1000U – Introduction to Energy Systems
- COMM 1050U – Technical Communications
- ENGR 3200U – Engineering Graphics and Design

##### Semester 2

- MATH 1020U – Calculus II
- MATH 2050U – Linear Algebra
- ENSY 1110U – Chemical Fundamentals
- ENVS 1000U – Environmental Science
- CSCI 1040U – Introduction to Programming for Scientists

#### **Year 2**

##### Semester 1

- ENSY 2210U – Electric Circuits for Energy Systems
- ENSY 2220U – Fluid Mechanics for Energy Systems
- ENGR 2140U – Problem Solving, Modelling and Simulation
- PHY 2050U – Thermodynamics and Heat Transfer
- BUSI 1700U – Introduction to Entrepreneurship

##### Semester 2

- ENSY 2330U – Mechanical Equipment and Systems
- ENSY 2410U – Low Carbon Technologies
- STAT 2800U – Statistics and Probability for Engineers
- ENGR 3380U – Strength of Materials
- SSCI 1470U – Impact of Science and Technology on Society

#### **Year 3**

##### Semester 1

- ENGR 3750U – Integrated Engineering Laboratory
- NUCL 3740U – Scientific Instrumentation
- BUSI 2200U – Marketing Management
- *Choice of Technology Course*

##### *Technologies Specialization*

- *Choice of Technology Course*

##### *Programs & Policies Specialization*

- *Choice of Program & Policy Course*

**Semester 2**

- ENSY 3600U – Sustainable Energy Thesis Project I
- BUSI 2050U – Managerial Economics
- COMM 2311U – Writing and Publishing in the Digital Age
- *Choice of Technology Course*

*Technologies Specialization*

- *Choice of Technology Course*

*Programs & Policies Specialization*

- *Choice of Program & Policy Course*

**Year 4****Semester 1**

- ENGR 4660U – Risk Analysis Methods
- BUSI 3930U – Leadership, Negotiation and Teamwork
- *Choice of Technology Course*
- *Choice of Program & Policy Course*
- *Choice of Program & Policy Course or Complementary Studies Elective*

**Semester 2**

- ENSY 4610U – Community and Urban Design
- ENSY 4600U – Sustainable Energy Thesis Project II
- ENSY 4700U – Energy Policy, Standards and Safety
- *Choice of Program & Policy Course or Complementary Studies Elective*

*Technologies Specialization*

- *Choice of Technology Course or Technical Elective*

*Programs & Policies Specialization*

- *Choice of Program & Policy Course*

**Technology Courses**

- ENSY 3730U Solar Energy Technologies
- ENSY 3830U Wind Energy Systems
- ENSY 3840U Fuel Cell and Hydrogen Systems
- ENSY 4300U Environmental Protection Systems
- ENSY 4400U Electric Power Systems
- ENSY 4500U Geo-engineered systems
- ENSY 4530U Hydroelectric Power
- ENSY 4620U Smart Grids
- NUCL 4460U Nuclear Power Systems

**Technical Electives**

- GEOG-ERSC 2401T Environmental Geology
- GEOG 2460T The Global Climate System
- ENSY 4800U Energy Systems Analysis

**Program & Policy Courses**

- BUSI 1600U Management of the Enterprise
- BUSI 2550U Introduction to Project Management
- BUSI 2700U Entrepreneurial Finance
- BUSI 3730U Creative Problem Solving, Entrepreneurship & Imagination
- BUSI 3750U Lean Start-up
- COMM 2310U Advanced Professional Writing & Editing
- COMM 3310U Communications, Communities and Social Change
- COMM 4510U Public Relations

- LGLS 3520U Law and Technology
- LGLS 4040U Law and Environment
- NUCL 5600G Future Role of Nuclear Energy
- POSC 2200U Fundamentals of Policy Theory
- POSC 3300U Building Sustainable Communities

