

**Faculty of Applied Science and Engineering  
University of Toronto**

**Engineering and Public Policy Task Force**

**Final Report  
May 2008**

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**Faculty of Applied Science and Engineering  
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**Engineering and Public Policy Task Force**

**Final Report**

**Summary and Recommendations**

Engineers must step up to the challenges of public policy. We face a host of technology-based and technology-driven challenges, local and global, from garbage disposal, car traffic, and air pollution in our cities to water crises, energy supply and climate change on the planet. The US National Academy of Engineering report *The Engineer of 2020* states that for the engineer to be a positive force for the future we must educate engineers ".....who are broadly educated, who see themselves as global citizens, who can be leaders in business and public service, and who are ethically grounded." Evolution of engineering education and the engineering profession can bring engineering's capability for quantitative analysis, problem solving, and technological design to the realm of citizenship and public policy. The Professional Engineers Act of Ontario stipulates an obligation on engineers to take care, in the broadest sense, of the public interest: "A practitioner shall..... regard the practitioner's duty to the public welfare as paramount."

The Task Force on Engineering and Public Policy was formed in the summer of 2007 with a mandate to articulate, evaluate and develop concepts for programming in engineering and public policy at the undergraduate and post-graduate level. Members of the Task Force were drawn from the Faculty of Applied Science and Engineering and from the School of Public Policy and Governance; faculty, students and alumni were represented. Task Force members reviewed technology and policy programs at other institutions and discussed many elements of Engineering and Public Policy. The Task Force sought to determine the views of others concerning Engineering and Public Policy through panel discussions, lectures, informal events, focus groups, and surveys. It was evident that there was considerable interest in establishing Engineering and Public Policy programs within the engineering curriculum.

The Task Force has the following recommendations:

- 1) That courses relevant to Engineering and Public Policy be identified (in Engineering or other faculties) or specially developed so that engineering students at the undergraduate and post-graduate level may enroll on a course-by-course basis.
- 2) That a Minor in Engineering and Public Policy be established for undergraduates across the Faculty.

- 3) That a course-based, Masters in Engineering and Public Policy (MEPP) be established.
- 4) That a Division of Engineering and Public Policy be established in the Faculty of Engineering and that the Director be empowered to develop, promote and execute relevant undergraduate and graduate programming.
- 5) That the expertise in Engineering and Public Policy among faculty in engineering be increased through hiring into the tenure stream, and through limited term appointments of public policy practitioners in the role of Visiting Fellows.
- 6) That a case for support be prepared to guide fundraising for Engineering and Public Policy programs and appointments.
- 7) That an individual be appointed to carry on with the development of Engineering and Public Policy at the University of Toronto (e.g. an Interim Director of the Division of Engineering and Public Policy).

## **Vision and Mission**

The Vision and Mission statements below were adopted by the Engineering and Public Policy Steering Committee in the spring of 2007, and served as a basis for discussion within the Task Force.

### **VISION**

An engineering profession that contributes significantly to public policy debate and formulation, and that considers the broadest public interest in all its works

### **MISSION**

To stimulate knowledge-creation and learning at the intersection of public policy and technology so that:

- Applied science and engineering knowledge and methodologies inform public policy
- Public policy concerns inform technology research, development, and implementation

To create educational programs so that:

- All engineering students are acquainted with their responsibilities and opportunities to contribute to public policy and to the public good
- Engineering students and professionals have the opportunity to acquire specialized knowledge of policy research and policymaking
- Engineering professionals have an increased capacity to communicate the often-difficult-to-communicate characteristics of technologies
- Public policy students have the opportunity to learn of the interdependence of technology and public policy

## **Background to the Development of Engineering and Public Policy at UofT**

An important place to begin to understand the opportunities for Engineering and Public Policy (EPP) at the University of Toronto is the provostial "Report of the Task Force on Public Policy Studies at the University of Toronto" issued in January 2004. This is an eloquent document that argues forcefully that:

"...the University of Toronto has the ingredients to create a network of educational and research resources in public policy that matches the University's ambition to be a leader among the major public research universities of the world."

[http://www.provost.utoronto.ca/scripts/index\\_.asp?action=31&U\\_ID=0&N\\_ID=6&P\\_ID=5135](http://www.provost.utoronto.ca/scripts/index_.asp?action=31&U_ID=0&N_ID=6&P_ID=5135)

The report recommends the establishment of a School of Public Policy and Governance (SPPG):

"To be a distinctive Canadian presence as leading centre of excellence in research and education in public policy and governance internationally, addressing issues of significance in Canadian and global contexts, and drawing upon the full range of relevant academic and professional disciplines."

Establishing a School of Public Policy and Governance (SPPG) became one of the goals of the "Stepping Up" strategic plan for the University 2004-2010.

In 2005 it was recognized that engineering could and should play a strong role in such a school. It should be noted that an engineering concern for public policy stems directly from the Professional Engineers Act: "A practitioner shall.... regard the practitioner's duty to the public welfare as paramount." In late 2005 Professor Carolyn Tuohy was leading a proposal to establish the school to be submitted to the Academic Initiative Fund (AIF). Professor Doug Reeve approached Dean Tas Venetsanopoulos and suggested that engineering play a part and offered to represent the faculty in discussions. The faculty was party to the AIF proposal which was successful. Through 2006, steps were taken to establish SPPG with the Faculty of Applied Science and Engineering being a partner. As the new school came into being, engineering was represented, on the search for the Director and the Council of Deans, by Professor Reeve. The plan called for the first students to begin their studies leading to a two-year Masters in Public Policy (MPP) in September 2007.

In the summer and fall of 2006, there were several discussions with Dean Cristina Amon (appointed July 1, 2006) and others concerning Engineering and Public Policy and the prospects for EPP programming in the Faculty. There are numerous examples of fields of research interest and engineering expertise within the Faculty where public policy interacts strongly with technology:

### Energy

- Alternative liquid fuels
- Electricity generation, transmission and use
- Photo-voltaics
- Hydrogen

### Environment

- Global climate

- Air pollution
- Persistent organic pollutants
- Municipal solid waste

#### Information and Communications Technology

- Internet regulation
- Telecommunications

#### Urban Infrastructure

- Transportation
- Residential buildings and codes
- Commercial buildings
- Water supply and sewage treatment

#### Health

- Health care optimization
- Biomedical engineering and ethics
- Over- and under-nutrition

#### Industry/Commerce

- Microelectronics
- Automotive
- Resource extraction and processing
- Service industry analysis and optimization

In October of 2006 a panel discussion called “Engineering and Public Policy – Meeting of the Minds” engaged people in a wide-ranging discussion. The panelists included:

- John McLaughlin, President & Vice Chancellor University of New Brunswick and President of the Canadian Academy of Engineering
- Pat Quinn, President of the Professional Engineers of Ontario
- Lester Lave, Professor of Engineering and Public Policy, Carnegie Mellon University
- Gerald Butts, Policy Secretary, Office of the Premier, Ontario
- Peter Wallace, Deputy Minister and Associate Secretary of the Cabinet, Policy, Ontario

The moderators’ were Professors Doug Reeve and Mark Stabile (Interim Director of the SPPG). Approximately 40 people attended.

