

# ATMOSPHERE/ENERGY

Atmosphere and energy are strongly linked: Fossil-fuel energy use contributes to air pollution, climate change, and perturbations to the weather, and the atmosphere feeds back as renewable wind, solar, and hydroelectric energy sources. Because atmospheric problems can be mitigated by increasing energy efficiency, developing new energy technologies, and shifting to less-polluting energy sources, and because it is important to study the atmospheric impacts of new energy technologies, the two areas, atmosphere and energy, are naturally coupled together.

The Atmosphere/Energy (A/E) undergraduate major provides a curriculum that prepares undergraduates for an A/E master's degree program, as well as careers in industry, research, consulting, government, non-governmental organizations, and academia. The A/E degree is *NOT* an ABET-accredited degree, as ABET accreditation is advantageous only for obtaining specific jobs that do not overlap with those that students obtaining the A/E degree would generally consider.

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

Students may also take courses in A/E to fulfill the requirements for a minor in the Department of Civil and Environmental Engineering.

## REQUIREMENTS

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
CME 102 Ordinary Differential Equations for Engineers	5

Group B:	
CME 106 Introduction to Probability and Statistics for Engineers	4
STATS 60 Introduction to Statistical Methods: Pre-calculus	5
STATS 110 Statistical Methods in Eng. and the Physical Sciences	4-5
GES 160 Statistical Methods for Earth and Env. Sciences	3-4

**Science (22 units minimum, including all of the following):**

PHYS 41 Mechanics	4
PHYS 43 Electricity/Magnetism or PHYS 45 Light/Heat	4
CHEM 31B Chemical Principles II (or CHEM 31X)	4
CEE 70 Environmental Science and Technology	3

**Engineering Fundamentals (three courses minimum, including the following):**

ENGR 30 Engineering Thermodynamics	3
<i>and at least one of the following two courses:</i>	
ENGR 60 Engineering Economy	3
ENGR 70A Programming Methodology	3-5

**Technology in Society**

STS 110 Ethics and Public Policy (also fulfills Writing in Major req.)	5
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**Engineering Depth (42 units minimum):**

*Required:*

CEE 64 Air Pollution: From Urban Smog to Global Change	3
CEE 173A Energy Resources	5

*At least 34 units from the following, with at least 4 courses from each group:*

Group A: Atmosphere

CEE 63 Weather and Storms	3
Either CEE 101B Mechanics of Fluids	3
or ME 70 Introductory Fluids Engineering	4
CEE 164 Introduction to Physical Oceanography	4
CEE 171 Environmental Planning Methods	3
CEE 172 Air Quality Management	3
CEE 172A Indoor Air Quality (Alt. years)	2-3
CEE 178 Introduction to Human Exposure Analysis	3
AA 100 Introduction to Aeronautics and Astronautics	3

