U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Advanced Manufacturing R&D for Clean Energy at the U.S. Department of Energy

Government University Industry Research Roundtable
Washington, DC

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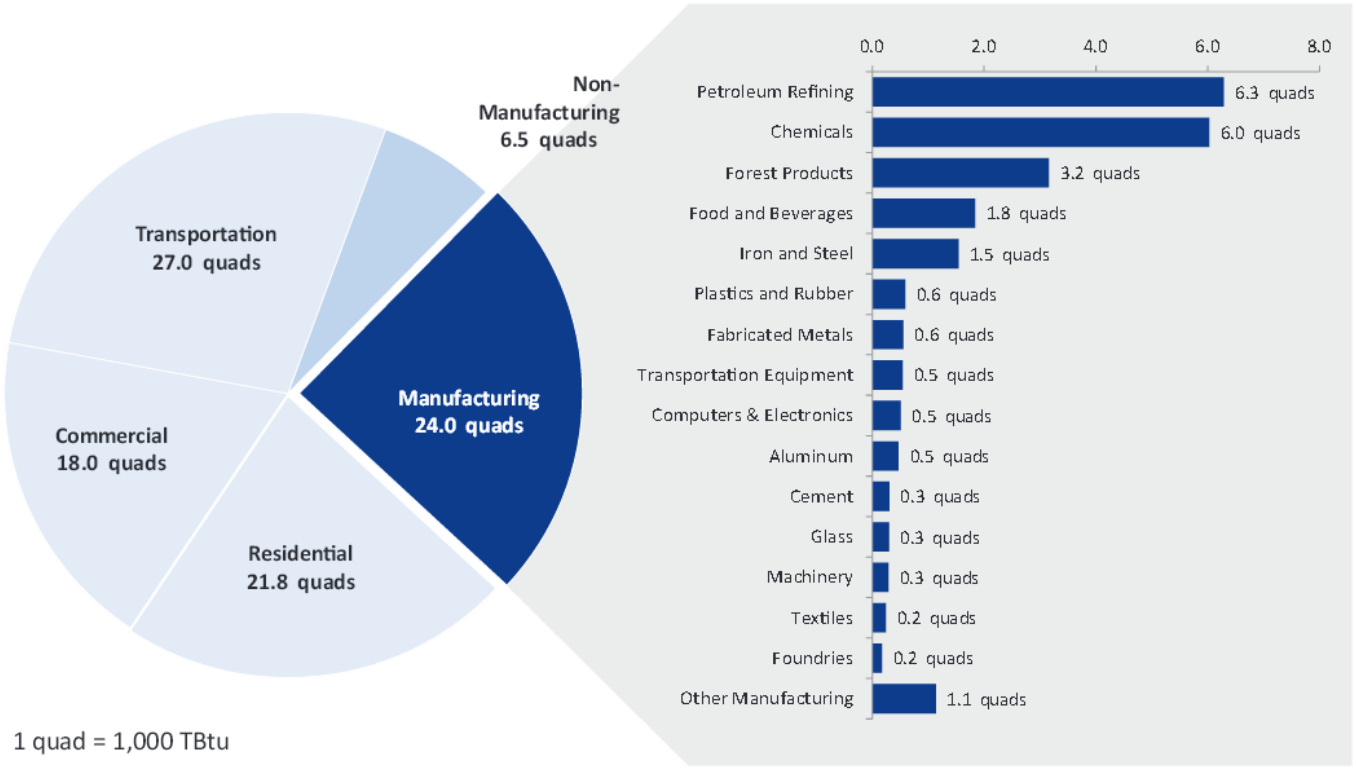
Advanced Manufacturing Office