It was evident that considerable work needed to be done in defining the concept of Engineering and Public Policy at the University of Toronto, in building awareness and in support, and in developing ideas concerning programming and research. There was also an identified need to investigate, more fully, similar programs at other universities. To achieve this, an Engineering and Public Policy Steering Committee of the Faculty was established in December 2006 with a view to reporting to the Dean within a few months. The committee composition was as follows: Doug Reeve (Chair) (Chem) Bryan Karney (Civil), Heather MacLean (Civil), Brenda McCabe (Civil and Vice Dean Grad Studies), Mike Carter (MIE), Prabha Kundur (Adjunct - ECE), John Voss (Alumnus),

Ex Officio: Cristina Amon (Dean), Mark Stabile (SPPG).

The steering committee met five times in early 2007. The steering committee deliberated and agreed on the Vision and Mission statement already presented in this document. The committee completed an investigation of EPP and related programs at other universities. Full details are provided in the Appendix to this report. Synopses of two of the programs which are of greatest relevance to the University of Toronto are given below. There are other related programs at MIT, Georgia Tech, Princeton, UC Berkeley, University of Michigan, and University of Maryland. The steering committee also looked for signs of interest among the students and the relevance in the courses at the University and found plenty of evidence of considerable enthusiasm for EPP.

**Carnegie Mellon University**  
**Department of Engineering and Public Policy**

The logo for Carnegie Mellon University, featuring the name "Carnegie Mellon" in white serif font on a dark red rectangular background.

Departmental objectives: “To be, and to be generally recognized as, the leading science and engineering-based university affiliated program focused on technology-based policy problems in the world; to provide a friendly, cheerful, intellectually rich and stimulating work environment for our students, our faculty and our staff.”

Director: M. Granger Morgan (Electrical Engineering)

Research concentrations: energy and environmental systems; information and communication technology policy; risk analysis and communication; technology policy and management

Programs offered:

- Main program: PhD in Engineering and Public Policy (extensive coursework, thesis)
- Secondary program: MS in Engineering and Public Policy (joint with BS Engineering or for those who do not finish PhD, coursework + thesis)
- BS Engineering/EPP or Computer Science/EPP double major (four-year engineering program with EPP-related electives)
- BS Engineering with Technology and Policy minor (6 courses)

Number of students: 65 in graduate program

Number of professors: 41 in department + 18 adjunct faculty

Number of courses: 15 graduate, 7 undergraduate (offered by department); students take related courses outside of department

Established 1975

<http://www.epp.cmu.edu>

**McMaster University**  
**Dofasco Centre for Engineering and Public Policy**



Vision: “To educate world class engineers from the public and private sectors to effectively shape public policy on matters of sustainability.”

Director: Gail Krantzberg (Civil Engineering)

Research concentrations: (based on publications list) Great Lakes ecology; sustainability

Programs offered:

- Master of Engineering and Public Policy (1 year program, 10 core courses, seminar week, research paper)

Number of students: 14 (January 2007)

Number of professors: 6 faculty + 10 affiliated

Established 2005

<http://msepmcmaster.ca/epp.html>

The work of the Steering Committee reported to the Dean and the Faculty Chairs' and Directors' (C&D) meeting on May 29, 2007 and received significant support for proceeding with development of the concept. It was the recommendation of the Steering Committee that a Task Force be formed to develop and articulate options for undergraduate and graduate programming.

As part of the effort to test the concepts of EPP, a panel discussion was organized for the annual meeting of the Canadian Academy of Engineering held in June, 2007. The panel was chaired by Professor Reeve and stimulated useful discussion which was supportive of development of EPP at the University.

## **The Task Force Mandate and Membership**

The Task Force was established based on the interim report of the Steering Committee on Engineering and Public Policy to Dean Amon and C&D. The mandate and membership were approved by Dean Amon.

### **TASK FORCE MANDATE (July 15, 2007)**

1. Articulate, evaluate and develop concepts for programming in engineering and public policy at the undergraduate and post-graduate level. Such as:
  - Phase I
    - Energy Policy Course for EngSci (for 2008-09)
    - EPP Seminar Course
    - Technology & Policy for SPPG
  - Phase II
    - Potential programs: MPP/MEng, MEPP, PhD, Undergrad Minor, Eng Sci Option
2. Recommend structures for creating the appropriate administrative framework within the Faculty such as a Division of Engineering and Public Policy
3. Recommend the framework for collaborative programs
4. Articulate resources required including academic appointments (joint? endowed?)
5. Conduct market research on program interest
6. Raise awareness of Engineering and Public Policy including related participation in the School of Public Policy and Governance

### **TASK FORCE MEMBERSHIP**

#### **Faculty**

Doug Reeve (Chair) – Chem. Eng  
Phil Byer\* - Civil Eng., Acting Director Centre for Environment  
Michael Carter – MIE, Dir. Health Care Res. Modeling Lab  
Reza Iravani\*\* - ECE  
Bryan Karney – Civil Eng., Chair Div. Environmental Engineering and Sustainable Energy Systems  
Prabha Kundur - ECE (Adjunct)  
Heather MacLean - Civil Eng.  
Brenda McCabe - Civil Eng., Vice Dean (Grad. Studies)  
Lisa Romkey - Engineering Science  
Eli Sone - MSE  
John Voss - Alumnus, Managing Director, Aegent Energy Advisors Inc

#### **Students\*\*\***

Mandana Fazl, Chem. Eng, Third Year  
Paul Kishimoto, Engineering Science, Fourth Year  
Jennifer McKellar, Civil, Graduate Studies  
Kaleb Ruch, School of Public Policy and Governance, Student, Masters in Public Policy

Ex officio

Cristina Amon - Dean

Mark Stabile – Director, School of Public Policy and Governance

Administrative support

Cindy Tam

\*On Administrative Leave from January 1, 2008

\*\*Left the Task Force at the beginning of October, 2007

\*\*\*Joined after the start of the Task Force at the suggestion of members

The Task Force met six times in the period August to December, 2007 and on April 30, 2008.

## **Building Awareness and Testing the Market**

### **PUBLIC FORUM**

A Panel Discussion called "Engaging Energy Policy Issues -The Challenges for Engineering Education and the Profession" was held on October 17, 2007.