### Complementary Studies Electives

- ANTH 1002T Applied Anthropology
- ANTH 2030T Technology and Humanity
- ANTH 2040T Law and Order in Ancient and Contemporary Culture
- BUSI 1520U Business Computer Applications
- BUSI 2000U Collaborative Leadership
- BUSI 2205U Principles of Marketing
- BUSI 2311U Organizational Behaviour
- BUSI 2603U Introduction to Operations Management
- BUSI 3330U Management of Change
- BUSI 3350U Developing Management Skills
- BUSI 3360U Occupational Health and Safety
- BUSI 3430U Personal Finance
- BUSI 3650U Innovation Management
- BUSI 3700U Strategic Management for Professionals
- BUSI 3710U Small Business Management
- ENGL 1001T Truth, Lies and Story Telling
- ENVS 3110U Economics and Politics of the Environment
- HIST 1201T Western Civilization to 1789
- HIST 1701T World History to 1800
- HIST 1702T World History 1800 – Present
- LGLS 2100U Public Law
- LGLS 3230U Law and Globalization
- PHIL 1000T Introduction to Philosophy: Knowledge and reality
- PHIL 1200T Critical Thinking
- PSYC 1000U Introduction to Psychology
- SOCI 1000U Introduction to Sociology

### Program map – BTech (Hons)

Year	Course	Course	Course	Course	Course
1 – 1	MATH 1000U Introductory Calculus	PHY 1010U Physics I	ENSY 1000U Introduction to Energy Systems	COMM 1050U Technical Communications	ENGR 3200U Engineering Graphics & Design
1 – 2	MATH 1020U Calculus II	MATH 2050U Linear Algebra	ENSY 1110U Chemical Fundamentals	ENVS 1000U Environmental Science	CSCI 1040U Introduction to Programming for Scientists
2 – 1	ENSY 2210U Electric Circuits for Energy Systems	ENSY 2220U Fluid Mechanics for Energy Systems	ENGR 2140U Problem Solving, Modelling & Simulation	PHY 2050U Thermodynamics and Heat Transfer	BUSI 1700U Introduction to Entrepreneurship

2 – 2	ENSY 2330U Mechanical Equipment and Systems	ENSY 2410U Low Carbon Technologies	STAT 2800U Statistics and Probability for Engineers	ENGR 3380U Strength of Materials	SSCI 1470U Impact of Science and Technology on Society
3 – 1	ENGR 3750U Integrated Engineering Lab	NUCL 3740U Scientific Instrumentation	BUSI 2200U Marketing Management	Technology Course	<i>Technologies Technology Course</i>  <i>Programs &amp; Policies Program &amp; Policy Course</i>
3 – 2	ENSY 3600U Sustainable Energy Thesis Project I	BUSI 2050U Managerial Economics	COMM 2311U Writing & Publishing in the Digital Age	Technology Course	<i>Technologies Technology Course</i>  <i>Programs &amp; Policies Program &amp; Policy Course</i>
4 – 1	ENGR 4660U Risk Analysis Methods	BUSI 3930U Leadership, Negotiation and Teamwork	Technology Course	Program & Policy Course	Program & Policy Course or Complementary Studies Elective
4 – 2	ENSY 4610U Community and Urban Design	ENSY 4600U Sustainable Energy Thesis Project II	ENSY 4700U Energy Policy, Standards and Safety	Program & Policy Course or Complementary Studies Elective	<i>Technologies Technology Course or Technical Elective</i>  <i>Programs &amp; Policies Program &amp; Policy Course or Complementary Studies Elective</i>

*Courses currently offered*

- ENGR 2140U – Problem Solving, Modelling and Simulation
- ENGR 3200U – Engineering Graphics and Design
- ENGR 3380U – Strength of Materials
- ENGR 3750U – Integrated Engineering Laboratory
- ENGR 4660U – Risk Analysis Methods
- NUCL 3740U – Scientific Instrumentation
- NUCL 4460U – Nuclear Power Systems

