

# Partnering for Clean Energy Manufacturing Competitiveness



U.S. DEPARTMENT OF  
**ENERGY**

Energy Efficiency &  
Renewable Energy

Libby Wayman  
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**Sustainable**  
TRANSPORTATION

**Renewable**  
ELECTRICITY GENERATION

**Energy Saving**  
HOMES, BUILDINGS,  
& MANUFACTURING

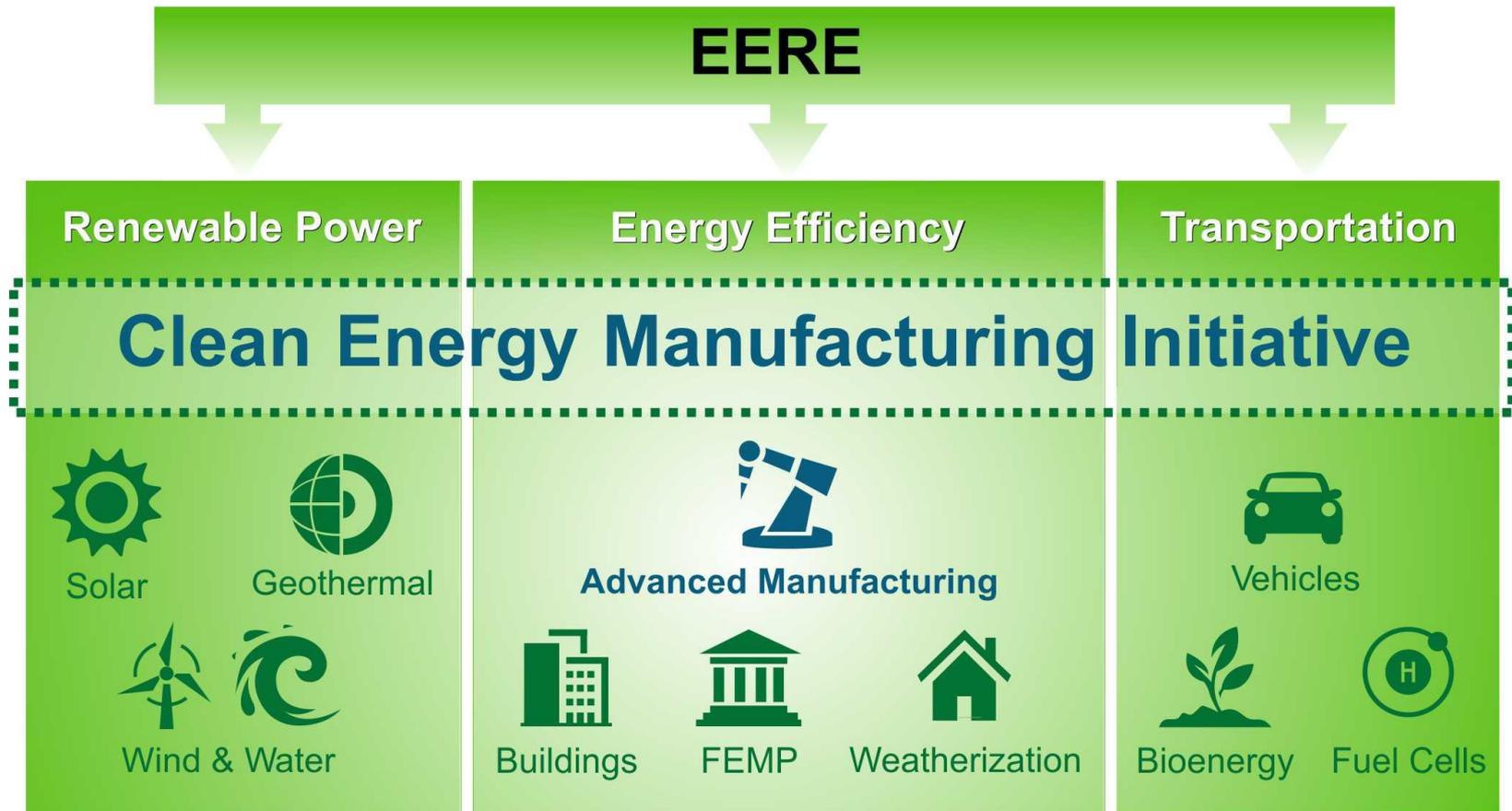
**Mission:**

**To create American leadership in the  
global transition to a clean energy economy**

**1) High-Impact Research, Development, and  
Demonstration to **Make Clean Energy** as **Affordable  
and Convenient** as Traditional Forms of Energy**