Our aim was to draw attention to energy policy as central to global climate change response and to economic well-being for all countries, but particularly for Canada. We wanted to stimulate discussion of issues:

"We have the potential to become "an energy superpower" and yet our record on conservation and on response to the challenge of Kyoto is poor. Energy policy in Canada is a complex mix of federal, provincial and local (think building codes, district heating and public transit) policies and politics. Engineers have much to bring to these questions. There is an opportunity to reshape engineering education; research, critical inquiry and learning, to bring engineering talent more fully to bear on public policy debate and formulation. The engineering profession can, and should, play a greater role in energy policy."

The panelists included:

- David Keith, Canada Research Chair in Energy and the Environment, University of Calgary
- Marie Lemay, CEO Engineers Canada, Ottawa
- Sean Conway, School of Policy Studies, Queen's University
- Oskar Sigvaldason, Past Chair, Energy Council of Canada, Director, Advisory Board, HATCH

With discussion leaders Professors Reeve and Stabile

The panel and the reception and dinner that followed were jointly sponsored by The Faculty of Applied Science and Engineering and The School of Public Policy and Governance. About 60 people attended the panel; discussion was lively and interesting. It should be noted that Professor Keith gave a lecture on "Engineering the Climate" earlier in the day.

### **FOCUS GROUPS FOR ALUMNI/AE AND STUDENTS**

The Task Force undertook to have two focus groups to seek out views of undergraduate students, graduate students and alumni. The discussion was focused with a series of questions such as:

- How do you define public policy?
- Can engineers contribute to public policy?
- What areas of public policy are most relevant?
- Were you exposed to public policy in your course work?
- What topics of EPP do you find most interesting?
- What do you think about a Minor in EPP?
- What do you think about a graduate program?

The framework for discussion and the detailed notes from the focus groups are given in the appendices.

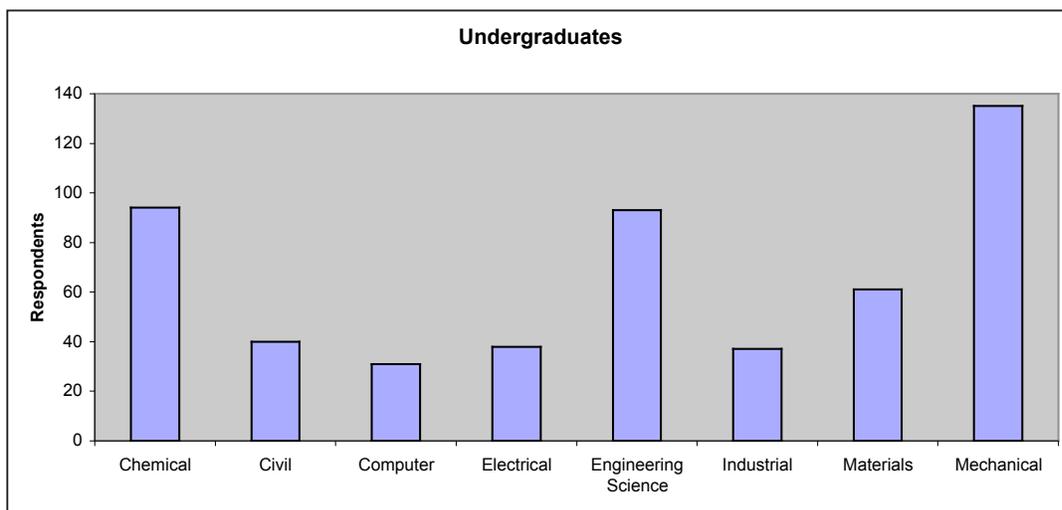
On the evening of November 28, 11 people, graduate students and recent alumni, gathered to discuss EPP. They were prompted to come by an invitation sent via Engineering Alumni News email and by an invitation to graduate students. Professor Reeve and Jennifer McKellar led the discussion and made notes. There was generally high enthusiasm for EPP - "engineers have a lot to offer". On the subject of the EPP Minor concerns were raised about accreditation and post-graduation licensing and whether it might not be better to have EPP only at the post-graduate level. On the subject of a post-graduate degree, discussion focused on course masters; the name MEPP was favoured.

On the evening of November 29, 13 undergraduate students gathered to discuss EPP. Paul Kishimoto and Mandana Fazl, undergraduate student members of the Task Force, led the discussion and made notes. There was interest in opportunities to broaden learning "MIT has 20% HSS and CS courses, UofT has only 5%"...."a strong belief that there is not enough exposure in the undergraduate program". EPP topics of greatest interest: energy, environment, healthcare, IT/telecommunications, international development. On the subject of the EPP courses - "would definitely take some of those".

### **UNDERGRADUATE STUDENT SURVEY**

The Task Force undertook to survey student opinion on a large scale. A framing document was prepared to introduce the concept and options for EPP and presented with the survey questions. The document contained the EPP Vision, Mission, and described proposals for an EPP Minor and for an MEPP. In the last week of the fall term, members of the Task Force visited numerous third year classes in the departments and Engineering Science with the aim of reaching a high proportion of third year students. EPP was introduced and the surveys distributed. Students responded anonymously using Scantron forms. (Some graduate students were also surveyed but too few to draw much from the results). The framing document, survey and detailed results are given in the appendices.

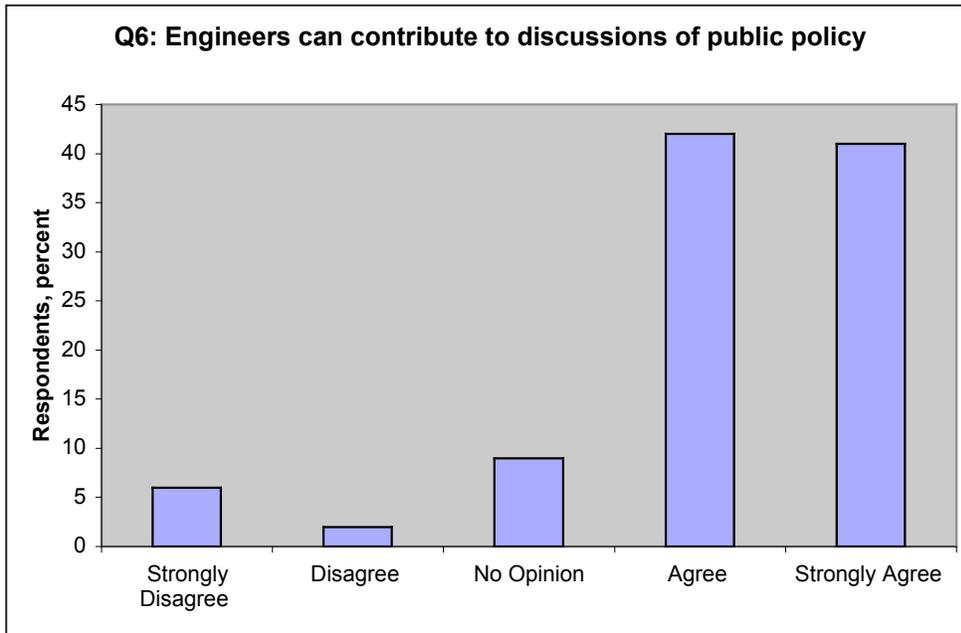
Responses were obtained from 457 undergraduates and 40 graduate students. The first section of the survey established the year and program of the respondents. The distribution of undergraduate respondents among programs is given in the figure below.