*Courses currently offered, content modified*

- ENSY 3730U – Solar Energy Technologies
- ENSY 2330U – Mechanical Equipment and Systems
- ENSY 3830U – Wind Energy Systems
- ENSY 3840U – Fuel Cell and Hydrogen Systems
- ENSY 4400U – Electric Power Systems
- ENSY 4530U – Hydroelectric Power

*New courses*

- ENSY 1000U – Introduction to Energy Systems
- ENSY 1110U – Chemical Fundamentals
- ENSY 2210U – Electric Circuits for Energy Systems
- ENSY 2220U – Fluid Mechanics for Energy Systems
- ENSY 2410U – Low Carbon Technologies
- ENSY 3600U – Sustainable Energy Thesis Project I
- ENSY 4300U – Environmental Protection Systems
- ENSY 4500U – Geo-engineered systems
- ENSY 4600U – Sustainable Energy Thesis Project II
- ENSY 4610U – Community and Urban Design
- ENSY 4620U – Smart Grids
- ENSY 4700U – Energy Policy, Standards and Safety

*Required courses provided by other units*

- BUSI 1700U – Introduction to Entrepreneurship
- BUSI 2050U – Managerial Economics
- BUSI 2200U – Marketing Management
- BUSI 3930U – Leadership, Negotiation and Teamwork
- COMM 1050U – Technical Communications
- COMM 2311U – Writing and Publishing in the Digital Age
- CSCI 1040U – Introduction to Programming for Scientists
- ENVS 1000U – Environmental Science
- MATH 1000U – Introductory Calculus
- MATH 1020U – Calculus II
- MATH 2050U – Linear Algebra
- PHY 1010U – Physics I
- PHY 2050U – Thermodynamics and Heat Transfer
- SSCI 1470U – Impact of Science and Technology on Society
- STAT 2800U – Statistics and Probability for Engineers

**Program details and degree requirements – BTech (Hons) Bridge**

Students who successfully complete all three bridge courses with a minimum cumulative C average (minimum 60 per cent or 2.0 on a 4.3 scale), will be eligible for admission to the third year of the university's four-year Bachelor of Technology in Sustainable Energy Systems (Honours) degree, with a slightly modified curriculum to ensure all learning outcomes are met. Students in the Bachelor of Technology Bridge program in Sustainable Energy Systems must successfully complete 87 credit hours, including all courses outlined in the following program map.

Although reasonable efforts will be made to adhere to the following program map, course requirements and term offerings may change. The most up-to-date list of course offerings will be available on the faculty website at [nuclear.uoit.ca](http://nuclear.uoit.ca).

**Bridge**

- ENSY 0101U – Calculus and Algebra for Energy Systems
- ENSY 0102U – Heat Transfer and Programming Preparation for Energy Systems
- ENSY 1110U – Chemical Fundamentals OR ENSY 0103U Strength of Materials and Scientific Instrumentation Preparation for Energy Systems depending on diploma

**Year 3**

## Semester 1

- ENSY 1000U – Introduction to Energy Systems
- ENGR 2140U – Problem Solving, Modelling and Simulation
- BUSI 1700U – Introduction to Entrepreneurship
- BUSI 2200U – Marketing Management
- *Choice of Technology Course*

*Technologies Specialization*

- *Choice of Technology Course*

*Programs & Policies Specialization*

- *Choice of Program & Policy Course*

## Semester 2

- ENSY 2330U – Mechanical Equipment and Systems
- ENSY 2410U – Low Carbon Technologies
- ENV5 1000U – Environmental Science
- BUSI 2050U – Managerial Economics
- COMM 2311U – Writing and Publishing in the Digital Age
- SSCI 1470U – Impact of Science and Technology on Society

**Year 4**

## Semester 1

- ENGR 4660U – Risk Analysis Methods
- BUSI 3930U – Leadership, Negotiation and Teamwork
- *Choice of Technology Course*
- *Choice of Program & Policy Course*
- *Choice of Program & Policy Course or Complementary Studies Elective*