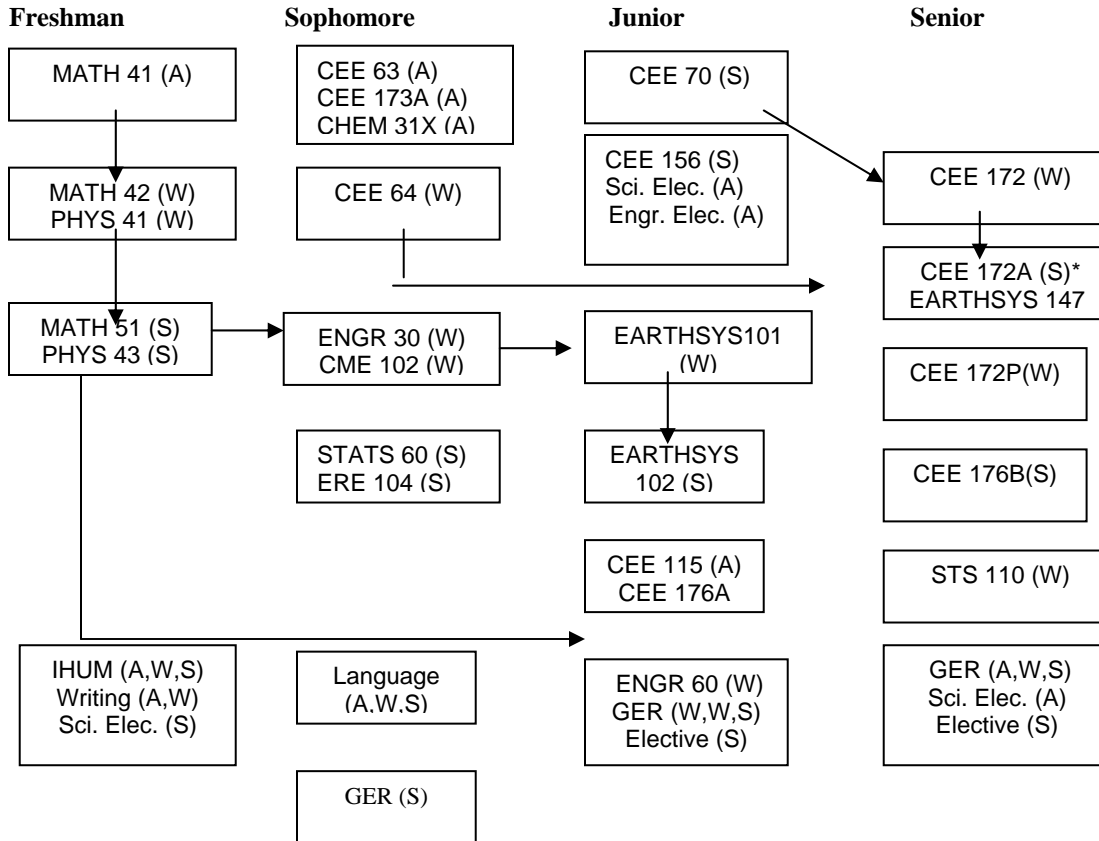
EARTHSYS 147 Control. Climate Chge/21st Cent. (alt. years)	3
EARTHSYS 111 Biology and Global Change	3
EARTHSYS 144 Fundamentals of GIS	4
EARTHSYS 184 Climate and Agriculture	3
GES 90 Introduction to Geochemistry	3-4
<b>Group B: Energy</b>	
CEE 115 Goals & Methods for the Sustainable Bldg Projects	3-4
CEE 142A Creating Sustainable Development	3
CEE 156 Building Systems	4
CEE 172P Distrib Generation & Grid Integrat of Renewables	3-4
CEE 176A Energy Efficient Buildings	3-4
CEE 176B Electric Power: Renewables and Efficiency	3-4
CEE 176F Energy Systems Field Trips (Alt. years)	4
CEE 177S Design for a Sustainable World	1-5
EARTHSYS 45N Energy Issues Confronting the World	3
EARTHSYS101 Energy and the Environment	3
EARTHSYS102 Renew. Energy Sources/Greener Energy Procs	3
ENERGY 104 Technology in the Greenhouse	3

### **SUGGESTED COURSE CONCENTRATIONS AND SEQUENCES**

Subject to the requirements outlined above, students have flexibility in selecting their depth electives and other courses to best suit their interests. On the following pages, two suggested programs are outlined, one with an emphasis on energy and the other on atmospheric studies. Either approach provides the necessary preparation for the master's degree program in Atmosphere/Energy.

