



**PROPOSAL TO ESTABLISH A NEW MASTER'S DEGREE PROGRAM**

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 [[mailto: curriculumplanning@asu.edu](mailto:curriculumplanning@asu.edu) ]. 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**

<b>College/School:</b>	Ira A. Fulton Schools of Engineering
<i>Note: Program ownership is coded at the College/School level first and may not be a center, department or division apart from it.</i>	
<b>Department/Division/School:</b>	School for Engineering of Matter, Transport and Energy (CMULTISCI)
<b>Proposing faculty group</b> (if applicable):	

<b>Name of proposed degree program:</b>	Modern Energy Production and Sustainable Use
<b>Proposed title of major:</b>	Modern Energy Production and Sustainable Use
<b>Master's degree type:</b>	MS - Master of Science
If Degree Type is "Other", provide degree type and proposed abbreviation:	

<b>Is a program fee required?</b>	No, a program fee is not required.
<i>Note: for more information about program fee requests, visit <a href="https://provost.asu.edu/curriculum-development/changemaker/form-instructions#fees">https://provost.asu.edu/curriculum-development/changemaker/form-instructions#fees</a></i>	
Is the unit willing and able to implement the program if the fee is denied?	N/A

<b>Requested effective term and year:</b>	Summer	2020
(The first semester and year for which students may begin applying to the program)		

**Delivery method and campus or location options:** *select all locations that apply*

Downtown Phoenix  
  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](mailto:asuonline@asu.edu) who can provide you with additional information regarding the online request process.*

<b>Do Not Fill in this information: Office Use Only</b>	<b>CIP Code:</b>
<b>Plan Code:</b>	

**PROPOSAL CONTACT**

<b>Name:</b>	Mia Kroeger	<b>Title:</b>	Assistant Director, Academic Services
<b>Phone number:</b>	480 727 9318	<b>Email:</b>	mia.kroeger@asu.edu



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DEAN APPROVAL(S)

This proposal has been approved by all necessary unit and college/school levels of review, and the college/school(s) has the resources to offer this degree program. I recommend implementation of the proposed degree program.

*Note: An electronic signature, an email from the dean or dean's designee, or a PDF of the signed signature page is acceptable.*

College/School/Division Dean  
name:

Signature:

Date:

4/24/19

**Please note:** Proposals for new degrees also require the review and recommendation of approval from the University Graduate Council, Curriculum and Academic Programs Committee (CAPC), the Academic Senate (2 readings), and the Office of the Provost before they can be put into operation.

**The final approval notification will come from the Office of the Provost.**

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. [https://www.energy.gov/sites/prod/files/2015/12/f27/EERE\\_Strategic\\_Plan\\_12.16.15.pdf](https://www.energy.gov/sites/prod/files/2015/12/f27/EERE_Strategic_Plan_12.16.15.pdf). These workers need to



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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



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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.*

5-YEAR PROJECTED ANNUAL ENROLLMENT					
Please utilize the following tabular format	1 <sup>st</sup> Year	2 <sup>nd</sup> Year (Yr. 1 continuing + new entering)	3 <sup>rd</sup> Year (Yr. 1 & 2 continuing + new entering)	4 <sup>th</sup> Year (Yrs. 1, 2, 3 continuing + new entering)	5 <sup>th</sup> Year (Yrs. 1, 2, 3, 4 continuing + new entering)
Number of Students Majoring (Headcount)	5	15	25	35	50

**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 ASSESMENT**

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> or contact [uoeee@asu.edu](mailto:uoeee@asu.edu) with any questions.