*Technologies Specialization*

- *Choice of Technology Course*

*Programs & Policies Specialization*

- *Choice of Program & Policy Course*

## Semester 2

- ENSY 4610U – Community and Urban Design
- ENSY 4600U – Sustainable Energy Thesis Project II
- ENSY 4700U – Energy Policy, Standards and Safety
- *Choice of Technology Course*
- *Choice of Program & Policy Course or Complementary Studies Elective*

*Technologies Specialization*

- *Choice of Technology Course or Technical Elective*

*Programs & Policies Specialization*

- *Choice of Program & Policy Course or Complementary Studies Elective*

**Technology Courses**

As above

**Technical Electives**

As above

**Program & Policy Courses**

As above

**Complementary Studies Electives**

As above

**Program map – BTech (Hons) Bridge**

Year	Course	Course	Course	Course	Course	Course
<b>Bridge</b>	ENSY 0101U Calculus and Algebra for Energy System	ENSY 0102U Heat Transfer and Programming Preparation for Energy Systems	ENSY 1110U Chemical Fundamentals OR ENSY 0103U Strength of Materials and Scientific Instrumentation Preparation for Energy Systems			
<b>3 – 1</b>	ENSY 1000U Introduction to Energy Systems	ENGR 2140U Problem Solving, Modelling and Simulation	BUSI 2200U Marketing Management	BUSI 1700U Introduction to Entrepreneurship	Technology Course	<i>Technologies Technology Course</i>  <i>Programs &amp; Policies Program &amp; Policy Course</i>
<b>3 – 2</b>	ENSY 2330U Mechanical Equipment and Systems	BUSI 2050U Managerial Economics	COMM 2311U Writing & Publishing in the Digital Age	ENSY 2410U Low Carbon Technologies	ENVS 1000U Environmental Science	SSCI 1470U Impact of Science and Technology on Society
<b>4 – 1</b>	ENGR 4660U Risk Analysis Methods	BUSI 3930U Leadership, Negotiation and Teamwork	Technology Course	Program & Policy Course	Program & Policy Course or Complementary Studies Elective	<i>Technologies Technology Course</i>  <i>Programs &amp; Policies Program &amp; Policy Course</i>
<b>4 – 2</b>	ENSY 4610U Community and Urban Design	ENSY 4600U Sustainable Energy Thesis Project II	ENSY 4700U Energy Policy, Standards and Safety	Program & Policy Course or Complementary Studies Elective	Technology Course	<i>Technologies Technology Course or Technical Elective</i>  <i>Programs &amp; Policies Program &amp; Policy Course or Complementary Studies Elective</i>

#### d. Calendar Copy

The Bachelor of Technology (BTech) in Sustainable Energy Systems program offered by the Faculty of Energy Systems and Nuclear Science ensures graduates possess a deep familiarity with the technologies associated with energy systems and various technological options, as well as the skills to continually assess new energy technologies and changes to energy systems. Graduates will also possess business and communication skills that will help them put their technical knowledge to use. Graduates will be well versed in the strengths and limitations of various energy supply options, which depend on local and regional conditions. Graduates will also develop a thorough understanding of regulatory and political aspects of energy supply.

BTech graduates will emerge ready for long careers in the continually changing energy field, whether in energy-focused technical, policy or project management positions. They are expected to work in fields such as energy auditing, wind energy, solar energy, smart (and micro) grids, building management, and government. Experiential learning opportunities will further prepare students for these positions. Further, BTech graduates will be well placed to pursue graduate studies in engineering, science or the social sciences.

The BTech in Sustainable Energy Systems program offers students the choice between two specializations: Technologies, and Programs and Policies.

The Technologies specialization is for students who are interested in focusing their degree on energy technologies. While students still learn about the economic and social aspects of energy systems, they take more technology-specific courses, broadening their technical expertise. This specialization is expected to appeal to students who are more interested in working directly with energy technologies, or in careers where the ability to assess many different energy technologies is a particular asset.