# Atmosphere/Energy

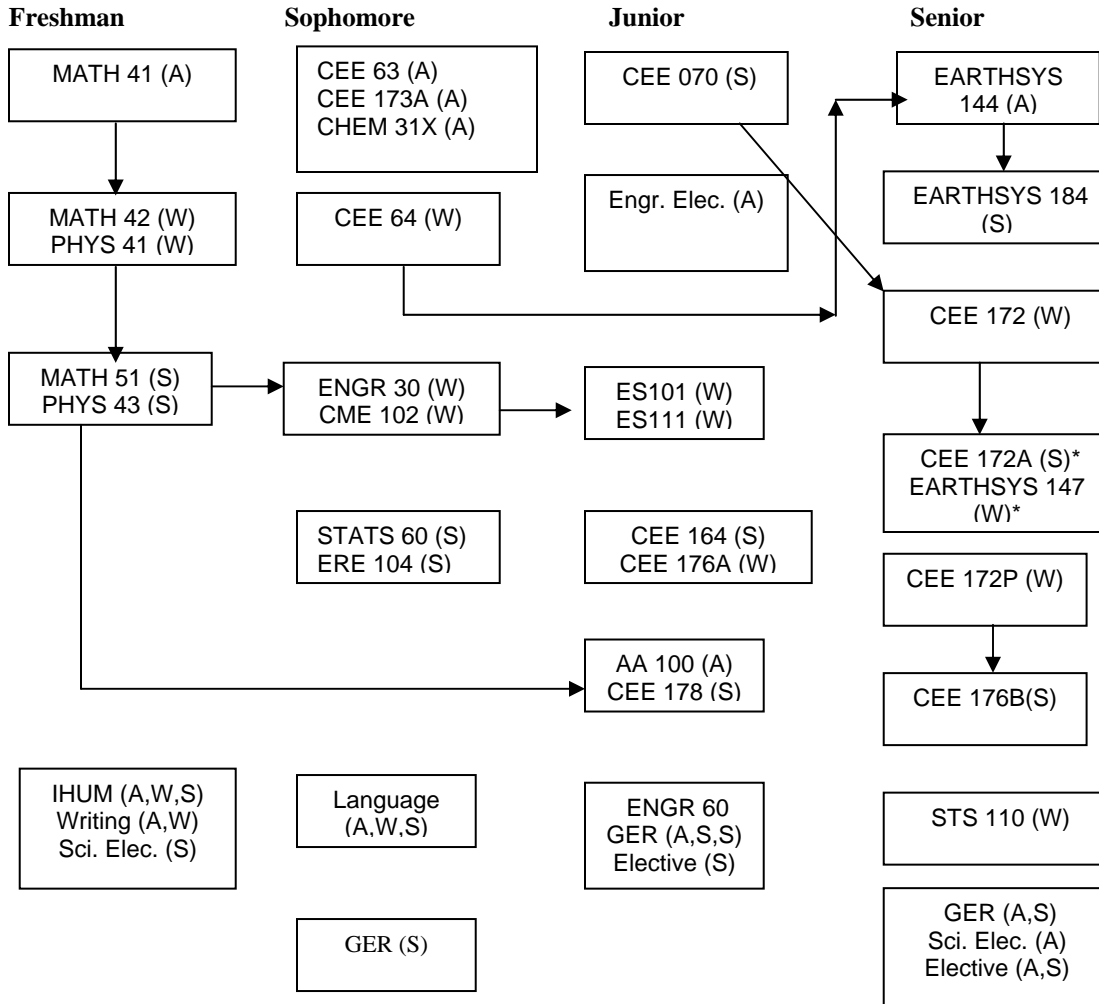
Typical Sequence of Courses  
Energy Emphasis



Arrows represent direct prerequisites  
\*Courses given alternate years.

# Atmosphere/Energy

Typical Sequence of Courses  
Atmosphere Emphasis



Arrows represent direct prerequisites  
\*Courses given alternate years.

