Innovations in Energy and Manufacturing

*HPC4Manufacturing: Modeling of Powder Dynamics in Metal Additive Manufacturing*

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Manufacturing accounts for roughly 25% of U.S. energy consumption.

Consumption is concentrated in energy-intensive industries.

Increasing energy productivity makes U.S. manufacturers more competitive while reducing energy impact.
AMO: Technology Focus Areas (MYPP 2017)

- Flow of Materials through Industry (Sustainable Manufacturing)
- Critical Materials
- Thermoelectric & Direct Energy Conversion Materials, Devices and Systems
- Wide Bandgap Power Electronics
- Materials for Harsh Service Conditions
- Advanced Materials Manufacturing
- Additive Manufacturing
- Composite Materials
- Roll-to-Roll Processing
- Process Heating
- Process Intensification
- Waste Heat Recovery
- Advanced Sensors, Controls, Platforms and Modeling
- Combined Heat and Power

Manufacturing Systems – Unit Operations
Production / Facility Systems – Energy and Resource Utilization
Beyond the Plant Boundaries – Supply Chain and Life Cycle
AMO: Three complementary strategies

Technical Partnerships: Direct engagement with Industry

Driving a corporate culture of continuous improvement and wide scale adoption of proven technologies, such as CHP, to reduce energy use in the industrial sector

R&D Consortia: Public-Private consortia model

Shared R&D Facilities offer affordable access to physical and virtual tools, and expertise, to foster innovation and adoption of promising technologies

R&D Projects: Bridging the innovation gap

Research and Development Projects to support innovative manufacturing processes and next-generation materials
Technical Partnerships: Better Plants Program

• Key component of President’s Better Buildings Initiative to improve energy efficiency of commercial and industrial buildings by 20% by 2020.
• Voluntary pledge by leading manufacturers and industrial-scale energy users to reduce energy intensity
• DOE provides technical assistance to meet goals

Better Plants Snapshot

<table>
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<tr>
<th>Partnership Size</th>
<th>Total</th>
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<tbody>
<tr>
<td>Number of Partner Companies</td>
<td>157</td>
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<tr>
<td>Approximate Number of Facilities</td>
<td>2,400</td>
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<tr>
<td>Percent of U.S. Manufacturing Energy Footprint</td>
<td>11.4%</td>
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Reported Savings through 2014

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<th>Reported Savings through 2014</th>
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<tr>
<td>Cumulative Energy Savings (TBtu)</td>
<td>457</td>
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<tr>
<td>Cumulative Cost Savings (Billions)</td>
<td>$2.4</td>
</tr>
<tr>
<td>Cumulative Avoided CO₂ Emissions (Million Metric Tons)</td>
<td>26.6</td>
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<tr>
<td>Average Annual Energy-Intensity Improvement Rate</td>
<td>2.1%</td>
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• To date, Better Plants Partners have reported **$2.4 billion in cumulative energy costs** (more than 0.45 Quads of energy)
Program goal is to accelerate the manufacturing capability of a multitude of AM technologies utilizing various materials from metals to polymers to composites.
High Performance Computing for Manufacturing

Apply modeling and simulation capabilities to manufacturing challenges

- Industry defined challenges
- Businesses Partner with National labs
- Business-friendly terms and streamlined partnering process

A computer simulation of the virtual blast furnace. Image courtesy of Purdue University – Calumet.
What does Success Look Like?

Energy Products Invented Here...

...And Competitively Made Here!