www.manufacturing.energy.gov

U.S Manufacturing Sector Energy Consumption



Petroleum Refining
6.3 Quads

Chemicals
6.0 Quads

Pulp and Paper
3.2 Quads

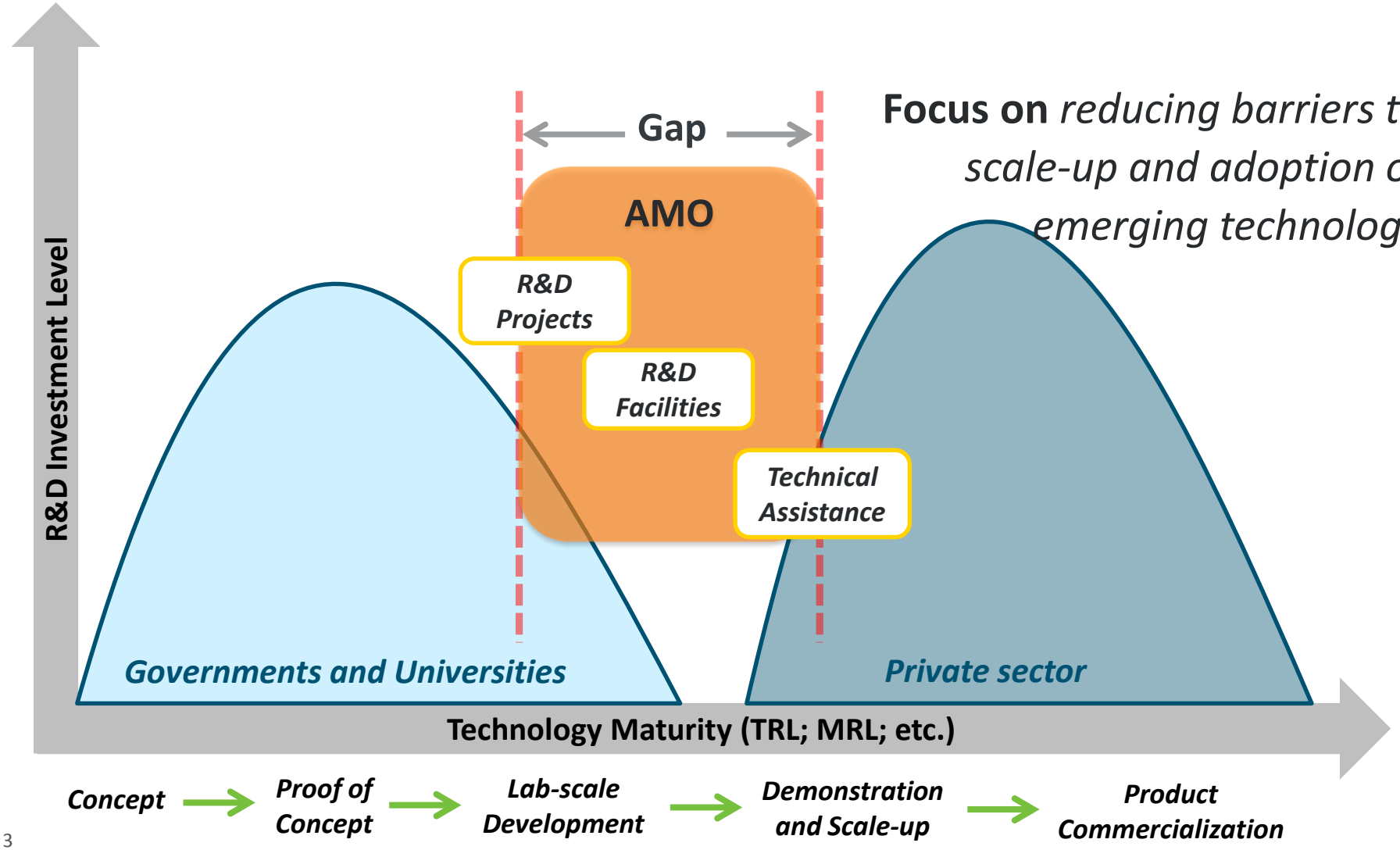
Food Processing
1.8 Quads

Iron & Steel
1.5 Quads

