This template is to be used only by programs that have received specific written approval from the Provost’s office to proceed with internal proposal development and review. The proposal template should be completed in full and submitted to the University Provost’s Office. It must undergo all internal university review and approval steps including those at the unit, college, and university levels. A program may not be implemented until the Provost’s Office notifies the academic unit that the program may be offered.

### MASTER'S DEGREE PROGRAM

<table>
<thead>
<tr>
<th>College/School:</th>
<th>Ira A. Fulton Schools of Engineering</th>
</tr>
</thead>
</table>

*Note: Program ownership is coded at the College/School level first and may not be a center, department or division apart from it.*

<table>
<thead>
<tr>
<th>Department/Division/School:</th>
<th>School for Engineering of Matter, Transport and Energy (CMULTISCI)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Proposing faculty group (if applicable):</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Name of proposed degree program:</th>
<th>Modern Energy Production and Sustainable Use</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Proposed title of major:</th>
<th>Modern Energy Production and Sustainable Use</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Master’s degree type:</th>
</tr>
</thead>
</table>

If Degree Type is “Other”, provide degree type and proposed abbreviation:

*Note: for more information about program fee requests, visit [https://provost.asu.edu/curriculum-development/changemaker/form-instructions#fees](https://provost.asu.edu/curriculum-development/changemaker/form-instructions#fees)*

<table>
<thead>
<tr>
<th>Is a program fee required?</th>
<th>No, a program fee is not required.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Is the unit willing and able to implement the program if the fee is denied?</th>
<th>N/A</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Requested effective term and year:</th>
<th>Summer 2020</th>
</tr>
</thead>
</table>

(The first semester and year for which students may begin applying to the program)

<table>
<thead>
<tr>
<th>Delivery method and campus or location options:</th>
<th>select all locations that apply</th>
</tr>
</thead>
</table>

- Downtown
- Polytechnic
- Tempe
- Thunderbird
- West
- Other:
- Both on-campus and ASU Online* - (check applicable campus(es) from options listed above)
- ASU Online only (all courses online and managed by ASU Online)

*Note: Once students elect a campus or Online option, students will not be able to move between the on-campus and the ASU Online options. Approval from the Office of the University Provost and Philip Regier (Executive Vice Provost and Dean) is required to offer programs through ASU Online. Please complete the ASU Online Offering form in Curriculum ChangeMaker to begin this request. Prior to completing the online Curriculum ChangeMaker form, please contact EdPlus at asuonline@asu.edu who can provide you with additional information regarding the online request process.*

<table>
<thead>
<tr>
<th>Do Not Fill in this information:</th>
<th>Office Use Only</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Plan Code:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>CIP Code:</th>
</tr>
</thead>
</table>

### PROPOSAL CONTACT

<table>
<thead>
<tr>
<th>Name:</th>
<th>Mia Kroeger</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title:</td>
<td>Assistant Director, Academic Services</td>
</tr>
<tr>
<td>Phone number:</td>
<td>480 727 9318</td>
</tr>
<tr>
<td>Email:</td>
<td><a href="mailto:mia.kroeger@asu.edu">mia.kroeger@asu.edu</a></td>
</tr>
</tbody>
</table>

Request to implement a new master’s degree program 11-6-17
1. PURPOSE AND NATURE OF PROGRAM

A. Provide a brief program description:

The School for Engineering of Matter, Transport, and Energy will offer the Master of Science in Modern Energy Production and Sustainable Use and will utilize its unique transdisciplinary expertise to provide graduate student training in fundamental science and engineering principles, and thereby facilitate the generation of human capital of those who can address grand challenges associated with future energy production and storage. The need for sustainable use will require engineers to rethink how things are manufactured and used. Manufacturing processes must be more energy efficient and use more sustainable materials. Manufactured products must be designed to operate more energy efficiently. Training will range from renewable solar and wind production to cleaner nuclear energy production. In addition, students will be trained in more efficient energy storage, energy-saving materials and manufacturing, and sustainable transportation. The six credits of sustainability elective coursework allow students the flexibility to take non-technical courses (e.g., energy policy or energy management) or an additional six credits of technical elective (TE) courses.

B. Will concentrations be established under this degree program? ☐ Yes ☒ No

(Please provide additional concentration information in the curricular structure section – number 7.)

2. PROGRAM NEED

Explain why the university should offer this program (include data and discussion of the target audience and market).

The U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy shares that as new energy technologies are developed and introduced for commercial use, they will create new jobs for American workers strengthening U.S. energy, security, environmental quality, and economic vitality. [Link](https://www.energy.gov/sites/prod/files/2015/12/f27/EERE_Strategic_Plan_12.16.15.pdf). These workers need to
be trained in a variety of transdisciplinary areas, from renewable energy generation and storage, energy-saving materials and manufacturing, and sustainable transportation.

This program will be more technical than the current Professional Science Masters (PSM) in Solar Energy Engineering and Commercialization (SEC). Like other PSM programs from across the country, it is a transdisciplinary degree program that provides students with a possible one-year path to graduation. The core and (technical electives) TEs of the PSM are less technical in nature and come from a much broader range of disciplines, compared to the MS which has a significant focus on engineering, science and math coursework. Given that SEC students come from engineering and a variety of non-technical undergraduate disciplines, the engineering content cannot be as technically rigorous as in the other SEMTE graduate courses. In addition, the SEC program requires that more than half of its electives courses be non-technical courses. SEC students typically find employment as managers and project leaders and do not pursue PhD degrees.

