Starting in the 2004-2005 academic year, the Department of Civil and Environmental Engineering at Stanford University began offering degree options in a new program called Atmosphere/Energy. This innovative program will bridge the gap between these two disciplines. The degree options include:

- B.S. with an Individually Designed Major in Engineering: Atmosphere/Energy
- B.S. in Environmental Engineering with a transcript designation of Atmosphere/Energy
- M.S. in Civil & Environmental Engineering with a transcript designation of Atmosphere/Energy
- Ph.D. in Civil & Environmental Engineering with a transcript designation of Atmosphere/Energy

Energy and Atmosphere are linked in two primary ways. First, fossil-fuel energy contributes directly to air pollution and climate change. Second, atmospheric winds and solar radiation are major sources of renewable energy. Because atmospheric problems can be mitigated best by increasing the efficiency with which energy is used, optimizing the use of natural energy resources, and understanding the effects of energy technologies on the atmosphere, the two areas, Energy and Atmosphere, are naturally coupled together.
Figure 1. Structure of programs from the viewpoint of “Engineering for Sustainability” in the Department of Civil and Environmental Engineering at Stanford University.

Figure 1 shows the organization of the Department of Civil and Environmental Engineering in terms of the concept of “Engineering for Sustainability” and how the Atmosphere/Energy program fits into that concept and how it links to programs outside of the department. The department, itself, consists of three main program areas, some of which consist of subprograms, as listed below.

**The Built Environment**
- Construction Engineering and Management
- Design/Construction Integration
- Structural Engineering and Geomechanics
- Geo
- Structural Engineering

**Water Systems**
- Environmental and Water Studies
- Environmental Engineering and Science
- Environmental Fluid Mechanics and Hydrology

**Atmosphere/Energy**
Bachelors of Science Degree Requirements

Starting in the 2007-2008 academic year, undergraduates pay pursue a pre-approved Individually-Designed Major (IDM). The degree conferred is

“Bachelor of Science with an Individually Designed Major in Engineering: Atmosphere/ Energy”

The Atmosphere/Energy (A/E) undergraduate major provides a curriculum that prepares undergraduates for a masters degree program of the same name as well as careers in industry, research, consulting, government, non-governmental organizations, and academia. The A/E degree is NOT an ABET-accredited degree. ABET accreditation is advantageous for entering certain specific design-oriented engineering fields, but our experience has been that the major job opportunities for students with an A/E degree do not require an accredited undergraduate degree.

A/E students take classes in both Atmosphere and Energy as well as classes that integrate the two fields. The curriculum is flexible in that students interested more in Energy or more in Atmosphere can take most of their Engineering Depth classes in their area of choice. Similarly, students desiring to focus more on technology or more on science can select the appropriate Depth classes to suit their interests.

Students may also take courses in A/E to fulfill the requirements for a minor in the Department of Civil and Environmental Engineering. Requirements for the major are listed below for convenience and are provided in the Handbook for Undergraduate Engineering Programs.

Requirements for the A/E Major

A total of 101 units are required, distributed as follows:

Mathematics (23 units minimum, including at least one class from each group):
- Group A:
  - Math 53 Ordinary Differential Equations with Linear Algebra (5 u)
  - CME 102 Ordinary Differential Equations for Engineers (5 u)
Group B:
- CME 106 Introduction to Probability and Statistics for Engineers (4 u)
- STATS 60 Introduction to Statistical Methods: Pre-calculus (5 u)
- STATS 110 Statistical Methods in Eng. and the Physical Sciences (4-5 u)
- GES 160 Statistical Methods for Earth and Env. Sciences (3-4 u)

Science (22 units minimum, including all of the following):
- Physics 41 Mechanics (4 u)
- Physics 43 Electricity/Magnetism (4 u, Sp) or Physics 45 Light/Heat (4 u)
- Chem 31B Chemical Principles II (or Chem 31X) (4 u)
- CEE 070 Environmental Science and Technology (3 u)

Engineering Fundamentals (three courses minimum, including the following):
- ENGR 30 Engineering Thermodynamics (3 u)

and at least one of the following two courses:
- ENGR 60 Engineering Economy (3 u)
- ENGR 70A or 70X Programming Methodology (3-5 u)

Technology in Society
- STS 110 Ethics and Public Policy (also fulfills Writing in Major req.) (5 u)

Engineering Depth (42 units minimum):
Required:
- CEE 064 Air Pollution: From Urban Smog to Global Change (3 u)
- CEE 173A Energy Resources (5 u)