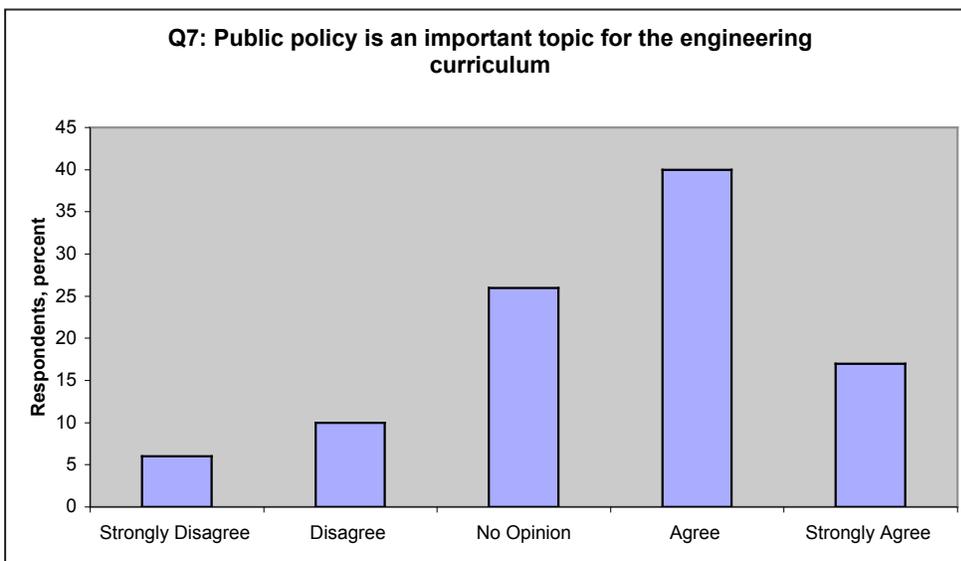
The second section of the survey asked: **Do you agree or disagree with the following statements?**

(Responses - 1. Strongly disagree 2. Disagree 3. No opinion 4. Agree 5. Strongly agree)

**Q6 Engineers can contribute to discussions of public policy** - Overall, more than 80% responded Strongly Agree or Agree with a high level of agreement in all programs.



**Q7 Public policy is an important topic for the engineering curriculum** - Overall, 55% responded Strongly Agree or Agree with a fairly high level of agreement in all programs, although agreement was higher in Civil and Chem and lower in Electrical.



**Q8 I have been exposed to public policy concepts in my engineering course work** - Overall, almost 50% responded Strongly Disagree or Disagree while 30% responded Strongly Agree or

Agree. Agreement was strongest in Civil, Chem, and EngSci and lowest in Electrical, Computer and Mechanical.

**Q9 I take an interest in public policy matters beyond my engineering education** - Overall, 45% responded Strongly Agree or Agree while 25% responded Strongly Disagree or Disagree. Most programs responded with 40% or more Strongly Agree or Agree except Electrical.

The third section of the survey asked:

**If it were offered (or had been offered) at UofT at a time appropriate in your educational progression would you enroll in one of the following?**

(Responses - 1. Absolutely not 2. Probably not 3. Maybe yes, maybe no 4. Probably yes 5. Definitely yes)

**Q10 - an undergraduate EPP Minor** - Overall, over 25% responded Definitely Yes or Probably Yes while about 45% responded Absolutely Not or Probably Not. Interest in enrolling was highest in Civil and Industrial and lowest in Electrical.

**Q11 - one undergraduate EPP Course** - Overall, 50% responded Definitely Yes or Probably Yes while about 25% responded Absolutely Not or Probably Not. Interest was fairly uniform across programs.

**Q12 - a one-year, course-based, postgraduate Masters in EPP** - Overall, 20% responded Definitely Yes or Probably Yes while over 50% responded Absolutely Not or Probably Not.

**Q13 - one postgraduate EPP Course** - Overall 25% responded Definitely Yes or Probably Yes while over 40% responded Absolutely Not or Probably Not. Interest was highest in Civil and lowest in Electrical.

### **Conclusions from the Survey**

Many undergraduate students believe that public policy is important in society, in engineering education and in their own lives. Half indicated an interest in taking a course related to EPP and 25% indicated an interest in an EPP Minor. Although it is clear that EPP is not for everyone, it is also clear that there is significant interest at the undergraduate level and an opportunity to provide meaningful courses that would be well subscribed. Interest in the MEPP was less, but as it is a specialized degree, this is to be expected. Nonetheless there was significant interest in the MEPP with fully 20% being positively inclined towards taking the degree.

## **Undergraduate Program Development**

Undergraduate Program Development was led by Professors Byer and Sone and Lecturer Romkey

### **EPP AVAILABLE TO ALL FACULTY STUDENTS**

It is proposed that new EPP courses be developed as discussed below and that they be available, course-by-course, to all engineering students. There are existing courses in Engineering and other Faculties that are relevant to EPP as listed in the tables that follow.

It is also proposed that EPP be recognized as an important, integral part of engineering design and engineering science and that steps be taken to facilitate permeation of EPP throughout the curriculum. This is analogous to the implementation of communications, and more recently of design, across the curriculum.

## **UNDERGRADUATE MINOR IN ENGINEERING AND PUBLIC POLICY**

### **Introduction**

The Undergraduate Engineering and Public Policy Minor course of study would be a collaborative effort across the Faculty, open to all engineering students interested in learning about public policy and policymaking processes and the intersection of public policy with technology. The Faculty is engaged in many research areas where there is strong interdependence of technology and public policy, including energy, urban infrastructure and transportation, health care, chemicals in the environment, information technology and telecommunications, manufacturing, and the resource industries.

### **Enrolment**

The proposed EPP Minor would be open to all students in Faculty.

