U.S. Department of Energy Workshop:
Microwave (MW) and Radio Frequency (RF) as Enabling Technologies for Advanced Manufacturing
Workshop Date: July 25, 2012,
2:00 – 5:30 PM
Venue: The 2nd World Congress on Microwave Energy Applications
July 23-27, 2012, Hilton Long Beach, Long Beach, CA
http://www.mrs.org/2gcmea-2012/

PURPOSE

The purpose of this workshop is to provide input that can help DOE strategically assess the potential for electrotechnologies such as microwave (MW) and radio frequency (RF) energy to impact advanced manufacturing. DOE is seeking information on the existing, emerging and future potential for electrotechnologies as a route to process improvement and as an enabling technology. The workshop will provide a forum for subject matter experts to highlight the opportunities for - and the barriers to - adoption by industry.

This workshop will gather input from a range of academic and industry experts during the 2nd Global Congress on Microwave Energy Applications (2GCMEA) in Long Beach, CA July 23-27, 2012. 2GCMEA is presented by the Microwave Working Group (MWG), together with the Association for Microwave Power in Europe for Research and Education (AMPERE), the International Microwave Power Institute (IMPI), the Japan Society of Electromagnetic Wave Energy Application (JEMEA) and microwave groups from China, India, Russia and Australia. Logistical and operational expertise is provided by MRS. Participants will offer the diverse expertise and perspectives needed to help DOE assess the current and future potential contributions of electrotechnologies.

The results of this effort will be used to inform research, development, demonstration, and deployment (RDD&D) priorities on those electrotechnologies that can have a pervasive impact on advanced manufacturing in the United States.

CONTEXT

For more than a half-century, physicists, engineers, chemists, materials scientists, biologists, food scientists, medical doctors and others have sought to exploit the interactions of microwave (MW) and radio frequency (RF) energy with materials. For industrial applications, the use of MW and RF dielectric heating technology has traditionally been viewed as a tool for improving a process, as a means to cost savings through improved efficiency. While cost savings by way of process improvement is certainly justified, it is likely the future advancement of this technology will be based upon the use of MW or RF as an *enabling technology*. The term *enabling technology* infers a value added to a product that is not readily achievable by other means. This has been a principal focus of many interdisciplinary researchers in recent years, resulting in advances that not only address process efficiency, but product value as well.

In order to stimulate and accelerate adoption of efficient, enabling technologies, the Department of Energy's Advanced Manufacturing Office (AMO) is planning to fund a number of Manufacturing Demonstration Facilities (MDFs).[1] These facilities will enable manufacturers to develop new, energy-efficient and flexible manufacturing technologies based on research and innovation performed in a shared infrastructure. Individual MDFs will leverage important, enabling technologies that have the potential to pervade and impact a broad range of industrial and manufacturing operations. DOE refers to such technologies as "Keystone" technologies. Toward this goal, this Workshop will elicit input regarding the potential of electrotechnologies as a Keystone technology, and the extent to which one or several MDFs could leverage the unique properties of electromagnetic (EM) energy.

MEETING PROCESS

Unlike meetings consisting only of presentations, this workshop is intended to be a creative dialogue in which participates are encouraged to voice their thoughts on the potential for electrotechnologies to drive efficiency and enable manufacturers to create improved, value-added materials and products. A professional facilitator will guide discussions.

The following guidance is offered to help participants better understand the meeting process:

Prior to the Meeting – Participants should review the information included in this announcement. You should begin thinking about the most effective ways to stimulate technological progress, and draw on your personal experience to identify best-case examples. If possible, discuss the study with colleagues to gain their thoughts and insights. You should become familiar with the concept of Manufacturing Demonstration Facilities (MDFs) by reviewing presentations from the MDF overview workshop that was held in Chicago on March 12, 2012.[1]

During the Meeting – During the workshop, you will be expected to actively share your insights and perspectives and to participate in creative discussion with other participants. Structured brainstorming and critical analysis will be used to draw out participants' best thinking and identify areas of consensus and key priorities. Participants should come prepared to work and to openly discuss their concerns and suggestions.

After the Meeting – The results of this meeting will be compiled in a draft meeting report. This draft will be circulated to all participants for review; participants will have 2-3 weeks to provide comments.

