

MINOR IN ENERGY SYSTEMS

The Energy Systems Minor provides students a 15-hour multidisciplinary educational opportunity to study energy systems. The minor includes courses which provide depth in an area relevant to energy that is within the scope of the student's chosen program. Depth course options available to students may vary depending on the program. Appropriate courses are selected by program faculty to meet the needs of their students. The minor also includes requirements for courses which cut across disciplines. These courses are intended to add breadth of knowledge in areas outside the student's major but important to energy systems. A terminal "capstone" or project course provides an opportunity for students from multiple disciplines to work together in multidisciplinary teams on a significant project in the energy area. Appropriate projects are either solicited from industry or faculty experts.

The minor is open to all Georgia Tech undergraduate students whose majors have approved the minor. The breadth courses and the capstone project course, courses taken by all students completing the minor, require one or more pre-requisites; specifically, basic economics, mathematics, and lab science courses.

Minor Program of Study & Guidelines

The minor includes requirements for courses which cut across disciplines. These courses are intended to add breadth of knowledge in areas outside the student's major but important to energy systems. A terminal "capstone" or project course provides an opportunity for students from multiple disciplines to work together in multidisciplinary teams on a significant project in the energy area.

The breadth courses and the capstone project course, courses taken by all students completing the minor, require one or more prerequisites; specifically, basic economics, mathematics, and lab science courses. The minor must consist of at least 15 credit hours and all courses in the minor also must be 3000 level and above.

A multidisciplinary or other minor may contain courses in a student's major field of study. A maximum of 6 credit hours of such courses may be used to satisfy the course requirements for the minor, provided these courses are not also used to satisfy any course requirement in the student's major degree program.

All courses counting toward the minor must be taken on a letter-grade basis and completed with an overall grade-point average of at least 2.00.

All courses in the minor also must be 3000 level and above.

Program of Study - Track for Aerospace Engineering Students

Prerequisite Courses

Students ordinarily pursue the minor upon completion of the needed prerequisites. However, the depth course requirements may be taken as soon as students have met the relevant prerequisites.

The prerequisites needed for one or more of the courses required for the minor (breadth courses and the capstone project course) are (all existing courses):

Code	Title	Credit Hours
Mathematics		
MATH 1551	Differential Calculus	2
MATH 1553	Introduction to Linear Algebra or MATH 1554 Linear Algebra	2
MATH 1552	Integral Calculus	4
MATH 2551	Multivariable Calculus	4
Physics		
PHYS 2211	Introductory Physics I	4
PHYS 2212	Introductory Physics II	4
Chemistry		
CHEM 1310	General Chemistry or CHEM 1210 Chemical Principles I	4
Economics		
Select one of the following:		3-6
ECON 2100 Economic Analysis and Policy Problems or ECON 2101 Global Economy		
ECON 2105 Principles of Macroeconomics & ECON 2106 Principles of Microeconomics		

Requirements

Code	Title	Credit Hours
Depth Courses		
Select 6 credit hours related to energy systems: ¹		6
AE 4701	Wind Engineering	
AE 4370	Life Cycle Cost Analysis	
NRE 3208	Nuclear Reactor Phys I	
NRE 3301	Radiation Physics	
AE 4461	Introduction to Combustion	
Breadth Courses		
Select two of the following: ²		6
ECON 3300 Economics of International Energy Markets		
PUBP 3350 Energy Policy		
CHEM 3700 The Science of Alternative Energy		
Capstone Course		
GT 4813	Project in Energy Systems ³	3
Total Credit Hours		15

- ¹
- The Depth Courses may have additional prerequisites; please check the current prerequisites.
 - A list of acceptable courses which meet the depth requirement is provided by each major approving the minor. Depth courses may be taken in the student's major to ensure the depth in that major needed to pursue a multidisciplinary minor. All acceptable depth courses must be consistent with the goals of the minor. Examples of acceptable courses include engineering courses covering a specific energy technology like solar or relevant engineering science.

- ² Students should strive to complete the necessary prerequisites and the depth courses prior to enrolling in the breadth courses. However, depth courses may be taken concurrently with the courses taken to meet the breadth requirement.
- Breadth courses may ordinarily serve as technical or free electives in the student's program of study. However, courses required by name and number and/or used to satisfy Core Areas A through E cannot be used to satisfy the requirements of a minor.
- ³ Ordinarily, students must complete all minor requirements before they can register for the Project in Energy Systems course.

Program of Study - Track for Chemical and Biomolecular Engineering Students

Prerequisite Courses

Students ordinarily pursue the minor upon completion of the needed prerequisites. However, the depth course requirements may be taken as soon as students have met the relevant prerequisites.