### **Course requirements**

The Faculty rules for Minors as follows:

“A set of courses in a subject area that is substantially distinct from a student’s chosen engineering-degree program or option, and that meets the following requirements:”

- Six or more courses
- Two or more third or fourth year courses
- Two or more “foundational” courses, of which 1 or more must be specified
- Two or more courses which require a foundational course as a prerequisite or co-requisite
- A maximum of one program or option core course, not counting a thesis or a design-project course.”

The foundational courses would have pre- or co-requisites of Engineering Economics and Probability and/or Statistics.

Three required foundational courses:

**1. Introduction to Public Policy** (3xx Fall) – Public policy basics, e.g. gov’t processes, legislative and regulatory environment, stakeholders, communication (written and oral) for policy development. Humanities and Social Sciences (HSS) elective that could also be open to A&S students. Taught by SPPG or A&S.

**2. Quantitative Methods for Public Policy** (3xx Fall or Spring) – Modeling and statistics, optimization, decision analysis, microeconomics, macroeconomics, technology and policy evaluation methods, e.g. cost-benefit and cost-effectiveness analyses and economic, environmental and social impact and life-cycle assessments. Technical Elective. Taught by Engineering. Required as a co-requisite - Introduction to Public Policy.

**3. Case Studies in Technology and Public Policy** (3xx Spring) – Case studies in the application of public policy to a variety (4-6) of technological areas (e.g. energy, environment, information, automotive, health, etc.) in the regulated and non-regulated areas, and the influence of technology on public policy. Student projects, lectures and seminar formats. Complementary Studies (CS) elective. Taught jointly by SPPG or A&S and/or Engineering. Required as a pre-requisite - Introduction to Public Policy. Required as a co-requisite - Quantitative Methods for Public Policy.

Students can fit this in within program elective constraints of two CS and two HSS.

Three required elective courses:

Two CS/HSS electives, of which at least one must be HSS, with relevance to public policy, e.g. in political science, law, environment and society, energy policy, technology and society (APS301, APS302), etc.

Engineering core or elective course (300+) with relevance to public policy, i.e. student should be able to justify link between the technical content of course and policy issues raised in foundation courses, for example:

- CIV550-Water Resources Engineering
- MIE512-Air Pollution
- CHE467-Environmental Engineering

### **EPP – Minor Course Requirements**

<b>Foundation Courses</b>	<b>Elective Courses HSS/CS</b>	<b>Elective Course from Engineering</b>
Intro to Public Policy	One HSS Course	One Technical Elective
Quantitative Methods	One HSS or CS Course	-
Case Studies	-	-

**MANAGEMENT**

The EPP Minor and the framework for facilitating individual courses would be managed by the Division of Engineering and Public Policy.

**RESOURCES**

The teaching resources are required to teach three new courses: Engineering faculty to teach one to two new courses and A&S/SPPG faculty to teach one to two courses. An important resource for students interested in EPP is counseling on the selection of HSS/CS courses. It is often difficult for students to identify appropriate courses from lists of courses and course descriptions, and students should be encouraged to select courses based on personal interests and goals within their core discipline and the area of public policy.

## **TABLES A&B**

### **Lists for potential courses for undergraduates**

#### **TABLE A**

#### **Potential Engineering Core or Elective Courses (300+)**

Note that these have not been fully reviewed in detail in terms of their relevance to public policy. In addition, approval should depend on the mix of basic science, engineering science and engineering design.

##### *Aerospace Science and Engineering*

AER407 Space Systems Design

##### *Biomedical Engineering*

BME510 Regenerative Medicine

##### *Chemical Engineering*

CHE462 Food Engineering

CHE466 Bioprocess Engineering

CHE467 Environmental Engineering

CHE469 Fuel Cells & Electrochemical Conversion Devices

CHE565 Aqueous Process Engineering

CHE568 Nuclear Engineering

##### *Civil Engineering*

CIV470 Smart Infrastructure

CIV516 Public Transit Operations & Planning

CIV531 Transport III – Planning

CIV550 Water Resources Engineering

CIV575 Building Science

##### *Electrical and Computer Engineering*

ECE413 Energy Systems & Distributed Generation

ECE419 Distributed Systems

ECE422 Radio & Microwave Wireless systems

ECE425 Optical Communication Systems

ECE446 Sensory Communication

ECE468 Computer Security

ECE516 Intelligent Image Processing

ECE527 Passive Photonic Devices

ECE533 Advanced Power Electronics

##### *Environmental Engineering*

EDV360 Environmental Impact and Risk Assessment

*Mechanical and Industrial Engineering*

MIE453 Bioinformatics Systems

MIE460 Manufacturing and Production Systems

MIE512 Air Pollution

MIE515 Alternative Energy Systems

MIE516 Combustion & Fuels

MIE561 Health Care Systems

*Material Science and Engineering*

MSE404 Extractive Metallurgy

MSE440 Biomaterial Processing & Properties

MSE558 Nanotechnology in Alternative Energy Systems

**TABLE B**  
**Potential Arts & Science CS and HSS Electives**

Note that these courses have not been fully reviewed in terms of their relevance to engineering and public policy, which are CS and which are HSS, or for their prerequisites. The faculty will need to work with Arts and Science, in some cases, to gain engineering student access to relevant courses.

*Commerce*

MGT262H1 Individual and Group Behaviour in Organizations  
MGT363 Organization Theory and Design

*Aboriginal Studies*

ABS201Y1 Introduction to Aboriginal Studies  
JAG321H1 Aboriginal People & Environmental Issues in Canada  
ABS350Y1 Aboriginal Health Systems  
ABS353H1 Aboriginal Perspectives in Canadian Politics and Law I

*Anthropology*

Several relevant courses exist to be considered

*Economics*

ECO100Y1 Introduction to Economics  
ECO105Y1 Principles of Economics for Non-Specialists

*Environment*

JGE221Y1 Environment and Sustainable Development  
JIE307Y1 Urban Sustainability  
ENV320Y1 National and International Environmental Policy making  
ENV321Y1 Approaches to Environmental Issues  
ENV350H1 Energy & Climate Change Policy and Politics  
ENV441H1 Politics of the Environment  
ENV445H1 US Environmental Politics  
ENV446H1 Cities & Urban Environmentalism in a Global Context  
ENV447H1 The Power of Economic Ideas  
INI308H1 The City of Toronto  
INI309H1 Urban Infrastructure

*Geography*

GGR107Y1 Environment, Food and People  
GGR124Y1 Urbanization, Contemporary Cities and Urban Life  
GGR216H1 Global Cities  
JGI216H1 Urbanization & Global Change  
GGR233Y1 Environmental Management for Sustainable Development  
GGR314H1 Global Warming  
GGR320H1 Geographies of Transnationalism, Migration and Gender