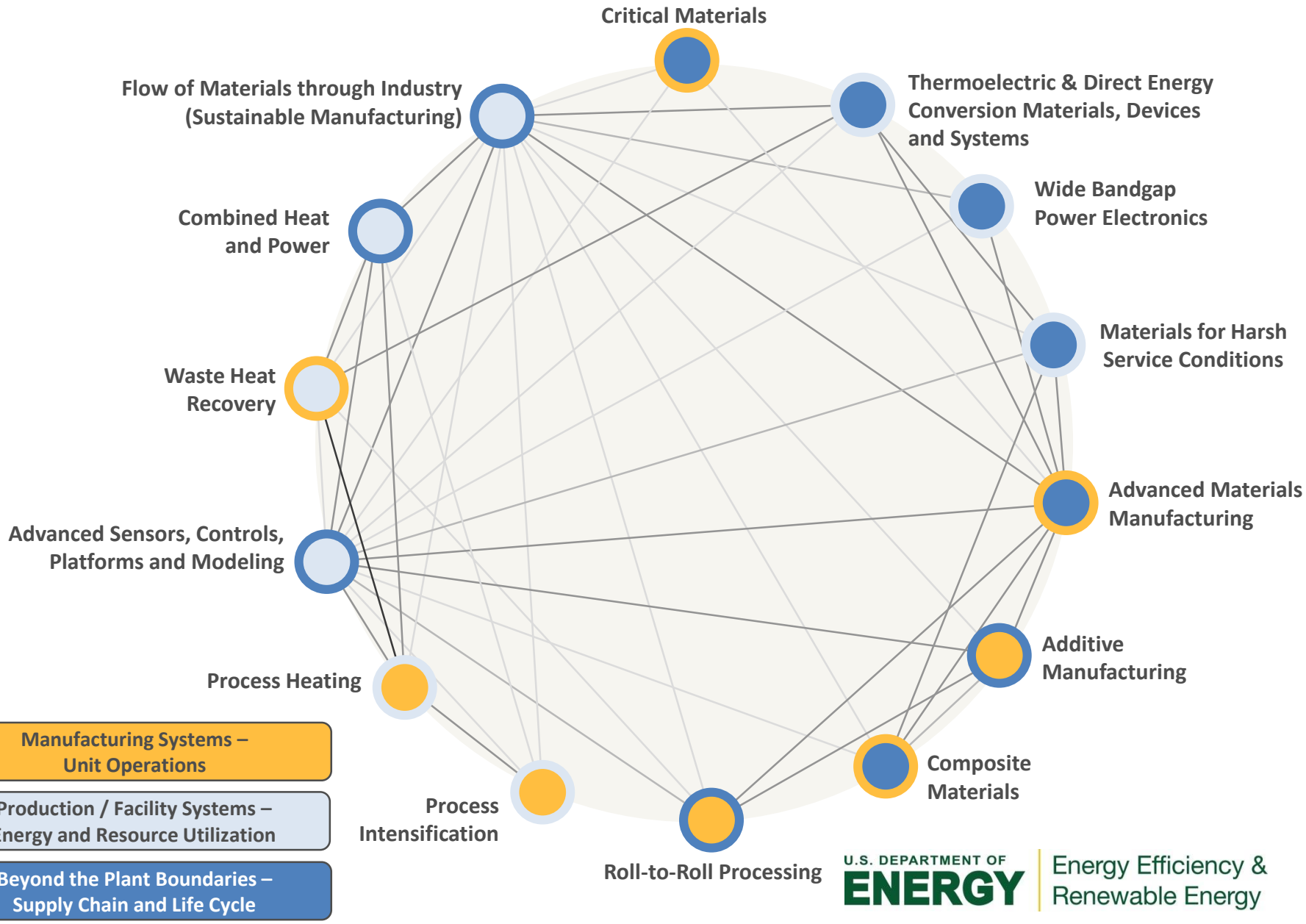
- Manufacturing accounts for roughly 25% of U.S. energy consumption
- Consumption is concentrated in energy-intensive industries
- Increasing energy productivity makes U.S. manufacturers more competitive while reducing energy impact