**2) **Breaking Down Barriers** to Market Entry**

# Coordination of Clean Energy Manufacturing in EERE



Collaboration toward:

- Common goal to collectively **increase U.S. manufacturing competitiveness**

Coordination for:

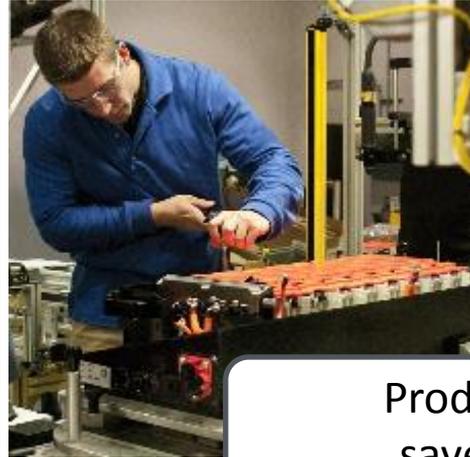
- Clean Energy Manufacturing Strategies
- National Clean Energy Manufacturing Priorities

# Clean Energy Manufacturing Initiative: 2 Objectives

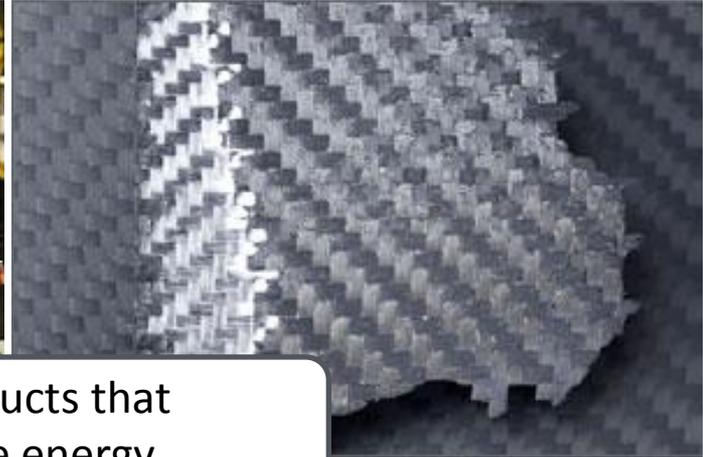
## 1. Increase U.S. competitiveness in the production of clean energy products



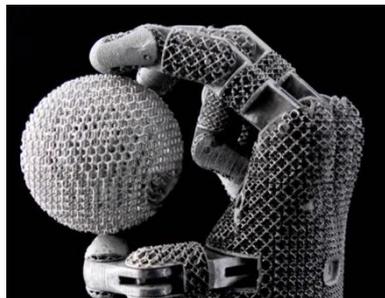
Products that generate clean energy



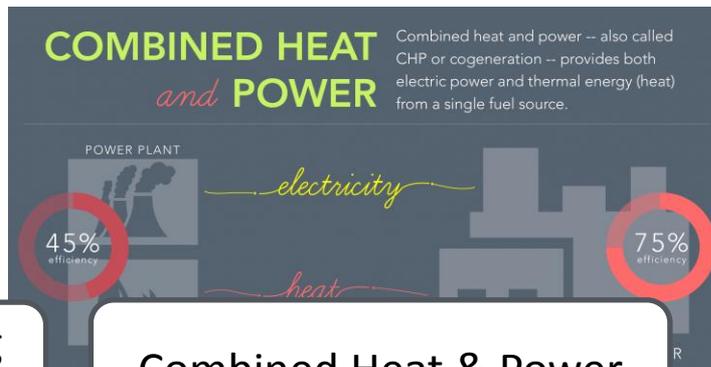
Products that save energy



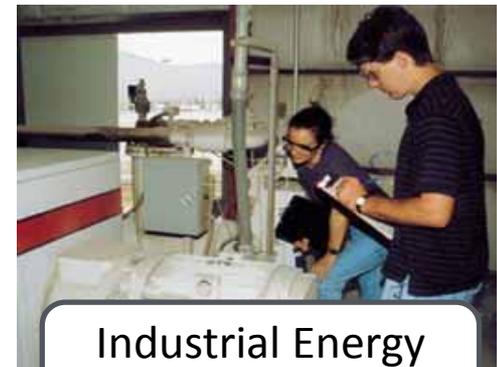
## 2. Increase U.S. manufacturing competitiveness across the board by increasing energy productivity