The Programs and Policies specialization is for students who are interested in taking an even broader approach to understanding and working with energy systems. While students still learn about multiple energy technologies, in detail, they also take more courses focused on the business, social, and political elements of energy systems. This specialization is expected to appeal to students who are more interested in working in a business or policy-making environment.

An 'energy system' can be defined as the technologies, infrastructure and behaviours that connect the flows of materials and energy (fuels and electricity) from natural resources to meet societal wants and needs. Graduates of the BTech program will have the combination of detailed technical knowledge, broad perspective and strong analytical skills to allow them to make a difference in how society supplies and uses energy.

#### **Work Placement/Internship Opportunities**

Optional work placement opportunities will be available. A 12- to 16-month optional Internship program is also available for students completing the third year of the program. Students must have a minimum CGPA of 2.3 to be eligible.

Other experiential learning opportunities, including field trips to local energy suppliers and participation in the City of Oshawa Teaching City initiative, may also be available.

### 3. RESOURCE REQUIREMENTS

#### a. Faculty Members, Current and New Faculty requirements

The Faculty of Energy Systems and Nuclear Science (FESNS) has 15 core faculty members with expertise in a wide range of engineering fundamentals and many specialty areas (smart grids, solar, nuclear technology, energy systems and policy, life cycle assessment). The faculty members expected to be consistently involved in the BTech program include:

**Akira Tokuhiro**, BSc, MSc, PhD

Dean and Professor

Nuclear reactor safety, nuclear systems design, hybrid energy systems, experiments

**Hossam Gaber**, BSc, PhD, P.Eng, FS Eng (TÜV Rheinland), CEM, Fellow RAMSP

Professor

Resilient smart energy grids and micro energy grids planning, control and protection

**Glenn Harvel**, BEng, MEng, PhD, P.Eng

Professor

Diagnostic techniques, energy systems and nuclear design, pollution control

**Daniel Hoornweg**, BSc, MSc, PhD, P.Eng

Associate Professor and Richard Marceau Chair

Energy systems, sustainable cities, risk identification and management

**Brian M. Ikeda**, BSc, MSc, PhD

Associate Professor

Corrosion and corrosion-assisted failure of metals, radioactive waste management

**Matthew Kaye**, BSc, MSc, PhD

Associate Professor

Applied thermodynamics, nuclear materials

**Lixuan Lu**, BSc, MSc, PhD, P.Eng

Professor

Nuclear power plant instrumentation and control, reliability and safety assessment

**Jennifer McKellar**, BSc, MSc, PhD, P.Eng

Assistant Professor

Techno-economic and environmental assessment of energy systems, decision-making

**Sharman Perera**, BEng, MSc, P.Eng

Associate Teaching Professor and Manager, Laboratory Services

**Igor Pioro**, MSc, PhD, Dr. Tech Sc., P.Eng

Professor

Thermalhydraulics of nuclear reactors and Generation IV nuclear-reactor concepts

The FESNS offers Bachelor of Engineering (BEng) degree programs in Nuclear Engineering, as well as in Energy Systems Engineering. The Energy Systems Engineering program is currently on hiatus; while that is the case, resources assigned to that program can be utilized to support the BTech. Sessional instructors may also be required; these are accounted for in the Business Plan.

When a version of the BEng Energy Systems Engineering reopens and/or as BTech enrollment continues to grow, then additional hiring may be required for either the BEng or BTech programs. As indicated in Section 4, the Business Plan accounts for the hiring of two new faculty members (in 2021-22, and 2022-23).

### **Teaching & Learning Centre**

The mission of the Teaching and Learning Centre (TLC) at the University of Ontario Institute of Technology is to empower faculty to reach their potential as educators and to create a culture where effective teaching is valued. We champion the scholarship of teaching and implementation of pedagogy. We create valuable teaching and learning professional development experiences. We move UOIT towards being a leader in teaching excellence, ultimately leading to greater student success.