AMO: Advanced Manufacturing Office

What we do: *Partner with industry, small businesses, universities, and regional entities to invest in emerging clean energy technologies.*



AMO: Technology Focus Areas (QTR 2015 energy.gov/qtr)



AMO: Three complementary strategies

Technical Assistance: 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

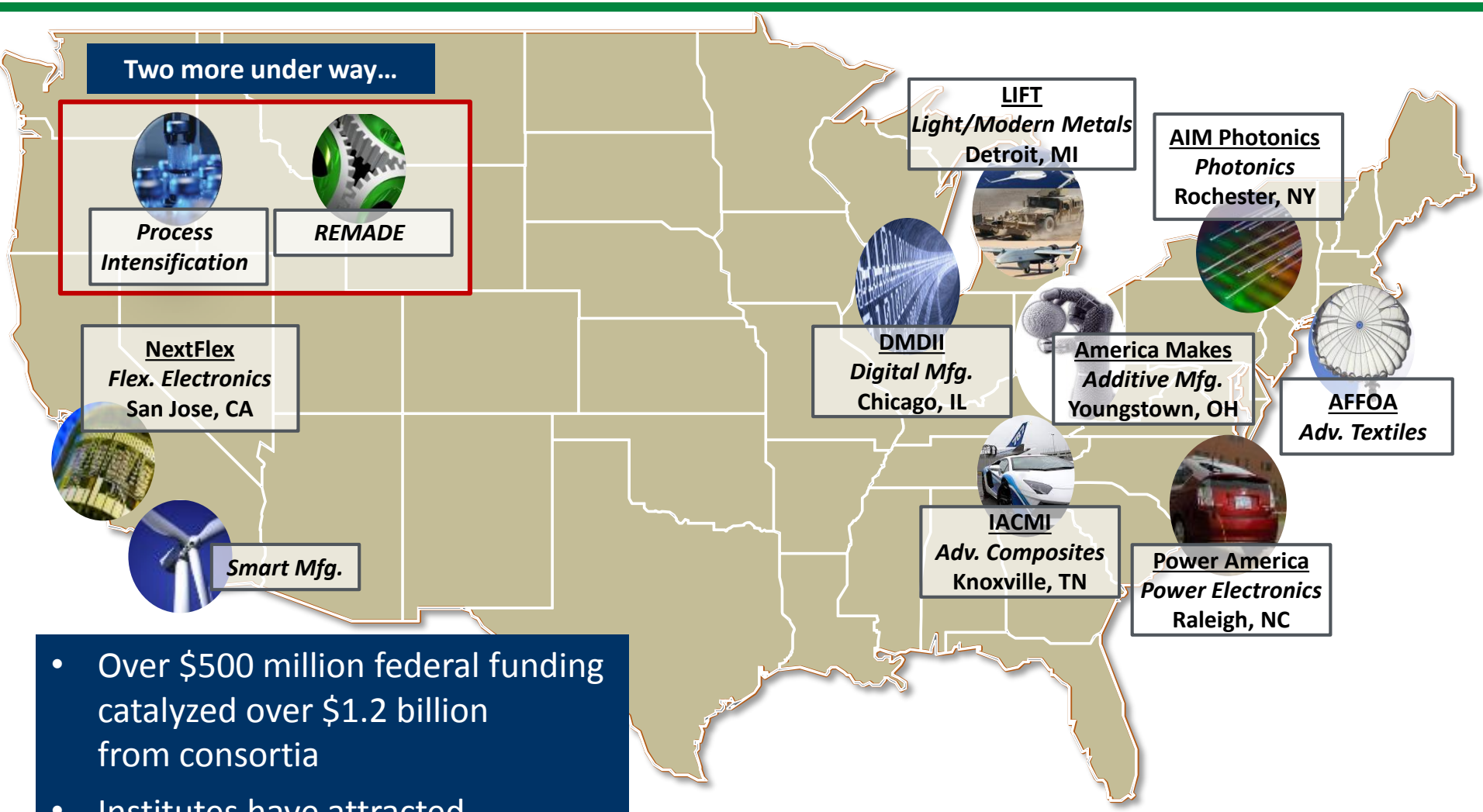
R&D Facilities: Public-Private consortia model