Advanced Manufacturing Technologies



Combined Heat & Power



Industrial Energy Efficiency

# Clean Energy Manufacturing Initiative

*Official launch on March 26, 2013*

## Key Components of Initiative

1. Manufacturing R&D:  
**>\$500 M in FY14 Request**
2. National Network for Manufacturing Innovation:  
**Carbon Fiber (Oak Ridge, TN)**  
**Additive Mfg (Youngstown, OH)**  
**Wide Band Gap Power Electronics Manufacturing Institute**
3. Deployment of energy productivity resources
4. Competitiveness analysis/strategies
5. Partnerships & engagement



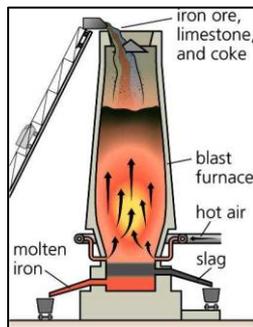
# EERE Manufacturing Resources

## Manufacturing R&D

### Clean Energy Technologies



### Energy Intensive Manufacturing Processes



## Manufacturing Energy Efficiency

- Industrial Assessment Centers



- Clean Energy Application Centers
- Better Plants Challenge



## Manufacturing R&D Facilities

### Manufacturing Demonstration Facility



Carbon Fiber Technology Facility

### Manufacturing Institutes



National Additive Manufacturing Innovation Institute - Pilot

Now released for competition:

**Next Generation  
Power Electronics  
Manufacturing  
Institute**

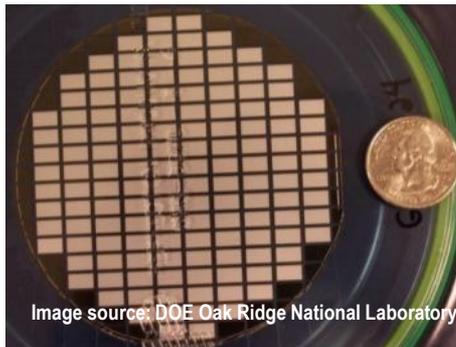
## Next Generation Power Electronics Manufacturing Institute

### Wide Bandgap (WBG) Semiconductors –

- Higher temperatures, voltages, and power loads compared to Silicon.
- Smaller, lighter, faster, and more reliable power electronic components for more efficient conversion, distribution, and use of electric power.



Semiconductor Material	Bandgap Energy (eV)
Silicon	1.1
Silicon Carbide	3.3
Gallium Nitride	3.4



### Clean Energy Manufacturing Innovation Institute –

- **Foundational technology.**
  - WBG power electronics critical to and broadly applicable across EERE portfolio in both energy-intensive industries and clean energy products.<sup>1</sup>
  - 80% of electricity will flow through power electronics by 2020.<sup>2</sup>
- **Impacts.**
  - Up to 75% reduction in electricity losses for AC-DC power conversion.
  - Up to 40% reduction in electricity losses for electric motors by enabling Variable-Speed Drives. This will enable 7% reduction in total industrial electricity consumption or more.
  - \$3.3 B market opportunity by 2020.<sup>3</sup>
- **U.S. competitiveness.** Opportunity to maintain U.S. technological lead in WBG and rebuild power electronics manufacturing lost overseas for Silicon.
- **Focus.** Cutting-edge manufacturing for high-quality, affordable devices or chips to enable mass adoption in power conversion systems.

# Spotlight: EERE Manufacturing R&D

## A Novel Flash Ironmaking Process

**Project Prime:** American Iron and Steel Institute (AISI)

**Project Partners:** University of Utah, U.S. Steel, Timken, Berry Metal, and ArcelorMittal

**Technology:** A novel ironmaking process is proposed that reduces energy consumption and greenhouse gases compared with blast furnaces and coke ovens. A falling stream of iron ore particles is directly converted to metal in just seconds using low cost natural gas. This project seeks to demonstrate the scaleup feasibility of the process allowing for new ironmaking capacity at a significantly lower capital cost than with traditional systems.

