The Challenges of Educating Engineers about Climate Change

Helene Hilger
Associate Professor Ermerita
Civil and Environmental Engineering
Founding Director, the UNC Charlotte IDEAS Center
Infrastructure, Design, Environment & Sustainability

UNC CHARLOTTE

Rates of Change

- Problem urgency vs. solution execution
- New innovations →  → Education?
- How long does it take for new courses to be considered? Where do they "come from" ?
- How long does it take for new courses to be offered once conceived? Where do they "go" after conception?

UNC CHARLOTTE

Drivers of Change

- Where does new course creation rank in the typical academic faculty reward system?
- Are the right incentives in place to stimulate the rapid creation of pedagogically sound courses and programs needed to be impactful in the near future?
- Substitute PROGRAM for course

UNC CHARLOTTE

The Educator's Education

Today's educators must be:

- Non-resistant
- Facile life-long le
- Brave?
- Humble
- Resourceful
- Generous

Just be careful not to title it "Energy Systems and Climate Change"

UNC CHARLOTTE

What do we Have?

Foot-in-the-door from Sustainability Education

- **Center for Sustainable Engineering** – a partnership of five universities that offers workshops and web resources for engineering educators (NSF & EPA)

  (http://www.csengin.org/csengine/index.html?skuvar=135)

- Some excellent resources, pioneers, and drivers --

- **Climate Change, Engineered Systems, and Society** -- Frameworks and a network of change agents (NSF)

  (http://www.onlineethics.org/Topics/Enviro/Climate.aspx)

UNC CHARLOTTE

What do we Have?

- Course level innovations:
  - Dedicated courses
  - Course modules
  - Course supplements
  - Homework and project topical content
  - Extra-curricular opportunities
- Programmatic innovations:
  - Minors
  - Certificate programs

UNC CHARLOTTE

Example:

Johns Hopkins – offers a series of professional non-thesis degrees:

- Master of Environmental Engineering
- MS in Environmental Engineering and Science (online)
- MS in Environmental Planning and Management (online)

Advanced Certificate for Post-Master's Study in Climate Change, Energy, and Environmental Sustainability (online) professional, non-thesis

Course offered: CC & Global Env'l Sustainability

Multidisciplinary; critical assessment of science, impacts, mitigation, adaptation, & policy relevant to climate change GES.

<http://ep.jhu.edu/graduate-degree-programs/environmental-engineering-science-and-management>

UNC CHARLOTTE

Example:

Stanford University -- Civil and Environmental Engineering undergraduate subprogram in Atmosphere/Energy (2004) with nuanced reference to CC http://cee.stanford.edu/about/atmoEnergy.html

University of Michigan -- Atmospheric, Oceanic and Space Sciences Engineering has an undergraduate concentration in Climate Impact Engineering. The study of Earth's changing climate. Core Earth system science courses and courses on environmental impacts on Earth systems.

http://aoss.engin.umich.edu/pages/undergraduate/climate-impact-engineering

University of Montana – Offers an interdisciplinary minor in Climate Change Studies that is open to all majors. The program educates students in three areas of the climate change issue: science, society, and solutions. Joint program with Colleges of Forestry, Arts and Sciences, and Technology.

http://www.umt.edu/catalog/cat/ccs.html

UNC CHARLOTTE

Professional Organization Leadership

- **ASCE: Certification in sustainability-themed courses. Fundamentals of Sustainable Engineering. Sustainable Project Management soon available and 11 more courses planned.**
  www.asce.org/sustainability
- **ASCE accepting (and encouraging) review comments on the draft 2014 National Climate Assessment document.** http://ncadac.globalchange.gov/
- **The Envision ISI infrastructure rating system is supported by ISI's educational courses for evaluators and verifiers** www.sustainableinfrastructure.org

UNC CHARLOTTE

Professional Organization Leadership

ASME meeting and manuscript:

Juan Lucena et al. 2011:

Integration of CC in the Analysis and Design of Engineered Systems: Barriers and Opportunities for Engineering Education

Proceedings of the ASME 2011 International Mechanical Engineering Congress & Exposition Nov 11-17, 2011, Denver, CO.

UNC CHARLOTTE

What do we Need?

- Early Adopter Recognition, Certification
  - Tenure-worthy; Program acknowledgement
  - Permission, encouragement to talk about climate change science
- Unity among drivers:
  - (1) Professional organizations
  - (2) Professional Licensing
  - (3) Accreditation
- Administrator education

UNC CHARLOTTE

What do we Need?

- Instructor resource support
- Link grant funding to multi-institutional transformations within a state? e.g. UNC-wide program development
- Have a "Tomorrow's Professor" type site for Climate Change for educators?
- Opportunities for students to see companies and employers looking for this constellation of expertise

UNC CHARLOTTE

Helene Hilger
UNC Charlotte IDEAS Center
Infrastructure, Design, Environment and Sustainability
hhilger@uncc.edu

UNC CHARLOTTE