Wisconsin Business-Education Partnerships in Energy, Power and Control

WIDRC Meeting
1/18/2013

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Director, Regional Development
Why Is EPC Industry Vital?

Energy, Power & Control (EPC):

- America Consumes Over $1.3 Trillion in Energy/Yr
- This Represents $4,116 for Every Man, Woman and Child in America
- We Spend More on Energy than Anything Else
- Uses of Energy
  - Transportation, Lighting, Heating & Cooling, TVs, Smart Phones, Notebooks, I-Pads

Power and Control Are the Key Enabling Technologies that Convert Energy into Useful Work
What is WERC?

- WERC is One of America’s Largest Energy, Power and Control (EPC) Industry Clusters
- WERC Catalyzes the EPC Industry in Greater Wisconsin/Midwest Region by Connecting and Synchronizing the Region’s Expansive Academic, Economic Development, Government, NGO and Industrial EPC Participants

**WERC is Focused on Maximizing Cooperative Activities Within Our Energy, Power and Control Industry Cluster**
Energy
- Generation
- Renewable
- Fossil
- Nuclear
- Bioenergy

Power
- Transmission
- Distribution
- Storage
- Conversion
- Quality

Control
- Industrial Automation
- Building Automation
- Energy Management
- SMART Grid & Microgrid
- Electric Vehicles

We Are Working on the Future of Energy, Power & Control

PUTTING ENERGY TO WORK
WERC Vision

• Wisconsin/Midwest to Become the Leading US Region for EPC:
  – Sales, Employment & Companies
  – Research & Technology Development
  – Targeting 5 %+ Annual Growth

• WERC to Become an Internationally Recognized EPC Leader:
  – Technology, Market, Public Policy and Workforce Research and Industry Development

We Are Focused on Becoming the US Leader in Energy, Power and Control
WERC 2015 Growth Targets

• Technology Innovation
  – 25% Annual Growth in Research Funding

• Market and Industry Expansion
  – 5% Annual Growth in Revenues

• Supportive Public Policy
  – Nationally Recognized Best Practices

• Workforce Development
  – 7.5% Annual Growth in Employment

• Organization Development
  – Over 100 Members and Supporters from Across the Midwest
Why We Started in Wisconsin

• Energy Power & Control in Wisconsin
  • 900 Companies
  • 100,000 Employees
  • Over $38 Billion in Sales

• Expanding Collaboration in Key Technology Sectors to Companies, Universities and Partners Throughout the Midwest Region

The Midwest Region Has Expansive Capabilities in Energy, Power & Control
WERC Industry Participants

Working Together to Grow and Advance Our Region’s Energy, Power and Control Industry
We Combine the Power of Wisconsin’s Top Four Engineering Research Universities with the Power of Industry and the Training Know-how of Leading Technical Colleges

Combining Technology Innovation, Workforce Development and Strategic Collaboration to Promote Industry Expansion

PUTTING ENERGY TO WORK
Executive Director and CEO – John Bobrowich

Operations
- Director: Thomas Fehring
  - Administration: Michael Hanson, Support and Administrative Coordinator - Lyle Masimore
  - Technology Innovation: Bill Weber, Doug Weber, Director- Bruce Beihoff

Supportive Public Policy
- Randall Satterfield, Art Harrington

Market and Industry Expansion
- Kevin Fletcher, Lee Swindall, Director- TBD

Workforce Development
- Joe Jacobsen, Michael Krauski

Technology Innovation
- Bill Weber, Doug Weber, Director- Bruce Beihoff

Responsibilities:
- Innovative R&D
- Research Partnerships
- New Discoveries and IP
- Research Centers
- IP Exchange
- Obtain Grant Funding

Responsibilities:
- Public Policy Education
- Public Policy Evaluation
- Public Policy Recommendations
- Strategic Public Policy Partnerships

Responsibilities:
- Market Research
- Target Market Growth Initiatives
- Industry Growth Initiatives
- Entrepreneurial Support
- VC Funding Support
- Industry Promotion
- Obtain Grant Funding