The prerequisites needed for one or more of the courses required for the minor (breadth courses and the capstone project course) are (all existing courses):

Code	Title	Credit Hours
Mathematics		
MATH 1551	Differential Calculus	2
MATH 1553	Introduction to Linear Algebra or MATH 1554 Linear Algebra	2
MATH 1552	Integral Calculus	4
MATH 2551	Multivariable Calculus	4
Physics		
PHYS 2211	Introductory Physics I	4
PHYS 2212	Introductory Physics II	4
Chemistry		
CHEM 1310	General Chemistry or CHEM 12 Chemical Principles I	4
Economics		
Select one of the following:		3-6
ECON 2100 Economic Analysis and Policy Problems or ECON 2101 Global Economy		
ECON 2105 Principles of Macroeconomics & ECON 2106 Principles of Microeconomics		

Requirements

Code	Title	Credit Hours
Depth Courses		
Select 6 credit hours related to energy systems: ¹		6
CHBE 4020 Chemical Engineering in Nanoscale Systems		
CHBE 4310 Bioprocess Engineering		
CHBE 4760 Biocatalysis and Metabolic Engineering		
CHBE 4803 Special Topics (Electrochemical Energy Storage & Conversion)		
CHBE 6130 Electrochemical Engineering		
Breadth Courses		
Select two of the following: ²		6

ECON 3300 Economics of International Energy Markets
PUBP 3350 Energy Policy
CHEM 3700 The Science of Alternative Energy
Capstone Course
GT 4813 Project in Energy Systems ³

³ GT 4813 Project in Energy Systems 3 15

Total Credit Hours 15

- ¹ The Depth Courses may have additional prerequisites; please check the current prerequisites.
- A list of acceptable courses which meet the depth requirement is provided by each major approving the minor. Depth courses may be taken in the student's major to ensure the depth in that major needed to pursue a multidisciplinary minor. All acceptable depth courses must be consistent with the goals of the minor. Examples of acceptable courses include engineering courses covering a specific energy technology like solar or relevant engineering science.
- ² Students should strive to complete the necessary prerequisites and the depth courses prior to enrolling in the breadth courses. However, depth courses may be taken concurrently with the courses taken to meet the breadth requirement.
- ³ Ordinarily, students must complete all minor requirements before they can register for the Project in Energy Systems course.

Program of Study - Track for Civil and Environmental Engineering Students

Prerequisite Courses

Students ordinarily pursue the minor upon completion of the needed prerequisites. However, the depth course requirements may be taken as soon as students have met the relevant prerequisites.

The prerequisites needed for one or more of the courses required for the minor (breadth courses and the capstone project course) are (all existing courses):

Code	Title	Credit Hours
Mathematics		
MATH 1551	Differential Calculus	2
MATH 1553	Introduction to Linear Algebra or MATH 1554 Linear Algebra	2
MATH 1552	Integral Calculus	4
MATH 2551	Multivariable Calculus	4
Physics		
PHYS 2211	Introductory Physics I	4
PHYS 2212	Introductory Physics II	4
Chemistry		
CHEM 1310	General Chemistry or CHEM 12 Chemical Principles I	4
Economics		
Select one of the following:		3-6
ECON 2100 Economic Analysis and Policy Problems or ECON 2101 Global Economy		
ECON 2105 Principles of Macroeconomics & ECON 2106 Principles of Microeconomics		
Requirements		
Depth Courses		
Select 6 credit hours related to energy systems: ¹		6
CHBE 4020 Chemical Engineering in Nanoscale Systems		
CHBE 4310 Bioprocess Engineering		
CHBE 4760 Biocatalysis and Metabolic Engineering		
CHBE 4803 Special Topics (Electrochemical Energy Storage & Conversion)		
CHBE 6130 Electrochemical Engineering		
Breadth Courses		
Select two of the following: ²		6

Requirements

Code	Title	Credit Hours	
Depth Courses			
Select 6 credit hours related to energy systems: ¹		6	
AE 4370	Life Cycle Cost Analysis	3	
CEE 4330	Air Pollution Engineering	3	
CEE 4450	Introduction to Petroleum Geomechanics	3	
CEE 4803	Marine and Hydrokinetic Renewable Energy	3	
EAS 3110	Energy, Environment, and Society	3	
EAS 4410	Climate and Global Change	3	
Breadth Courses			
Select two of the following: ²		6	
ECON 3300 Economics of International Energy Markets			
PUBP 3350 Energy Policy			
CHEM 3700 The Science of Alternative Energy			
Capstone Course			
GT 4813	Project in Energy Systems ³	3	
Total Credit Hours		30	