See Appendix II

**7. CURRICULAR STRUCTURE**

**A. Curriculum Listing**

Required Core Courses for the Degree Choose 4 from the list below:			
Prefix and Number	Course Title	New Course?	Credit Hours
MAE 579	Wind Energy	No	3
MAE 582	Renewable Energy: Mechanical Systems	No	3
MAE 576	Energy Efficiency	No	3
MSE 560	Nanomaterials in Energy Production and Storage	No	3
CHE 578	Biomass Energy Conversion Technology	No	3
CHE 573	Fuel Cells and Biofuel Cells	Yes	3
SEC 501	Solar Engineering and Commercialization I	No	3
ALT 535	Applied Photovoltaics	No	3
<i>Section sub-total:</i>			12
Elective or Research Courses <i>(as deemed necessary by supervisory committee)</i>			
Prefix and Number	Course Title	New Course?	Credit Hours
	Mathematics Requirement (choose one) • MAE 501 Linear Algebra in Engineering	No	3



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	<ul style="list-style-type: none"> <li>• MAE 502 Partial Differential Equations in Engineering</li> <li>• MAE 505 Perturbation Methods</li> <li>• MAE 512 Random Vibrations</li> <li>• MAE 521 Structural Optimization</li> <li>• MAE 528 Advanced Computational Mechanics</li> <li>• MAE 542 Design Geometry and Kinematics</li> <li>• MAE 598 Special Topics                             <ul style="list-style-type: none"> <li>○ Design Optimization</li> <li>○ LMI Methods in Optimal and Robust Control</li> <li>○ Spectral Methods in Computational Fluid Dynamics</li> </ul> </li> <li>• IEE 570 Advanced Quality Control</li> <li>• IEE 572 Design Engineering Experiments</li> <li>• STP 5XX or higher</li> <li>• MAT 5XX or higher</li> </ul>		
SOS 5XX	Sustainability electives (Any SOS 500 and above)	No	6
MAE 5XX OR MSE 5XX OR CHE 5XX	Technical electives	No	9
<b>Section sub-total:</b>			18
<b>Culminating Experience(s)</b> <i>E.g. – Capstone course, portfolio, written comprehensive exam, applied project, thesis (must be 6 credit hours with oral defense)</i>			<b>Credit Hours</b>
Portfolio			0
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.			
<b>Section sub-total:</b>			0
<b>Total required credit hours</b>			<b>30</b>

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.

**8. 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?

Yes  No



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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.

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

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



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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  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](mailto: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.





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**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.*

Terms	Years	University Late Fee Deadline
<input checked="" type="checkbox"/> Spring (regular) <input type="checkbox"/> Session B	(year): 2020 (year):	July 1st October 1st
<input checked="" type="checkbox"/> Fall (regular) <input type="checkbox"/> Session B	(year): 2020 (year):	December 1st February 8th
<input checked="" type="checkbox"/> Summer (regular) <input type="checkbox"/> Summer B	(year): 2020 (year):	May 14th May 14th
<i>Note: Session B is only available for approved online programs.</i>		

**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)**



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**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



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**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.

- |  |   |
|--|---|
| <input type="checkbox"/> <a href="#">Architecture &amp; Construction</a>         | <input type="checkbox"/> <a href="#">Interdisciplinary Studies</a>      |
| <input type="checkbox"/> <a href="#">Arts</a>                                    | <input type="checkbox"/> <a href="#">Law &amp; Justice</a>              |
| <input type="checkbox"/> <a href="#">Business</a>                                | <input type="checkbox"/> <a href="#">Mathematics</a>                    |
| <input type="checkbox"/> <a href="#">Communication &amp; Media</a>               | <input type="checkbox"/> <a href="#">Psychology</a>                     |
| <input type="checkbox"/> <a href="#">Education &amp; Teaching</a>                | <input type="checkbox"/> <a href="#">STEM</a>                           |
| <input checked="" type="checkbox"/> <a href="#">Engineering &amp; Technology</a> | <input type="checkbox"/> <a href="#">Science</a>                        |
| <input type="checkbox"/> <a href="#">Entrepreneurship</a>                        | <input type="checkbox"/> <a href="#">Social and Behavioral Sciences</a> |
| <input type="checkbox"/> <a href="#">Health &amp; Wellness</a>                   | <input type="checkbox"/> <a href="#">Sustainability</a>                 |
| <input type="checkbox"/> <a href="#">Humanities</a>                              |   |