Responsibilities:
- Identify Workforce Needs
- Develop a Dynamic Workforce
- Facilitate Training Projects
- Promote Industry Recruitment
- Develop Strategic Relationships
- Obtain Grant Funding

Responsibilities:
- Build Awareness of EPC
- Build Awareness of WERC
- Grow Membership and Funding
- Identify New Partnerships
- Facilitate Funder Collaboration
- Identify New Funding Opportunities

Development and Strategic Collaboration
- Alan Perlstein, Director- TBD
  - Regional Dev.: Ray Walter

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Technology Focus Areas

• **Customer & Utility Microgrids**
  - $17.3B Market by 2015

• **Building Energy Efficiency**
  - $20.0B Market by 2020

• **Energy Storage**
  - $50.0B Market by 2020

• **Renewable Energy**
  - $30B Market by 2017

• **Energy Water Nexus**

• **Biofuels**
Strategic Growth Via Road Maps

Environment/Market Trends

Segment Trends/Metrics

Central Roadmap

Projects and Outcomes

Technology Gaps and Enablers
Road Maps Drive Our Missions

• **Technology Innovation**
  – Transformational R & D in the Microgrid Industry Through Academic/Industry Collaboration and Better Awareness and Use of Existing IP

• **Market & Industry Development**
  – Market Research, Industry Development and Promotional Activities to Drive Growth of the Microgrid Industry

• **Supportive Public Policy**
  – Public Policy and Standards Research that Support and Promotes the Growth of the Microgrid Industry

• **Workforce Development**
  – Workforce Requirements Research and Development Boards across Business, Universities, Technical Colleges and WIB’s to Advise and Align Workforce Training to Meet the Workforce Needs of the Microgrid Industry

• **Development and Strategic Collaboration**
  – Microgrid Project Participant Expansion Across the Country and World
ENERGY SYSTEMS The WERC Difference

“WERC Delivers A Systems Perspective”

FUNDAMENTAL POLICY, ECONOMIC ECOLOGY MODELING
Social System Dynamics
Environmental Dynamics
Ecology/Policy Modeling

FUNDAMENTAL SYSTEMS
Integrated Systems Dynamics
Multi-Physics and Control Modeling
Advanced Integrated Systems

SOURCES
Nuclear
Fossil Fuel
Hydro
Wave
Wind
PV
Bio
Hybrid

ENERGY NETWORKS
GRIDS & U-GRID
Thermal Grid Interactions
Bio/Chem-Grid Transports
Automation Hybridization

LOADS
Heavy Industry
Commercial
Transportation
Home
Military
Data
Communications

STORAGE
Electro-Chemical
Thermal / Chemical
Solid State / Hybrid
Hydro
Bio

PUTTING ENERGY TO WORK
A Microgrid is an energy system network consisting of:

- distributed energy resources
- multiple electrical loads

And operating as a single, autonomous grid either in parallel to or islanded (disconnected) from the existing utility power grid.

Customer Owned Microgrid

- Control is behind PCC or Customer Interface
- Implies market participation for Energy, Capacity or Ancillary Service
Microgrid Benefits

• Customer, Developer or Utility Owned
  – Improved Reliability
  – Improved Power Quality
  – Improved Security
  – Value Derived from Market Impacts
    • Energy Export
    • Demand Response (Capacity)
    • Ancillary Services (Voltage Regulation, Power Factor and Frequency Regulation)
  – Renewable Integration (PV alone is “unavailable”)

PUTTING ENERGY TO WORK
WERC Microgrid Centers

- Facilities in Milwaukee and Madison
- Provide complementary Microgrid R&D test, demonstration, education and workforce training facilities for WERC universities, technical colleges & companies
- Madison facility will provide opportunity to explore new architectures and control algorithms focusing on interactions between sources, loads & storage
- Milwaukee facilities can be used to research, demonstrate, educate across energy management, CHP, hardware and controls. Actual distributed generation with natural variability.