- ¹ The Depth Courses may have additional prerequisites; please check the current prerequisites.
- A list of acceptable courses which meet the depth requirement is provided by each major approving the minor. Depth courses may be taken in the student's major to ensure the depth in that major needed to pursue a multidisciplinary minor. All acceptable depth courses must be consistent with the goals of the minor. Examples of acceptable courses include engineering courses covering a specific energy technology like solar or relevant engineering science.
- ² Students should strive to complete the necessary prerequisites and the depth courses prior to enrolling in the breadth courses. However, depth courses may be taken concurrently with the courses taken to meet the breadth requirement.
- Breadth courses may ordinarily serve as technical or free electives in the student's program of study. However, courses required by name and number and/or used to satisfy Core Areas A through E cannot be used to satisfy the requirements of a minor.
- ³ Ordinarily, students must complete all minor requirements before they can register for the Project in Energy Systems course.

Program of Study - Track for Electrical and Computer Engineering Students

Prerequisite Courses

Students ordinarily pursue the minor upon completion of the needed prerequisites. However, the depth course requirements may be taken as soon as students have met the relevant prerequisites.

The prerequisites needed for one or more of the courses required for the minor (breadth courses and the capstone project course) are (all existing courses):

Code	Title	Credit Hours
Mathematics		
MATH 1551	Differential Calculus	2
MATH 1553	Introduction to Linear Algebra or MATH 1554 Linear Algebra	2

MATH 1552	Integral Calculus	4
MATH 2551	Multivariable Calculus	4
Physics		
PHYS 2211	Introductory Physics I	4
PHYS 2212	Introductory Physics II	4
Chemistry		
CHEM 1310	General Chemistry or CHEM 12 Chemical Principles I	4
Economics		
Select one of the following:		3-6
ECON 2100	Economic Analysis and Policy Problems or ECON 2101 Global Economy	
ECON 2105	Principles of Macroeconomics & ECON 2106 and Principles of Microeconomics	

Requirements

Code	Title	Credit Hours
Depth Courses		
Select 6 credit hours of depth courses related to energy systems: ¹		6
ECE 3070	Electromechanical and Electromagnetic Energy Conversion ²	
ECE 3071	Modern Electric Energy Systems ²	
ECE 4320	Power System Analysis and Control	
ECE 4321	Power System Engineering	
ECE 4325	Electric Power Quality	
ECE 4330	Power Electronics	
ECE 4335	Electric Machinery Analysis	
NRE 3208	Nuclear Reactor Phys I	
NRE 3301	Radiation Physics	
Breadth Courses		
Select two of the following: ³		6
ECON 3300	Economics of International Energy Markets	
PUBP 3350	Energy Policy	
CHEM 3700	The Science of Alternative Energy	
Capstone Course		
GT 4813	Project in Energy Systems ⁴	3
Total Credit Hours		15

- ¹ The Depth Courses may have additional prerequisites; please check the current prerequisites.
- A list of acceptable courses which meet the depth requirement is provided by each major approving the minor. Depth courses may be taken in the student's major to ensure the depth in that major needed to pursue a multidisciplinary minor. All acceptable depth courses must be consistent with the goals of the minor. Examples of acceptable courses include engineering courses covering a specific energy technology like solar or relevant engineering science.
- Any course on this list that is taken for ECE elective, engineering elective, or approved elective credit can count for this minor.

² If used for EE Breadth credit, ECE 3070 and ECE 3071 cannot be used for this minor.

- ³ Students should strive to complete the necessary prerequisites and the depth courses prior to enrolling in the breadth courses. However, depth courses may be taken concurrently with the courses taken to meet the breadth requirement.
- Breadth courses may ordinarily serve as technical or free electives in the student's program of study. However, courses required by name and number and/or used to satisfy Core Areas A through E cannot be used to satisfy the requirements of a minor.
- ⁴ Ordinarily, students must complete all minor requirements before they can register for the Project in Energy Systems course.

Program of Study - Track for Industrial and Systems Engineering Students

Prerequisite Courses

Students ordinarily pursue the minor upon completion of the needed prerequisites. However, the depth course requirements may be taken as soon as students have met the relevant prerequisites.