The new MS degree is attractive to students from engineering and sciences disciplines. The core and technical elective courses are engineering based, sciences and math based. Students in the new degree program have the flexibility to take up to six credits of non-technical sustainability coursework (e.g., energy policy or energy management) and six credits of technical sustainability courses (e.g., energy analytics and statistical modeling). This new MS degree will have a more flexible and eclectic course offering than the current MSE in Sustainable Engineering, PhD in Sustainable Energy, and MS & MSE Civil, Environmental and Sustainable Engineering degrees. Students will be able to use any SEMTE graduate course as a technical elective. In addition, student will be able choose from a list approved technical electives from chemistry, physics, civil engineering, and electrical engineering. Graduates with this degree can pursue a PhD degree in either mechanical engineering, materials science, chemical engineering, electrical engineering, civil engineering or sustainability. In addition, graduates with this degree can find employment as practicing engineers - such as environment engineers (US Dept. of Labor projected 2026 employment 58,300 people), chemical engineers (US Dept. of Labor projected 2026 employment 35,100 people), materials engineers (US Dept. of Labor projected 2026 employment 28,000 people), and mechanical engineers (US Dept. of Labor projected 2026 employment 324,100 people), https://www.bls.gov/ooh/architecture-and-engineering/home.htm. An Emsi report generated for a master’s certificate emphasizing energy-related engineering jobs shows similar results. Regional trends predict the job market will increase by 6.7% from 262,185 in 2017 to 279,751 jobs by 2023. This is an increase of 17,566 new jobs.

3. IMPACT ON OTHER PROGRAMS

Attach any letters of collaboration or support from impacted programs (see checklist sheet). Please submit as a separate document.

See Appendix III

4. PROJECTED ENROLLMENT
How many new students do you anticipate enrolling in this program each year for the next five years?

Note: The Arizona Board of Regents (ABOR) requires that nine master’s degrees be awarded every three years. Thus, the projected enrollment numbers must account for this ABOR requirement.

<table>
<thead>
<tr>
<th>5-YEAR PROJECTED ANNUAL ENROLLMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Please utilize the following tabular format</td>
</tr>
<tr>
<td>1st Year</td>
</tr>
<tr>
<td>Number of Students Majoring (Headcount)</td>
</tr>
</tbody>
</table>

5. ACCREDITATION OR LICENSING REQUIREMENTS (if applicable)
Provide the names of the external agencies for accreditation, professional licensing, etc. that guide your curriculum for this program, if any. Describe any requirements for accreditation or licensing.

None

6. STUDENT LEARNING OUTCOMES AND ASSESSMENT
Attach a PDF copy of the assessment plan printed from the University Office of Evaluation and Educational Effectiveness assessment portal demonstrating UOEEE’s approval of your assessment plan for this program. Visit the assessment portal at [https://uoeee.asu.edu/assessment-portal](https://uoeee.asu.edu/assessment-portal) or contact uoeee@asu.edu with any questions.

See Appendix II

7. CURRICULAR STRUCTURE
A. Curriculum Listing

<table>
<thead>
<tr>
<th>Required Core Courses for the Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choose 4 from the list below:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prefix and Number</th>
<th>Course Title</th>
<th>New Course?</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAE 579</td>
<td>Wind Energy</td>
<td>No</td>
<td>3</td>
</tr>
<tr>
<td>MAE 582</td>
<td>Renewable Energy: Mechanical Systems</td>
<td>No</td>
<td>3</td>
</tr>
<tr>
<td>MAE 576</td>
<td>Energy Efficiency</td>
<td>No</td>
<td>3</td>
</tr>
<tr>
<td>MSE 560</td>
<td>Nanomaterials in Energy Production and Storage</td>
<td>No</td>
<td>3</td>
</tr>
<tr>
<td>CHE 578</td>
<td>Biomass Energy Conversion Technology</td>
<td>No</td>
<td>3</td>
</tr>
<tr>
<td>CHE 573</td>
<td>Fuel Cells and Biofuel Cells</td>
<td>Yes</td>
<td>3</td>
</tr>
<tr>
<td>SEC 501</td>
<td>Solar Engineering and Commercialization I</td>
<td>No</td>
<td>3</td>
</tr>
<tr>
<td>ALT 535</td>
<td>Applied Photovoltaics</td>
<td>No</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Elective or Research Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>(as deemed necessary by supervisory committee)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prefix and Number</th>
<th>Course Title</th>
<th>New Course?</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics Requirement (choose one)</td>
<td></td>
<td>No</td>
<td>3</td>
</tr>
<tr>
<td>MAE 501 Linear Algebra in Engineering</td>
<td></td>
<td>No</td>
<td>3</td>
</tr>
</tbody>
</table>

Request to implement a new master’s degree program 11-6-17
# PROPOSAL TO ESTABLISH A NEW MASTER'S DEGREE PROGRAM

### COURSES

**A. Course Prefix(es):** Provide the following information for the proposed graduate program.

**i. Will a new course prefix(es) be required for this degree program?**

<table>
<thead>
<tr>
<th>New Course Prefix(es)</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>☐</td>
<td>☑</td>
</tr>
</tbody>
</table>

1. List all required core courses and total credit hours for the core (required courses other than internships, thesis, capstone course, etc.).
2. Omnibus numbered courses cannot be used as core courses.
3. Permanent numbers must be requested by submitting a course proposal to Curriculum ChangeMaker for approval.

| MAE 502 Partial Differential Equations in Engineering |
| MAE 505 Perturbation Methods |
| MAE 512 Random Vibrations |
| MAE 521 Structural Optimization |
| MAE 528 Advanced Computational Mechanics |
| MAE 542 Design Geometry and Kinematics |
| MAE 598 Special Topics |
| o Design Optimization |
| o LMI Methods in Optimal and Robust Control |
| o Spectral Methods in Computational Fluid Dynamics |
| IEE 570 Advanced Quality Control |
| IEE 572 Design Engineering Experiments |
| STP 5XX or higher |
| MAT 5XX or higher |
| SOS 5XX Sustainability electives (Any SOS 500 and above) | No | 6 |
| MAE 5XX OR MSE 5XX OR CHE 5XX Technical electives | No | 9 |

**Section sub-total:** 18

**Culminating Experience(s)**

*E.g. – Capstone course, portfolio, written comprehensive exam, applied project, thesis (must be 6 credit hours with oral defense)*

<table>
<thead>
<tr>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portfolio</td>
</tr>
</tbody>
</table>

The portfolio consists of two projects completed by the student in their engineering classes, chosen by the student, from the student’s iPOS. A paper summarizing the projects and synthesizing the knowledge obtained, plus a cover page is attached to the portfolio in one pdf format.