The TLC provides faculty with a range of tools and facilities to assist them in providing a rich learning experience for students. Experts at the TLC provide support in various areas including curriculum development, multimedia design, learning technology and in the overall improvement of teaching practice.

In addition, the TLC funds teaching-related projects from the Teaching Innovation Fund (TIF) for proposals by faculty members aimed at developing new methods in teaching and learning. The TLC facilitates teaching awards at the University and supports faculty in their application for external awards and funding opportunities that focus on teaching and learning.

#### **b. Additional Academic and Non-academic Human Resources**

The Faculty of Energy Systems and Nuclear Science (FESNS) has assembled a team of exceptionally-qualified academic and non-academic administrative, engineering and laboratory staff, including:

- Kerry Morrison, BA (Hons), MEd, Senior Academic Advisor, Academic Advising Coordinator
- Robin Secord, BA, Academic Advisor
- Bob Goldman, BA, MA, MPA, Manager-Administration
- Sharman Perera, BEng, MAsc, P.Eng, Senior Lecturer and Manager, Laboratory Services
- Khalid Rizk, P.Eng, Engineering Specialist
- Robert Ulrich, Laboratory Technician
- Callan Brown, Laboratory Technician

As the BTech program grows additional support will be required. The Business Plan presented in Section 4 accounts for one half-time academic advisor in the first two years of the program, and one full-time academic advisor after that. In particular, with the expected significant enrollment of students from China, English-language support may be required. The Business Plan also accounts for one half-time laboratory technician, to help develop and equip new laboratories to support the BTech program. The first year course, ENSY 1110U Chemical Fundamentals for Energy Systems will require a laboratory technician with chemistry expertise.

Additional academic resources include industry practitioners who provide their expertise to FESNS programs as sessional lecturers, as well as faculty members from the Faculties of Business and IT (FBIT), Engineering and Applied Science (FEAS), Science (FS), and Social Science and Humanities (FSSH).

### c. Student Support Requirements

Students in the BTech program will be well-supported by programs and resources currently in place for FESNS and UOIT students. All undergraduate students have access to an extensive support system that ensures a quality student experience. In addition to the outlined services below, students may also take advantage of the Campus Childcare Centre, Campus Bookstores, Housing and Living Resources as well as the Student Association. Further information can be found at: <http://studentlife.uoit.ca/>

#### **Academic Advising**

The FESNS has a dedicated Academic Advising staff available to help students make choices that will lead to their academic success. Kerry Morrison and Robin Secord support students throughout their educational journey and assist students with academic advising, learning support and career and professional planning. The personalized services students receive in FESNS help them make the best choices in support of their academic and personal achievement (<http://nuclear.uoit.ca/undergraduate/academic-advising/index.php>).

#### **Student Learning Centre**

The Student Learning Centre fosters a high level of academic excellence in the UOIT community by working with all UOIT students, undergraduate and graduate, to achieve educational success. Foundational knowledge and prerequisite skills are essential to all university level courses, and competency with these skills is vital for strong academic performance. The subject specialists offer support services in mathematics, writing, study skills, ESL and physics. With the additional support of peer tutors and workshops, the Centre can further accommodate the needs of a specific course or program. <http://studentlife.uoit.ca/student-learning/>

#### **Student Accessibility Services (SAS)**

The staff work as a collaborative team to ensure students with disabilities have equal opportunities for academic success. The SAS operates under the Ontario Human Rights Code (OHRC) and the Accessibility for Ontarians with Disabilities Act (AODA). Services are provided for students with documented disabilities. Accommodation supports include but are not limited to:

- Adaptive technology training;
- Alternate format course material;
- Learning skills support;
- Testing support; and
- Transition support for incoming students.

#### **Careers and Internships**

The Career Centre offers comprehensive career service assistance and a variety of valuable resources to help students along their career paths:

- Assistance with creating effective job-search documents;
- Career Counselling;
- Interview preparation;
- Job market information; and
- Job search strategies.