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

11 Manufacturing Innovation Institutes launched to date



- Over $500 million federal funding catalyzed over $1.2 billion from consortia
- Institutes have attracted hundreds of companies and universities as active partners from across the country

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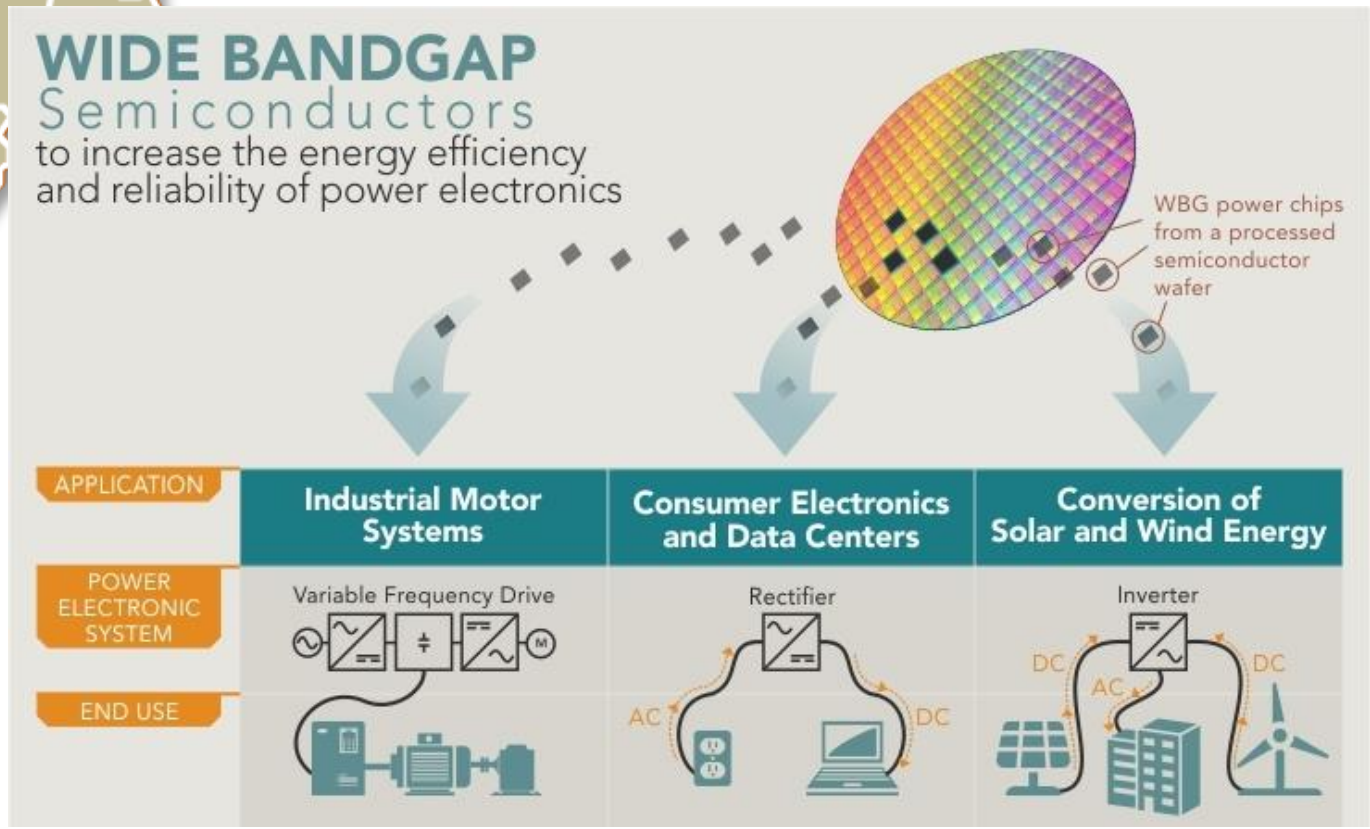
DOE NNMI Institute #1 – PowerAmerica (Raleigh, NC)

PowerAmerica: Develop advanced manufacturing processes that will enable large-scale production of wide bandgap semiconductors.