**Section sub-total:** 0

**Total required credit hours**

30

---

11-6-17
If yes, complete the Course Prefixes / Subjects Form for each new prefix and submit it as part of this proposal submission. Form is located under the courses tab.

B. New Courses Required for Proposed Degree Program: Provide course prefix, number, title, credit hours and brief description for any new courses required for this degree program.

CHE 573 Fuel Cells and Biofuel Cells

Comprehensive analysis of fuel cell technologies. We will begin by discussing the different types of fuel cells and the thermodynamic and kinetic fundamentals that control their performance. Then, we will discuss materials and techniques used to characterize fuel cells. We will finish the course with a specific analysis of biofuel cells and their applications.

9. FACULTY, STAFF, AND RESOURCE REQUIREMENTS

A. Faculty

i. Current Faculty – Complete the table below for all current faculty members who will teach in the program. If listing faculty from an academic unit outside of the one proposing the degree, please provide a support statement from that unit.

<table>
<thead>
<tr>
<th>Name</th>
<th>Rank</th>
<th>Highest Degree</th>
<th>Area of Specialization/Expertise</th>
<th>Estimated Level of Involvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terry Alford</td>
<td>Professor</td>
<td>PhD</td>
<td>Organic Solar Cells</td>
<td>Graduate Program Chair</td>
</tr>
<tr>
<td>Peter Crozier</td>
<td>Professor</td>
<td>PhD</td>
<td>Nanomaterials in Energy Production and Storage</td>
<td>Instructor</td>
</tr>
<tr>
<td>Candance Chan</td>
<td>Associate Prof.</td>
<td>PhD</td>
<td>Electrochemical Energy Storage and Conversion</td>
<td>Instructor</td>
</tr>
<tr>
<td>Shuguang Deng</td>
<td>Professor</td>
<td>PhD</td>
<td>Biomass Energy Conversion Technology</td>
<td>Instructor</td>
</tr>
<tr>
<td>Cesar Torres</td>
<td>Associate Prof.</td>
<td>PhD</td>
<td>Fuel Cells &amp; Biofuel Cells</td>
<td>Instructor</td>
</tr>
<tr>
<td>Ronald Calhoun</td>
<td>Associate Prof.</td>
<td>PhD</td>
<td>Wind Energy and Renewable Energy</td>
<td>Instructor</td>
</tr>
<tr>
<td>Patrick Phelan</td>
<td>Professor</td>
<td>PhD</td>
<td>Energy Management</td>
<td>Instructor</td>
</tr>
</tbody>
</table>

ii. New Faculty - Describe the new faculty hiring needed during the next three years to sustain the program. List the anticipated hiring schedule and financial sources for supporting the addition of these faculty members.

None

iii. Administration of the program - Explain how the program will be administered for the purposes of admissions, advising, course offerings, etc. Discuss the available staff support.

The graduate program chair will be responsible for the program and will report directly to the SEMTE director. All admissions and advising activities will follow the current SEMTE process.

Given that all courses except one are already exist, there is adequate SEMTE staff in place to support this effort.

B. Resource requirements needed to launch and sustain the program: Describe any new resources required for this program’s success such as new staff, new facilities, new library resources, new technology resources, etc.

None
APPENDIX
OPERATIONAL INFORMATION FOR GRADUATE PROGRAMS
(This information is used to populate the Graduate Programs Search/catalog website.)

1. **Proposed title of major:** Modern Energy Production and Sustainable Use

2. **Marketing description** *(Optional - 50 words maximum. The marketing description should not repeat content found in the program description.)*

Where do sustainable engineering and renewable energy production meet? How can you apply your technical engineering skills to creating solutions for complex energy systems? Demonstrate real-world, proven capabilities and interdisciplinary thinking by mastering skills related to renewable energy generation and storage, energy-saving materials and manufacturing, and sustainable transportation.

3. **Provide a brief program description** *(Catalog type (i.e. will appear in Degree Search) – no more than 150 words. Do not include any admission or curriculum information.)*

This Master of Science in Modern Energy Production and Sustainable Use prepares students for professional careers in transdisciplinary areas from renewable energy generation and storage, energy-saving materials, manufacturing, sustainable transportation, and related fields in industry, government and educational institutions.

4. **Delivery/Campus Information Options:** On-campus only (ground courses and iCourses)

5. **Campus(es) where program will be offered:**

   ASU Online curriculum consists of courses that have no face-to-face content. iCourses are online courses for students in on-campus programs. iCourses may be included in a program, but may not comprise the entirety of a program. On-campus programs must have some face-to-face content.

   **Note:** Office of the Provost approval is needed for ASU Online delivery option.

   - [ ] ASU Online only (all courses online and managed by ASU Online)
   - [ ] All other campus or location options (please select all that apply):
     - [ ] Downtown Phoenix
     - [ ] Polytechnic
     - [x] Tempe
     - [ ] West
     - [ ] Other: ____________

   - [ ] Both on-campus and ASU Online* - (check applicable campus(es) from options listed above)

   **Note:** Once students elect a campus or Online option, students will not be able to move between the on-campus and the ASU Online options. Approval from the Office of the University Provost and Philip Regier (Executive Vice Provost and Dean) is required to offer programs through ASU Online. Please complete the ASU Online Offering form in Curriculum ChangeMaker to begin this request. Prior to completing the online Curriculum ChangeMaker form, please contact EdPlus at asuonline@asu.edu who can provide you with additional information regarding the online request process.