The prerequisites needed for one or more of the courses required for the minor (breadth courses and the capstone project course) are (all existing courses):

Code	Title	Credit Hours
Mathematics		
MATH 1551	Differential Calculus	2
MATH 1553	Introduction to Linear Algebra or MATH 1554 Linear Algebra	2
MATH 1552	Integral Calculus	4
MATH 2551	Multivariable Calculus	4
Physics		
PHYS 2211	Introductory Physics I	4
PHYS 2212	Introductory Physics II	4
Chemistry		
CHEM 1310	General Chemistry or CHEM 12 Chemical Principles I	4
Economics		
Select one of the following:		3-6
ECON 2100 Economic Analysis and Policy Problems or ECON 2101 Global Economy		
ECON 2105 Principles of Macroeconomics & ECON 2106 Principles of Microeconomics		

Requirements

Code	Title	Credit Hours
Depth Courses		
Select 6 credit hours of depth courses related to energy systems: ¹		6
AE/ME 4701	Wind Engineering	
ECE 3072	Electrical Energy Systems	
ISYE 4803	Special Topics (Energy and Environment)	
ME 4011	Internal Combustion Engines	
ME 4325	Introduction to Fuel Cell Systems	

ME 4823	Special Topics (Mechatronic sys in Hybrid-electric power trains)
ME 4171	Environmentally Conscious Design and Manufacturing
ME 4172	Designing Sustainable Engineering Systems
ME 4803	Special Topics in Mechanical Engineering (Thermal Systems Engineering)
NRE 4610	Introduction to Plasma Physics and Fusion Engineering

Breadth Courses

Select two of the following:² 6

CHEM 3700	The Science of Alternative Energy
EAS 4410	Climate and Global Change
EAS 3110	Energy, Environment, and Society
ECON 3300	Economics of International Energy Markets
PUBP 3315	Environmental Policy and Politics
PUBP 3350	Energy Policy
PUBP 3600	Sustainability, Technology, and Policy
PUBP 4440	Science, Technology, and Regulation
PHIL 4176	Environmental Ethics

Capstone Course

GT 4813	Project in Energy Systems ³	3
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Total Credit Hours 15

- ¹ The Depth Courses may have additional prerequisites; please check the current prerequisites.
- A list of acceptable courses which meet the depth requirement is provided by each major approving the minor. Depth courses may be taken in the student's major to ensure the depth in that major needed to pursue a multidisciplinary minor. All acceptable depth courses must be consistent with the goals of the minor. Examples of acceptable courses include engineering courses covering a specific energy technology like solar or relevant engineering science.
- ² Students should strive to complete the necessary prerequisites and the depth courses prior to enrolling in the breadth courses. However, depth courses may be taken concurrently with the courses taken to meet the breadth requirement.
- ³ Ordinarily, students must complete all minor requirements before they can register for the Project in Energy Systems course.

Program of Study - Track for Mechanical Engineering Students

Prerequisite Courses

Students ordinarily pursue the minor upon completion of the needed prerequisites. However, the depth course requirements may be taken as soon as students have met the relevant prerequisites.

The prerequisites needed for one or more of the courses required for the minor (breadth courses and the capstone project course) are (all existing courses):

Code	Title	Credit Hours
Mathematics		
MATH 1551	Differential Calculus	2
MATH 1553	Introduction to Linear Algebra or MATH 1554 Linear Algebra	2

MATH 1552	Integral Calculus	4
MATH 2551	Multivariable Calculus	4
Physics		
PHYS 2211	Introductory Physics I	4
PHYS 2212	Introductory Physics II	4
Chemistry		
CHEM 1310	General Chemistry	4
or CHEM 12Chemical Principles I		
Economics		
Select one of the following:		3-6
ECON 2100 Economic Analysis and Policy Problems		
or ECON 2101Global Economy		
ECON 2105 Principles of Macroeconomics		
& ECON 2110and Principles of Microeconomics		
Requirements		
Code	Title	Credit Hours
Depth Courses		
Select 6 credit hours related to energy systems: ¹		6
ME 4011	Internal Combustion Engines	
ME 4315	Energy Systems Analysis and Design	
ME 4325	Introduction to Fuel Cell Systems	
ME 4321	Refrigeration and Air Conditioning	
ME 4823	Special Topics (Mechatronic Systems in Hybrid-Electric Powertrains)	
ME 4823	Special Topics (Renewable Energy Systems)	
ME 4171	Environmentally Conscious Design and Manufacturing	
ME 4172	Designing Sustainable Engineering Systems	
ME 4701	Wind Engineering	
ECE 3071	Modern Electric Energy Systems	
NRE 3208	Nuclear Reactor Phys I	
NRE 4214	Reactor Engineering	
NRE 4610	Introduction to Plasma Physics and Fusion Engineering	
Breadth Courses²		6
CHEM 3700The Science of Alternative Energy		
ECON 3300 Economics of International Energy Markets		
PUBP 3350 Energy Policy		
Capstone Course		
GT 4813	Project in Energy Systems ³	3
Total Credit Hours		15

- ¹ The Depth Courses may have additional prerequisites; please check the current prerequisites.
- A list of acceptable courses which meet the depth requirement is provided by each major approving the minor. Depth courses may be taken in the student's major to ensure the depth in that major needed to pursue a multidisciplinary minor. All acceptable depth courses must be consistent with the goals of the minor. Examples of acceptable courses include engineering courses covering a specific energy technology like solar or relevant engineering science.