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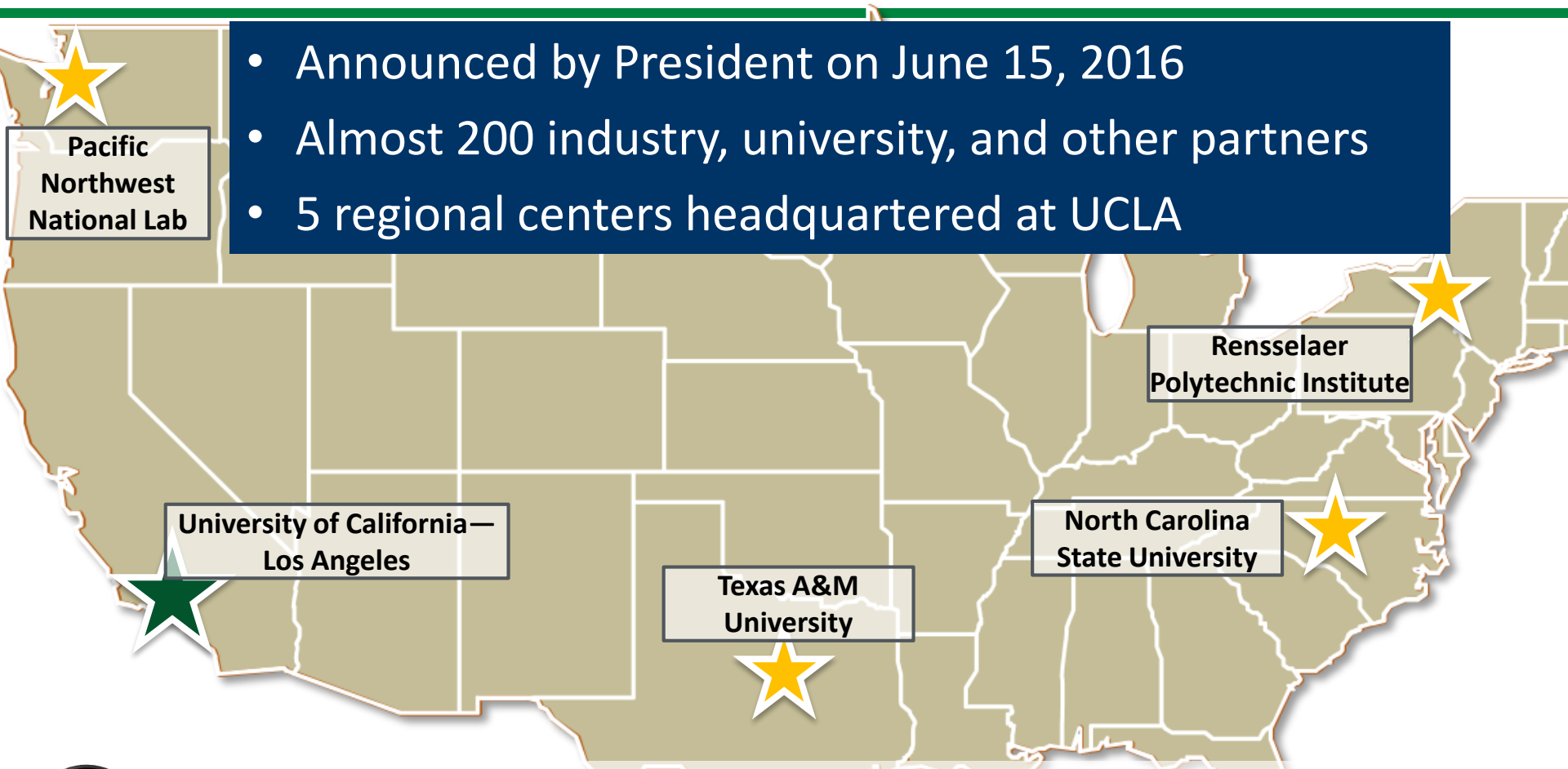
DOE NNMI Institute #2 – Carbon Fiber Composites (Oak Ridge, TN)

Institute for Advanced Composite Material Manufacturing (IACMI): Develop and demonstrate technologies to produce carbon fiber composites at 50% the cost and 75% less energy.