6. **Admission Requirements:**

   Applicants must fulfill the requirements of both the Graduate College and the Ira A. Fulton Schools of Engineering.

   Applicants are eligible to apply to the program if they have earned a bachelor’s or master’s degree in any engineering, physical science or related field, from a regionally accredited institution.

   Applicants must have a minimum of a 3.00 cumulative GPA (scale is 4.00 = "A") in the last 60 hours of a student's first bachelor's degree program, or applicants must have a minimum of a 3.00 cumulative GPA (scale is 4.00 = "A") in an applicable master's degree program.
Applicants are required to submit:
1. graduate admission application and application fee
2. official transcripts
3. three letters of recommendation
4. professional resume
5. personal statement
6. proof of English proficiency

Additional Application Information
An applicant whose native language is not English (regardless of current residency) must provide proof of English proficiency.

Applicants whose native language is not English are required to achieve a minimum score of 90 on the TOEFL iBT.

7. Application Review Terms (if applicable session):
Indicate the first term and year in which applications will be opened for admission. Applications will be accepted on a rolling basis after that time.

*Note: It is the academic unit’s responsibility to display program deadline dates on their website.*

<table>
<thead>
<tr>
<th>Terms</th>
<th>Years</th>
<th>University Late Fee Deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td>☑ Spring (regular)</td>
<td>(year): 2020</td>
<td>July 1st</td>
</tr>
<tr>
<td></td>
<td>(year):</td>
<td>October 1st</td>
</tr>
<tr>
<td>☑ Fall (regular)</td>
<td>(year): 2020</td>
<td>December 1st</td>
</tr>
<tr>
<td></td>
<td>(year):</td>
<td>February 8th</td>
</tr>
<tr>
<td>☑ Summer (regular)</td>
<td>(year): 2020</td>
<td>May 14th</td>
</tr>
<tr>
<td></td>
<td>(year):</td>
<td>May 14th</td>
</tr>
</tbody>
</table>

*Note: Session B is only available for approved online programs.*

Program admission deadlines website address: https://semte.engineering.asu.edu/programs/

8. Curricular Requirements:
Curricular Structure Breakdown for the Academic Catalog:
*(To be completed by the Graduate College)*

30 credit hours and a portfolio

**Required Core (12 credit hours)**
Choose four courses:
- ALT 535 Applied Photovoltaics (3)
- CHE 573 Fuel Cells and Biofuel Cells (3)
- CHE 578 Biomass Energy Conversion Technology (3)
- MAE 579 Wind Energy (3)
- MAE 576 Energy Efficiency (3)
- MAE 582 Renewable Energy: Mechanical Systems (3)
- MSE 560 Nanomaterials in Energy Production and Storage (3)
- SEC 501 Solar Engineering and Commercialization I (3)

**Mathematics Elective (3 credit hours)**
Sustainability Electives (6 credit hours)

Technical Electives (9 credit hours)

Culminating Experience (0 credit hours)
Portfolio (0)

Additional Curriculum Information
The modern energy production and sustainable use program only offers a nonthesis, portfolio option.

Please see the academic unit for a list of approved elective coursework. Other coursework may be used with approval of the academic unit.

During the last semester of their program, students will submit a portfolio containing at least two projects from previous engineering coursework along with a paper explaining the projects. Students must successfully complete the portfolio requirements to pass the culminating experience.

9. Comprehensive Exams:
Master's Comprehensive Exam (when applicable), please select from the appropriate option.

   N/A

10. Allow 400-level courses: □ Yes ☒ No
Note: No more than 6 credit hours of 400-level coursework may be included on a graduate student plan of study.

11. Committee:
Required number of thesis committee members (must be at least 3 including chair or co-chairs): N/A
Required number of non-thesis option committee members (must be a minimum of one): 1
12. **Keywords**: List all keywords that could be used to search for this program. Keywords should be specific to the proposed program – limit 10 keywords.

Energy
Sustainability
Solar
Renewable Energy
Energy Storage
Energy Production
Engineering
Physical Science

13. **Area(s) of Interest**

A. Select one (1) primary area of interest from the list below that applies to this program.

- Architecture & Construction
- Arts
- Business
- Communication & Media
- Education & Teaching
- Engineering & Technology
- Entrepreneurship
- Health & Wellness
- Humanities
- Interdisciplinary Studies
- Law & Justice
- Mathematics
- Psychology
- STEM
- Science
- Social and Behavioral Sciences
- Sustainability

B. Select one (1) secondary area of interest from the list below that applies to this program.

- Architecture & Construction
- Arts
- Business
- Communications & Media
- Education & Teaching
- Engineering & Technology
- Entrepreneurship
- Health & Wellness
- Humanities
- Interdisciplinary Studies
- Law & Justice
- Mathematics
- Psychology
- STEM
- Science
- Social and Behavioral Sciences
- Sustainability
14. Contact and Support Information:

<table>
<thead>
<tr>
<th>Office Location - Building Code &amp; Room: (Search ASU map)</th>
<th>ECG 207</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campus Telephone Number: (may not be an individual’s number)</td>
<td>480 965 4979</td>
</tr>
<tr>
<td>Program Email Address: (may not be an individual’s email)</td>
<td><a href="mailto:semtegrad@asu.edu">semtegrad@asu.edu</a></td>
</tr>
<tr>
<td>Program Website Address: (if one is not yet created, use unit website until one can be established)</td>
<td><a href="https://semte.engineering.asu.edu/">https://semte.engineering.asu.edu/</a></td>
</tr>
<tr>
<td>Program Director (Name):</td>
<td>Dr. Terry Alford</td>
</tr>
<tr>
<td>Program Director (ASURITE):</td>
<td>allnutt</td>
</tr>
<tr>
<td>Program Support Staff (Name):</td>
<td>Tiffany Wingerson</td>
</tr>
<tr>
<td>Program Support Staff (ASURITE):</td>
<td>tdelpra</td>
</tr>
<tr>
<td>Admissions Contact (Name):</td>
<td>Tiffany Wingerson</td>
</tr>
<tr>
<td>Admissions Contact (ASURITE):</td>
<td>tdelpra</td>
</tr>
</tbody>
</table>

15. Application and iPOS Recommendations: List the Faculty and Staff who will input admission/POS recommendations to Gportal and indicate their approval for Admissions and/or POS:

<table>
<thead>
<tr>
<th>NAME</th>
<th>ASURITE</th>
<th>ADMSN</th>
<th>POS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tiffany Wingerson</td>
<td>tdelpra</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Amy Newberg</td>
<td>anewber1</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Christine Quintero</td>
<td>csquint1</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
**APPENDIX II**

**ASSESSMENT PLAN**

*University Office of Evaluation and Educational Effectiveness*

*Academic Program Assessment Plan*

**ES-GR-CMULTISCI-MAJ-Modern Energy Production and Sustainable Use**

**Status:** UOEExE Provisional Approval

**Comments:**

<table>
<thead>
<tr>
<th>Element</th>
<th>Outcome</th>
<th>Measure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP_2Goal</td>
<td>0</td>
<td></td>
<td>Graduates of this degree program, MS Modern Energy Production and Sustainable Use (MEPSU) will be able to identify and interpret literature across multiple disciplines that apply to defined Energy Production and Sustainable Use problems.</td>
</tr>
<tr>
<td>Plan_2Concepts</td>
<td>1</td>
<td></td>
<td>Graduates will be to recognize potential problems and solutions in a variety of trans-disciplinary areas from renewable energy generation and storage, energy-saving materials and manufacturing, and sustainable transportation.</td>
</tr>
<tr>
<td>Plan_3Competencies</td>
<td>1</td>
<td></td>
<td>Core competencies will include recognizing and interpreting challenges in energy production (wind, nanomaterials, biomass, and/or solar) and sustainable use (nanomaterials for energy storage, photovoltaics, fuel cells, biofuel cells, and/or mechanical systems).</td>
</tr>
<tr>
<td>AP_1Process</td>
<td>1</td>
<td>1</td>
<td>Will use a rubric to review student's portfolio or applied project upon completion of the program.</td>
</tr>
<tr>
<td>Measure</td>
<td>1</td>
<td>1</td>
<td>Will use a rubric to assess student's ability to identify potential problems in the area of energy production and sustainable use and their ability to formulate potential solutions after the of the second semester using an e-portfolio.</td>
</tr>
<tr>
<td>PC</td>
<td>1</td>
<td>1</td>
<td>80% of the students will be able to demonstrate proficiency in recognizing and interpreting challenges in energy production.</td>
</tr>
<tr>
<td>Measure</td>
<td>1</td>
<td>2</td>
<td>Will use a rubric to assess graduates poster presentation. The abilities to organize a detailed literature review and argue their identified problems and solutions will be assessed. This will be done as part of degree completion.</td>
</tr>
<tr>
<td>PC</td>
<td>1</td>
<td>2</td>
<td>80% of student will be able to demonstrate proficiency in this area.</td>
</tr>
<tr>
<td>Measure</td>
<td>1</td>
<td>3</td>
<td>Use the results from the graduate report card to assess a survey of graduates on critical thinking and quantitative skills upon graduation in the areas of recognizing and interpreting challenges in energy production (wind, nanomaterials, biomass, and/or solar) and sustainable use (nanomaterials for energy storage, photovoltaics, fuel cells, biofuel cells, and/or mechanical systems).</td>
</tr>
<tr>
<td>PC</td>
<td>1</td>
<td>3</td>
<td>80% or more of the students state that their training student will be able to demonstrate and recognize and interpret challenges in energy production (wind, nanomaterials, biomass, and/or solar) and sustainable use (nanomaterials for energy storage, photovoltaics, fuel cells, biofuel cells, and/or mechanical systems was strong or very strong.</td>
</tr>
<tr>
<td>Element</td>
<td>Outcome Measure Description</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>-----------------------------</td>
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<td></td>
</tr>
<tr>
<td><strong>Outcome 2</strong></td>
<td>Graduates of MS MEPU graduate program will be able to solve complex problems by integrating concepts and methods from materials science and engineering, mechanical engineering, and chemical engineering. Graduates will also be able to apply principles of scientific inquiry to solve quantitative problems in the field of energy production and storage and transportation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Plan_2Concepts</strong></td>
<td>This program will be more technical than our current offerings in the PSM Solar Energy Engineering and Commercialization program. It will have more flexible and eclectic course offerings than the current degree programs and will attract students from the engineering and physical science disciplines.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Plan_3Competencies</strong></td>
<td>Core competencies will include training in the science associated with energy production and storage and transportation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>AP_1Process Measure</strong></td>
<td>Will use a rubric to assess student's ability to apply the concepts associated with energy production and storage and transportation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PC Measure</strong></td>
<td>Instructor will use a rubric in each course to assess student's ability to solve quantitative problems associated with energy production and storage and transportation at conclusion of each semester using an e-portfolio.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PC</strong></td>
<td>80% of the students will be able to demonstrate proficiency using the rubric associated with each course.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Measure</strong></td>
<td>80% of the students will be able to demonstrate proficiency in the area associated with the science of energy production and storage and transportation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Outcome 3</strong></td>
<td>Graduates of MS MEPSU graduate program will be able to identify issues associated with sustainability use. Graduates will be ability to apply principles of sustainability to solve qualitative problems in the field of energy production and storage and transportation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Plan_2Concepts</strong></td>
<td>Graduates will be to recognize potential problems and solutions associated with sustainable use of energy.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Plan_3Competencies</strong></td>
<td>Core Competencies will include training in the fundamental aspects of sustainable energy and current issues associated with sustainable energy.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>AP_1Process Measure</strong></td>
<td>Will review student's e-portfolio submission upon completion of the program.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PC Measure</strong></td>
<td>Will use a rubric to assess the student's ability to use the principles of sustainability to identify a potential problem using an e-portfolio. This would occur at the end of the second semester.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PC</strong></td>
<td>80% of the students will show proficiency according to the rubric.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Measure</strong></td>
<td>Will use a faculty developed rubric to assess the student's ability to use the principles of sustainability to formulate potential solution upon completion of the program.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PC</strong></td>
<td>80% of student will be able to demonstrate proficiency according to the rubric.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If you have questions, please e-mail assessment@asu.edu or call UOECE at (480) 727-1731.
Hello,