## Atmosphere/Energy

Energy Emphasis

Sample 4-Year Plan

	<i>Fall</i>				<i>Winter</i>				<i>Spring</i>			
	Class	Math/ Sci	Engr	Other	Class	Math/ Sci	Engr	Other	Class	Math/ Sci	Engr	Other
<i>Freshman</i>	MATH 41	5			MATH 42	5			MATH 51	5		
	IHUM			5	IHUM			5	IHUM			5
	Writing			3	Writing			3	Sci. Elec.	3		
					Phys 41	4			Phys 43	4		
	<i>Subtotals</i>	<i>5</i>	<i>0</i>	<i>8</i>	<i>Subtotals</i>	<i>9</i>	<i>0</i>	<i>8</i>	<i>Subtotals</i>	<i>12</i>	<i>0</i>	<i>5</i>
	<b>Total</b>			<b>13</b>	<b>Total</b>			<b>17</b>	<b>Total</b>			<b>17</b>
<i>Sophomore</i>	Language			5	Language			5	Language			5
	CEE 173A		5		CEE 64		3		Stats 60	5		
	Chem 31X	4			CME 102	5			ERE 104			3
	CEE 63		3		ENGR 30		3		GER			3
	<i>Subtotals</i>	<i>4</i>	<i>8</i>	<i>5</i>	<i>Subtotals</i>	<i>5</i>	<i>6</i>	<i>5</i>	<i>Subtotals</i>	<i>5</i>	<i>0</i>	<i>11</i>
	<b>Total</b>			<b>17</b>	<b>Total</b>			<b>16</b>	<b>Total</b>			<b>16</b>
<i>Junior</i>	Sci Elec	4			ES 101			3	ES 102			3
	Engr. Elctv.		3		GER			5	GER			3
	CEE 070	3			CEE 176A		4		CEE 115		3	
	Elective			5	ENGR 60		3		CEE 156		4	
	<i>Subtotals</i>	<i>7</i>	<i>3</i>	<i>5</i>	<i>Subtotals</i>	<i>0</i>	<i>7</i>	<i>8</i>	<i>Subtotals</i>	<i>0</i>	<i>7</i>	<i>6</i>
	<b>Total</b>			<b>15</b>	<b>Total</b>			<b>15</b>	<b>Total</b>			<b>13</b>
<i>Senior</i>	GER			3	CEE 172		3		GER			3
	GER			3	STS 110			5	CEE 172A*		3	
	Elective			4	CEE 172P		4		CEE 176B		4	
	Elective			3	GER			3	Elective			3
	<i>Subtotals</i>	<i>0</i>	<i>0</i>	<i>13</i>	<i>Subtotals</i>	<i>0</i>	<i>7</i>	<i>8</i>	<i>Subtotals</i>	<i>0</i>	<i>7</i>	<i>6</i>
	<b>Total</b>			<b>13</b>	<b>Total</b>			<b>15</b>	<b>Total</b>			<b>13</b>

Total Math & Science Units: 47  
 Total Engineering Units: 45  
 Total Other Units: 88  
**Total Units: 180**

**Notes:**

\* or EARTHSYS 147 (3 units) in alternate years

## Atmosphere/Energy Atmosphere Emphasis

*Sample 4-Year Plan*

	<i>Fall</i>				<i>Winter</i>				<i>Spring</i>			
	Class	Math/ Sci	Engr	Other	Class	Math/ Sci	Engr	Other	Class	Math/ Sci	Engr	Other
<i>Freshman</i>	MATH 41	5			MATH 42	5			MATH 51	5		
	IHUM			5	IHUM			5	IHUM			5
	Writing			3	Writing			3	Sci. Elec.	3		
	<i>Subtotals</i>	<i>5</i>	<i>0</i>	<i>8</i>	<i>Subtotals</i>	<i>9</i>	<i>0</i>	<i>8</i>	<i>Subtotals</i>	<i>12</i>	<i>0</i>	<i>5</i>
<b>Total</b>			<b>13</b>	<b>Total</b>			<b>17</b>	<b>Total</b>			<b>17</b>	
<i>Sophomore</i>	Language			5	Language			5	Language			5
	CEE 173A			5	CEE 64		3		Stats 60	5		
	Chem 31X	4			CME102	5			ERE 104			3
	CEE 63		3		ENGR 30		3		GER			3
<i>Subtotals</i>	<i>4</i>	<i>3</i>	<i>10</i>	<i>Subtotals</i>	<i>5</i>	<i>6</i>	<i>5</i>	<i>Subtotals</i>	<i>5</i>	<i>0</i>	<i>11</i>	
<b>Total</b>			<b>17</b>	<b>Total</b>			<b>16</b>	<b>Total</b>			<b>16</b>	
<i>Junior</i>	AA 100		3		ES 111			3	GER			3
	Engr Elctv		3		CEE 164		4		CEE 178		3	
	CEE 070	3			ES 101			3	GER			3
	GER			5	ENGR 60		3		Elective			5
<i>Subtotals</i>	<i>3</i>	<i>6</i>	<i>5</i>	<i>Subtotals</i>	<i>0</i>	<i>7</i>	<i>6</i>	<i>Subtotals</i>	<i>0</i>	<i>3</i>	<i>11</i>	
<b>Total</b>			<b>14</b>	<b>Total</b>			<b>13</b>	<b>Total</b>			<b>14</b>	
<i>Senior</i>	CEE 161S		3		CEE 172		3		CEE 161T		3	
	GER			3	STS 110			5	CEE 172A*		3	
	Sci. Elect.	4			CEE 176A		4		CEE 176B		4	
	Elective			4	GER			3	Elective			4
<i>Subtotals</i>	<i>4</i>	<i>3</i>	<i>7</i>	<i>Subtotals</i>	<i>0</i>	<i>7</i>	<i>8</i>	<i>Subtotals</i>	<i>0</i>	<i>10</i>	<i>4</i>	
<b>Total</b>			<b>14</b>	<b>Total</b>			<b>15</b>	<b>Total</b>			<b>14</b>	