At least 34 units from the following, with at least 4 courses from each group:
Group A: Atmosphere
- CEE 063 Weather and Storms (3 u)
- CEE 101B Mechanics of Fluids (or ME 70) (3-4 u)
- CEE 164 Introduction to Physical Oceanography (4 u)
- CEE 161S The Atmosphere and Global Environmental Change (3)
- CEE 161T Aerosols, Clouds, and Climate Change (3 u)
- CEE 171 Environmental Planning Methods (3 u)
- CEE 172 Air Quality Management (3 u)
CEE 172A Indoor Air Quality (Alt. years) (2-3 u)
CEE 178 Introduction to Human Exposure Analysis (3 u)
AA 100 Introduction to Aeronautics and Astronautics (3 u)
BioSci 147 Controlling Climate Change/21st Century (Alt. years) (3 u)
EarthSys 111 Biology and Global Change (3 u)
GES 90 Introduction to Geochemistry (3-4 u)

Group B: Energy
CEE 115 Goals and Methods for the Sustainable Building Projects (3-4 u)
CEE 136 Green Architecture (4 u)
CEE 156 Building Systems (4 u)
CEE 176A Energy Efficient Buildings (3-4 u)
CEE 176B Electric Power: Renewables and Efficiency (3-4 u)
CEE 176F Energy Systems Field Trips (Alt. years) (4 u)
EarthSys101 Energy and the Environment (3 u)
EarthSys 102 Renewable Energy Sources/Greener Energy Proc (3 u)
EarthSys 45N Powering the Rim: Energy Issues for the Pacific (3 u)
GES 145 Energy Flow and Policy: The Pacific Rim (3 u)
ERE 104 Technology in the Greenhouse (3 u)
Master of Science Degree Requirements

The Department of Civil and Environmental Engineering now offers an M.S. degree in Civil and Environmental Engineering with a special field designation on the transcript of Atmosphere/Energy.

Students admitted to graduate study in the department can satisfy the requirements for the M.S. degree in Civil and Environmental Engineering by completing a minimum of three quarters of full tuition registration and a minimum of 45 u of study beyond the B.S. degree. All 45 u must be taken at Stanford. A minimum 2.75 grade point average (GPA) is required for candidates to be recommended for the M.S. degree. No thesis is required.

The M.S. degree in Civil and Environmental Engineering requires at least 30 u at the graduate level (courses numbered 200 or above) and at least 24 u from the School of Engineering). Courses numbered below 100 may not be used to fulfill the 45-unit degree requirement.

Additional requirements for the MS degree in Civil and Environmental Engineering with an emphasis on Atmosphere/Energy include the completion of

- A minimum of 30 units in combined atmosphere- and energy-related courses
- Of these 30 units, a minimum of 4 energy-core courses taken for letter grades.
- Of these 30 units, a minimum of 4 atmosphere-core courses taken for letter grades.
- The remainder of the 30 units may be from either atmosphere- or energy-related courses
- 15 additional units to fulfill the 45-unit M.S. degree requirement

Students may take up to 6 out of the 45 units required for the M.S. degree on a pass/no credit basis (instead of receiving a letter grade), but these pass/no credit courses cannot count towards the minimum requirement of 4 atmosphere-related plus 4 energy-related courses.

These requirements allow students the flexibility to select courses closest to their interest while maintaining the goal of giving students a background in both energy and atmosphere.

Courses available
(some are offered in alternate years)

Energy Core (select four of the following)

- CEE 176A Energy Efficient Buildings (3-4 u, Win)
- CEE 176B Electric Power: Renewables and Efficiency (3-4 u, Spr)
CEE 207A Energy Resources (4-5 u, Aug)
CEE 215. Goals and Methods of Sustainable Building Projects (3u, Win)
CEE 256 Building Systems (4 u, Spr)
EE 293A Fundamentals of Energy Processes (3 u, Aut)
EE 293B Fundamentals of Energy Processes (3 u, Win)
EarthSys 245 Energy Flow Policy: The Pacific Rim (3u, not given 0-7-08)
Energy 104 Technology in the Greenhouse (3 u, Spr)
MatSci 302 Solar Cells (3u, Spr)
ME 260 Fuel Cell Science Technology (3 u, Spr)
MS&E 243 Energy and Environmental Policy Analysis (3 u, Spr)

Energy Electives (may be taken beyond the four required energy courses)
CEE 236 Green Architecture (4 u, Win)
CEE 276F Energy Systems Field Trips (1-2 u, Win)
CEE 301 Energy Seminar (1 u, Aut, Win, Spr)
EarthSys101 Energy and the Environment (3 u, Win)
EarthSys102 Renewable Energy Sources and Greener Energy Proc (3 u, Spr)
Energy 269 Geothermal Reservoir Engineering (3u, not given 2007-08)
MatSci 316 Nanoscale Science, Engineering, and Technology (3u, Win)
MS&E 248 Economics of Natural Resources (3-4 u Aut)
ME 222 Design for Sustainability (2-3 u, Spr)
ME 370A Energy Systems I: Thermodynamics (3 u, Aut)
ME 370B Energy Systems II: Modeling and Advanced Concepts (4 u, Win)

