Interdisciplinarity@WMU- Phase One planning Template

1. **Brief Overview**: Provide a brief overview of the proposed interdisciplinary initiative. What types of questions would the initiative ask? What types of complex problems would it seek to solve?

Modern energy systems are at the forefront of a technology revolution driven by the need to reduce carbon emissions while increasing reliability and efficiency of energy delivery to all types of consumers. Integration of renewable sources, state-of-the-art communication systems, advanced cybersecurity, energy storage, and energy-efficient materials, are just a few of the many widely relevant energy topics that bring multifaceted technological challenges requiring the participation and collaboration of multiple engineering and technology disciplines. Modern energy systems with smart capabilities and comparable technological challenges include power grids, power generation units, transportation systems, industrial facilities, and commercial buildings; these examples and other devices and systems present efficiency, safety, environmental, and economic challenges for energy generation, extraction, conversion, transportation, storage and/or utilization.

We propose the creation of an Interdisciplinary MS Program in Energy Engineering and Technology considering not only its ever increasing importance in both technical and societal contexts, but also its natural alignment with the vision and mission of the College of Engineering and Applied Sciences (CEAS). First, it will provide a markedly unique and enhanced educational experience to our students for success in the worldwide job market. Second, it will promote research and innovation activities by bringing together individuals and groups with different sets of skills, viewpoints, and experiences, but with the common goal of advancing energy technology that benefits society. Third, by supporting collaboration between units in shared teaching and research efforts, it will enable a cost-effective utilization of resources across our College. Fourth, the Program will offer distinction from other comparable universities that can be leveraged in recruiting and marketing.

2. **Impacted units**: What existing units, programs, and colleges would be involved in the proposed initiative? What other possibilities for collaboration across campus or in the broader community might exist now or in the future?

All Departments of CEAS are expected to be involved in this effort given the breadth of cross-sectional topics involved in energy. Besides collaboration between CEAS units, the proposed Program brings a direct opportunity to collaborate with other university units in topics related to energy policy, sustainability, climate change, chemistry, physics, mathematics, geography, and meteorology, just to name a few. The Program at initial launch will be primarily CEAS oriented with increased participation of other university units over time. In the broader community, this Program will enhance already existing industrial partnerships including utilities, vehicle manufacturers, and regional corporations, as well as local, regional and federal agencies, among others.
3. **Impact on teaching, learning, and curricula**: Describe the anticipated impact of the proposed initiative on teaching, learning, and curricula. How might this initiative help to grow enrollment, including by reaching new audiences of learners through continuing education, dual enrollment, or professional certification? How will the proposed initiative positively impact the training of undergraduate and graduate students? How does it enhance our institutional commitment to diversity, equity, and inclusion?

According to the 2020 US Energy and Employment Report, the energy sector employed 6.8 million people by the end of 2019, outperforming the rest of the economy in job creation. In addition, the only universities offering energy engineering MS programs in Michigan comparable to the one proposed here are the University of Michigan (ME in Energy Systems Engineering) and Wayne State University (MS in Alternative Energy Technology). From this information, it is evident that the proposed Program has the potential to attract a substantial number of students, thus enhancing enrollment in our College by offering a learning experience with a focus on an area of great relevance, social impact, and job opportunities. In terms of student training, this program will allow students to experience enhanced educational and research experiences through the utilization of different specialized energy-related laboratories across the College. It is envisioned that different tracks in the Program will be created to offer particular emphasis in major topics such as energy generation, energy transmission, transportation, environmental impacts, renewables, energy storage, and security, among others. Diverse viewpoints and experiences will be brought in from instruction across different University units.

4. **Impact on research and creative activity**: Describe the anticipated impact of the proposed initiative on research and creative activity. How will this initiative promote discovery and creative scholarship? How might it result in increased external funding?

This program will promote research and innovation activities by bringing together individuals and groups with different sets of skills and experiences but with the common goal of advancing energy technology. This is expected to impact publication record, generation of intellectual property and external funding. Federal agencies, such as the Department of Energy, solicit proposals in energy research topics that commonly require the participation of interdisciplinary groups for a better chance of success.

5. **Efficiencies and/or cost savings**: How might the proposed initiative contribute to increased efficiencies and/or cost savings, for example by reducing administrative positions (e.g. chairs/directors), sharing staff support services and/or by sharing facilities?

The collaboration between units in shared teaching and research efforts will enable a more cost-effective utilization of resources across our College and eventually the University. The Program will not require the creation of new administrative staff positions, taking advantage of existing support. Students will experience the use of several teaching and research laboratories that they otherwise may not while constrained to their existing Program, without the need for additional facilities or infrastructure.

6. **Impact on course offerings and workload**: At present, proposed initiatives will only be feasible and sustainable if they can be supported by existing resources, including instructional capacity, faculty and staff time, and facilities. Will the proposed initiative streamline existing course or program offerings? Could the initiative help create more equitable and sustainable workload for faculty, for
example, by reducing the need to offer under enrolled courses, reducing the frequency of course offerings or eliminating the need to teach some courses?

Given the number of faculty members with energy-related expertise and laboratory facilities, the proposed program is completely feasible and sustainable with the human and infrastructure resources available. There are already a large number of energy-related courses available in several CEAS units that can be offered as part of the proposed Program. This proposal also opens the door to enhancing the curricula of the College by updating courses or creating new ones with a focus on relevant energy problems and challenges. Opening courses to Program participants currently restricted to other majors, such as those restricted to Electrical and Computer Engineering or to Mechanical and Aerospace Engineering, will promote opportunities for increased enrollment.

7. **Additional Information**: What additional information would you like to provide in support of this proposal?

Several of the proposers from four different CEAS departments (Wu, ChPE; Asumadu and Gomez, ECE; Meyer, MAE; and Bhattacharjee, CS) have worked together before on energy related NSF Major Research Instrumentation Program submissions and have already established a good working relationship and commitment to the energy field. This core, along with new members with additional energy-related experience, provides the foundation needed for the development of a Program that is relevant and timely, as well as cognizant and respectful of the current economic environment.

8. **Contact**
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