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[1] For more information on MDFs, see the "Additional Information" section at the end of this announcement, as well as:
http://www1.eere.energy.gov/manufacturing/resources/workshops.html

AGENDA

Time	Activity
2:00-2:30 PM	**Opening Session - AMO** o Presentation of Industry Energy Futures: Efficiency & Energy o Advanced Manufacturing: Enabling & Keystone Technologies o Manufacturing Demonstration Facilities
2:30-3:30 PM	**Industry and Academic Panel Discussion - The state of industrial electrotechnology deployment worldwide.** o Recent trends o Country-by-country status o Drivers of and barriers to deployment – technical and business perspectives
3:30-3:45	**Short Break**
3:45-5:15 PM	**Facilitated Discussion – How Can the Future be Different?** o Potential of Electrotechnologies for efficiency o Potential of Electrotechnologies as Keystone technology o Barriers: Technical, Economic, Other? o Drivers of Change o Value of the MDF approach: pros & cons o Future Uncertainties o Needs of Technology Suppliers and Technology Users
5:15 - 5:30 PM	**Next Steps and Closing Remarks**

LOCATION

The session will be held on July 25, 2012 from 2:00PM – 5:30 PM at the Hilton Long Beach

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Need Information?

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MANUFACTURING DEMONSTRATION FACILITIES

Manufacturing Demonstration Facilities (MDFs) are collaborative communities, sharing a common infrastructure, designed to provide timely, affordable access to physical and virtual tools and to enable demonstration of new materials and critical processes important to advancing the industrial sector. The Advanced Manufacturing Office (AMO) plans to establish several of these facilities–each targeting a unique technology in advanced manufacturing.

Work conducted by MDF partners and users will provide real data that are needed to reduce the technical risk associated with full commercialization of promising energy-efficient processes and materials innovations. MDF work is intended to reduce manufacturing energy use and greenhouse gas emissions on a life-cycle basis; lower production costs; create jobs for American workers; and support the competitiveness of U.S. Industry. After an initial public-funding seed period of five years, MDFs should be financially self-sufficient.

The MDFs will be organized to foster an open exchange of pre-competitive manufacturing best-practices and know-how -- including design and processing tools, qualification and certification approaches, and fabrication costing methods -- but still protect company proprietary intellectual property. Each MDF will be managed and staffed with designers, manufacturing experts, and product evaluators to guide and train users and will also provide the opportunity for equipment suppliers and partners to improve their own technologies by learning from other users.

Technology developers may conduct work at the MDFs using a variety of collaboration instruments. Plans for the MDFs include hosting interns and guest workers from industry, academia, and government to accelerate pre-competitive development of rapid, flexible manufacturing technologies. Public-private shared infrastructure devoted to advanced manufacturing, like that provided through an MDF, has been a key recommendation of both industry and academia.

The Advanced Manufacturing Office (AMO) partners with industry, small business, universities, and other stakeholders to identify and invest in emerging technologies with the potential to create high-quality domestic manufacturing jobs and enhance the global competitiveness of the United States.

Opportunities for Electrotechnologies

<u>New Products, Materials, and Processes with Electrotechnologies</u>
Because electromagnetic energy interacts with different materials in unique ways, electromagnetic technologies (electrotechnologies) have the potential to develop entirely new or enhanced manufactured products and materials as well as new approaches and processes for producing such materials. Advancements have been made in applications electrotechnologies across a number of areas; some examples include:

- Microwave Processing of Ceramics
  Joining & Welding
  Binder Burnout and Sol-Gel Processing
  Sintering, Annealing and Ablation
- Microwave and Radio Frequency Processing of Polymers
  Composites Curing
  Polymerization Acceleration
  Solid Phase Polymerization
  MW Processing of Heat Sensitive Polymer Emulsions
- Microwave Synthesis & Reactions
  Organic Synthesis – Accelerated Reactions & New Materials Catalysis
  Inorganic Reactions – Hard Coatings, Oxides and Complexes
  Synthetic Diamond Production
- Microwave Processing of Conductive Materials
  Curing of Carbon Fiber Reinforced Plastics (CFRPs)
  Sintering of Powdered Metals
  Metals and Conductive Materials Processing
- Waste Remediation and Environmental Applications
  In-Situ RF Treatment of Contaminated Soils
  Medical and Bio-Medical Waste Sterilization by MW
  Hazardous Waste Processing by MW
- *MW & RF Solvent Extraction and Separation Techniques*
- MW and/or RF Drying of heat sensitive materials including textiles, polymers, and components of energy storage devices
- Intelligent packaging of foods
- Printed electronics
- More efficient drying of paper, paperboard, and wood building products
- MW, RF and electron beam curing of structural panels and composite structures