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- Students should strive to complete the necessary prerequisites and the depth courses prior to enrolling in the breadth courses. However, depth courses may be taken concurrently with the courses taken to meet the breadth requirement.
 - Breadth courses may ordinarily serve as technical or free electives in the student's program of study. However, courses required by name and number and/or used to satisfy Core Areas A through E cannot be used to satisfy the requirements of a minor. All courses in the minor also must be 3000 level and above.
- ³ Ordinarily, students must complete all minor requirements before they can register for the Project in Energy Systems course.

Program of Study - Track for Economics (including EIA, and GEML) Students

Prerequisite Courses

Students ordinarily pursue the minor upon completion of the needed prerequisites. However, the depth course requirements may be taken as soon as students have met the relevant prerequisites.

The prerequisites needed for one or more of the courses required for the minor (breadth courses and the capstone project course) are (all existing courses):

Code	Title	Credit Hours
Mathematics		
MATH 1551	Differential Calculus	2
MATH 1553	Introduction to Linear Algebra	2
or MATH 1554Linear Algebra		
MATH 1552	Integral Calculus	4
MATH 2551	Multivariable Calculus	4
Physics		
PHYS 2211	Introductory Physics I	4
PHYS 2212	Introductory Physics II	4
Chemistry		
CHEM 1310	General Chemistry	4
or CHEM 12Chemical Principles I		
Economics		
Select one of the following:		3-6
ECON 2100 Economic Analysis and Policy Problems		
or ECON 2101Global Economy		
ECON 2105 Principles of Macroeconomics		
& ECON 2110and Principles of Microeconomics		

Requirements

Code	Title	Credit Hours
Depth Courses¹		
ECON 4440	Economics of Natural Resources and the Environment	3
ECON 4340	Economics of Industrial Competition	3
Breadth Courses		
Select 6 credit hours from the following: ²		6
ME 3700 Introduction to Energy Systems Engineering		
PUBP 3350 Energy Policy		
CHEM 3700The Science of Alternative Energy		

Capstone Course

GT 4813	Project in Energy Systems ³	3
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Total Credit Hours

15

- ¹ The Depth Courses may have additional prerequisites; please check the current prerequisites.
- A list of acceptable courses which meet the depth requirement is provided by each major approving the minor. Depth courses may be taken in the student's major to ensure the depth in that major needed to pursue a multidisciplinary minor. All acceptable depth courses must be consistent with the goals of the minor. Examples of acceptable courses include economics courses covering economic analysis of complex systems.
- ² Students should strive to complete the necessary prerequisites and the depth courses prior to enrolling in the breadth courses. However, depth courses may be taken concurrently with the courses taken to meet the breadth requirement.
- ³ Ordinarily, students must complete all minor requirements before they can register for the Project in Energy Systems course.

Program of Study - Track for Public Policy Students

Prerequisite Courses

Students ordinarily pursue the minor upon completion of the needed prerequisites. However, the depth course requirements may be taken as soon as students have met the relevant prerequisites.

The prerequisites needed for one or more of the courses required for the minor (breadth courses and the capstone project course) are (all existing courses):

Code	Title	Credit Hours
Mathematics		
MATH 1551	Differential Calculus	2
MATH 1553	Introduction to Linear Algebra or MATH 1554 Linear Algebra	2
MATH 1552	Integral Calculus	4
MATH 2551	Multivariable Calculus	4
Physics		
PHYS 2211	Introductory Physics I	4
PHYS 2212	Introductory Physics II	4
Chemistry		
CHEM 1310	General Chemistry or CHEM 121 Chemical Principles I	4
Economics		
Select one of the following:		3-6
ECON 2100 Economic Analysis and Policy Problems or ECON 2101 Global Economy		
ECON 2105 Principles of Macroeconomics & ECON 2110 Principles of Microeconomics		

Requirements

Code	Title	Credit Hours
Depth Courses		
Select 6 credit hours of depth courses related to energy systems: ¹		6

PUBP 3315 Environmental Policy and Politics

PUBP 3600 Sustainability, Technology, and Policy

PHIL 4176 Environmental Ethics

PUBP 4440 Science, Technology, and Regulation

Breadth CoursesSelect 6 credit hours from the following:²

ME 3700 Introduction to Energy Systems Engineering

ECON 3300 Economics of International Energy Markets

CHEM 3700 The Science of Alternative Energy

Capstone Course

GT 4813	Project in Energy Systems ³
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Total Credit Hours

15

- ¹ The Depth Courses may have additional prerequisites; please check the current prerequisites.

