

U.S. DEPARTMENT OF
ENERGY

Office of
ENERGY EFFICIENCY &
RENEWABLE ENERGY

Advanced Manufacturing Office Overview

TRANSFORM Initiative

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<https://www.energy.gov/eere/amo/advanced-manufacturing-office>

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EERE's Advanced Manufacturing Office (AMO)

U.S. DEPARTMENT OF
ENERGY

Office of
**ENERGY EFFICIENCY &
RENEWABLE ENERGY**

Advanced
Manufacturing
Office

BUDGET

\$396M
FY21

**WHAT
WE
DO**

Partner with industry, academia, states, and National Laboratories to catalyze R&D and the adoption of advanced manufacturing technologies and practices

STAFF

~70

Feds, contractors, and fellows
GOLDEN, CO AND DOE HEADQUARTERS



R&D Projects
FY21 = \$218M

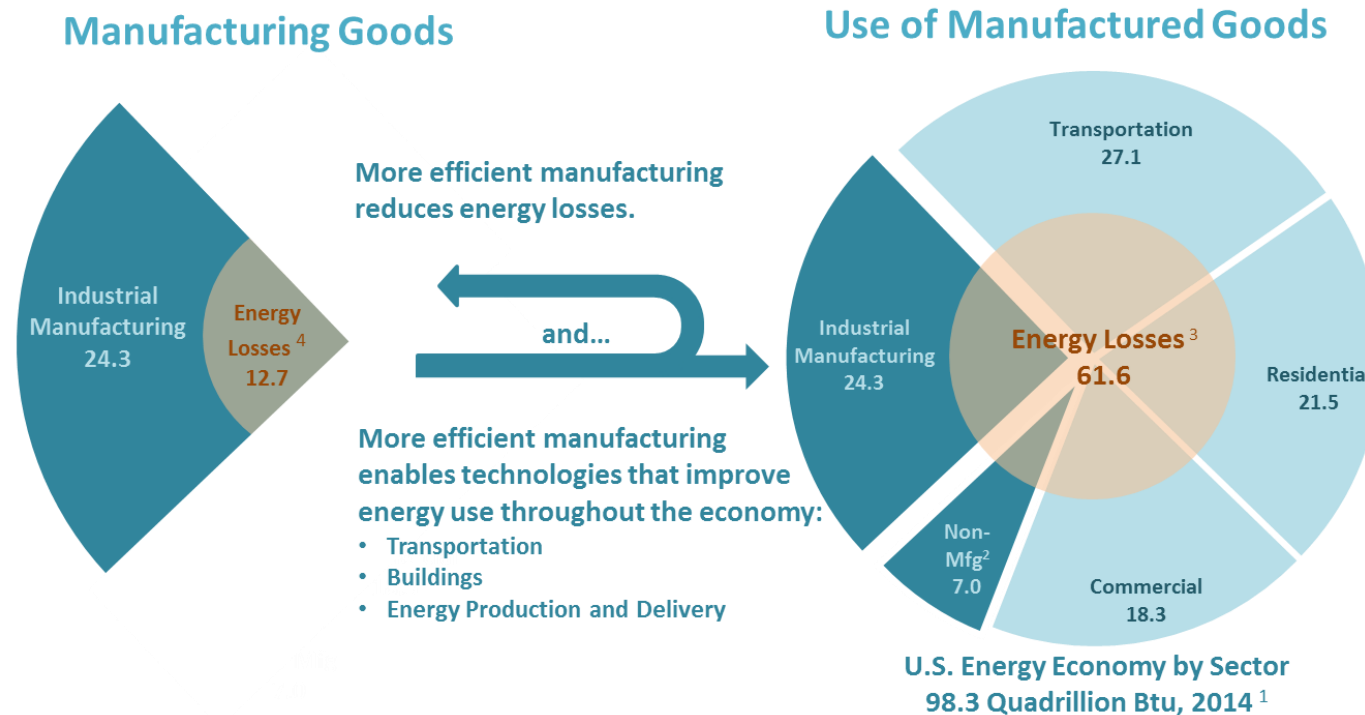


R&D Consortia
FY21 = \$133M



Technical Assistance
FY21 = \$45M

AMO Vision and Mission



VISION: U.S. global leadership in sustainable and efficient manufacturing for a growing and competitive economy.

MISSION: Catalyze research, development and adoption of energy-related advanced manufacturing technologies and practices to drive U.S. economic competitiveness and energy productivity.

AMO Guiding Principles

AMO works to increase energy and material efficiency in manufacturing to drive energy productivity and economic growth.