Atmosphere Core (select four of the following)
CEE 172 Air Quality Management (3 u, Win)
CEE 261S Atmosphere and Global Environmental Change (3-4 u, Aut)
CEE 261T Aerosols, clouds, and climate change (3u, Win.)
CEE 261U Atmospheric Heterogeneous Processes (3u, Spr.)
CEE 263A Air Pollution Modeling (3-4 u, Spr)
CEE 263B Numerical Weather Prediction (3-4 u, Spr, not given 07-08)
CEE 263C Weather and Storms (3 u, Aut)
CEE 263D Air Pollution: Urban Smog to Global Change (3 u, Win)
CEE 278A Air Pollution Physics and Chemistry (3 u, Aut)
CEE 278B Atmospheric Aerosols (3 u, Spr, not given 07-08)
CEE 278C Indoor Air Quality (2-3 u, Spr.)
AA 210A Fundamentals of Compressible Flow (3u, Aut)
BioSci 247 Controlling Climate Change in the 21st Century (3u, Win, not given 07-08)
BioSci 264 Biosphere-Atmosphere Interactions (4u, Win)
GES 223 Planetary Systems: Atmospheres, Surfaces, & Interiors (3u, Win, not given 07-08)
MS&E 294 Climate Policy Analysis (3 u, Win)

Atmosphere Electives (may be taken beyond the four required atmosphere courses)
AA 214A Numerical Methods in Fluid Mechanics (3u, Aut)
CEE 171 Environmental Planning Methods (3 u, Win)
CEE 276 Introduction to Human Exposure Analysis (3 u, Spr)
EarthSys 111 Biology and Global Change (3 u, Win)
EarthSys 112 Environmental Economics and Policy (5 u, Win)
GES 142 Remote Sensing of Land Use and Land Cover (4 u, not given 07-08)
GES 144 Fundamentals of Geographic Information Science (4 u, Spr)
Law 605 International Environmental Law: Climate Change (3.75 u, Aut)
ME 352A Radiative Heat Transfer (3u, Aut, not given 07-08)
ME 361 Turbulence (3u, Spr)
ME 362A Physical Gas Dynamics (3u, Aut)

Ph.D. Program
The Ph.D. degree is offered under the general regulations of the University as set forth in the “Graduate Degrees” section of the Stanford University Bulletin. The degree requires a minimum of 135 u of graduate study, at least two years of which must be at Stanford with a minimum GPA of 3.0 in post-M.S. course work. The time to completion, though, generally varies from 4-6 years, on average. All candidates for the Ph.D. degree are required to complete CEE 200 in conjunction with a one-quarter teaching assistantship/course assistantship. Please see the Department of Civil and Environmental Engineering handbook for further requirements, including specific Ph.D. coursework unit requirements.

A student desiring to obtain a Ph.D. degree in Civil and Environmental Engineering with an emphasis on Atmosphere/Energy should apply for the Ph.D. though the Atmosphere/Energy Program. It is often advisable to discuss the potential application with a faculty member of the program prior to submission.
Graduate Student Aid
M.S. and Ph.D. Students
Applicants accepted into the M.S. program in Civil and Environmental Engineering will be considered for a limited number of partial and full financial aid packages based on merit. Financial aid may take the form of fellowships, teaching assistantships, and research assistantships. Students are also encouraged to apply for outside fellowships.

Applicants accepted into the Ph.D. program in Civil and Environmental Engineering are funded by a research assistantship provided by a faculty member or by an external fellowship. Students are encouraged to discuss their application with a faculty member prior to submitting it. For more information, please visit this website: http://www-ce.stanford.edu/admissions.html#FinancialAid

MAP Sustainable Energy Fellowships
Students are encouraged to apply for 12 or 24-week fellowships sponsored by Mineral Acquisition Partners, Inc. (MAP). This program matches students with non-governmental organizations (NGOs), such as the Rocky Mountain Institute, Natural Resources Defense Council, the Union of Concerned Scientists, and Worldwatch Institute, chosen based on their efforts to identify and solve the challenges of developing a more sustainable energy future. More information can be found at the following website: http://www.stanford.edu/group/ews/mapming/

Application
Students interested in applying to the M.S. or Ph.D. program in Civil and Environmental Engineering with an emphasis on Atmosphere/Energy may obtain an application at the following website: http://gradadmissions.stanford.edu/.