



## MEMORANDUM

**To:** Executive Committee of Faculty Council (January 20, 2015)  
Faculty Council (February 10, 2015)

**From:** Professor Markus Bussmann  
Chair, Engineering Graduate Education Committee (EGEC)

**Date:** December 10, 2014

**Re:** EGEC Information Report: Emphasis in Sustainable Energy

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## REPORT CLASSIFICATION

This is a routine or minor policy matter that has been approved by the Engineering Graduate Education Committee on behalf of Faculty Council<sup>1</sup>. It will be considered by the Executive Committee for endorsing and forwarding to Faculty Council for information.

## BACKGROUND

An emphasis in Sustainable Energy is designed to be one of the pillars of the Institute for Sustainable Energy's Educational Program. As a Faculty-wide extra-departmental unit with representation from all FASE departments, the ISE strives to broaden the energy education of our students. By exposing graduate students to a wide variety of energy issues and technologies, students who complete the emphasis in Sustainable Energy as part of their MEng, MAsc or PhD programs will develop an understanding of the limitations, challenges, and opportunities that face contemporary energy systems, touching on both established and emerging technologies and their points of intersection.

## PROPOSAL

The proposal for an emphasis in Sustainable Energy is attached, along with the calendar copy.

## PROPOSAL/MOTION

For information.

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<sup>1</sup> As a result of the 2005 Task Force on Graduate Education at the University of Toronto, EGEC has delegated authority to "consider and approve on behalf of Faculty Council and/or recommend to Faculty Council and/or SGS, matters relating to graduate curriculum, policy, new initiatives, program and course changes".



## University of Toronto Minor Modification – Change to an Existing Graduate Program Emphasis in Sustainable Energy

<b>Programs being modified:</b>	Aerospace Studies, MEng, MASc, PhD Chemical Engineering & Applied Chemistry, MEng, MASc, PhD Civil Engineering, MEng, MASc, PhD Electrical & Computer Engineering, MEng, MASc, PhD Materials Science & Engineering, MEng, MASc, PhD Mechanical & Industrial Engineering, MEng, MASc, PhD
<b>Graduate units:</b>	the above six
<b>Faculty / academic division:</b>	Applied Science & Engineering
<b>Dean’s Office contact:</b>	Markus Bussmann
<b>Version date:</b>	December 10, 2014

	<i>Changing Admission Requirements</i>		<i>Renaming Field, Concentration or Emphasis</i>
	<i>Changing Program Length or Requirements</i>		<i>Renaming of Program or Degree</i>
	<i>Changing Timing of Program Requirements</i>	<b>X</b>	<i>Creating a new Emphasis</i>
	<i>Adding/Removing Option (i.e. part-time, flex-time)</i>		<i>Changes to programs affecting a MOA</i>

# 1 Summary

MEng students in each of six graduate units can earn an emphasis in Sustainable Energy by completing four courses from the following lists, including at least one core course.

MASc and PhD students in each of the six graduate units can earn an emphasis in Sustainable Energy by completing at least three courses from the following lists, and must complete a thesis towards their degree on a topic related to sustainable energy. Topics will be approved by the Institute of Sustainable Energy steering committee.

## Core courses

APSxxxxH: Introduction to Energy Engineering Projects \* - new course, to be developed for Sept, 2015

MIE1120H: Current Energy Infrastructure and Resources \*

MIE515H: Alternative Energy Systems \*

## Elective courses

MIE516H: Combustion and Fuels \*

MIE517H: Fuel Cell Systems \*

MIE1128H: Materials for Clean Energy Technologies \*

MIE1129H: Nuclear Engineering I \*

MIE1130H: Nuclear Engineering II \*

MIE1715H: Life Cycle Engineering \*

ECE533H: Power Electronics

ECE1055H: Dynamics of HVdc/ac Transmission Systems

ECE1057H: Static Power Converters I - Principles of Operation and Applications

ECE1085H: Power System Optimization

ECE1094H: Mathematical Methods in Power Systems

ECE1086H: Power Management for PV Systems

CIV575H: Studies in Building Science

CIV576H: Sustainable Buildings \*

CIV577H: Infrastructure for Sustainable Cities \*

CIV1303H: Water Resources Systems Modelling \*

CIV1307H: Life Cycle Assessment and Sustainability of Engineering Activities \*

MSE558H: Nanotechnology in Alternate Energy Systems \*

MSE1022H: Special Topics in Materials Science I: Electrochemical Energy Storage - Materials & Systems \*

