The EESS education and research area focuses on air quality, water quality, remediation, industrial ecology, sustainable engineering, energy, and nanotechnology to provide skills, analysis tools, and technologies to meet environmental stewardship and sustainability challenges of the 21st Century.

MS Concentrations in Environmental Engineering, Sustainability and Science

Air Quality Engineering and Science

This concentration in the MS program provides students with in-depth knowledge of the sources, behaviors and effects of major pollutants, especially airborne particulate matter. With six faculty specializing in air quality in the College of Engineering we integrate measurements and modeling with issues of policy and decision making to allow evaluation of complex air quality problems. Coursework is interdisciplinary, and aims to provide skills, analysis tools, and technologies to meet emerging sustainability challenges.

Recommended Courses

The following courses are recommended for this concentration, but the MS program is flexible and students should work with their academic advisors to tailor coursework towards their own individual interests.

- **06-620** Global Atmosphere Chemistry: Fundamentals and Data Analysis Methods
- **12-751** Air Quality Engineering
- **12-781** Fundamentals of Atmospheric Aerosols
- **19-626** Climate Science and Policy
- **19-653** Special Topic: Climate Change Mitigation
- **24-620** Special Topic: Aerosol Measurement Technology
- **24-740** Combustion and Air Pollution Control

Additional Courses

The following crosscutting courses relate to this concentration and may be of interest for additional course work, depending on individual student goals.

- **12-704** Probability and Estimation Methods for Engineering Systems
- **12-706** Civil Systems Investment Planning and Pricing
- **12-726** Mathematical Modeling of Environmental Quality Systems
- **12-728** Remediation Engineering
- **12-741** Data Management
- **12-749** Special Topic: Climate Change Adaptation
- **19-688** Innovation for Energy and the Environment
- **48-569** GIS/CAFM
Water Quality Engineering and Science

This MS concentration gives students skills and experience with issues and approaches in water quality engineering from fundamental physical, chemical and biological perspectives, with applications to both natural and engineered systems. Students gain knowledge and skills to address modern challenges in water quality protection and restoration, including:

- Chemistry of natural waters
- Fate processes for organic contaminants in waters
- Physical-chemical and biological processes
- Water and wastewater treatment
- Environmental quality modeling

Recommended Courses
The following courses are recommended for this concentration, but the MS program is flexible and students should work with their academic advisors to tailor coursework towards their own individual interests and career goals.

12-702  Fundamentals of Water Quality Engineering
(if not previously taken)
12-720  Water Resources Chemistry
12-724  Biological Wastewater Treatment
12-725  Fate, Transport, and Physicochemical Processes of Organic Contaminants in Aquatic Systems
12-726  Mathematical Modeling of Environmental Quality Systems
12-729  Environmental Microbiology for Engineers

Additional Courses
The following crosscutting courses relate to this concentration and may be of interest for additional course work, depending on individual student goals.

12-657  Water Resources Engineering
12-658  Hydraulic Structures
12-704  Probability and Estimation Methods for Engineering Systems
12-706  Civil Systems Investment Planning and Pricing
12-712  Introduction to Sustainable Engineering
12-714  Environmental Life Cycle Assessment
12-718  Sustainable Engineering Project
12-728  Remediation Engineering
12-749  Special Topic: Climate Change Adaptation
12-750  Infrastructure Management
19-688  Innovation for Energy and the Environment
48-569  GIS/CAFM
Energy systems engineers belong to a broad and multidisciplinary field concerned with energy efficiency and sustainability in infrastructure systems and manufacturing processes. This EESS/AIS concentration provides students with knowledge and skills for analysis and management of existing energy infrastructure and systems, and for development of innovations to improve the performance of multiple systems. Related courses focus on tools for planning, pricing, operation, and integration of energy systems, and for life cycle assessment of environmental performance. This interdisciplinary concentration combines fundamental principles of engineering and science with public policy, adaptive design and technical analysis of energy technologies and related infrastructure.

Recommended Courses
The following courses are recommended for this concentration, but the MS program is flexible and students should work with their academic advisors to tailor coursework towards their own individual interests.

- 12-706 Civil Systems Planning and Pricing
- 12-712 Introduction to Sustainable Engineering
- 12-714 Environmental Life Cycle Assessment
- 12-749 Special Topics: Climate Change Adaptation
- 12-750 Infrastructure Management
- 39-611 Energy Demand and Utilization

Additional Courses
The following crosscutting courses relate to this concentration and may be of interest for additional course work, depending on individual student goals.

- 12-747 Sustainable Buildings
- 12-748 Mechanical and Electrical System Design for Buildings
- 19-443 Special Topics in EPP: Sustainable Energy for the Developing World
- 19-626 Climate Science and Policy
- 19-688 Innovation and Energy for the Environment
- 19-696 Special Topics: Sustainable Development and Innovation
- 19-881 Seminar in Electricity Market Restructuring
- 19-883 Special Topics: Seminar in Climate & Energy Decision Making Under Uncertainty
- 24-424 Energy and the Environment
- 39-610 Energy Conversion and Supply
- 39-613 Energy Transport and Storage
- 48-569 GIS/CAFM
Sustainability and Green Design

The concept of sustainability seeks to meet the needs of current generations without compromising those of future generations. This EESS concentration aims to create context for engineering decisions in the 21st century and to educate future decision makers in the industry about how the global and local drivers of sustainability are likely to affect their choices. Students examine the challenges of modern design with regard to:

- Sustainable and climate-resilient infrastructure
- Energy and environment
- Life cycle assessment
- Carbon footprinting

Courses introduce students to the economic, environmental, and social implications of infrastructure. Graduates are able to make decisions specifically geared toward sustainable engineering practices, and to define sustainability with respect to local as well as global effects.

Recommended Courses
The following courses are recommended for this concentration, but the MS program is flexible and students should work with their academic advisors to tailor coursework towards their own individual interests and career goals.

- 12-712 Introduction to Sustainable Engineering
- 12-714 Environmental Life Cycle Assessment
- 12-718 Sustainable Engineering Project
- 12-747 Sustainable Buildings
- 12-748 Mechanical and Electrical System Design for Buildings

Additional Courses
The following crosscutting courses relate to this concentration and may be of interest for additional coursework, depending on individual student goals.

- 12-704 Probability and Estimation Methods for Engineering Systems
- 12-706 Civil Systems Investment Planning and Pricing
- 12-726 Mathematical Modeling of Environmental Quality Systems
- 12-741 Data Management
- 12-749 Special Topics: Climate Change Adaptation
- 12-750 Infrastructure Management
- 19-688 Innovation for Energy and the Environment
- 39-611 Energy Demand and Utilization
- 48-569 GIS/CAFM

For a full listing of available courses and their descriptions, visit the Course Catalog in the HUB (cmu.edu/hub)