RENEWABLE ENERGY AND SUSTAINABILITY SYSTEMS

Graduate Program Head
Ali Demirci

Program Code
RESS

Campus(es)
World Campus (M.P.S.)

Degrees Conferred
Master of Professional Studies (M.P.S.)

The Graduate Faculty
View (https://secure.gradsch.psu.edu/gpms/index.cfm?searchType=fac&prog=RESS)

The intercollege RESS professional master’s program (iMPS-RESS) is an online-interdisciplinary master's degree program designed to prepare professionals in the fields of renewable energy and sustainability systems to lead the world's transformation from an unsustainable, fossil energy economy to a renewable, sustainable basis of operation. For example, attaining an ambitious national goal of 25% of energy from renewable resources by the year 2025 in the U.S. requires a tremendous increase in renewable energy production and use in ways that are sustainable, environmentally sound, and reliable. The iMPS-RESS program is designed to address the critical need for professionals with relevant expertise in renewable energy and sustainability systems.

The program provides broad coverage of topics related to renewable energy and sustainability systems while providing in-depth coverage of select topics such as solar, wind, bioenergy, and sustainability management and policy. Students are required to follow a focused curriculum that combines requisite rigor with flexibility appropriate to a rapidly changing field. Students take a number of core program courses that provide an in-depth understanding of the sustainability framework relevant to energy and sustainability systems and, in consultation with their program adviser, select additional courses from a broad array of electives designed to meet their individual learning goals. While not required to do so, students may choose from one of four program options that provide specialized technical instruction in various aspects of renewable energy and sustainability systems. A comprehensive Scholarship and Academic Research Integrity (SARI) plan embeds ethics and integrity training both at the start and at the end of the master's program. A capstone course is required of all students that serves to aggregate the material learned and provide a summative educational experience within the framework of a semester long group-based project.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (http://gradschool.psu.edu/prospective-students/how-to-apply). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions (http://gradschool.psu.edu/graduate-education-policies).

Educational Background

Academic performance and/or professional experience must be equivalent to that expected for admission to a typical resident-program master's degree. Applications must include a statement of professional goals, a curriculum vita or resume, and three letters of recommendation. Official records of scores on the Graduate Record Exam (GRE) are also required. However, this requirement may be waived under certain circumstances; please contact the program directly.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students) for more information.

Core Application Packet

- Statement of Purpose: A statement of professional experience and goals (up to 500 words)
- Vita or resume
- Three letters of recommendation. The individuals writing letters should be familiar with you and comfortable discussing your professional and/or academic strengths and accomplishments. Preferably, all letters will be written within the last six months and reference the applicant's current career goals and/or ability to perform graduate level study.
- Official transcripts from all post-secondary institutions attended (http://www.gradschool.psu.edu/prospective-students/how-to-apply/new-applicants/requirements-for-graduate-admission)
- Test of English as a Foreign Language (TOEFL) or International English Language Testing System (IELTS) score, if applicable
- Nonrefundable application fee

Admissions Process

Applications will be evaluated by the iMPS-RESS Admissions Committee based on the applicants' technical qualifications for the program relative to their area of interest, their previous educational experience, and English Language proficiency. In general, successful applicants are expected to have earned a junior/senior grade-point average of at least 3.0 on a 4.0 scale. Applicants with a marginal record are encouraged to first complete a related Graduate Certificate before applying for admission to the iMPS-RESS program. Exemplary performance in the graduate certificate will be taken into consideration for possible admission into the iMPS-RESS program, but completion of a certificate does not imply or guarantee admission into a degree program.

Degree Requirements

Master of Professional Studies (M.P.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Requirements (http://gradschool.psu.edu/graduate-education-policies).

The iMPS-RESS degree is conferred upon students who earn a minimum of 32 credits of course work while maintaining an average grade-point average of 3.0 or better in all course work, including at least 18 credits at the 500 or 800 level (with at least 6 credits at the 500 level), and who complete a quality culminating capstone project in consultation with a graduate adviser. The program curriculum includes:

- 11 credits of core courses,
- 9-12 credits of a selected option (or adviser-approved course of study),
- 6-9 credits of electives, and
- a 3-credit capstone course (ABE 589).
Substitutions for required courses, either with resident-education courses, alternate online courses, or courses from other institutions, will be considered on a case-by-case basis, and must be petitioned and approved by the Academic Program Chair, with input from the student’s adviser.

### Bioenergy Option
The Bioenergy Option will create graduates who can lead the development of the rapidly expanding bioenergy industry. Many companies are not able to hire staff with appropriate training to meet their R&D, management, and production needs. As a result, there is a large and unmet need to train professionals at the master’s level with skills in applied science, communication, business, social and industry perspectives for the emerging bio-based economy. Important components of this industry include crop production, harvesting, storage, ecology, genetics, fermentation, engineering, value chain systems modeling, marketing, economics, and sociology.

NOTE: A background in systems science, engineering, or physics is strongly recommended for students interested in this option. Students may contact the Option Leader for more information.