- Launched in January 2015
- $70 million Federal support matched by $180 million non-Federal
- 94 Total members including 72 industry members, 14 universities, and 2 national labs
- 46 Small and medium-sized industry partners

DOE NNMI Institute #3 – Smart Manufacturing (Los Angeles, CA)

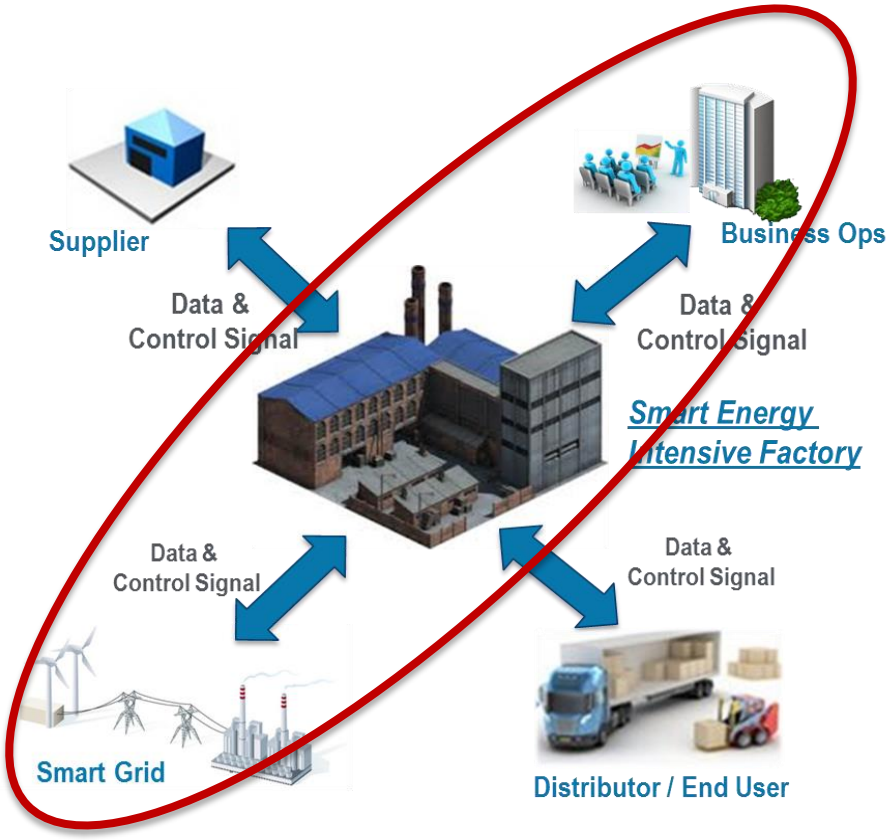
- Announced by President on June 15, 2016
- Almost 200 industry, university, and other partners
- 5 regional centers headquartered at UCLA



Clean Energy Smart Manufacturing Innovation Institute (CESMII): Spur advances in smart sensors and digital process controls to drive energy efficiency of U.S. manufacturing.

DOE NNMI Institute #3 – Smart Manufacturing (Los Angeles, CA)

- Advanced sensors and controls for real-time process management



Focus on Real-Time For Energy Management

Institute Goals

- >50% improvement in energy productivity
- >50% reduction in installation cost of Smart Manufacturing hardware and software
- 15% Improvement in Energy Efficiency at systems level
- Increase productivity and competitiveness across all manufacturing sectors

Two upcoming DOE-led NNMI Institutes

Up to $70 million in Federal cost share for each:

Modular Chemical Process Intensification: Focus on breakthrough technologies to dramatically improve energy efficiency of novel chemical manufacturing processes.

