Cornell University

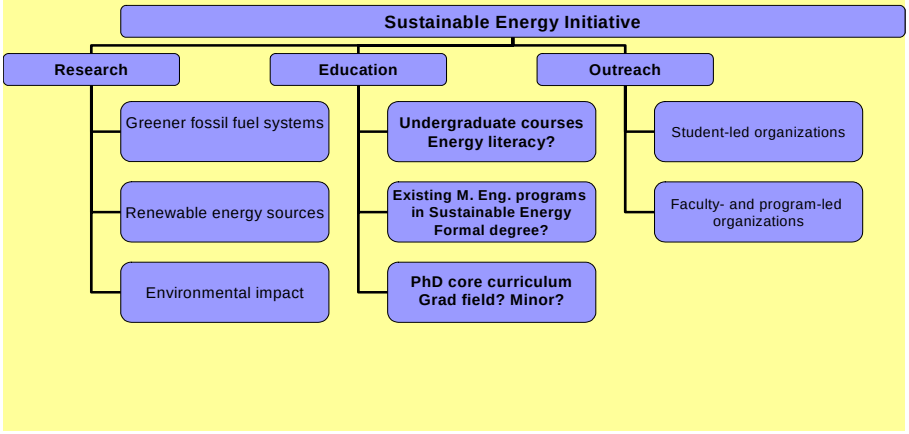
Sustainable Energy Initiative
Energy Curriculum
College of Engineering
Cornell University
ECC Meeting
Spring 2008

Sustainable Energy Initiative

Our Philosophy:

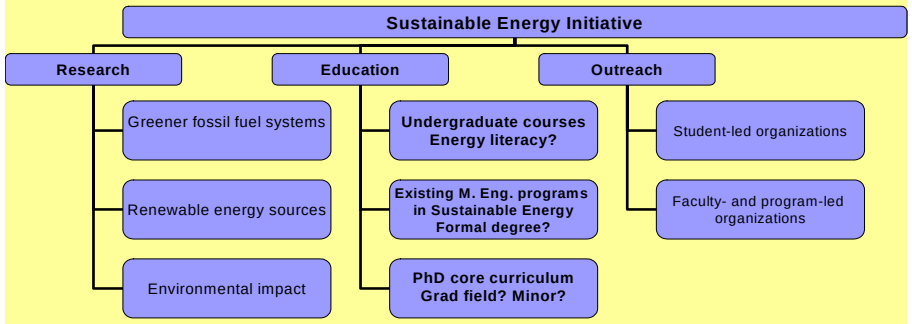
- Fossil fuels will continue to dominate for the next 50 years at least
- Gradual transition to renewable energy sources
- Cornell's College of Engineering Energy Initiative will study both existing and new technologies.
- Our goals:
  - Make current technologies cleaner and investigate carbon capture strategies
  - Develop sustainable renewable sources

Sustainable Energy Initiative: Program Organization



Over 40 faculty, over 100 PhD students, several hundred undergraduates. Many Engineering departments represented.

Relationship of Engineering College's Sustainable Energy Initiative and the Cornell Center for a Sustainable Future



CCSF: Broad scope covering energy, environment, economics, politics, agriculture, sociological and business issues. Will touch most of the University

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Sustainable Energy Initiative: Hallmarks of the Cornell Education

- *Global, systems approach* focused on producing benign energy solutions
- *Interdisciplinary teamwork*, Cornell's *forte.*
  Bring together those who create energy systems with those who measure and predict its environmental impact.
  - Non-traditional, de-'balkanizing' view of academic training
  - Cuts across traditional graduate and undergraduate boundaries
- *Leverage Cornell strengths*
  - Engineering and Physical Sciences
  - Ag. School and Applied Econ. & Management
  - Environmental Studies, Water/Climate Systems
  - Modeling and simulation
  - Flexibility of the field system
    - Students form a thesis committee from faculty mentors in virtually any department relevant to their topic
    - Fosters innovative combinations of problem-solving approaches

Sustainable Energy: Intended Impacts of the Educational Program

- Highlight international interactions
  See US needs as part of a global solution
- Overall goal
  Educate both specialists in Sustainable Energy Systems and well informed generalists

Sustainable Energy: Undergraduate Education

- Key goal: Develop and disseminate energy literacy across the college, across the university, beyond the university
- Progress:
  - Collated a rich list of related courses
  - Created a web site: http://www.geo.cornell.edu/eas/energy/
- Questions for the Council:
  - What are the key elements of energy literacy?
  - How best to teach this?
  - Should we move to a coherent "curriculum"?
  - If so, what are core concepts? [Core course(s) and electives]
  - Offer a minor in Sustainable Energy?

Sustainable Energy: M.Eng. Education

- Chemical Engineering M.Eng. concentration in Energy Economics and Engineering
  - New in 2006-7 with growing enrollment
  - Core courses provide a systems view
    - Energy Economics
    - Energy Engineering
  - Required ancillary courses in existing and renewable energy sources, business, social/environmental impact
- New joint Engr/JGSM program combining an M. Eng. in Sustainable Energy with an MBA: MESE program
- Question to the Council
  - **How best to market existing M. Eng. degree programs in Sustainable Energy Systems?**

Sustainable Energy: Graduate Education

- Plan to develop a core set of courses to provide a novel systems view of sustainable energy systems
  - Management of Earth-Energy Systems
    - **Interplay of technology, environment, economics, politics, sociology– systems view [engineering shown as a player within the larger context of other issues]**
  - Energy Systems Engineering
    - **Systems approach for processes and products, consideration of birth-to-death [engineering-centric but shown in the context of benign earth interactions]**
  - Systems Modeling for Sustainable Living
    - **Hands-on project to apply what was learned above**
- Questions to the Council
  - **No PhD degree in Sustainable Energy (at least for now) because there would be insufficient depth?**
  - **Create a graduate field of Sustainable Energy so that we can offer a graduate minor?**

Summary of Key Questions for your input

- How to define and spread energy literacy, starting at Cornell, but intended to have an impact well beyond our walls.
- How to expand and market our M.Eng. and M.Eng./MBA offerings in Sustainable Energy.
- In reformulating PhD graduate training in Sustainable Energy, have we picked appropriate core courses and how do you view our suggestion that advising thesis topics must bring together energy and earth concerns from the outset?

Final Thoughts

- From your business experience, what are the 'holes' in understanding energy systems that we should address?
- How do we balance providing a broad education in energy-earth systems against deep technical knowledge within existing fields?

Cornell: Committed to sustainability

• We generate 16% of our own power
• Campus-wide energy use *steady* over the past decade
• 1,100-kilowatt hydroelectric plant in Fall Creek (2%) and a steam/electricity co-generation plant extract energy from steam (14%) (over twice that of conventional power plants)
• A new heat and power plant will be completed in 2010. It will reduce our coal usage by nearly 50%.
• Cornell reduced carbon dioxide emissions through energy efficiency by 50,000 tons per year between 1980 and 2000
• Lake source cooling reduced electricity use for air conditioning by 86% (total electricity use by 10%).