- A list of acceptable courses which meet the depth requirement is provided by each major approving the minor. Depth courses may be taken in the student's major to ensure the depth in that major needed to pursue a multidisciplinary minor. All acceptable depth courses must be consistent with the goals of the minor. Examples of acceptable courses include economics courses covering economic analysis of complex systems.

- ² Students should strive to complete the necessary prerequisites and the depth courses prior to enrolling in the breadth courses. However, depth courses may be taken concurrently with the courses taken to meet the breadth requirement.
- Breadth courses may ordinarily serve as technical or free electives in the student's program of study. However, courses required by name and number and/or used to satisfy Core Areas A through E cannot be used to satisfy the requirements of a minor.

- ³ Ordinarily, students must complete all minor requirements before they can register for the Project in Energy Systems course.

Program of Study - Track for Biology Students

Prerequisite Courses

Students ordinarily pursue the minor upon completion of the needed prerequisites. However, the depth course requirements may be taken as soon as students have met the relevant prerequisites.

The prerequisites needed for one or more of the courses required for the minor (breadth courses and the capstone project course) are (all existing courses):

Code	Title	Credit Hours
Mathematics		
MATH 1551	Differential Calculus	2
MATH 1553	Introduction to Linear Algebra or MATH 1554 Linear Algebra	2
MATH 1552	Integral Calculus	4
MATH 2551	Multivariable Calculus	4
Physics		
PHYS 2211	Introductory Physics I	4
PHYS 2212	Introductory Physics II	4
Chemistry		
CHEM 1310	General Chemistry or CHEM 121 Chemical Principles I	4

Economics

Select one of the following:

ECON 2100 Economic Analysis and Policy Problems
or ECON 2105 Global EconomicsECON 2105 Principles of Macroeconomics
& ECON 2106 Principles of Microeconomics

3-6

Requirements

Code Title

Credit
Hours**Depth Courses**Select 6 credit hours of depth courses related to energy systems:¹

4. All courses counting toward the minor must be completed with an overall average GPA of at least 2.0.
5. All courses counting toward the minor must be completed with a letter grade basis.
6. A maximum of 3 credit hours of transfer credit may be used to satisfy the course requirements for a minor. This includes courses taken at another institution or credit earned through the AP or IB program, assuming the scores meet Georgia Tech minimum standards.
7. It is the **major advisor's responsibility** to verify that students are using only courses from the designated block(s) from the student's major field of study that are allowed to satisfy a minor program, that they are not using any Core Area A-E courses (including humanities and social sciences), and that they are not using any courses for more than one minor or certificate. Any free elective course used to satisfy the course requirements of the student's major degree program may also be used to satisfy the course requirements for a minor.

BIOL 4221 Biological Oceanography	
BIOL 4410 Microbial Ecology	
BIOL 4418 Microbial Physiology	
BIOL 4440 Plant Physiology	
CHEM 3511 Survey of Biochemistry	
CHEM 4511 Biochemistry I	
CHEM 4512 Biochemistry II	
EAS 4410 Climate and Global Change	
EAS 3110 Energy, Environment, and Society	

Breadth CoursesSelect 6 credit hours from the following:²

6

ME 3700 Introduction to Energy Systems Engineering
ECON 3300 Economics of International Energy Markets
PUBP 3350 Energy Policy**Capstone Course**GT 4813 Project in Energy Systems³

3

Total Credit Hours

15

1. The Depth Courses may have additional prerequisites; please check the current prerequisites.
2. A list of acceptable courses which meet the depth requirement is provided by each major approving the minor. Depth courses may be taken in the student's major to ensure the depth in that major needed to pursue a multidisciplinary minor. All acceptable depth courses must be consistent with the goals of the minor. Examples of acceptable courses include science courses which cover energy science like biomass or other relevant basic science.
3. Students should strive to complete the necessary prerequisites and the depth courses prior to enrolling in the breadth courses. However, depth courses may be taken concurrently with the courses taken to meet the breadth requirement.
4. Ordinarily, students must complete all minor requirements before they can register for the Project in Energy Systems course.

