

Graduate Interdisciplinary Specialization in Data-Driven Sustainable Energy Systems

Program Overview

Updated 8/30/2022

Program Rationale

The purpose of the Graduate Interdisciplinary Specialization (GIS) in Data-Driven Sustainable Energy Systems is to provide graduate students with interdisciplinary training in energy-system modeling, data science, energy policy, business, and energy technologies. The GIS will provide students with an interest in sustainable energy the opportunity to develop their data analytic and computational skills, as well as provide them a more holistic understanding of economics, business, finance policy and law as it relates to sustainable, distributed, and digitized energy systems. Students will also strengthen their communication skills through experiential learning encounters and develop the ability to innovate, be adaptive, and design forward-thinking solutions to sustainable energy problems. Any graduate student who is interested in sustainable energy is welcome and encouraged to enroll in the program.

Curriculum

The curriculum for the GIS in Data-Driven Sustainable Energy Systems consists of six courses totaling 19 credit hours:

1. **Required introductory course (3 credits).** ISE 6020: Foundations of Data-Driven Sustainable Energy Systems must be taken to fulfill the introductory course requirement.
2. **Four elective courses (12 credits).** The elective courses should be selected in consultation with the student's advisor and the EmPOWERment Program Coordinator and must be outside of the student's primary area of study to ensure intellectual breadth. Elective courses may count towards both the primary degree and the GIS. Electives should be selected from a specially curated menu of courses in 5 thematic areas related to sustainable energy systems: 1) energy system modeling; 2) information systems; 3) energy policy, regulation, and economics; 4) energy-business modeling; and 5) energy technologies, components, and subsystems.
3. **Required capstone course (4 credits).** PUBAFRS 8620: Innovating for Sustainable Energy Systems must be taken to fulfill this requirement and should be taken following completion of the other courses within the GIS.

Specialization Guidelines

- Per graduate school guidelines, the GIS in Data-Driven Sustainable Energy Systems requires a minimum of 10 and no more than 20 semester credit hours of graduate level coursework.
- A graduate interdisciplinary specialization involves two or more graduate programs outside the student's home program. Nine credit hours must be taken outside of the student's home program in at least three courses and at least two other programs. Thus, if you are an ISE student, you must select at least three courses from the GIS course menu that come from outside that curriculum. These courses can come from other programs in the College of Engineering or from other colleges.
- Credit hours can include work already required as part of the student's degree program.
- If there is a course that fits the competencies but is not listed here, it may be possible to substitute it for a listed course. Contact the EmPOWERment program coordinator for more information.
- Enroll for the Specialization through OSU Graduate School at this address: <https://gradsch.osu.edu/pursuing-your-degree/career-development/degree-options/applying-graduate-minors-and>

Questions? Contact the EmPOWERment program coordinator.

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Advising Worksheet

CORE COURSEWORK (19 CREDIT HOURS)

Name: _____

Primary graduate program/major: _____

1. Complete foundations course (3 credits):

Course	Semester Completed
ISE 6020: Foundations of Data-Driven Sustainable Energy Systems ¹	

2. Complete one course in four of the program's five thematic areas² (12 credits):

Thematic Area	Course	Semester Completed

3. Complete capstone course (4 credits):

Course	Semester Completed
PUBAFRS 8620: Innovating for Sustainable Energy Systems	

¹ Student either takes ISE6020 or, when applicable, the cross-listed section of the course in their department.

² These courses should be selected in consultation with your adviser in your primary graduate program/major and the EmPOWERment program coordinator. Courses selected are required to be outside of the area of focus of your primary graduate program/major. Even if it is listed under multiple thematic areas, a single course cannot be counted towards more than one thematic area for purposes of meeting this requirement.