A variety of events are hosted on campus during the academic year including employer information and networking sessions, job fairs, and interviews conducted by leading employers.

### **Student Engagement and Equity**

Student Engagement and Equity supports students' successful transition into the university and provides opportunities for them to develop their leadership and professional skills throughout their university career. Services provided through Student Engagement and Equity include:

- Orientation and events through first year
- Specialized programming for first generation, graduate, indigenous, international, mature, online, transfer, and diploma-to-degree pathways students
- Equity and inclusivity programming
- Assistance and advice for living off campus
- Peer mentoring to help students through first year
- Opportunities to grow and develop leadership skills through the Ambassador program.

### **Student Mental Health Services**

Student Mental Health Services helps students learn how to better manage the pressures of student life. Students can:

- Attend a drop-in session;
- Participate in events and activities that promote positive health and well-being;
- Access tools and resources online to learn about mental health and how to maintain good health and wellness;
- Work with a mental health professional to address concerns;
- Contact the Student Lifeline for immediate help and assistance; and
- Get answers to frequently asked questions about mental health.

Student Mental Health Services offers short-term counselling and therapy services to students. Students in distress will also be provided support and counselling as needed. There is no cost and services are confidential. For students who need long-term counselling support or specialized mental health services, UOIT will provide referrals to assist the student in accessing resources in the local community or in the student's home community.

### **Athletics and Recreation Facilities**

UOIT offers a number of recreation facilities and fitness opportunities to meet all lifestyles and needs. On-campus facilities include the state-of-the-art FLEX Fitness Centre which overlooks Oshawa Creek, five gymnasiums, a 200-metre indoor track, two aerobic/dance studios, the Campus Ice Centre, Campus Fieldhouse, a soccer pitch, a fastball diamond, squash courts and an indoor golf-training centre.

### **Campus Health Centre**

The Campus Health Centre provides assistance in numerous confidential health-care options including:

- A medical clinic with daily access to physician and nursing staff;
- Allergy injections, immunizations and influenza injections;
- An on-site laboratory (blood work, STI testing, throat swabs, etc.);
- Complementary Health Services featuring acupuncture, chiropractic, custom orthotics, massage therapy, nutritional counselling and physical therapy;

- Gynaecological health-care and prescriptions; and
- Treatment of disease, illness and injury.

### **Student Awards and Financial Aid**

Student Awards and Financial Aid (SAFA) is dedicated to helping students understand the variety of options available to finance their education. Budgeting and financial planning are essential to their success and Student Awards and Financial Aid is on hand to help create the right financial plan. Financial assistance can be in the form of bursaries, employment (both on-campus and off), parental resources, scholarships, student lines of credit and the Ontario Student Assistance Program (OSAP).

#### d. Physical Resource Requirements

### **Library Resources**

Please see Appendix C

### **Laboratories**

The FESNS already has high quality labs available for its Energy Systems Engineering students that BTech students will be able to share. Equipment used by students in laboratories includes bench-scale photovoltaic panels, dissectible fuel cells and a wind chamber. As described in Section 4, the Business Plan accounts for the need to develop and equip laboratories for the new BTech-specific courses.

### **Technology-Enriched Learning Environment (TELE)**

UOIT is a leader among North American universities in implementing and using curriculum and industry specific software in a technology-enriched learning environment (TELE). Our unique environment is adapted to each discipline based on faculty requirements and input for optimal student learning. We are committed to providing the greatest value for students' investment in education and technology while studying at UOIT.

One of the greatest advantages of UOIT's approach to TELE is that all students have equal access to the same technology, resources and services. Whether you are inside or outside of the classroom, your state-of-the-art academic software allows you to download class notes, work on your own or with others and enjoy seamless access to all online resources. The TELE program has two operating models: Full TELE and Bring-Your-Own-Device (BYOD) TELE depending on respective Faculty.