GGR330H1 Atmosphere and Human Health  
GGR333H1 Energy Supply and Use  
GGR338H1 Environmental Problems in Developing Countries  
GGR341H1 Arctic Canada  
GGR342H1 The Changing Geography of Southeast Asia  
GGR343H1 The Changing Geography of China  
GGR344H1 Changing Geography of Russia and Ukraine  
JGI346H1 The Urban Planning Process  
GGR350H1 Canada in a Global Context  
GGR357H1 Geography of Housing and Housing Policy  
GGR439H1 Global Political Geography  
GGR451H1 Health and Place

*History*

HIS103Y1 Statecraft and Strategy: An Introduction to the History of International Relations  
HIS304H1 Topics in Middle East History  
JHP304Y1 Ukraine: Politics, Economy and Society  
HIS311Y Introduction to Canadian International Relations  
HIS318Y Canadian Environmental History  
HIS324Y1 Science, Technology and the Development of Modern Culture  
HIS329H1 Globalization and History

*History and Philosophy of Science and Technology*

HPS100 Introduction to History and Philosophy of Science  
HPS201H1 Origins of Western Technology  
HPS202H1 Technology in the Modern World  
HPS306H1 Technology and War  
HPS307H1 History of Energy  
HPS311H1 History of Physics  
HPS312H1 History of Chemistry  
HPS313H1 Two Hundred Years of Electricity  
HPS319H1 History of Medicine II  
HPS344H1 History of Mainframe Computing  
HIS431H1 History of Technology II

*Political Science*

POL103Y1 Canada in Comparative Perspective  
POL105Y1 Ethics and the Public Sphere  
POL108Y1 Global Networks  
POL201Y1 Politics of Development: Issues and Controversies  
POL208Y1 Introduction to International Relations  
POL214Y1 Canadian Government and Politics  
POL203Y1 U.S. Government and Politics  
POL207Y1 Politics in Europe  
POL301Y1 Government and Politics in Africa

+Any other poly sci course, if we can gain access to year 3&4 courses...

*Sociology*

SOC213Y1 Law and Society

SOC220Y1 Social Inequality in Canada

SOC244H1 Sociology of Health Care

SOC260Y1 Power and Policy in Canadian Society

SOC278Y1 Introduction to Social Policy

*Peace and Conflict Studies*

UNI260Y1 Introduction to Peace and Conflict Studies

*Women and Gender Studies*

WGS160Y1 Introduction to Women and Gender Studies

WGS367H1 The Politics of Gender and Health

*Employment Relations*

WDW244H1 Labour Relations

WDW260H1 Organizational Behaviour

## **Graduate Program Development**

Graduate Program Development was led by Professors Carter, McCabe, and Byer

It was evident from the market survey work done that there was considerable interest in post-graduate education in EPP. As a related indicator of interest in the wider area of public policy, the first round applications to the SPPG MPP program numbered in the hundreds, with many strong candidates and an extremely high yield on offers. It should be noted that as a consequence of the high level of interest the MPP program, for September 2008, will open a second section and increase intake to 40. This high level of interest not only encourages development of a graduate program in EPP, it also indicates that such a development will not undermine the newly initiated MPP program.

The Task Force discussed options for professional course-based degree programs: MEng (Public Policy); MEng/MPP and MEPP. The MEng has a reputation of being a technical degree and MEng(Public Policy) would not provide sufficient distinction for those wanting Public Policy credentials. The conclusion about a joint degree was that it would be a complicated sell to engineers. It was decided that the best option would be a Masters in Engineering and Public Policy (MEPP), a twelve-month program, with eight courses and a major paper based on work over the summer, i.e. a research project or an internship.

There was discussion about the courses required for the MEPP and the source of those courses. Engineering would have to mount some new core courses and we would look to SPPG and Arts & Science for others. Graduate students in programs other than MEPP may wish to take one or two EPP courses as electives. EPP courses could be in subjects such as cities, energy, health care, environment, and telecommunications.

It was agreed that post-graduate programming should not be extended, at this time, to research stream MASc and PhD work specializing in Public Policy. A Collaborative Program was also discussed but as these programs are aimed at multidisciplinary research studies it was not thought appropriate for EPP at this time.

### **ELECTIVE COURSES AVAILABLE TO ALL GRADUATE STUDENTS**

It is proposed that a suite of elective courses relevant to Engineering and Public Policy be developed to be available to all Faculty graduate students. It is proposed that new EPP courses be developed as discussed below. There are existing courses in Engineering and other faculties that are relevant to EPP as listed in the following table. A framework can be created to facilitate interested students in taking such courses.

### **MASTERS IN ENGINEERING AND PUBLIC POLICY (MEPP)**

#### **Introduction**

The Masters in Engineering and Public Policy (MEPP) would be a collaborative effort by departments across the Faculty open to all engineering students interested in learning about public policy and policymaking processes and the intersection of public policy with technology. The Faculty is engaged in many fields of engineering where there is strong interdependence between technology and public policy such as energy, urban infrastructure and transportation,

health care, chemicals in the environment, information technology and telecommunications, manufacturing, and the resource-extraction industries.

The majority of MEPP students would be expected to attend full-time and complete the requirement of the MEPP in twelve months. However, it is recognized that some students would find it desirable to undertake an MEPP on a part-time basis and, in limited number, such students should be accommodated.

### Enrolment

The MEPP would be open to students with an undergraduate degree in engineering from a Canadian university or to students with an undergraduate degree in engineering from foreign universities who have at least two years of Canadian work experience. The purpose of these conditions is to ensure that students have some knowledge of the Canadian policy regime. Admission based on undergraduate marks or equivalent work experience.

MEPP enrolment would initially be capped at thirty.

### Course Requirements

Eight courses and a major project

Two core courses from the School of Public Policy and Governance (SPPG):

#### **The Policy Process (PPG1001)**

The public policy challenges of the 21st century require policy-makers to see issues from multiple perspectives – not only from the perspective of the state, but also from the perspective of others whose actions will be essential to the achievement of collective goals. They also need a view that spans sectors– to understand how actions taken in one policy sector have impacts in others, and how certain big challenges, such as safety and risk assessment, and big objectives, such as improving health status or prosperity, require complementary actions to be taken in many sectors. Meeting these challenges requires skills not only of analysis and evaluation, but also of negotiation, contracting, conflict resolution and consensus building, and an appreciation of how actions taken in different policy arenas are themselves inter-connected.

This seminar course examines how policy is developed through networks. It examines how issues emerge, priorities are established, and agendas are set and managed. Factors to be considered include the potential and the limits of rational actor models in the real world of policy-making, the role of bureaucratic and political actors, organized interests and advocacy groups, and the potential for new models and options for the engagement of stakeholders and citizens at large. In addition, the course will examine issues that will be further considered in integrating seminars, such as the impact of media, the shifting and blurring of the boundary between public and private sectors; the role of science and academic research in public policy; conflict resolution, and attitudes toward risk.