MANUFACTURING

Uses roughly 25% of the nation's primary energy



Represents nearly 80% of energy use in energy-intensive sectors



Generates 11% of the U.S. GDP and 12 million jobs



Incurs \$150 billion in energy costs annually



AMO GOALS

- Improve the **productivity, competitiveness, energy efficiency, and security** of U.S. manufacturing
- Reduce the **life cycle energy and resource impacts** of manufactured goods
- Leverage diverse **domestic energy resources and materials** in U.S. manufacturing, while strengthening environmental stewardship
- Transition DOE-supported innovative technologies and practices into **U.S. manufacturing capabilities**
- Strengthen and advance the **U.S. manufacturing workforce**



Industrial Decarbonization

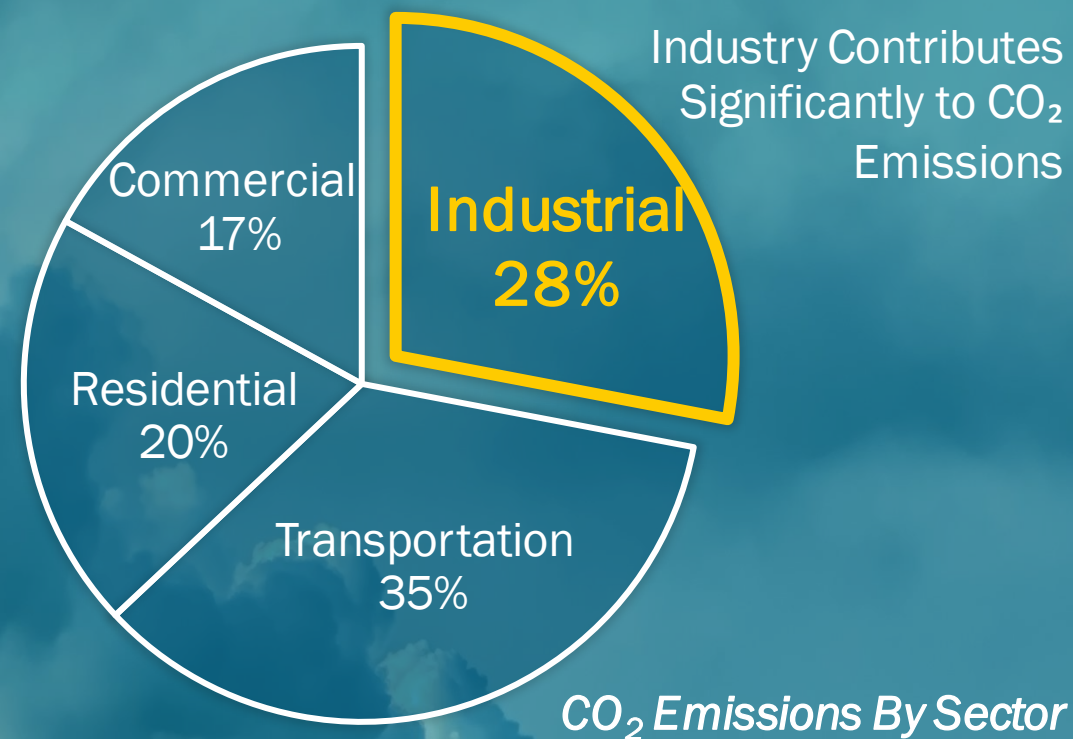
THE U.S. INDUSTRIAL SECTOR

manufacturing | agriculture | mining | construction

ACCOUNTS FOR **32%** of the nation's primary energy use
28% of CO₂ emissions

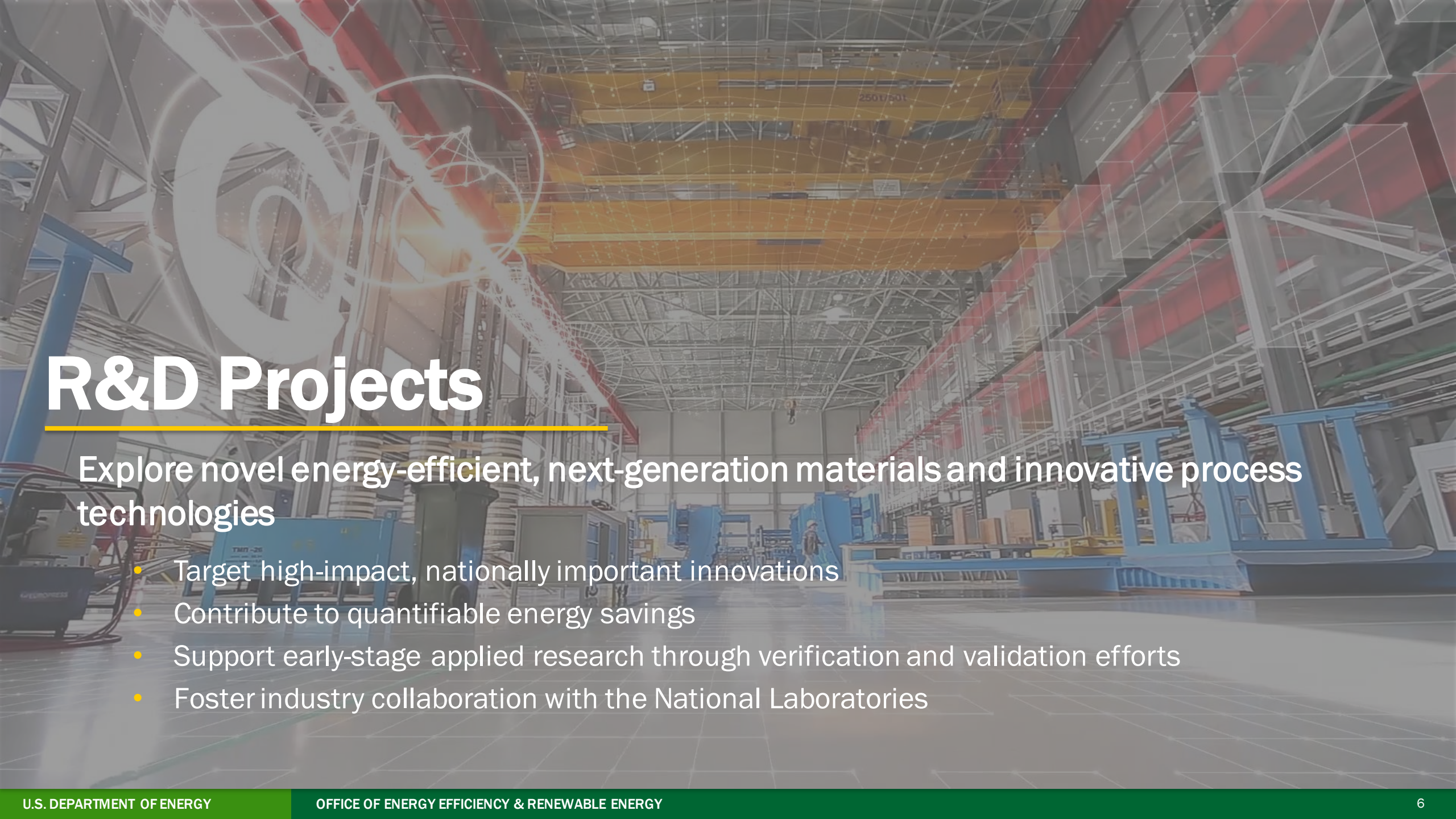
Anticipated industrial sector energy demand growth of 30% by 2050 may result in a

15% CO₂ emissions increase



Technological advances in manufacturing will be critical to enabling decarbonization for other sectors.

Decarbonizing the industrial sector is key to addressing the climate crisis and achieving economy-wide, net-zero emissions by 2050.



R&D Projects

Explore novel energy-efficient, next-generation materials and innovative process technologies

- Target high-impact, nationally important innovations
- Contribute to quantifiable energy savings
- Support early-stage applied research through verification and validation efforts
- Foster industry collaboration with the National Laboratories

Lab-embedded Entrepreneurship Programs

“Spin in” the nation’s top innovators to the National Laboratories to mature their ideas from concept to first product



- ① Recruit the best energy technology innovators



- ② Leverage expert mentorship and world-class facilities at the National Labs on a win-win basis



- ③ Position people and technology for market

**\$120
million**

received by investors in additional federal and private funding, including philanthropy, angel investors, venture capital, and more

