Environmentally Benign and Energy Conscious Design and Manufacturing for the 21st Century in the Global Economy

(Green Manufacturing Practices for materials, designs, products, and processes)

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Participants: Colleges of Engineering, Arts and Sciences (Chemistry, Physics, Biology and Environmental Studies), and Business; and local industries

Description of the Project: Western Michigan University’s Manufacturing Research Center requests $3 million in FY 2010-2011, and $1 million per year for four (4) additional years (2011-2014) to support its Green Manufacturing (Environmentally Benign and Energy Conscious) applied research and development efforts to assist manufacturing industries improve their economic competitiveness and create jobs. The funding request (first year of three year program, 2010-2011) includes: Program Support: $1,000,000, Educational materials development and delivery to employees and students: $1,000,000, and Equipment: $1,000,000. The funding will support collaborative activities among the university, industry and community to enhance economic and workforce development, and provide technology transfer. One key area of focus for the funded activity will be advancing the use of environmentally friendly materials, designs, products, manufacturing processes and systems i.e. green engineering. The funding will support the following activities.

- Enhance a multi college and multi university research program emphasizing the confluence of environment, energy and manufacturing principles in an interdisciplinary collaborative approach with participation from the basic and applied sciences, and engineering disciplines.
  - Develop prototype, pilot plant processes and systems for applied research, assessment and introduction of novel environmentally benign materials and processes into the manufacturing system (products and processes).

- Assist industry and government to assess and implement sustainable (environmental and energy) systems supported by appropriate scientific and economic indicators. Special emphasis will be on smaller companies that lack technical expertise to deal with new innovations (new materials and processes to achieve environmental and energy benefits).

- Develop education materials, including courses and seminars, for students and employees to advance understanding and competence to deal with ever-increasing complexities of environmental and energy impacts associated with manufacturing processes and operations. Special emphasis will be on the use of “green” materials and processes in manufactured products.

Objectives of WMU’s Green Manufacturing Research Program: The University has developed a research culture that promotes practical, multi/interdisciplinary and collaborative research to incubate people and ideas. We propose a comprehensive program to address needs in the areas of research, industrial-economic development, and education.

1. Research: Science, Engineering and Technology: Establish analytical tools for analysis and benchmarking of the consequences of the environmental and energy impacts of design and manufacturing decisions with full accountability to society and the global economy, with special emphasis on the introduction of green materials and processes to manufactured products.
2. Commerce and Economic Development: Assist manufacturing companies with environmentally benign manufacturing practices, with a targeted program to help small manufacturing companies that lack the depth and breadth of expertise to take advantage of these emerging technologies.

3. Education and Outreach: Educate the workforce, especially women and minorities, for the global challenges facing manufacturers relative to environmental and energy issues. Develop leading edge competencies for companies to take advantage of the benefits of technology without incurring environmental related degradation of plant and facilities through proper design and appropriate manufacturing processes.

What is the problem to be solved and what is unique: Manufacturing companies want to take advantage of the emerging environmentally benign and energy conscious materials in their product designs and manufacturing processes. Small companies in particular, are thwarted in their efforts to take advantage of the potential of these new technologies due to a lack of critical in-house scientific and technology knowledge. This funding initiative will take advantage of, and build upon, the success of the existing manufacturing, environment and energy research centers and programs at WMU. The focus of the proposed initiative will be on fundamental developments of “green” materials incorporated into products and manufacturing processes with a resulting environmentally favorable impact coupled with efficient utilization of energy resources. This activity includes the recycling and reuse of materials at the end of the product’s life cycle. The proposed funding will directly lead to the enhanced global competitiveness for manufacturing companies. Materials, designs and processes will be created that are more environmentally friendly, energy efficient, and economically viable, to better compete in worldwide markets. This will lead to the expansion of businesses and create additional jobs in the workplace, and concomitant economic development. The demand for environmentally benign and energy efficient products and services will continue to increase across all manufactured goods and services. This will lead to additional needs for goods and services, and result in the creation of more jobs and continued economic development.

Why fund us (WMU and PIs): The University, through its MRC, has initiated a new program in the area of environmentally benign product design and manufacturing (EBDM). This Green Manufacturing initiative is titled “Environmental Benign and Energy Conscious Design and Manufacturing for the 21st Century in the Global Economy”. The requested funding will support research and collaboration with industry to develop strategies, procedures, and systems to achieve economically feasible, environmentally benign, and energy efficient materials, designs, and manufacturing processes. The funded activities will lead to developing the “scale up” of processes for large scale manufacturing operations and job creation using “green engineering principles and technologies” as an integral segment of the manufacturing system.

Previous federal/state funding for similar project: An earmark is in process (2009-2010) for $1million to support the start up of this Green Manufacturing Initiative. This initial funding will be used for program support in the first year. Concurrently, two additional efforts are being developed and initiated, there include: Green Manufacturing Industrial Consortium, and a B.S. curriculum/degree in Energy, Environment and Economics, for Science, Engineering and Technology students; the latter is proposed as a cooperative program with community colleges. We (MFE) have applied for (requested) two additional faculty positions to support this work, one
in Green Manufacturing and the other in Energy Manufacturing, but so far our requests have not been filled, but we will keep trying.

**Results to date of current earmark**

The funding for the current earmark arrived September 15, 2010 (about 2 months ago); even though the award was announced in October of 2009. Work began on the research program in January 2010 (using a backstop account), with the anticipation of actual funding arriving later in the year. The current award ($ funding) runs through September 2011.

**Major Milestones:**
1. We currently employ 8 students on the research (Green) team. Five (5) faculty have actively participated in the research activities (four from CEAS and one from A&S, chemistry). We also employ a staff person as program coordinator.
2. We have established a web site: [http://www.wmich.edu/mfe/mrc/greenmanufacturing/](http://www.wmich.edu/mfe/mrc/greenmanufacturing/) and have produced publications and presentations and numerous articles about the initiative and project results.
3. We have completed a number of projects (five so far) and have a number of projects in process (approximately 10) involving our industrial partners. Companies that we have engaged so far include: Armstrong, Bells, Burroughs, Cascade Engineering (DMStrategist), Erdman Machine, Haworth, Herman Miller, Kellogg, Ottawa Gage, Sustainable Research Group. Other companies that we are currently engaged (but not on a project basis) include: Denso, Eaton, FabriKal, Kalsec, Landscape Forms, Perrigo, Post, JCI, Stryker, Whirlpool and we are working to development a partnership with Borg Warner, Consumers Energy, JTI, L3, Pfizer, Steelcase, Sauder, and others.
4. We have organized an industrial consortium to support the earmark, and will host our first formal meeting December 7, 2010. Participants include: Herman Miller, Haworth, Cascade, Kellogg, Post, Denso, Fabri-Kal, Landscape Forms, Sustainable Research Group (SRC).
5. We held two meetings so far this year for our industrial partners, one in March in Battle Creek (partnered with BCU) and our official kickoff event in May at the Parkview Campus. The Battle Creek event attracted about 30 people and the Kalamazoo event had about 100 attendees.
6. We are also partnering with SRC, MMTC, the Right Place, and Consumers Energy along with the EPA and DOE to develop a west Michigan E3 (energy, environment, economy) program similar to the program initiated in southeast Michigan this year. The E3 program is very similar to our E³ program, which promotes energy efficiency in manufacturing operations, with an emphasis on small businesses.

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