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

- |  |   |
|--|---|
| <input type="checkbox"/> <a href="#">Architecture &amp; Construction</a> | <input type="checkbox"/> <a href="#">Interdisciplinary Studies</a>      |
| <input type="checkbox"/> <a href="#">Arts</a>                            | <input type="checkbox"/> <a href="#">Law &amp; Justice</a>              |
| <input type="checkbox"/> <a href="#">Business</a>                        | <input type="checkbox"/> <a href="#">Mathematics</a>                    |
| <input type="checkbox"/> <a href="#">Communications &amp; Media</a>      | <input type="checkbox"/> <a href="#">Psychology</a>                     |
| <input type="checkbox"/> <a href="#">Education &amp; Teaching</a>        | <input checked="" type="checkbox"/> <a href="#">STEM</a>                |
| <input type="checkbox"/> <a href="#">Engineering &amp; Technology</a>    | <input type="checkbox"/> <a href="#">Science</a>                        |
| <input type="checkbox"/> <a href="#">Entrepreneurship</a>                | <input type="checkbox"/> <a href="#">Social and Behavioral Sciences</a> |
| <input type="checkbox"/> <a href="#">Health &amp; Wellness</a>           | <input type="checkbox"/> <a href="#">Sustainability</a>                 |
| <input type="checkbox"/> <a href="#">Humanities</a>                      |   |



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**14. Contact and Support Information:**

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

**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:

NAME	ASURITE	ADMSN	POS
Tiffany Wingerson	tdelpra	X	X
Amy Newberg	anewber1	X	X
Christine Quintero	csquint1	X	X



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APPENDIX II

ASSESSMENT PLAN

University Office of Evaluation and Educational Effectiveness 10-14-2019  
Academic Program Assessment Plan

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

Status: UOEEE Provisional Approval

Comments:

Element Outcome Measure Description

AP\_2Goal 0 [Redacted]

Outcome	1		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.
Plan_2Concepts	1		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.
Plan_3Competencies	1		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).
AP_1Process	1	1	Will use a rubric to review student's portfolio or applied project upon completion of the program.
Measure	1	1	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.
PC	1	1	80% of the students will be able to demonstrate proficiency in recognizing and interpreting challenges in energy production.
Measure	1	2	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.
PC	1	2	80% of student will be able to demonstrate proficiency in this area.
Measure	1	3	Use the results from the graduate report card to asses 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).
PC	1	3	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.



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Element Outcome Measure Description

Outcome	2		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
Plan_2Concepts	2		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.
Plan_3Competencies	2		Core competencies will include training in the science associated with energy production and storage and transportation.
AP_1Process	2	1	Will use a rubric to assess student's ability to apply the concepts associated with energy production and storage and transportation.
Measure	2	1	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.
PC	2	1	80% of the students will be able to demonstrate proficiency using the rubric associated with each course.
Measure	2	2	Students will complete a self-assessment at the end of the program. Program chair and curriculum committee will use data to identify strengths and weaknesses of the program. For identified weaknesses, improvement plans will be generated and implemented.
PC	2	2	80% of the students will be able to demonstrate proficiency in the area associated with the science of energy production and storage and transportation.
Outcome	3		Graduates of MS MEPSU graduate program will be able to identify issues associated with sustainability use. Graduates will be able to apply principles of sustainability to solve qualitative problems in the field of energy production and storage and transportation.
Plan_2Concepts	3		Graduates will be able to recognize potential problems and solutions associated with sustainable use of energy.
Plan_3Competencies	3		Core Competencies will include training in the fundamental aspects of sustainable energy and current issues associated with sustainable energy.
AP_1Process	3	1	Will review student's e-portfolio submission upon completion of the program.
Measure	3	1	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.
PC	3	1	80% of the students will show proficiency according to the rubric.
Measure	3	2	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.
PC	3	2	80% of student will be able to demonstrate proficiency according to the rubric.

Re: If you have questions, please e-mail [assessment@asu.edu](mailto:assessment@asu.edu) or call UOEEE at (480) 727-1731.