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Elective Courses by Thematic Area

Thematic Area 1 Energy-Systems Modeling

ATMOSSC 5901	Climate System Modeling
CIVILEN 5420	Remote Sensing of Environment
EARTHSC 5650	Glaciology
EARTHSC 5651	Hydrogeology
EARTHSC 5655	Land Surface Hydrology
EARTHSC 5751	Quantitative Reservoir Modeling
ENR 5400	Interventions to Promote Pro-environmental Behavior
ENR 7150	Environment, Risk and Decision Making
ENR 7380	Climate and Society
ENR 7400	Communicating Environmental Risk
ENR 8400	Theories in Environmental Social Sciences
ENVENG 6610	Analytic Frameworks for Science, Engineering, and Policy
GEOG 5803	Sustainable Energy Geographies
ISE 5043	Power Systems - Analysis and Operation
ISE 5220	Complementarity Theory & Applications
ISE 5225	Electricity Market Analytics

Thematic Area 2 Information Systems

BUSOBA 6400	Statistics and Data Analysis for Managers
CIVILEN 5001	Introduction to GIS
CIVILEN 7453	Photogrammetric Computer Vision
CSE 5234	Distributed Enterprise Computing
CSE 5241	Introduction to Database Systems
CSE 5244	Data Management in the Cloud
CSE 5361	Numerical Methods
CSE 5471	Information Security
CSE 5521	Survey of Artificial Intelligence I: Basic Techniques
CSE 6333	Distributed Algorithms
CSE 6521	Artificial Intelligence
ENVENG 6220	Data Analysis in Environmental Engineering
ESQREM 8659	Structural Equation Modeling
GEOG 5210	Fundamentals of GIS
GEOG 5212	Geospatial Databases
GEOG 8902	Applied Climatology
HCS 5887	Introduction to Experimental Design
ISE 5194	Introduction to Operations Analytics
ISE 6120	Quality Improvement and Analytics
ISE 7210	Large Scale Optimization
ISE/ECE 7202	Reinforcement Learning
MATH 5601	Essentials of Numerical Methods
MATH 5603	Numerical Linear Algebra
MBA 6273	Data Analysis for Managers
PUBAFRS 7571	Multivariate Data Analysis
PUBAFRS 8782	Seminar in Public Policy Modeling
SOCIOL 6649	Intro to Quantitative Research/Multiple Regression
STAT 5302	Intermediate Data Analysis II
STAT 5510	Statistical Foundations of Survey Research
STAT 5730	Introduction to R for Data Science
STAT 5740	Introduction to SAS Software
STAT 5760	Statistical Consulting Support from the SCS
STAT 6450	Applied Regression Analysis