Students are required to take the following courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABE 884</td>
<td>Biomass Energy Systems</td>
<td>3</td>
</tr>
<tr>
<td>ABE 885</td>
<td>Biomass Harvesting and Logistics</td>
<td>3</td>
</tr>
<tr>
<td>ABE 888</td>
<td>Conversion Technologies for Bioenergy Production</td>
<td>3</td>
</tr>
<tr>
<td>FOR 880</td>
<td>Bioenergy Feedstocks</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Total Credits</strong></td>
<td>12</td>
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</tbody>
</table>

### Solar Energy Option
The Solar Energy Option will create graduates who can lead project and policy development in the solar energy industry. The skills of master’s level solar systems project development include solar resource assessment for selected locales, effective communications to design to maximize the solar economic utility to the client/stakeholders, knowledge of thermal- and electric-derived solar conversion technologies, technical knowledge of design in hybridized solar systems design, and the social and policy context of solar systems project design. Courses in the solar option will have two parallel paths to address either:

1. Utility-industrial solar electric and solar thermal projects (e.g., large-scale solar and industrial processing); or
2. Distributed solar electric and solar thermal projects (e.g., residential and commercial built environment).

NOTE: A background in systems science, engineering, or physics is strongly recommended for students interested in this option. Students may contact the Option Leader for more information.

Students are required to take the following courses:

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<thead>
<tr>
<th>Code</th>
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<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>AE 878</td>
<td>Solar Project Development and Finance</td>
<td>3</td>
</tr>
<tr>
<td>EME 810</td>
<td>Solar Resource Assessment and Economics</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Select 6 credits from the following:</td>
<td></td>
</tr>
<tr>
<td>AE 862</td>
<td>Distributed Energy Planning and Management</td>
<td></td>
</tr>
<tr>
<td>AE 868</td>
<td>Commercial Solar Electric Systems</td>
<td></td>
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<tr>
<td>EME 811</td>
<td>Solar Thermal Energy for Utilities and Industry</td>
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<tr>
<td>EME 812</td>
<td>Utility Solar Power and Concentration</td>
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<tr>
<td></td>
<td><strong>Total Credits</strong></td>
<td>12</td>
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</tbody>
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### Sustainability Management and Policy Option
The Sustainability Management and Policy Option will create graduates who will lead sustainability project planning and policy development, given the systems approach of sustainability in business and government. The demand is already high for graduate leaders with deep understanding of the science of sustainability, combined with systems acumen to assess risk and plan for renewable energy projects, and communication skills to develop new policy implementation. The expanded fields of renewable energy, energy trading, and sustainability systems management dictate that master’s level education be centralized to the science of sustainability, analysis of market and non-market strategies, communication to facilitate energy policy development, and systems thinking approaches to unify the project development approach.

Students are required to take the following courses:
# Renewable Energy and Sustainability Systems

## Required Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
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<tbody>
<tr>
<td>BA 850</td>
<td>Sustainability Driven Innovation</td>
<td>3</td>
</tr>
<tr>
<td>EME 803</td>
<td>Applied Energy Policy</td>
<td>3</td>
</tr>
<tr>
<td>EME 805</td>
<td>Renewable Energy and Nonmarket Enterprise</td>
<td>3</td>
</tr>
<tr>
<td>EME 807</td>
<td>Technologies for Sustainability Systems</td>
<td>3</td>
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Total Credits: 12

## Wind Energy Option

The Wind Energy Option will produce graduates who have broad understanding of the wind farm development process, as well as technical depth in turbine technology and the science of properly siting wind turbines. Graduates will be able to model wind project performance; balance the complexities of permitting, logistics, and the ecological impacts of wind project development; and conduct turbine load and acoustic analyses. They will also understand the limitations of models and will be equipped as leaders for producing advancement in the industry.

NOTE: A background in incompressible fluid mechanics, statics, and dynamics is highly recommended for students interested in this option. Students may contact the Option Leader for more information.

Students are required to take the following courses:

<table>
<thead>
<tr>
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<th>Title</th>
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</thead>
<tbody>
<tr>
<td>AERSP 583</td>
<td>Wind Turbine Aerodynamics</td>
<td>3</td>
</tr>
<tr>
<td>AERSP 880</td>
<td>Wind Turbine Systems</td>
<td>3</td>
</tr>
<tr>
<td>AERSP 886</td>
<td>Engineering of Wind Project Development</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits: 9

## Student Aid

World Campus students in graduate degree programs may be eligible for financial aid. Refer to the Tuition and Financial Aid section (http://www.worldcampus.psu.edu/tuition-and-financial-aid) of the World Campus website for more information.

## Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Agricultural and Biological Engineering (ABE) Course List (https://bulletins.psu.edu/university-course-descriptions/graduate/abe)

Energy and Mineral Engineering (EME) Course List (https://bulletins.psu.edu/university-course-descriptions/graduate/eme)

Systems Engineering (SYSEN) Course List (https://bulletins.psu.edu/university-course-descriptions/graduate/sysen)

## Learning Outcomes

1. Execute and evaluate sustainability or renewable energy systems using baseline, techno-economic, life cycle, or cost/benefit analyses.

2. Demonstrate fundamental understanding of the principles of energy science, including resource availability and conversion technologies.

3. Demonstrate an appreciation for the commercialization process relative to project and product development.

4. Demonstrate the ability to make sound decisions in complex situations.

5. Evaluate sustainability decisions in the broader context of society’s interests.