REMADE: Dramatically reduce life-cycle energy consumption through the development of technologies for reuse, recycling, and remanufacturing of materials.

What does Success Look Like?

Energy Products Invented Here…

…And Competitively Made Here!

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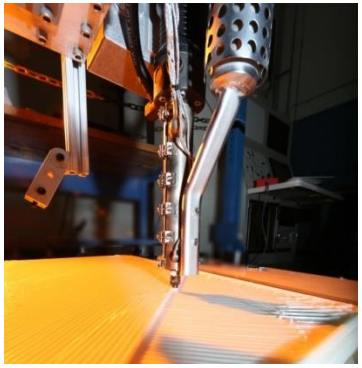
Backup Slides

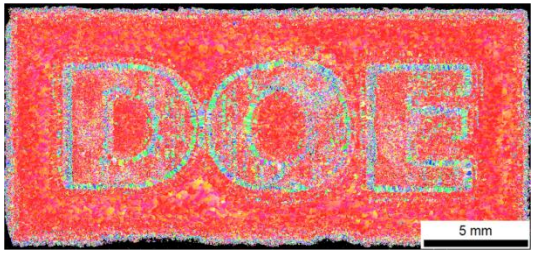
Manufacturing Demonstration Facility

Supercomputing Capabilities

Spallation Neutron Source

America Makes





Additive Manufacturing

Arcam electron beam processing AM equipment

POM laser processing AM equipment

Program goal is to accelerate the manufacturing capability of a multitude of AM technologies utilizing various materials from metals to polymers to composites.

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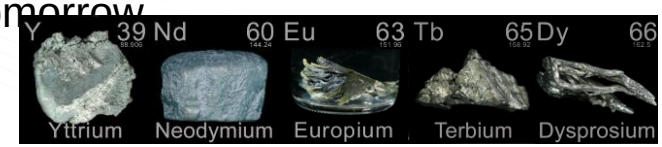
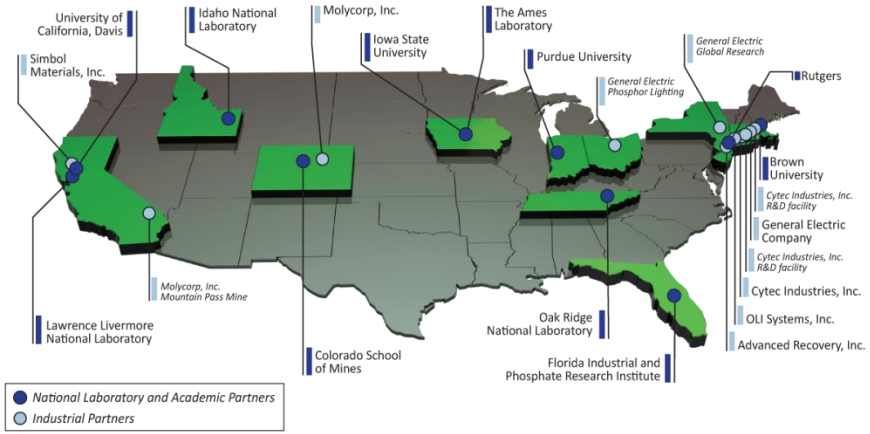
CMI Accelerating Energy Innovations

Critical Materials Institute

Eliminate materials criticality as an impediment to the commercialization of clean energy technologies for today and tomorrow





Selected Goals

- Materials supply chains assured for clean energy manufacturing in the US
- Have one technology in each of its three technical focus areas ready for use by industry
- Develop updated criticality assessments to ensure relevance of CMI research and identify potential critical materials for clean energy

Funding

- Up to $120M for operations from June 2013-June 2018

ORNL is managed by UT-Battelle for the US Department of Energy

OAK RIDGE National Laboratory