Through collaborative research projects, students will develop skills in issue tracking, priority setting, agenda management, and framing and presentation of policy proposals. Required of all first year students.

Taught by SPPG

(This course is intended for students with little background in public policy. Students who have taken the Undergraduate Minor in EPP would be required to take PPG1000H Governance and Institutions instead)

#### **Putting Policy into Action: Strategic Implementation (PPG1007)**

This course provides students with contemporary analytical frameworks and techniques useful for implementing public policy and managing organizational performance to achieve policy objectives. It examines how public organizations realize their distinctive competencies within an evolving context in which the role of government is being redefined, and how these competencies are enhanced through appropriate management of people, capabilities, networks and resources. The course may include comparative analysis of public organizations in different

jurisdictions and contexts, and with different mandates. Through lectures, case studies and projects, students will build knowledge and skill in areas such as strategic analysis, performance measurement and management, organizational structure, networks and alternative delivery models, project management and organizational learning and change. This is a foundational survey course that also facilitates student participation in the Integrating Seminars and in their Internship placement. Required of all first year students.  
Taught by SPPG

Four MEPP-core courses from Engineering:

### **Topics in Engineering and Public Policy (APS1201)**

This course will provide students with an understanding of how decision-makers in governments and other institutions can effectively use technical and scientific information in developing public policy. It will also be reinforced that technical and scientific information are not all that drive the policy process and therefore you will be introduced to social, economic and political considerations that input into the public policy arena. In this course students will acquire specialized knowledge of policy research and policymaking through presentations and discussion led by public policy experts in industry, government and academia. Students will also apply technical and social analytical methods to address a current, open-ended technology and public policy issue.

Taught by Engineering.

(Students who have taken the Undergraduate Minor in EPP would be required to take a course at a higher level)

### **Quantitative Methods for Data and Policy Analysis (APS12XX)**

This course introduces the fundamental principles and quantitative methods used in policy analysis. It will consider economic-based decision making methods, such as benefit-cost analysis. The integration of uncertainty into formal methods is a fundamental component of the course. This class will emphasize the application of statistical concepts, methodologies to analyze public policy issues, and interpreting results understanding. By the end of the course, students will be able to conduct quantitative and qualitative assessments of policy decisions including modeling, visualization, and communication of results.

Taught by Engineering.

(Students who have taken the Undergraduate Minor in EPP would be required to take a course at a higher level)

### **Economics for Public Policy (APS12XX)**

Taught by A&S and SPPG jointly.

### **One EPP-related elective course**

(See table following)

### **Major Project (APS12XX)**

A report on a major project undertaken during the summer through an internship or research work. It is expected that the project could be completed by full-time activity of six weeks. Equivalent to two courses. Note: the University will provide assistance to students wishing to do an internship but placement is not guaranteed. Supervised by Engineering and collaborating departments.

### **Two technical elective courses:**

From an engineering discipline in the expected area of application.

### MEPP Course Requirements

<b>Core Courses from SPPG</b>	<b>Core Courses from Engineering</b>	<b>Technical Electives</b>	<b>Major Project</b>
Policy Process	Topics in EPP	One Technical Elective	Equivalent to two courses
Strategic Implementation	Quantitative Methods	One Technical Elective	-
-	Economics	-	-
-	EPP – Related Elective	-	-

#### **MANAGEMENT**

The MEPP and the framework for facilitating individual courses would be managed by the Division of Engineering and Public Policy.

#### **RESOURCES**

The teaching and supervisory resources required for the MEPP include: Engineering faculty to teach two new courses; Engineering faculty to supervise the major reports; and funds to compensate other units such as SPPG and A&S who teach MEPP students.

## TABLE C

### Courses Related to Engineering and Public Policy

Courses currently offered in the University and have content suitable for students with a focus on Engineering and Public Policy.

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#### Department of Civil Engineering (CIV)

CIV531H Transport III – Planning (Eric Miller)

CIV1535H Transportation and Development (Eric Miller)

CIV1310H Infrastructure Economics (Chris A. Kennedy)

CIV1399H Special Studies in Engineering: Design of Infrastructure for Sustainable Cities and Neighbourhoods (Chris A. Kennedy)

CIV1307H Evaluating the Sustainability of Engineering Activities (Heather L. MacLean)

#### Centre for the Environment (ENV)

*Course code associations:*

ENV – Centre for the Environment

JEI – Joint Environment/Mechanical and Industrial Engineering

JPV – Joint Environment/Political Science

JGE – Joint Geography/Environmental Studies

JPG – Joint Geography/Planning

JVP – Joint Environment/Philosophy

ENV1001H Environmental Decision Making (Philip Byer, Ingrid Leman Stefanovic)

ENV1002H Case Studies in Canadian Environmental Policy Making (Mark Winfield)

ENV1444H Capitalist Nature (Scott Prudham)

ENV1701H Environmental Law (Paul Muldoon)

ENV1703H Water Resource Management (Lino Grima, Jim Dooley)

ENV1704H Risk Analysis and Management (Lino Grima)

JEI1901 Technology, Society and the Environment (Bill Vanderburg)

JGE1420H Urban Waste Management

JPV1201H Politics, Bureaucracy and the Environment (Richard Stren)

JPG1416H Environmental Consequences of Land Use Change (Tenley Conway)

JVP2147H Environmental Philosophy

#### Department of Geography

*Course code associations:*

JPG – Joint Planning/Geography

PLA – Planning

JGE – Joint Geography/Centre for Environment

FOR – Forestry

JPG1512 Place, Politics and the Urban (R. Alan Walks)

JPG 1402H Environment and Development (A. Boland)

PLA 1102H Urban and Regional Dynamics (R. DiFrancesco)

PLA 1103H The Legal Basis of Planning and Policy-making (S. Makuch)

PLA 1105H Planning Decision Methods (TBA)

JPG 1501H The Political Economy of Cities (J. Hackworth)  
PLA 1503H Planning and Social Policy (S. Ruddick)  
PLA 1551H Policy Analysis (J. Farrow)  
JPG 1554H Transportation and Urban Form (P. Hess)  
PLA 1601H Environmental Planning and Policy (TBA)  
JGE 1609H Cities, Industry, and the Environment (P. Desrochers)  
FOR3003H Socioeconomic Influences on Forest Ecosystems (S. Kant)  
JGE 1420H Urban Waste Management: an International Perspective (V. Maclaren)

