

Energy and Sustainability Focus Advice

What these pages cover:

All of Cornell's MEng programs will help you improve your technical skills in a range of disciplinary areas to equip you for a technical career as an engineer or engineering management. However you will also have the freedom to add some specialization or focus to your program. This page and its associated linked pages are intended to help students in any of Cornell's MEng programs consider adding some focus on Energy and Sustainability to their programs.

Introduction:

It has become clear that probably the most pressing needs of our world are those related to solving the problem of sustainability, particularly in areas related to energy sources, storage, and utilization. Due to population growth and the rise of expectations and standards of living across the globe, energy requirements and the related sustainability issues are perhaps the major challenges facing engineering. Engineers with the relevant interests and background will find many outstanding career opportunities in the energy and sustainability areas.

Cornell's MEng programs are solidly based in disciplinary skills. However Cornell's breadth, depth, and long standing commitment to energy and the environment make it possible for Cornell MEng students in any discipline to add some focus in energy and sustainability to their programs.

A very wide variety of relevant courses and MEng projects are available at Cornell along with a systems view of approaching such very complex problems. These web pages collect information and advice for people interested in planning some focus on these energy and sustainability problems in their MEng programs.

Designing a Focus for Your MEng Program

With details varying by field you will find you have quite a bit of flexibility to design a focus in energy and sustainability into your Cornell MEng program. The Cornell MEng program requires 30 credits of technical courses including a minimum of 3 credits of individual design experience (depending on field). At least 21 credit must be in the field and related areas (as defined by the field). Again, varying by field, there are generally at least two courses that can be taken outside the field and related area. Also, many energy and sustainability courses are considered as related areas to most fields.

Several fields have specific “concentrations” defined (e.g., Chemical Engineering and Earth & Atmospheric Sciences) and formal minors (e.g., Mechanical and Aerospace Engineering). The present web pages are intended to help you decide how to design your program, including whether one of the existing concentrations or minors would suit your interests.

Initial Background for Your Interests

Undergraduate Preparation:

There are several fundamental areas that are necessary background to energy and sustainability that you are likely to have studied as part of your undergraduate degree program. They include thermodynamics, fluid dynamics, heat and mass transfer, earth & atmospheric sciences, and systems and modeling. Depending on your previous studies you may have enough background in these for graduate level study supporting your present interests. If you do not have sufficient background in some area then you may have to add take some additional course work in that area.

Basic Background:

Depending on your field and your field and your interests you will probably need to increase your skills in graduate-level courses in some of the basic disciplines underlying energy and sustainability such as thermodynamics, fluid dynamics, heat and mass transfer, combustion, water and soil chemistry, earth & atmospheric sciences, systems engineering & modeling, and business.

For example you would need fairly different advanced course work to work in say biofuels, versus wind energy, versus oilfield exploration.

Designing a Focus for Your MEng Program

Survey and Overview Courses:

Cornell Engineering has several survey and overview courses intended to give students breadth in where the applications in energy and sustainability are going. It is recommended that some of these be included in a focus on these areas. Five of them are:

- CHEME 6640 Energy Economics
- CHEME 6650 Energy Engineering
- ECE 5880 Energy Seminar II
- ECE 5870 Energy Seminar I
- MAE 5010 - Future Energy Systems

Planning the Emphases of Your Focus:

The areas of energy and sustainability are very broad; a person need to narrow down his interests to some subset of the possibilities. A list of subtopics follows that can be considered in planning what areas you would like to learn more about:

Wind Energy	Transportation Energy Use and Efficiency
Wave and Tidal	Home and Industrial Heating, Cooling, and Efficiency
Photovoltaic	Energy and Fuels Distribution and Storage Systems
Solar Thermal	Environmental and Sustainability Effects
Nuclear	Pollution (Air, Water, Soil,)
Biofuels	Global Warming
Geothermal	Resource Depletion (Minerals, Soil, Water)
Carbon Dioxide Capture	
Resource Geology	
Engines	
Fuel Cells	
Batteries	

Systems vs. Specialization

In addition to deciding on the specific technologies/applications of interest to you, one should consider where your interests lie between depth in specialized technical areas and an overall or systems view of design, modeling, and integration of complex energy systems. If you are interested in technical depth then you should seek relevant advanced courses in your home discipline while if you are interested in an overall systems view some courses should be in systems engineering, management and business areas.

Developing Your Focus Program

There a variety of resources available to help you decide among the many possibilities open to you. Some of them are:

The MEng Energy and Sustainability Course List (**add link**). This list includes a large number of senior and graduate level courses relevant to energy and sustainability. (An even more comprehensive list exists at (ad link) but it also includes lower level and more specialized courses that are less likely to be of interest to MEng students.

Several Fields offer web pages which may be of interest. For example see:

Chemical Engineering - Energy Economics and Engineering Concentration -
http://www.cheme.cornell.edu/cheme/graduate/energymeng.cfm#CP_JUMP_2334

Civil and Environmental Engineering <http://www.cee.cornell.edu/research/research-concentrations/eng-systems-and-management/index.cfm>

Earth & Atmospheric Sciences
http://www.geo.cornell.edu/eas/energy/research_front_page/climate_change.html

Mechanical and Aerospace Engineering
<http://www.mae.cornell.edu/index.cfm/page/undergrad/apc/concentrations.htm>

Systems Engineering <http://www.systemseng.cornell.edu/program.html>

May add more here

Steps in Developing Your Specific Focus

1. Think about your particular interests and career aspirations and plan what focus and emphases you would like
2. Find what courses are available in those areas (E.g., see the MEng Energy and Sustainability Course List (**add link**)). Other links which cover courses at all levels can be found at:
http://www.geo.cornell.edu/eas/energy/classes/courses_by_department.html and
<http://www.geo.cornell.edu/eas/energy/classes/>
3. After collecting some of your ideas about focus and classes you may want to take discuss your interests with faculty. Relevant faculty would be your field-assigned MEng advisor and also faculty who teach the energy and sustainability courses that you are considering.
4. Find a relevant project. This will involve looking into any project lists your field may have as well as talking to faculty who teach the energy and sustainability courses that you are considering.

Relation of Courses to General MEng Course Requirements

1. Some of your focus courses will probably be in your MEng major field or will be “cross-listed” in your field and thus are likely to apply to your field’s MEng requirements.
2. Some of your courses may have to be among the number of electives allowed by your field.
3. Remember that the college’s MEng requirements allow the use of 400-level courses if they are in areas that you have not studied previously. Such courses may have to be approved individually by your field or your MEng advisor.