Total Math & Science Units:	47
Total Engineering Units:	45
Total Other Units:	88
<b>Total Units:</b>	<b>180</b>

**Notes:**

\* or EARTHSYS 147 (3 units) in alternate years

## INSTRUCTIONS FOR DECLARING MAJOR IN ENGINEERING: ATMOSPHERE/ENERGY (BS-ENGR)

1. Enter your major declaration for Atmosphere/Energy in Axess. Select ENGR-BS as your major and Atmosphere/Energy as your subplan.
2. Pick up your academic folder from your freshman/sophomore adviser and print out your Stanford transcript (unofficial is fine) from Axess.
3. Download and complete your major Program Sheet, which you can obtain from the UGHB website at <http://ughb.stanford.edu/>. Be sure to fill in all courses that you have taken and those which you plan to take. You will have the opportunity to revise this later, so please fill in as many courses as you can.
4. Bring your academic folder, transcript and completed program sheet to the CEE Student Services office to Room 316 of the Jerry Yang and Akiko Yamazaki Environment & Energy (Y2E2) Building and request to have a CEE advisor assigned to you. You may request a specific advisor if you wish. Office hours are 10:00 am to noon and 2:00 to 4:00 pm, Monday through Friday.
5. Meet with Mark Jacobson and have him review and sign your program sheet.
6. Return your signed program sheet to the CEE Student Services Specialist, who upon receiving your signed sheet will approve your major declaration in Axess.
7. You are encouraged to meet with Mark Jacobson at least once a quarter to review your academic progress. Changes to your program sheet can be made by printing out a revised sheet, obtaining your A/E undergraduate adviser's signature, and returning the approved sheet to the CEE Student Services Office. *NOTE – It is very important to confirm that your program sheet is up to date at least one quarter prior to graduation. Changes to your program may not be accepted within your final quarter.*

### Other information:

- Procedures for requesting transfer credits and program deviations are described in detail in at the beginning of Chapter 4: "Policies and Procedures." The relevant forms may be downloaded from <http://ughb.stanford.edu> under the "Petitions" link. If you are requesting transfer credits or program deviations, you should bring your completed petition form with your transcript to the CEE Student Services office. Attach your program sheet on file in CEE.
- Check with the CEE Student Services Office to make sure that you are on the CEE undergraduate student email list for important announcements about department events and activities.
- **Note: The online version of the UGHB is considered the definitive and final version of SoE requirements for each major.** Since corrections or updates may have been made after this Handbook went to press in August 2008, download the online AE program sheet from [ughb.stanford.edu](http://ughb.stanford.edu) to ensure you are using an accurate major plan.