World-class Microgrid Research & Test Environments
Madison Microgrid is Research-oriented w/ Emulated Sources

**WEI Building**

- Each source and load has rating of ~50 kW
- Power supplies and dynos controlled to emulate RE sources

**480 V AC**

- **Static Switch**
- **Isolation Transformer**

- **Dyno #1**
  - *Emulation of Wind Turbines, Gen Sets, Etc.*

- **Dyno #2**
  - *Emulation of PV, Fuel Cells, Etc.*

- **Load Bank**

- **Inverter-Based Sources**
  - **Supply #1**
  - **Supply #2**

- **GenSet**

**Madison Microgrid is Research-oriented w/ Emulated Sources**

**PUTTING ENERGY TO WORK**
Madison MicroGrid

- Building Completed
- Punch List Execution
- Departments moved by 2-1-2013
- Lab Integration by 5-1-2013
Milwaukee Microgrid #1

UWM USR Building

- 100kW PV solar, with inverter in voltage and current mode.
- 100kW wind turbine w/ induction gen.
- 100kW gas engine w/ synchronous gen.
- 50kWh, 25kW Zn-Brom. energy storage

UW Milwaukee Microgrid uses Actual Source Hardware with Controls Modified for Microgrid Compatibility

PUTTING ENERGY TO WORK
Advanced Research

Coupled Microgrids

**Smart Switch:**
- Seamless separation
- Automatic re-synchronizing

**Two Coupled Microgrids:**
- Distribution level
- Customer level with high *Local Reliability & CHP*

Standard building block for “Smart Distribution”
Integrated Energy Systems: Microgrids, Bioenergy, and CHP

- New Executive Order issued in August 2013 calling for 40 GW of new CHP in the industrial sector by 2020
- Opportunities to integrate microgrids, CHP, and biofuels
Introducing….WERC-IPX

• What is an Intellectual Property Exchange?
  – A marketplace for intellectual property that is arranged to facilitate the easy discovery of useful intellectual property and to easily acquire a desired set of rights in that property for your use.
    • Assist with efficient technology transfer
    • Provide reasonable and transparent pricing for IP rights
    • Provide a source of new revenue for IP owners

• What makes WERC-IPX unique?
  – Focused on Energy, Power, and Control
  – Predefined generic license agreements and non-disclosure agreements
  – Exclusive to WERC members
• Phase 1 – 2013
  – Expect a few hundred publicly available properties
  – Indexed for searching
  – Quarterly off-line updates
  – Generic licenses and terms & conditions

• Phase 2 – Future
  – Over 1000 properties
  – Smart searching available for research members
  – EPC Classification
  – Non-public properties
  – On-line secure system
How Can You Participate?

• Become a WERC SUPPORTER
  – For Companies and Individuals Who Wish to Support Our
    Organization But Not Engage in Our Core Mission Committees
    – WERC Corporate Supporter (3 Levels)
    – WERC Individual Supporter (1 Level)

• Become a WERC MEMBER
  – For Companies and Individuals Who Wish to Be Actively
    Engaged in our Organization and Our Core Mission Committees
    – WERC Research Member (3 Levels)
    – WERC Member (3 Levels)
    – WERC Individual Member (1 Level)

Participation in WERC Benefits our Industry
WERC Supporter Benefits **PLUS:**

- Participation in Mission Committees
- Private Contributor Website
- On-line EPC Industry Market Information
- Participation in all WERC Meetings and Events
- Participation in WERC Research Projects
- Networking with WERC Membership and WERC Partners
- Access to Member Company, University and Technical College Leadership
- Recognition and PR Tied to WERC Events

**Active Participation in WERC Allows Your Company to Better Support, Shape and Connect to Our EPC Industry**
WERC Upcoming Meetings

• January 17, UW Madison
• March 21 S&C Electric Chicago
• May 16 Location TBD

See Ray Walter for Details
Thank You

Questions?

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