Attached is the following proposal:

Ira A. Fulton Schools of Engineering
School for Engineering of Matter, Transport and Energy
Proposal to establish a Graduate Degree Program
MS in Modern Energy Production and Sustainable Use

Best,

Sergio Quiros
Specialist Senior, Academic and Student Affairs
Ira A. Fulton Schools of Engineering
Arizona State University
Tempe, AZ 85287-8109
Phone: 480/727-5770
Email: Sergio.Quiros@asu.edu
From: Raja Ayyanar <rayanar@asu.edu>
Sent: Friday, February 15, 2019 3:01 PM
To: Robert Monahan <Robert.Monahan@asu.edu>
Cc: Anamitra Pal <Anamitra.Pal@asu.edu>; Daniel Tylavsky <tylavsky@asu.edu>; Jiangchao Qin <qin@asu.edu>; Keith Holbert <Keith.Holbert@asu.edu>; Kory Hedman <Kory.Hedman@asu.edu>; Lalitha Sankar <l.sankar@mainex1.asu.edu>; Meng Wu <mengwu1@mainex1.asu.edu>; Mojdeh Hedman <mojdeh.khorsand@asu.edu>; Qin Lei <qin.lei@asu.edu>; Vijay Vittal <vijay.vittal@asu.edu>; Yang Weng <yang.weng@asu.edu>
Subject: RE: Impact Statement from MS in Electrical Engineering

Hello Bob,

The power group has no objection to the proposed MS program. Its impact on our program is not significant. The students of the proposed MS program may consider our EEE46X and EEE47X courses as part of their electives. Earlier we had asked for the title of MAE 583 to be changed to Energy Efficiency Technologies instead of Energy Management and we would like to reiterate that since Energy Management is too broad and includes several topics we cover in many of our courses.

Best,
Raja

Raja Ayyanar | Professor | ERC 587
School of Electrical, Computer and Energy Engineering
Arizona State University | Tempe, AZ 85287-5706
480.727.7307 | rayanar@asu.edu

From: Robert Monahan
Sent: Wednesday, January 30, 2019 9:15 AM
To: Raja Ayyanar <rayanar@asu.edu>
Subject: Fwd: Impact Statement from MS in Electrical Engineering

Hello Dr Ayyanar, can you please provide an impact statement?

Thank you.

Bob Monahan

From: Mia Kroeger
Sent: Tuesday, January 22, 2019 12:25:09 PM
To: Robert Monahan
Cc: Tiffany Wingerson
Subject: Impact Statement from MS in Electrical Engineering

Hi Bob,
We are proposing a new MS program to start in fall 2019 and are requesting an impact statement from your Electrical Engineering, MS program. Can you please assist?
The Polytechnic School, Ira A. Fulton Schools of Engineering – Impact Statement

From: Bradley Rogers <BRADLEY.ROGERS@asu.edu>
Sent: Tuesday, February 19, 2019 8:18 AM
To: Cindy Boglin <Cindy.Boglin@asu.edu>
Cc: Mia Kroeger <Mia.Kroeger@asu.edu>
Subject: Re: Impact Statement from MSTech - Technology (Alternative Energy Technologies)

Thank you for the inclusion of our courses in this proposal, and we have no concerns with the proposed program.

Brad

Brad Rogers
Associate Director, The Polytechnic School
Ira A Fulton Schools of Engineering
ASU at the Polytechnic Campus
Sutton Hall, 140G
Mesa, AZ 85212

BRogers@asu.edu
480 727 1034

From: Mia Kroeger
Sent: Tuesday, January 22, 2019 12:23 PM
To: Cindy Boglin <Cindy.Boglin@asu.edu>
Cc: Tiffany Wingerson <Tiffany.Wingerson@asu.edu>
Subject: Impact Statement from MSTech - Technology (Alternative Energy Technologies)

Hi Cindy,
We are proposing a new MS program to start in fall 2019 and are requesting an impact statement from your MS Tech – Technology (Alternative Energy Technologies). Can you please assist?

Thank you!