PROPOSAL TO ESTABLISH A NEW MASTER'S  
DEGREE PROGRAM

APPENDIX III

SUPPORT AND IMPACT STATEMENTS

Ira A. Fulton Schools of Engineering – Official Submission

**From:** [Sergio Quiros](#)  
**To:** [curriculumplanning@asu.edu](mailto:curriculumplanning@asu.edu)  
**Cc:** [Mia Kroeger](#); [Jeremy Helm](#)  
**Subject:** IFSE Proposal to Establish a Graduate Degree Program: MS in Modern Energy Production and Sustainable Use  
**Date:** Wednesday, April 24, 2019 2:27:23 PM  
**Attachments:** [MS in Modern Energy Production and Sustainable Use Proposal 021819.pdf](#)  
[MS in Modern Energy Production and Sustainable Use Proposal 121818.docx](#)

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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 G. 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](mailto:Sergio.Quiros@asu.edu)



PROPOSAL TO ESTABLISH A NEW MASTER'S  
DEGREE PROGRAM

School of Electrical, Computer and Energy Engineering, Ira A. Fulton Schools of Engineering – Impact Statement

From: Raja Ayyanar <[rayyanar@asu.edu](mailto:rayyanar@asu.edu)>  
Sent: Friday, February 15, 2019 3:01 PM  
To: Robert Monahan <[Robert.Monahan@asu.edu](mailto:Robert.Monahan@asu.edu)>  
Cc: Anamitra Pal <[Anamitra.Pal@asu.edu](mailto:Anamitra.Pal@asu.edu)>; Daniel Tylavsky <[tylavsky@asu.edu](mailto:tylavsky@asu.edu)>; Jiangchao Qin <[jqin@asu.edu](mailto:jqin@asu.edu)>; Keith Holbert <[Keith.Holbert@asu.edu](mailto:Keith.Holbert@asu.edu)>; Kory Hedman <[Kory.Hedman@asu.edu](mailto:Kory.Hedman@asu.edu)>; Lalitha Sankar <[lsankar@mainex1.asu.edu](mailto:lsankar@mainex1.asu.edu)>; Meng Wu <[mengwu1@mainex1.asu.edu](mailto:mengwu1@mainex1.asu.edu)>; Mojdeh Hedman <[mojdeh.khorsand@asu.edu](mailto:mojdeh.khorsand@asu.edu)>; Qin Lei <[Qin.Lei@asu.edu](mailto:Qin.Lei@asu.edu)>; Vijay Vittal <[Vijay.Vittal@asu.edu](mailto:Vijay.Vittal@asu.edu)>; Yang Weng <[Yang.Weng@asu.edu](mailto: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 | [rayyanar@asu.edu](mailto:rayyanar@asu.edu)

From: Robert Monahan  
Sent: Wednesday, January 30, 2019 9:15 AM  
To: Raja Ayyanar <[rayyanar@asu.edu](mailto:rayyanar@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

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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?





PROPOSAL TO ESTABLISH A NEW MASTER'S  
DEGREE PROGRAM

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](mailto:BRogers@asu.edu)  
480 727 1034

From: Mia Kroeger  
Sent: Tuesday, January 22, 2019 12:23 PM  
To: Cindy Boglin <[Cindy.Boglin@asu.edu](mailto:Cindy.Boglin@asu.edu)>  
Cc: Tiffany Wingerson <[Tiffany.Wingerson@asu.edu](mailto: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 MSTech –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](mailto:Mia.Kroeger@asu.edu)  
Website: [semte.engineering.asu.edu](http://semte.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](mailto:Christopher.G.Boone@asu.edu)>  
Sent: Thursday, December 19, 2019 11:42 AM  
To: James Collofello <[JAMES.COLLOFELLO@asu.edu](mailto: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



P.O. Box 875502 | Tempe, Arizona | 85287-5502

PH: 480-965-2236 | Main: 480-965-2975

[SchoolOfSustainability.asu.edu](http://SchoolOfSustainability.asu.edu)

Executive Assistant: [Lorraine.Protocollo@asu.edu](mailto:Lorraine.Protocollo@asu.edu)

*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](mailto:JAMES.COLLOFELLO@asu.edu)>  
Sent: Tuesday, November 26, 2019 12:53 PM  
To: Christopher Boone <[Christopher.G.Boone@asu.edu](mailto: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



