The University Senate of Michigan Technological University

PROPOSAL 06-07
(Voting Units: Academic)

PROPOSAL FOR AN UNDERGRADUATE CERTIFICATE IN INTERNATIONAL SUSTAINBLE DEVELOPMENT ENGINEERING

Submitted (March 3, 2006) by the
Department of Civil & Environmental Engineering
and the Sustainable Futures Institute
Revised (March 29, 2006)
Revised (April 18, 2006)
Revised (September 29, 2006)

Introduction

This proposal recommends establishing a formal *Undergraduate Certificate in International Sustainable Development Engineering*. In 1992, Maurice Strong, Secretary General of the 1992 United Nations Conference on Environment and Development, stated that "The concept of sustainable development would be impossible without the full input of engineers." Sustainable development is defined as "development that meets the needs of the present without compromising the ability of the future to meet its needs" (*Our Common Future*, 1987).

In the coming decades engineers will contribute to the eradication of poverty, hunger and disease by promoting sustainable resource utilization, appropriate technology, beneficial infrastructure, and social change. The goal of this undergraduate certificate is to enable students to become effective agents for international sustainable development. The certificate requires that students complete a 6-credit design project during their senior year that will take place in a developing community. In the past six years, the International Senior Design course has provided 105 students a capstone design engineering experience set in a developing nation (e.g., Bolivia, Dominican Republic). Social, economic, cultural, and philosophical interconnections to engineering will serve as required core concepts of this program. Our mission is to promote international sustainable development by nurturing and educating engineering students to value and implement this vision of a better world.

Rationale

Society, the environment, and economic/industrial development - the "triple bottom line" - are inherently interconnected, both domestically and globally. Without fundamental changes in current engineering practice, the future is in jeopardy. Healthy societies require a sustainable future, in which human and industrial systems support an enhanced well-being of all living systems on the planet by recognizing and seeking to understand their interconnectivity. Change must begin in the place where most change is born – within our nation's universities.

While engineering students take general education courses in world cultures, history, and geography, a meaningful sustainable development education would include a significant international engineering experience. Of the nearly 175,000 American students that studied abroad in 2003, only 3% were engineering students, which is only 1% of the Americans students enrolled in engineering programs (American Association of Engineering Societies) Over the last twenty years the number and proportion of engineering students studying abroad has increased, but very slowly. For decades, international programs have not offered options designed for engineering students, but universities are beginning to see benefits in study-

abroad for engineers, and some engineering students are also branching into humanities studies such as languages, social science, cultural studies, and public policy.

Upon graduation students will have gained skills for working in diverse interdisciplinary teams, consensus building, appreciation for how engineering can assist the global community, critical thinking, oral and written communication as well as community service. The National Academy of Engineering called for such engineering education in their recent report, "The Engineer of 2020." The pedagogy in the *International Sustainable Development Engineering* certificate will be based on problem-based learning and will integrate service learning and an international field experience into the classroom. Students may continue their education in one of Michigan Tech Master's International Programs or through the Graduate Certificate in Sustainability.

We have high expectations. We intend that graduates from this certificate program will become influential leaders of society. We are training students in ways of thinking that are desperately needed to solve our current and future world problems. They will be uniquely suited to meet the challenges of business and government as well as to pursue research, public service and academia through higher education. With the unique required core experiences in this program as a foundation, we feel confident that graduates will be making a difference at all levels of society—from their personal lives to international affairs. Through elective courses, students will be able to accumulate additional technical training in their sustainability studies.

I. Title of Certificate

International Sustainable Development Engineering

II. Catalog Description

The goal of sustainable engineering is to create ecologically and socially appropriate solutions within the capacity of nature without compromising future generations. This certificate provides students breadth in the areas of ethics, resource equity, interactions between technology and society, engineering connections with the environment, engineering materials and water/sanitation, all at a global perspective. An international senior design experience that requires students to work on an engineering problem set in the developing world is required to complete the certificate.

III. List of Courses

Page 4 contains a figure that shows how courses are taken over the four years.

Required courses (16 credits)

- ENG3530 Undergraduate Colloquium in Sustainability (1 credit)
- BA4790 Ecology and Organizations (preferred) **or** BA4600 Management of Technology and Innovation **or** BA4780 International Business Communication (3 credits)
- CE3503 Introduction to Environmental Engineering (preferred) **or** CE3501 Fundamentals of Environmental Engineering (3 credits)
- HU2702 Ethical Theory and Moral Problems **or** HU4625 Risk Communication (3 credits)
- CE4905/CE4990 International Senior Design (6 credits)

French/Spanish Language or Culture Elective (Choose **at least one** 3-credit course from the following list)

- HU 2271 - Level I-A French Language and Culture
- HU 2272 - Level I-B French Language and Culture
- HU 2273 - Transitional Level I French Language and Culture
- HU 3262 - Topics in Francophone Cultures
- HU 3271 - Level II-A French Language and Culture
- HU 3272 - Level II-B French Language and Culture
- HU 3273 - Level II French Composition and Conversation

- HU 2291 - Level I-A Spanish Language and Culture
- HU 2292 - Level I-B Spanish Language and Culture
- HU 2293 - Transitional Level I Spanish Language and Culture
- HU 3264 - Topics in Spanish-Speaking Cultures
- HU 3291 - Level II Spanish Language and Culture
- HU 3292 - Level II-B Spanish Language and Culture
- HU 3293 - Level II Spanish for Special Purposes

Technology and Society Elective (Choose **at least one** 3-credit course from the following list)

- SS2800 Science, Technology, & Society
- SS3580 Technology and Western Civilization
- SS3620 International Environmental Technology Policy
- SS3800 Energy Technology and Policy
- SS3810 Culture, Science & Technology
- SS3890 Industry and the World Economy

Total Requirements: 22 credits

IV. Pre-Requisites

BA4600 (senior standing)
BA4780 (UN1001 and (UN1002 or UN1003) and UN2001 and UN2002
BA4790 (UN2002)
CE3501 (MA 2150 or MA 2160) and (CH 1100 or CH 1110)
CE3503 (MA 2150 or MA 2160) and (CH 1100 or CH 1110)
HU2272 (HU2271)
HU3262 (UN1002 or UN1003)
HU3271 (HU2272 or HU2273)
HU3272 (HU3271)
HU3273 (HU2272 or HU2273)
HU2292 (HU2291)
HU3264 (UN1002 or UN1003)
HU3291 (HU2292 or HU2293)
HU3292 (HU3291)
HU3293 (HU2293 or HU3291 or HU3292)
HU4625 (UN2002)
SS3580, SS3620, SS3800, SS3810, SS3890 (UN2002)

V. New Courses

None

VI. Estimated Costs

There is no additional cost in introducing an Undergraduate Certificate in International Sustainable Development Engineering. All courses (except ENG3530) identified above are either required or elective courses available to all students who satisfy course prerequisites. All of the courses are offered on a regular basis except ENG3530 which was added to the catalog for the 2005-2006 year. The Technology and Society Elective and the French/Spanish Language/Culture Elective allow a student a wide variety of selection.

VII. Planned Implementation Date

Spring 2007

Introduced in Senate: 25 October 2006
Adopted by Senate: 8 November 2006