### Industry Benefits:

- Up to 20% reduction in energy consumption vs. historical, by eliminating pelletizing and sintering
- Elimination of cokemaking
- Up to 39% reduction in CO<sub>2</sub> emissions with the use of natural gas instead of coke
- Up to 50% reduction in capital cost of new ironmaking facilities



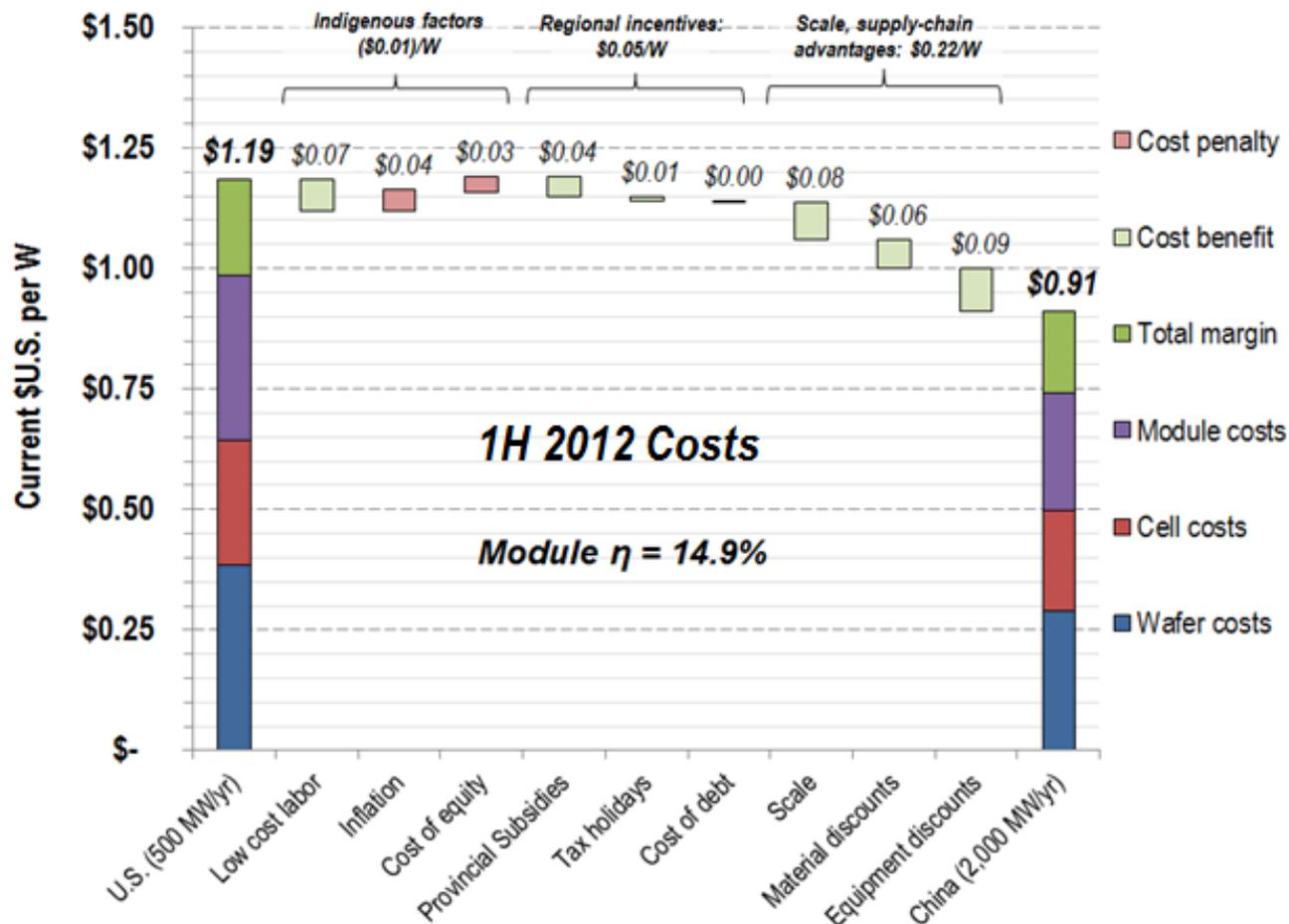
Computer graphic showing bench scale flash smelter currently under construction (2013). *Image courtesy of Berry Metal Company.*

# Partnering on Existing EERE Manufacturing Resources

Focus Area	Partnership Opportunities
Manufacturing R&D	<ul style="list-style-type: none"><li>• Identify R&amp;D priorities for manufacturing competitiveness</li><li>• Key conveners of R&amp;D teams</li></ul>
National Network for Manufacturing Innovation	<ul style="list-style-type: none"><li>• Identify topics for NNMI Institutes</li><li>• Key conveners of teams</li></ul>
Deployment of energy productivity resources	<ul style="list-style-type: none"><li>• Joint Workshops (CHP)</li><li>• Investing in Manufacturing Communities Partnership</li></ul>

# Competitiveness Analysis

## Silicon PV: Comparative Cost Assessment



Source: Original Clean Energy Manufacturing Initiative – SunShot research

Goodrich, A.; Buonassisi, T.; Powell, D.; James, T. "Assessing the Drivers of Regional Trends in Solar Photovoltaic Manufacturing", E&ES (submitted), October 2012.