PROPOSAL TO ESTABLISH A NEW MASTER'S  
DEGREE PROGRAM

**From:** Candice Carr Kelman  
**Sent:** Friday, February 1, 2019 10:19 AM  
**To:** Lisa Murphy <[Lisa.M.Murphy@asu.edu](mailto:Lisa.M.Murphy@asu.edu)>; Mia Kroeger <[Mia.Kroeger@asu.edu](mailto:Mia.Kroeger@asu.edu)>  
**Cc:** Caroline Harrison <[Caroline.Harrison@asu.edu](mailto:Caroline.Harrison@asu.edu)>; Nicole Darnall <[ndarnall@asu.edu](mailto: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](mailto:Mia.Kroeger@asu.edu)>  
**Cc:** Candice Carr Kelman <[Candice.Carr.Kelman@asu.edu](mailto:Candice.Carr.Kelman@asu.edu)>; Caroline Harrison <[Caroline.Harrison@asu.edu](mailto:Caroline.Harrison@asu.edu)>; Nicole Darnall <[ndarnall@asu.edu](mailto: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](mailto:Mia.Kroeger@asu.edu)>  
**Sent:** Monday, January 28, 2019 11:19 AM  
**To:** Lisa Murphy <[Lisa.M.Murphy@asu.edu](mailto: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](mailto:Lisa.M.Murphy@asu.edu)>  
**Cc:** Tiffany Wingerson <[Tiffany.Wingerson@asu.edu](mailto:Tiffany.Wingerson@asu.edu)>  
**Subject:** Impact Statement from School of Sustainability

Hi Lisa,



**PROPOSAL TO ESTABLISH A NEW MASTER'S  
DEGREE PROGRAM**

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](mailto:Mia.Kroeger@asu.edu)

Website: [semte.engineering.asu.edu](http://semte.engineering.asu.edu)



PROPOSAL TO ESTABLISH A NEW MASTER'S  
DEGREE PROGRAM

The College of Liberal Arts and Sciences – Impact Statement

Dr. Milner,  
Thank you for your support!

From: Fabio Milner <[milner@asu.edu](mailto:milner@asu.edu)>  
Sent: Wednesday, January 30, 2019 10:03 AM  
To: Mia Kroeger <[Mia.Kroeger@asu.edu](mailto:Mia.Kroeger@asu.edu)>  
Cc: Tiffany Wingerson <[Tiffany.Wingerson@asu.edu](mailto:Tiffany.Wingerson@asu.edu)>; Fabio Milner <[milner@asu.edu](mailto:milner@asu.edu)>; Kyle Rader <[kwraeder@asu.edu](mailto:kwraeder@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](mailto: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](mailto:jenny.smith@asu.edu)>  
Cc: Tiffany Wingerson <[Tiffany.Wingerson@asu.edu](mailto: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



PROPOSAL TO ESTABLISH A NEW MASTER'S  
DEGREE PROGRAM

New College of Interdisciplinary Arts and Sciences – Impact Statement

From: Patricia Friedrich <[Patricia.Friedrich@asu.edu](mailto:Patricia.Friedrich@asu.edu)>  
Sent: Wednesday, October 30, 2019 6:24:22 PM  
To: Stacey Kimbell <[kimbell@asu.edu](mailto:kimbell@asu.edu)>; Mia Kroeger <[Mia.Kroeger@asu.edu](mailto: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](mailto:kimbell@asu.edu)>  
Cc: Sergio Quiros <[Sergio.Quiros@asu.edu](mailto:Sergio.Quiros@asu.edu)>; Tiffany Wingerson <[Tiffany.Wingerson@asu.edu](mailto:Tiffany.Wingerson@asu.edu)>; Terry Alford <[TA@asu.edu](mailto: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](mailto:Mia.Kroeger@asu.edu)  
Website: [semte.engineering.asu.edu](http://semte.engineering.asu.edu)



PROPOSAL TO ESTABLISH A NEW MASTER'S  
DEGREE PROGRAM

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



## PROPOSAL TO ESTABLISH A NEW MASTER'S DEGREE PROGRAM

### (NEW GRADUATE INITIATIVES)

#### PROPOSAL PROCEDURES CHECKLIST

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](mailto: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](mailto: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](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](http://graduate.asu.edu/faculty_staff/policies).