Program of Study - Track for Chemistry and Biochemistry Students

1. Courses at the 1000 level may NOT be used toward the minor.
2. A maximum of 3 credit hours of Special Topics (in biochemistry) courses may be included in the minimum 15 credit hours of a minor program.
3. A maximum of 3 credit hours of CHEM 4699 may be used toward the minor.

Prerequisite Courses

Students ordinarily pursue the minor upon completion of the needed prerequisites. However, the depth course requirements may be taken as soon as students have met the relevant prerequisites.

The prerequisites needed for one or more of the courses required for the minor (breadth courses and the capstone project course) are (all existing courses):

Code	Title	Credit Hours
Mathematics		
MATH 1551	Differential Calculus	2
MATH 1553	Introduction to Linear Algebra or MATH 1554 Linear Algebra	2
MATH 1552	Integral Calculus	4
MATH 2551	Multivariable Calculus	4
Physics		
PHYS 2211	Introductory Physics I	4
PHYS 2212	Introductory Physics II	4
Chemistry		
CHEM 1310	General Chemistry or CHEM 12 Chemical Principles I	4
Economics		
Select one of the following:		3-6
ECON 2100 Economic Analysis and Policy Problems or ECON 2105 Global Economics		
ECON 2105 Principles of Macroeconomics & ECON 2106 Principles of Microeconomics		

Requirements

Code	Title	Credit Hours
Depth Courses		
Select 6 credit hours of depth courses related to energy systems: ¹		6
CHEM 3511 Survey of Biochemistry		
CHEM 4113 Applications of Inorganic Chemistry in Current Energy Research		
CHEM 4XXX Chemistry Elective		

or CHEM 5284 Environmental Analytical Chemistry		Economics				
CHEM 4XX Chemistry Elective		Select one of the following:	3-6			
or CHEM Chemistry of Electronic Organic Materials		ECON 2100 Economic Analysis and Policy Problems				
Breadth Courses		or ECON 2101 Global Economy				
Select 6 credit hours from the following: ²	6	ECON 2105 Principles of Macroeconomics				
ME 3700 Introduction to Energy Systems Engineering		& ECON 2106 Principles of Microeconomics				
ECON 3300 Economics of International Energy Markets						
PUBP 3350 Energy Policy						
Capstone Course		Requirements				
GT 4813 Project in Energy Systems ³	3	Code	Title			
Total Credit Hours	15		Credit Hours			
Depth Courses						
1	<ul style="list-style-type: none"> The Depth Courses may have additional prerequisites; please check the current prerequisites. A list of acceptable courses which meet the depth requirement is provided by each major approving the minor. Depth courses may be taken in the student's major to ensure the depth in that major needed to pursue a multidisciplinary minor. All acceptable depth courses must be consistent with the goals of the minor. Examples of acceptable courses include science courses which cover energy science like biomass or other relevant basic science. 					
2	<ul style="list-style-type: none"> Students should strive to complete the necessary prerequisites and the depth courses prior to enrolling in the breadth courses. However, depth courses may be taken concurrently with the courses taken to meet the breadth requirement. Breadth courses may ordinarily serve as technical or free electives in the student's program of study. However, courses required by name and number and/or used to satisfy Core Areas A through E cannot be used to satisfy the requirements of a minor. 					
3	<ul style="list-style-type: none"> Ordinarily, students must complete all minor requirements before they can register for the Project in Energy Systems course. 					
Breadth Courses						
Select 6 credit hours from the following: ²	6	ME 3700 Introduction to Energy Systems Engineering				
ECON 3300 Economics of International Energy Markets		ECON 3300 Economics of International Energy Markets				
PUBP 3350 Energy Policy		PUBP 3350 Energy Policy				
Capstone Course		Code	Title			
GT 4813 Project in Energy Systems ³	3					
Total Credit Hours	15					
Depth Courses						
1	<ul style="list-style-type: none"> The Depth Courses may have additional prerequisites; please check the current prerequisites. A list of acceptable courses which meet the depth requirement is provided by each major approving the minor. Depth courses may be taken in the student's major to ensure the depth in that major needed to pursue a multidisciplinary minor. All acceptable depth courses must be consistent with the goals of the minor. Examples of acceptable courses include science courses which cover energy science like biomass or other relevant basic science. 					
2	<ul style="list-style-type: none"> Students should strive to complete the necessary prerequisites and the depth courses prior to enrolling in the breadth courses. However, depth courses may be taken concurrently with the courses taken to meet the breadth requirement. Breadth courses may ordinarily serve as technical or free electives in the student's program of study. However, courses required by name and number and/or used to satisfy Core Areas A through E cannot be used to satisfy the requirements of a minor. All courses in the minor also must be 3000 level and above. 					
3	<ul style="list-style-type: none"> Ordinarily, students must complete all minor requirements before they can register for the Project in Energy Systems course. 					
Prerequisite Courses						
Students ordinarily pursue the minor upon completion of the needed prerequisites. However, the depth course requirements may be taken as soon as students have met the relevant prerequisites.						
The prerequisites needed for one or more of the courses required for the minor (breadth courses and the capstone project course) are (all existing courses):						
Code	Title	Credit Hours				
Mathematics						
MATH 1551 Differential Calculus		2				
MATH 1553 Introduction to Linear Algebra		2				
or MATH 1554 Linear Algebra						
MATH 1552 Integral Calculus		4				
MATH 2551 Multivariable Calculus		4				
Physics						
PHYS 2211 Introductory Physics I		4				
PHYS 2212 Introductory Physics II		4				
Chemistry						
CHEM 1310 General Chemistry		4				
or CHEM 1210 Chemical Principles I						
Prerequisite Courses						
Students ordinarily pursue the minor upon completion of the needed prerequisites. However, the depth course requirements may be taken as soon as students have met the relevant prerequisites.						
The prerequisites needed for one or more of the courses required for the minor (breadth courses and the capstone project course) are (all existing courses):						
Code	Title	Credit Hours				
Mathematics						
MATH 1551 Differential Calculus		2				