**Stanford University ♦ School of Engineering**  
**Atmosphere/Energy**  
**2008–2009 Program Sheet**

*Final version of completed and signed program sheet due to the department no later than one month prior to the last quarter of senior year.*

**\*Follow all requirements as stated for the year of the program sheet used.\***

Name: \_\_\_\_\_ SU ID: \_\_\_\_\_  
 Email: \_\_\_\_\_ Local Phone: \_\_\_\_\_  
 Date: \_\_\_\_\_ Date BS expected: \_\_\_\_\_

**Mathematics and Science Requirements**

Dept	Course	Title	Transfer/AP Approval			Unit	Grade
			✓ if Transfer	Initials	Date		
<i>Mathematics (23 units minimum)</i>							
CME	102	Math/Comp. Methods for Eng. (req'd; see note 1)				5	
CME	106	Statistical Methods (req'd; see note 2)				4	
<i>Mathematics Unit Total (23 units minimum)</i>							

*Science (22 units minimum)*

PHYS	41	Mechanics (req'd)				4	
PHYS	43 or 45	Electricity & Magnetism OR Light & Heat (req'd)				4	
CHEM	31B or 31X	Chemical Principles (req'd) (or ENGR 31)				4	
CEE	70	Environmental Science & Technology (req'd)				3	
<i>Science Unit Total (22 units minimum)</i>							
<i>(45 units minimum)</i>							

**Technology in Society Requirement**

STS	110	Ethics and Public Policy (req'd) WIM; see note 3)				5	
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**NOTES**

- \* This form is available as an Excel file at <http://ughb.stanford.edu/>. The printed form must be signed by the advisor and, if required, by the departmental representative. Changes must be initialed in ink.
  - \* Read all emails from the Office of Student Affairs; this is the SoE's only effective method of communicating key information to ENGR majors.
  - \* All courses listed on this form must be taken for a letter grade if offered by the instructor.
  - \* Minimum Grade Point Average (GPA) for all courses in Engineering Fundamentals and Materials Science and Engineering Depth (combined) is 2.0.
  - \* Transfer and AP credits in Math, Science, Funds., & TIS must be approved by the SoE Dean's Office. Transfer credits in Engineering Depth must be approved by the Advisor. Transfer credit information and petitions are available at <http://ughb.stanford.edu/transfer.html>.
  - \* All courses listed on this form must only be included under one category; no double-counting.
- (1) Math 53 may be substituted for CME 102
  - (2) The statistical methods requirement may also be satisfied by taking STATS 60, STATS 110, or GES 160.
  - (3) Fulfills the "Writing in the Major" (WIM) requirement; offered Wtr quarter

*program sheet continues on page 2*

## Atmosphere/Energy

### Engineering Fundamentals (3 courses required)

ENGR	30	Engineering Thermodynamics				3
ENGR	60 (or 70A)	Engineering Economy or Programming Methodology				3 to 5
		<i>Fundamental Elective</i>				
<i>Engineering Fundamentals Total</i>						

### Engineering Depth (42 units minimum)

Dept	Course	Title	Transfer/AP Approval			Units	Grade
			✓ if Transfer	Initials	Date		
<i>Required:</i>							
CEE	64	Air Pollution: From Urban Smog to Global Change				3	
CEE	173A	Energy Resources				5	

### Depth Electives (at least 34 units, 4 courses minimum from each of Groups A and B; see note 4)

<b>Group A: Atmosphere</b>							
<b>Group B: Energy</b>							
<i>Atmosphere/Energy Engineering Depth Total (42 units minimum)</i>							

### Program Totals

Mathematics and Science (45 units minimum)

Atmosphere/Energy Depth (42 units minimum)

### Program Approvals

#### Advisor

Printed Name: \_\_\_\_\_ Date: \_\_\_\_\_

Signature: \_\_\_\_\_

#### Departmental

Printed Name: \_\_\_\_\_ Date: \_\_\_\_\_

Signature: \_\_\_\_\_

#### School of Engineering (signature not required prior to graduation)

Printed Name: \_\_\_\_\_ Date: \_\_\_\_\_

Signature: \_\_\_\_\_

### NOTES (continued from page 1)

- (4) Choose at least 4 courses from each of the two groups: Group A (Atmosphere): CEE 63; 101B or ME 70; CEE 164, 171, 172, 172A, 178; AA 100, EARTHSYS 111; EARTHSYS 144; EARTHSYS 147, EARTHSYS 184; GES 90. Group B (Energy): CEE 115, 142A, 156, 176A,B or F; 177S; EARTHSYS 45N, 101, 102; or ERE 104.