Mia Kroeger
Assistant Director, Academic Services
School for Engineering of Matter, Transport & Energy
Ira A. Fulton Schools of Engineering
Arizona State University | P.O. Box 876106 | Tempe, AZ 85287-6106 – Mailing Address
501 E. Tyler Mall | Engineering Center G-Wing, #207 | Tempe, AZ 85287-6106 – Physical Address
Phone: (480) 965-2335 | Fax: (480) 727-9321 | Email: Mia.Kroeger@asu.edu
Website: jemte.engineering.asu.edu
PROPOSAL TO ESTABLISH A NEW MASTER'S DEGREE PROGRAM

School of Sustainability – Impact Statement

From: Christopher Boone <Christopher.G.Boone@asu.edu>
Sent: Thursday, December 19, 2019 11:42 AM
To: James Collofello <JAMES_Collofello@asu.edu>
Subject: RE: Statement of Collaboration and Impact

Dear James,

The School of Sustainability is happy to support the proposal for the MS in Modern Energy Production and Sustainable Use.

I wish you every success with the new degree program.

Chris

Christopher Boone
Dean and Professor

Arizona State University
School of Sustainability

The School of Sustainability embraces ASU's mission as being a comprehensive public research university, measured not by whom it excludes, but rather by whom it includes and how they succeed; advancing research and discovery of public value; and assuming fundamental responsibility for the economic, social, cultural and overall health of the communities it serves. We support and foster a culture of inclusiveness, tolerance, and respect that promotes equal opportunity and diversity among SOS faculty, staff, and students and through our engagement with diverse communities within and beyond the University.

From: James Collofello <JAMES_Collofello@asu.edu>
Sent: Tuesday, November 26, 2019 12:53 PM
To: Christopher Boone <Christopher.G.Boone@asu.edu>
Subject: Statement of Collaboration and Impact

Hi Christopher,

FSE is requesting a Statement of Collaboration and impact for the attached new program. Can you please review and respond?

Thanks,

jim

James S. Collofello
Vice Dean for Academic and Student Affairs
Professor of Computer Science and Engineering
From: Candice Carr Kelman
Sent: Friday, February 1, 2019 10:19 AM
To: Lisa Murphy <Lisa.M.Murphy@asu.edu>; Mia Kroeger <Mia.Kroeger@asu.edu>
Cc: Caroline Harrison <Caroline.Harrison@asu.edu>; Nicole Darnall <ndarnall@asu.edu>
Subject: RE: Impact Statement from School of Sustainability

Hi Mia,
The School of Sustainability has no objections to this program and supports its creation. We look forward to collaborating with you.
Best,
Candice

From: Lisa Murphy
Sent: Monday, January 28, 2019 11:35 AM
To: Mia Kroeger <Mia.Kroeger@asu.edu>
Cc: Candice Carr Kelman <Candice.Carr.Kelman@asu.edu>; Caroline Harrison <Caroline.Harrison@asu.edu>; Nicole Darnall <ndarnall@asu.edu>
Subject: FW: Impact Statement from School of Sustainability

Hi Mia,
My apologies for missing your initial email. I’m copying others here in the School of Sustainability so we can review the proposal and assist with the impact statement.

Best,

Lisa Murphy
Director, Academic Services
School of Sustainability | Arizona State University
P.O. Box 875502 | Tempe, Arizona | 85287-5502
PH: 480-965-7255 | Main: 480-727-6963

From: Mia Kroeger <Mia.Kroeger@asu.edu>
Sent: Monday, January 28, 2019 11:19 AM
To: Lisa Murphy <Lisa.M.Murphy@asu.edu>
Subject: FW: Impact Statement from School of Sustainability

Hi Lisa,
Just following up on the email below.

Thank you.

From: Mia Kroeger
Sent: Tuesday, January 22, 2019 12:30 PM
To: Lisa Murphy <Lisa.M.Murphy@asu.edu>
Cc: Tiffany Wingerson <Tiffany.Wingerson@asu.edu>
Subject: Impact Statement from School of Sustainability

Hi Lisa,
We are proposing a new MS program to start in fall 2019 and are requesting an impact statement from the School of Sustainability. Are you able to assist or direct me to someone who can, please?

Thank you!

Mia Kroeger  
Assistant Director, Academic Services  
School for Engineering of Matter, Transport & Energy  
Ira A. Fulton Schools of Engineering  
Arizona State University | P.O. Box 876106 | Tempe, AZ  85287-6106 – Mailing Address  
501 E. Tyler Mall | Engineering Center G-Wing, #207 | Tempe, AZ  85287-6106 – Physical Address  
Phone: (480) 965-2335 | Fax: (480) 727-9321 | Email: Mia.Kroeger@asu.edu  
Website: semte.engineering.asu.edu
The College of Liberal Arts and Sciences – Impact Statement

Dr. Milner,
Thank you for your support!

From: Fabio Milner <milner@asu.edu>
Sent: Wednesday, January 30, 2019 10:03 AM
To: Mia Kroeger <Mia.Kroeger@asu.edu>
Cc: Tiffany Wingerson <Tiffany.Wingerson@asu.edu>; Fabio Milner <milner@asu.edu>; Kyle Rader <kwrader@asu.edu>
Subject: Re: Impact Statement from CLAS

Dear Mia,

CLAS has no issues with the proposed MS.

Best,
Fabio

Fabio Augusto Milner, PhD
Associate Dean of Graduate Initiatives
College of Liberal Arts and Sciences
Director of Mathematics for STEM Education
School of Mathematical and Statistical Sciences
Arizona State University

Armstrong Hall, Office 285
P: 480/965-5877 | F: 480/965-1093
milner@asu.edu
URL: https://clas.asu.edu/content/fabio-milner

From: Mia Kroeger
Sent: Tuesday, January 22, 2019 12:31 PM
To: Jenny Smith <jenny.smith@asu.edu>
Cc: Tiffany Wingerson <Tiffany.Wingerson@asu.edu>
Subject: Impact Statement from CLAS

Hi Jenny,

We are proposing a new MS program to start in fall 2019 and are requesting an impact statement from CLAS. Are you able to assist or direct me to someone who can, please?