MATH 1553	Introduction to Linear Algebra or MATH 1554 Linear Algebra	2
MATH 1552	Integral Calculus	4
MATH 2551	Multivariable Calculus	4
Physics		
PHYS 2211	Introductory Physics I	4
PHYS 2212	Introductory Physics II	4
Chemistry		
CHEM 1310	General Chemistry or CHEM 1210 Chemical Principles I	4
Economics		
Select one of the following:		3-6
ECON 2100	Economic Analysis and Policy Problems	
or ECON 2101 Global Economy		
ECON 2105	Principles of Macroeconomics	
& ECON 2106 Principles of Microeconomics		

Additional Guidelines

- A maximum of 6 credit hours of Special Topics courses may be included in a minor program or the student may complete 3 credit hours of Special Topics and 3 credit hours of either Special Problems or Undergraduate Research.
- A maximum of 3 credit hours of transfer credit may be used to satisfy the course requirements for a minor. This includes courses taken at another institution or credit earned through the AP or IB program, assuming the scores meet Georgia Tech minimum standards.
- It is the **major advisor's responsibility** to verify that students are using only courses from the designated block(s) from the student's major field of study that are allowed to satisfy a minor program, that they are not using any Core Area A-E courses (including humanities and social sciences), and that they are not using any courses for more than one minor or certificate. Any free elective course used to satisfy the course requirements of the student's major degree program may also be used to satisfy the course requirements for a minor.

Requirements

Code	Title	Credit Hours
Depth Courses		
Select 6 credit hours related to energy systems: ¹		6
PHYS 3141 Thermodynamics		
PHYS 3232 Optics I		
PHYS 4251 Biophysics		
PHYS 4262 Solid-state Physics		
PHYS 4263 Nuclei, Particles, and Fields		
Breadth Courses		
Select two of the following: ²		6
ECON 3300 Economics of International Energy Markets		
PUBP 3350 Energy Policy		
CHEM 3700 The Science of Alternative Energy		
Capstone Course		
GT 4813 Project in Energy Systems ³		3
Total Credit Hours		15

¹ • The Depth Courses may have additional prerequisites; please check the current prerequisites.
 • A list of acceptable courses which meet the depth requirement is provided by each major approving the minor. Depth courses may be taken in the student's major to ensure the depth in that major needed to pursue a multidisciplinary minor. All acceptable depth courses must be consistent with the goals of the minor. Examples of acceptable courses include engineering courses covering a specific energy technology like solar or relevant engineering science.

² • Students should strive to complete the necessary prerequisites and the depth courses prior to enrolling in the breadth courses. However, depth courses may be taken concurrently with the courses taken to meet the breadth requirement.
 • Breadth courses may ordinarily serve as technical or free electives in the student's program of study. However, courses required by name and number and/or used to satisfy Core Areas A through E cannot be used to satisfy the requirements of a minor.

³ Ordinarily, students must complete all minor requirements before they can register for the Project in Energy Systems course.