Thematic Area 3
Energy Policy, Regulation, and Economics

AEDE 6110	Applied Quantitative Methods I
AEDE 6120	Applied Quantitative Methods II
AEDE 7130	Applied Econometrics I
AEDE 7140	Applied Econometrics II
AEDE 7310	Advanced Environmental Economics
AEDE 7320	Advanced Resource Economics
CIVILEN 5420	Remote Sensing of Environment
EARTHSC 5203	Geo-environment and Human Health
EARTHSC 5206	Advanced Oceanography
EARTHSC 5651	Hydrogeology
EARTHSC 5655	Land Surface Hydrology
EARTHSC 6750	Paleoclimatology
ECON 6700	Survey of Mathematical Methods in Economics
ECON 6701	Survey of Statistical Methods in Economics
ECON 6731	Survey of Econometric Methods I
ECON 6732	Survey of Econometric Methods II
ECON 8731	Econometrics I
ECON 8732	Econometrics II
ENR 5210	US Environmental Impact Assessment
ENR 5211	International Environmental Impact Assessment
ENR 7450	Frameworks and Theories of Environmental Policy
ENR 7520	Environmental Science and Law
ENVENG 5600 / PUBAFRS 5600	Science, Engineering, and Public Policy
ENVENG 6610	Analytic Frameworks for Science, Engineering, and Policy
GEOG 5301	Sustainable Transportation
GEOG 5402	Land Use Geography
GEOG 5803	Sustainable Energy Geographies
ISE 5225	Electricity Market Analytics
ISE 6840	Market Engineering and Applications
LAW8309	Environmental Law
LAW8310	Energy Law
LAW8311	Climate Change Law
PUB AFRS 8782	Seminar in Public Policy Modeling
PUBAFRS 5610	Innovation, Policy and the Global Economy
PUBAFRS 5770	Risk & Decision Analysis
PUBAFRS 7509	Disaster Preparedness and Response
PUBAFRS 7531	Economic Development, Planning and Policy
PUBAFRS 7534	Privatization
PUBAFRS 7535	Regulation and Deregulation
PUBAFRS 7910	Energy and Environmental Policy Capstone
PUBAFRS 8030	Seminar in Public Policy
PUBAFRS 8050	Seminar in Public Economics
RURLSOC 5500	Diffusion of Innovations
RURLSOC 5580	Social Impact Assessment
RURLSOC 7550	Rural Community Development in Theory and Practice
RURLSOC 7560	Environmental Sociology
RURLSOC 8500	Development Sociology in Theory and Practice
STAT 5302	Intermediate Data Analysis II
STAT 5550	Introductory Time Series Analysis
STAT 6450	Applied Regression Analysis
STAT 6550	The Statistical Analysis of Time Series
STAT 6620	Environmental Statistics

Thematic Area 4
Energy Business Modeling

BUSOBA 7253*	Sustainable Operations
BUSOBA 7259*	Operations and Technology Strategy
CRPLAN 6425	Measuring Resilience to Disasters for Planning
EARTHSC 5661	Petroleum Geology
EARTHSC 5687	Borehole Geophysics
EARTHSC 5751	Quantitative Reservoir Modeling
ENR 5400	Interventions to Promote Pro-environmental Behavior
ENR 7150	Environment, Risk and Decision Making
ENR 7380	Climate and Society
ENR 7400	Communicating Environmental Risk
ENR 7430	Sustainability Psychology
ENR 8400	Theories in Environmental Social Sciences
MBA 6220	Finance
MBA 6223	Finance
MBA 6233	Operations Management
MBA 6261	Global Environment of Business
RURLSOC 5500	Diffusion of Innovations
RURLSOC 7550	Rural Community Development in Theory and Practice
RURLSOC 7560	Environmental Sociology
RURLSOC 8500	Development Sociology in Theory and Practice

*BUSOBA 7253 and BUSOBA 7259 are each 1.5-unit courses and should be taken in combination to completely satisfy the 3.0-unit requirement for the thematic area that the courses will be applied to.

Thematic Area 5
Energy Technology, Components, and Sub-systems

BUSOBA 7253*	Sustainable Operations
BUSOBA 7259*	Operations and Technology Strategy
CIVILEN 5760	Transportation Networks
CIVILEN 6210	Building Physics
CIVILEN 6211	Building Energy Simulation
ECE 5025	Power Electronics Devices, Circuits, and Applications
ECE 5042	Power Systems
ECE 5237	Photovoltaic Lab
ECE 5400 / CIVILEN 5750	Instrumentation, Signals, and Control in Transportation Applications
ECE 6541	Advanced Topics in Sustainable Energy
ENVENG 5195 / PUBHEHS 5395	Engineering Design for Environmental Health
FABENG 5310	Ecological Engineering and Science
FABENG 5540	Biomass Conversion to Bioenergy
FABENG 5550	Sustainable Waste Management
FABENG 5820	Environmental Controls and Air Quality
MATSCEN 5572	Materials for Energy Technology
MBA 6233	Operations Management
MBA 6261	Global Environment of Business

*BUSOBA 7253 and BUSOBA 7259 are each 1.5-unit courses and should be taken in combination to completely satisfy the 3.0-unit requirement for the thematic area that the courses will be applied to.