Thank you!

Mia Kroeger
Assistant Director, Academic Services
School for Engineering of Matter, Transport & Energy
New College of Interdisciplinary Arts and Sciences – Impact Statement

From: Patricia Friedrich <Patricia.Friedrich@asu.edu>
Sent: Wednesday, October 30, 2019 6:24:22 PM
To: Stacey Kimbell <kimbell@asu.edu>; Mia Kroeger <Mia.Kroeger@asu.edu>
Subject: Re: impact statement

Dear Mia:

New College has no concerns and is in support of this proposal, anticipating no impact on our programs. Thank you very much.

Patricia Friedrich, PhD
Associate Dean of Academic Programs and Faculty Affairs,
New College of Interdisciplinary Arts and Sciences
Professor of Linguistics/Rhetoric and Composition,
School of Humanities, Arts, and Cultural Studies
Arizona State University
P. O. Box 37100
4701 W. Thunderbird Rd. Mail Code 3051
Phoenix, AZ, USA 85069-7100
voice 602 543-6046

From: Mia Kroeger
Sent: Tuesday, October 29, 2019 2:43 PM
To: Stacey Kimbell <kimbell@asu.edu>
Cc: Sergio Quiros <Sergio.Quiros@asu.edu>; Tiffany Wingerson <Tiffany.Wingerson@asu.edu>; Terry Aiford <TA@asu.edu>
Subject: Impact statement

Hi Stacey,

We’ve been asked by the Graduate College to request an impact statement from your Dean or designated Associate Dean for our proposed new degree program, MS in Modern Energy Production and Sustainable Use.

The proposal is attached. Please let me know if you have any questions. Thank you!

Mia Kroeger, M. Ed.
Assistant Director, Academic Services
School for Engineering of Matter, Transport & Energy
Ira A. Fulton Schools of Engineering
Arizona State University | P.O. Box 876106 | Tempe, AZ 85287-6106 – Mailing Address
501 E. Tyler Mall | Engineering Center G-Wing, #207 | Tempe, AZ 85287-6106 – Physical Address
Phone: (480) 965-2335 | Fax: (480) 727-9321 | Email: Mia.Kroeger@asu.edu
Website: semte.engineering.asu.edu
College of Integrative Sciences and Arts – Impact Statement

From: James Collofello <JAMES.COLLOFELLO@asu.edu>
Date: November 26, 2019 at 1:30:04 PM MST
To: Sergio Quiros <Sergio.Quiros@asu.edu>
Subject: FW: Statement of Collaboration and Impact

fyi

James S. Collofello
Vice Dean for Academic and Student Affairs
Professor of Computer Science and Engineering
School of Computing Informatics and Decision Systems Engineering
Ira A. Fulton Schools of Engineering
Arizona State University

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From: Duane Roen (Dean) <Duane.Roen@asu.edu>
Sent: Tuesday, November 26, 2019 1:16 PM
To: James Collofello <JAMES.COLLOFELLO@asu.edu>
Subject: RE: Statement of Collaboration and impact

Jim,

CISA is happy to support FSE’s proposal for an MS in Modern Energy Production and Sustainable Use.

Please let us know if you need CISA to offer other forms of support besides this statement of collaboration and impact.

Best,
Duane

Duane Roen
Vice Provost, Polytechnic campus
Dean, College of Integrative Sciences and Arts
Arizona State University
Mail Code: 2780
Academic units should adhere to the following procedures when requesting new curricular initiatives (degrees, concentrations or certificates).

- Obtain the required approval from the Office of the Provost to move the initiative forward for internal ASU governance reviews/approvals. Please see the academic strategic plan website at: https://provost.asu.edu/curriculum-development.

- Submit any new courses that will be required for the new curricular program to the Curriculum ChangeMaker online course approval system for review and approval.
  - Additional information can be found at the Provost’s Office Curriculum Development website: Courses link
  - For questions regarding proposing new courses, send an email to: courses@asu.edu

- Prepare the applicable proposal template and operational appendix for the proposed initiative.

- Obtain letters or memos of support or collaboration (if applicable).
  - when resources (faculty or courses) from another academic unit will be utilized
  - when other academic units or degree programs may be impacted by the proposed request
  - if the program will have an online delivery option support will be required from the Provost’s office and ASU Online. (Please complete the ASU Online Offering form in Curriculum ChangeMaker to begin this request.)

- Obtain the internal reviews/approvals of the academic unit.
  - internal faculty governance review committee(s)
  - academic unit head (e.g. Department Chair or School Director)
  - academic unit Dean or their designee (will submit approved proposal to the curriculumplanning@asu.edu email account for further ASU internal governance reviews (as applicable, University Graduate Council, CAPC and Senate)

Additional Recommendations

All new graduate programs require specific processes and procedures to maintain a successful degree program. Below are items that the Graduate College strongly recommends that academic units establish after the program is approved for implementation.

- Establish satisfactory academic progress policies, processes and guidelines – Check within the proposing academic unit and/or college to see if there are existing academic progress policies and processes in place. If none have been established, please go to http://graduate.asu.edu/faculty_staff/policies and scroll down to the academic progress review and remediation processes (for faculty and staff) section to locate the reference tool and samples for establishing these procedures.

- Establish a Graduate Student Handbook for the new degree program – Students need to know the specific requirements and milestones they must meet throughout their degree program. A Graduate Student Handbook, provided to students when they are admitted to the degree program and published on the website for the new degree, gives students this information. To be included in the handbook are the unit/college satisfactory academic progress policies, current degree program requirements (outlined in the approved proposal) and a link to the Graduate Policies and Procedures website: http://graduate.asu.edu/faculty_staff/policies.