#### ***Full TELE services***

Students in the FESNS participate in the Full TELE program. Undergraduate students in the Full TELE model receive a laptop uploaded with course-specific software. At the beginning of each new academic year a software or hardware (laptop) refresh takes place at the Distribution Center. It is mandatory that undergraduate students in the Full TELE model partake in the yearly refresh process to be equipped with the appropriate software that they require in accordance to the year and program of study for their current academic year.

- **Hardware** – UOIT undergraduate students participating in the Full TELE model receive a new laptop in the first and third year of study (third year students will return the laptop received in their first year for a new one).
- **Software** – UOIT undergraduate students participating in the Full TELE model receive a software refresh in the second and fourth year. The software refresh process involves the reinstallation of software they require in accordance to the student's year and program of study.
- **Exam support services** – IT Services provides hardware, software and technical support during examinations. IT team will be equipped with loaner laptops in the event of major technical issues.

An annual fee for the Full TELE model covers the use of hardware (laptop), extensive technical service (including repair), a wide range of program- specific software, exam support, loaner laptops, insurance, and virus protection.

### **Information Technology Resources**

IT Services strives to provide quality services to students at UOIT. To support these objectives, the following components are included:

- Wireless network
- Wired network
- IT Service Desk
- General workstations
- Printing services

#### ***Wireless network***

Wireless internet connection is available in public areas and open-air locations around the UOIT campus where students congregate (North Oshawa and Downtown locations).

#### ***Wired network***

To ensure the success of the technology-enriched learning environment, a comprehensive data network has been installed on campus. This includes network drops in lecture halls and designated areas as well as network drops for each residence suite.

UOIT students benefit from networked classrooms and learning spaces. Each ergonomically-designed space has data network connection access and electrical connections to ensure battery regeneration. In addition, classrooms include electronic projection equipment and full multimedia support.

#### ***IT Service Desk***

The IT Service Desk is equipped with certified technicians and experienced IT professionals offering technical support services on a drop-in, call-in or email basis.

#### ***GUWs***

UOIT undergraduate students are able to use general workstations available at the library and have access to BYOD TELE model course-specific software.

#### ***Printing services***

Printing services are available to students in the following areas: labs, classrooms, study common areas, the Learning Commons and the Library. All UOIT students receive print credits every year,

more Printpacks can be purchased through the Campus Bookstore if students require additional printing services.

#### 4. BUSINESS PLAN

##### a. Statement of Funding Requirement

Table 2. Projected revenue and expenses by year.

	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25
TOTAL REVENUE	652,000	1,392,400	1,678,960	1,954,080	2,033,080	2,033,080
EXPENSES						
Sessionals Teaching Assistants	18,312	45,780	64,092	73,324	36,624	36,624
Assistants	4,660	9,962	12,289	14,543	15,164	15,164
Sub-total	22,972	55,742	76,381	87,867	51,788	51,788
TOTAL EXPENSES	492,521	155,291	345,466	524,935	468,856	443,856
NET REVENUE	159,479	1,237,109	1,333,494	1,429,145	1,564,224	1,589,224

Key assumptions underlying the data above:

1. Revenue is based on a steady state of \$12,000 for domestic students (tuition/grant), and \$19,000 for international students.
2. TA support estimated as 50 hours for every 20 students (\$38/h plus 9% benefits)
3. Lab equipment purchased for 7 courses (new labs) in Year 1 (estimated/averaged at \$50,000 per course), along with purchases of additional equipment for existing labs (\$20,000 total for 3 courses)
4. Student advising: half for Years 1 and 2; full for Year 3 and beyond
5. Lab technician: half beginning in Year 1
6. New faculty: one beginning in Year 3, another beginning in Year 4

## **5. APPENDICES**

- A. Program Maps
- B. New Course Proposals and Required Course Changes
- C. Library Report
- D. Completed Notice Intent
- E. Course Information Sheets and Course Outlines
- F. Faculty CVs
- G. Energy Systems Programs at Ontario Colleges