**Rotman School of Business**

*Course code associations:*

BTC – Biotechnology

CHL – Community Health

BTC2001 Science, Technology, Organizations and Society (Hugh Gunz, Anthony K. P. Wensley)

CHL5121H Genomics, Bioethics and Public Policy (Halla Thorsteinsdottir, Abdallah Daar)

**Department of Public Health Sciences**

*Course code associations:*

HAD – Health Administration

BME – Biomedical Engineering

CHL – Community Health

HAD5010, 5020, 5030 H Canada's Health System and Health Policy (Paul Williams)

BME1456H Technology, People and Places in the New Health Care (Peter C. Coyte, Warren Winkelman)

CHL5102H Social and Political Forces in Health (Ann Robertson)

**Department of Economics (ECO)**

ECO 2908H,S Environment & Resource Economics (Matthew Turner)

Many other courses may be appropriate

## **Administrative Framework - Division of Engineering and Public Policy**

It is recommended that:

A Division of Engineering and Public Policy be established in the Faculty of Engineering and that the Director be empowered to raise awareness about EPP and to develop, promote and execute undergraduate and graduate programming.

### **DIVISION CHARACTERISTICS AND STRUCTURE**

#### **Mission**

- 1) Graduate and undergraduate programming in EPP
- 2) Promotion of EPP internally and externally

#### **Proposed Timing**

July 1, 2008 - Interim Director starts

2008-2009 - To Faculty Council, Provost and Governing Council for approval

July 1, 2009 - Director starts

September 2010 - First students in the graduate degree program and the undergraduate minor.

#### **Leadership**

Chair of the Division (appointed by Engineering in consultation with SPPG)(Also Associate Director of the SPPG)

Graduate Steering Committee

Undergraduate Steering Committee

Advisory Council (External)

#### **Governance**

An extra-departmental Unit (EDU) type B operated by the Faculty of Engineering.

(EDU Bs do not have the right to make primary appointments of teaching staff. Cross-appointments must be approved by the Dean/Chair of the unit of the primary appointment).

#### **Resource Needs and Funding**

Chair 50% temporary administrative appointment (principal appointment in one of the departments)

Admin Assistant and Space (look for synergies with other units e.g. Division of Environmental Engineering and Energy Systems). It is expected that the Division will provide counselling to students on course selection and research/internship opportunities.

No other appointments greater than 49% to EPP Division

Main funding from Faculty of Engineering

Target funding from endowments - programs, etc.

Teaching resources (through the new budget model)

The University holds teaching and research in public policy as a strategic priority and has committed significant funding through AIF to the establishment of the SPPG. It is recognized that public policy is a subject that will appeal to many alumni and so represents an important

fundraising opportunity. It is recommended that a case for support be prepared to guide fundraising for support of EPP programs and appointments.

### **GRADUATE PROGRAMMING BY DIVISION - PROFESSIONAL MASTERS - MEPP**

Proposed design in a separate section of this report

Students enrolled by the EPP Division

### **UNDERGRADUATE PROGRAMMING BY DIVISION**

#### New Elective Courses for all Faculty Students

EPP Division promotes existing courses relevant to EPP and proposes, and may fund or sponsor, new electives.

#### Undergraduate Minor in EPP

Proposed design in a separate section of this report

Managed by EPP Division according to Faculty rules for Minors

Open to all students in Faculty

## **Recent Progress**

### **UPDATE ON SPPG**

The SPPG admitted 27 students to start the MPP program in September of 2007. All students in the program were successful in obtaining summer (2008) placements. In the second recruitment, just past, there was another very strong applicant pool; the SPPG will expand for the fall of 2008, opening a second section and aiming for a total intake of 40 students.

There are presently five engineering professors affiliated with SPPG: Professors Byer, Carter, Karney, MacLean and Reeve. Other engineering faculty would be welcome at SPPG. Those interested should introduce themselves to the Professor Mark Stabile, Director of the SPPG.

### **NEW COURSES RELEVANT TO EPP**

There have been a number of new courses developed that are relevant to EPP.

APS 1201 *Topics in Engineering and Public Policy* was proposed as a new course and, in the spring term of 2008 just past, taught by Professor MacLean with assistance from Jon Norman. The course description was given in the preceding section on Graduate Studies. There were a number of high-profile guest speakers. Twenty-one students were enrolled.

HAD 7001: *Operations Research Tools for Quantitative Health Care Decision Making* was also offered for the first time this past term. It was taught by Professor Carter with assistance from Dionne Aleman in the Department of Health Policy, Management and Evaluation, Faculty of Medicine.

This course introduces quantitative methods and their applications to health care decision making. The use of these methods has recently become an active and growing area of practice and research in contexts including wait list management, patient flow, population demand estimates, health human resource management and the coordination of resources for elective and emergency services. This course is designed to provide health care decision makers with an introduction to several useful quantitative methods that can provide insight and support for complex decisions.

APS 3XX *Energy Policy* will be offered for the first time in Spring 2009 as part of the new Engineering Science Energy Option. It will be led by Professor Greg Evans.

An introduction to public policy including the role and interaction of technology and regulation; procedures for legislation and policy setting at the municipal, provincial and federal levels; energy policy; energy planning and forecasting including demand management and conservation incentives; policy analysis, implementation, evaluation and evolution. Analyses of case studies of energy and associated environmental policies e.g. Kyoto Protocol, Clean Air Act, California Low Carbon Standard and Renewable Fuels Standard; Evaluating policy effectiveness with respect to conservation and demand management for various utilities and sectors.

### **STUDENT ACTIVITIES RELEVANT TO EPP**

*Citizen Engineer* is a policy study group that was initiated by the members of the Chemical Engineers Graduate Student Association (CEGSA). It meets to discuss policy issues, invites guest speakers, and undertakes policy research on issues of interest (e.g. Energy Policy and Municipal Solid Waste).

*Engineers for the World* is a policy issues group formed by Engineering Science students.

### **PUBLIC FORUM FOR EPP**

The University of Toronto School of Public Policy and Governance, in cooperation with the Faculty of Engineering, has been commissioned to seek out international thought-leaders on electricity policy. The focal point for this effort is an intensive, one-day workshop on June 4-5, 2008: *Current Affairs - Perspectives on Electricity Policy for Ontario*. This initiative is supported by: the Ontario Ministry of Energy, The Ontario Power Authority, The Independent Electricity System Operator, Hydro One, and The Ontario Centers of Excellence. Professors Reeve, Karney, Byer and MacLean have been involved in the organization the workshop.

### **PRESENTATION OF THE TASK FORCE REPORT**

The Task Force Report is scheduled to presentation to the Faculty of Engineering Deans, Chairs, and Directors on May 13, 2008

May 8, 2008