MSE1028H: Advanced Materials Science: Thin-Film Materials & Processing

CHE568H: Nuclear Engineering \*

CHE1118H: Industrial Catalysis

CHE1123H: Liquid Biofuels \*

CHE1143H: Transport Phenomena \*

CHE1053H: Electrochemistry \*

CHE1142H: Applied Chemical Thermodynamics \*

AER0507H: Introduction to Fusion Energy \*  
AER1304H: Fundamentals of Combustion \*  
AER1315H: Sustainable Aviation  
AER1415H: Optimization Concepts and Applications

[\*] indicates a course that has content accessible to other engineering disciplines, and a history of students from other disciplines taking the course. Courses without the [\*] designation may be open to other students, but are in general discipline-specific.

## 2 Effective Date of Change

September, 2015

## 3 Academic Rationale

The proposed emphasis in Sustainable Energy is designed to be one of the pillars of the Institute for Sustainable Energy's Educational Program. As a Faculty-wide extra-departmental unit with representation from all FASE departments, the ISE strives to broaden the energy education of our students. By exposing graduate students to a wide variety of energy issues and technologies, students who complete the emphasis in Sustainable Energy as part of their MEng, MASc or PhD programs will develop an understanding of the limitations, challenges, and opportunities that face contemporary energy systems, touching on both established and emerging technologies and their points of intersection.

In addition to the course requirements, students pursuing the emphasis in Sustainable Energy will be exposed to the full range of activities offered by the Institute for Sustainable Energy, including the ongoing seminar series, events to introduce students to members of the energy industry, social groups dedicated to energy systems, and a range of scholarships and awards administered by ISE.

## 4 Impact on Students

This emphasis offers graduate students in six units the opportunity to "specialize" in Sustainable Energy, along paths that combine technical content in their field with access to courses that are accessible to students from different disciplines.

The emphasis offers MEng students with an interest in Sustainable Energy the chance to earn a small designation in addition to their degree, and more importantly, a curricular path. For MASc and PhD students, the emphasis provides an opportunity to broaden their perspective beyond that of their thesis topic.

## 5 Consultation

The Institute for Sustainable Energy Steering Committee prepared this proposal, with the input of graduate student members.

The proposal has also been approved by the Graduate Coordinators and Chairs of each of the six graduate units, and by the Engineering Graduate Education Committee (EGEC).

## 6 Resources

None

## 7 Governance Approval

**Unit Sign-Off** – Graduate Coordinators and Chairs of each of the six graduate units, November 14, 2014.

**Dean’s Office Sign-Off** – Markus Bussmann, Vice-Dean, Graduate Studies, November 21, 2014.

**Faculty/Division Council Approval (or delegated body) if applicable** – approved by the Engineering Graduate Education Committee (EGEC) on behalf of the Council of the Faculty of Applied Science & Engineering on November 14, 2014, and presented to the Council of the Faculty of Applied Science & Engineering for information on February 10, 2015.

## Appendix A: Calendar Entry for Sustainable Energy Emphasis

Doctoral-stream (MAsc/PhD) students must successfully complete:

- At least three half courses (1.5 FCE) from the course lists below.
- A thesis in an area of relevance to sustainable energy with approval of the Institute of Sustainable Energy steering committee.

Master of Engineering (MEng) students must successfully complete:

- Four courses (2.0 FCEs) from the course lists below, of which at least one (0.5 FCE) must be a core course.

Core Courses:

APS 1032H, MIE 515H, MIE 1120H

Elective Courses:

AER 507H, AER 1304H, AER 1315H, AER 1415H, CHE 568H, CHE 1053H, CHE 1118H, CHE 1123H, CHE 1142H, CHE 1143H, CIV 575H, CIV 576H, CIV 577H, CIV 1303H, CIV 1037H, ECE 533H, ECE 1055H, ECE 1057H, ECE 1085H, ECE 1086H, ECE 1094H, MIE 516H, MIE 517H, MIE 1128H, MIE 1129H, MIE 1130H, MIE 1715H, MSE 558H, MSE 1022H, MSE 1028H