NREL chart using data from Mints, P.; Donnelly, J. (2011). "Photovoltaic Manufacturing Capacity and Competitive Analysis 2010/2011." Report NPS-Supply 6, Navigant Solar Services Program. Palo Alto, CA.

# Competitiveness Strategies

Examples for Solar PV Clean Energy Manufacturing Strategy:

- **LEVEL PLAYING FIELD**

- Clean Energy Manufacturing Analysis informed U.S. decision on solar tariffs with China
- Companies moving back to the USA from China (Silevo – 200MW factory announcement in USA)

- **INCREASE EX-IM EFFORTS**

- U.S. thin film solar manufacturing – completely driven by Ex-Im finance to India

- **QUALITY CERTIFICATION**

- High quality U.S. products not being valued by project investors

- **ACCELERATE U.S. DEMAND THROUGH COST REDUCTION**

- Reduce soft costs, financing costs
- Reliability database, securitization

# Partnering on Competitiveness Analysis & Strategies

Focus Area	Partnership Opportunities
Competitiveness Analysis	<ul style="list-style-type: none"><li>• Compare supply chain roadmapping analyses</li><li>• Collaborate on analyses</li><li>• Form/suggest private sector teams to provide input to analysis</li></ul>
Competitiveness Strategies	<ul style="list-style-type: none"><li>• Participate in generation of strategies</li><li>• Implementation of strategies</li></ul>

# Outreach & Engagement for Ideas

## Regional Summits

- Showcase regional Clean Energy Manufacturing
- Highlight Clean Energy Manufacturing resources
- Seek input & ideas
- Foster networking and partnerships



First Regional Summit: Toledo OH, June 21

## Council on Competitiveness

Collaboration to create new  
Public-Private-Partnership  
Models for Manufacturing



*American Energy & Manufacturing  
Competitiveness Summit*

*(Dec 2013 – DC)*

# Partnering on Engagement & Idea Generation

Focus Area	Partnership Opportunities
Regional Summits	<ul style="list-style-type: none"><li>• Advise regional summits</li><li>• Partner on regional summits</li><li>• Attend regional summits and provide input</li><li>• Speak in regional summits</li></ul>
Council on Competitiveness Dialogue Series: <i>American Energy &amp; Manufacturing Competitiveness Partnership</i>	<ul style="list-style-type: none"><li>• Participate in dialogues: help design a Public-Private Partnership</li><li>• Be a founding member of the PPP</li><li>• Key convener for PPP membership</li></ul>

# Partnering for Clean Energy Manufacturing Competitiveness

EERE Priority	Partnership Opportunities
CEMI-Specific	
Manufacturing R&D	<ul style="list-style-type: none"> <li>• Identify R&amp;D priorities for manufacturing competitiveness</li> <li>• Key conveners of R&amp;D teams</li> </ul>
National Network for Manufacturing Innovation	<ul style="list-style-type: none"> <li>• Identify topics for NNMI Institutes</li> <li>• Key conveners of teams</li> </ul>
Deployment of energy productivity resources	<ul style="list-style-type: none"> <li>• Joint Workshops (CHP)</li> <li>• Investing in Manufacturing Communities Partnership</li> </ul>
Competitiveness analysis/strategies	<ul style="list-style-type: none"> <li>• Participate in Competitiveness Analysis</li> <li>• Participate in generation of strategies</li> <li>• Implementation of strategies</li> </ul>
Partnerships & engagement	<ul style="list-style-type: none"> <li>• Partner on CEMI Regional Summits</li> <li>• Participate in Council on Competitiveness Dialogue Series to design a Public-Private Partnership</li> <li>• Be a founding member of a PPP</li> </ul>
Broad Partnership	Need a mechanism for ongoing, systemic partnership – ideas?

# DOE Clean Energy Manufacturing Initiative

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**A Flexible Platform Where We Can Work Together to Drive  
American Energy & Manufacturing Competitiveness**

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Director, Clean Energy Manufacturing Initiative

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# Thank You