10 innovators

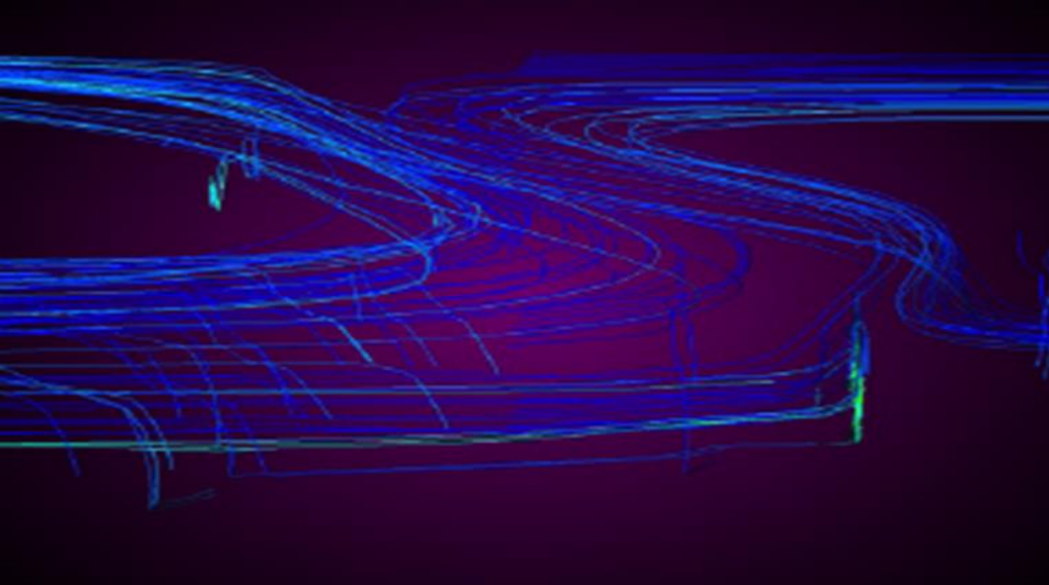
from the programs have been named to Forbes’ prestigious “30 under 30” since 2016

High Performance Computing (HPC)

CAPABILITY

HPC expedites the development of energy-efficient manufacturing processes across U.S. industry—boosting competitiveness and global leadership.

- HPC-developed machine-learning tools enable manufacturers to make real-time process adjustments instead of taking machinery offline.
- HPC tools can improve energy and material productivity by harnessing large amounts of data.



SUCCESS

REAL-TIME PROCESS CONTROL FOR GLASS MANUFACTURING

- Develop a machine-learning algorithm that can be run off of a desktop computer to replace the computational fluid dynamics model
- Make real-time, online adjustments by leveraging the new fast-running prediction tool
- Increase productivity in other industries using similar tools



R&D Projects from Fiscal Year 2020 Funding Opportunity

\$123.6 million
awarded
with an additional
\$44.7 million in cost share

46 projects
selected

23 states
represented

Efficiency Improvements in Advanced Manufacturing Processes

\$69.4 million for 27 projects

Efficiency Improvements in Chemical Manufacturing

\$25 million for 8 projects

Connected, Flexible, and Efficient Manufacturing Facilities, Products, and Energy Systems

\$29.1 million for 11 projects

R&D Consortia

Public/private partnerships addressing

- Coordinated R&D efforts across a supply chain or market sector for greater impact
- Robust education and workforce development
- Connecting manufacturing ecosystems

Consortia Highlights: Manufacturing Institutes

Manufacturing Institute Model: Create an innovation ecosystem that accelerates technology development and facilitates the transfer of innovative advanced manufacturing technology to U.S industry by:

- providing shared research facilities to manufacturers;
- developing advanced manufacturing workforce skills; and
- a catalyzing federal investment of \$70 million for initial 5 year collaboration, attracting additional private and public investment.

Per Congressional direction, AMO plans to add a seventh institute with FY21 funds.

EXISTING
INSTITUTES



PowerAmerica (2014): Wide-bandgap semiconductors



Institute for Advanced Composites Manufacturing Innovation (2015): carbon fiber composites



Clean Energy Smart Manufacturing Innovation Institute (2016): smart manufacturing



Rapid Advancement of Process Intensification Deployment (2017): chemical process intensification



Reducing EMbodied-energy And Decreasing Emissions Institute (2017): recycling and remanufacturing



Cybersecurity Manufacturing Innovation Institute (2020): energy efficient, cyber-secure manufacturing

Advanced Manufacturing Hubs

Modeled after the Manhattan Project, manufacturing hubs span basic and applied research to address high-priority areas essential to energy in manufacturing.

Critical Materials Institute

- DOE energy innovation hub led by Ames Laboratory
- Works to enhance critical materials resiliency for energy technologies through R&D to:
 - Diversify the supply chain for critical materials, including domestic production and processing
 - Develop element, material, and/or system substitutes to reduce dependence
 - Drive recycling, reuse, and more efficient use of critical materials



National Alliance for Water Innovation

- Energy-water desalination hub led by Lawrence Berkeley National Laboratory
- Focused on early-stage research on desalination and water-treatment technologies to secure affordable and energy-efficient water supplies from nontraditional water sources



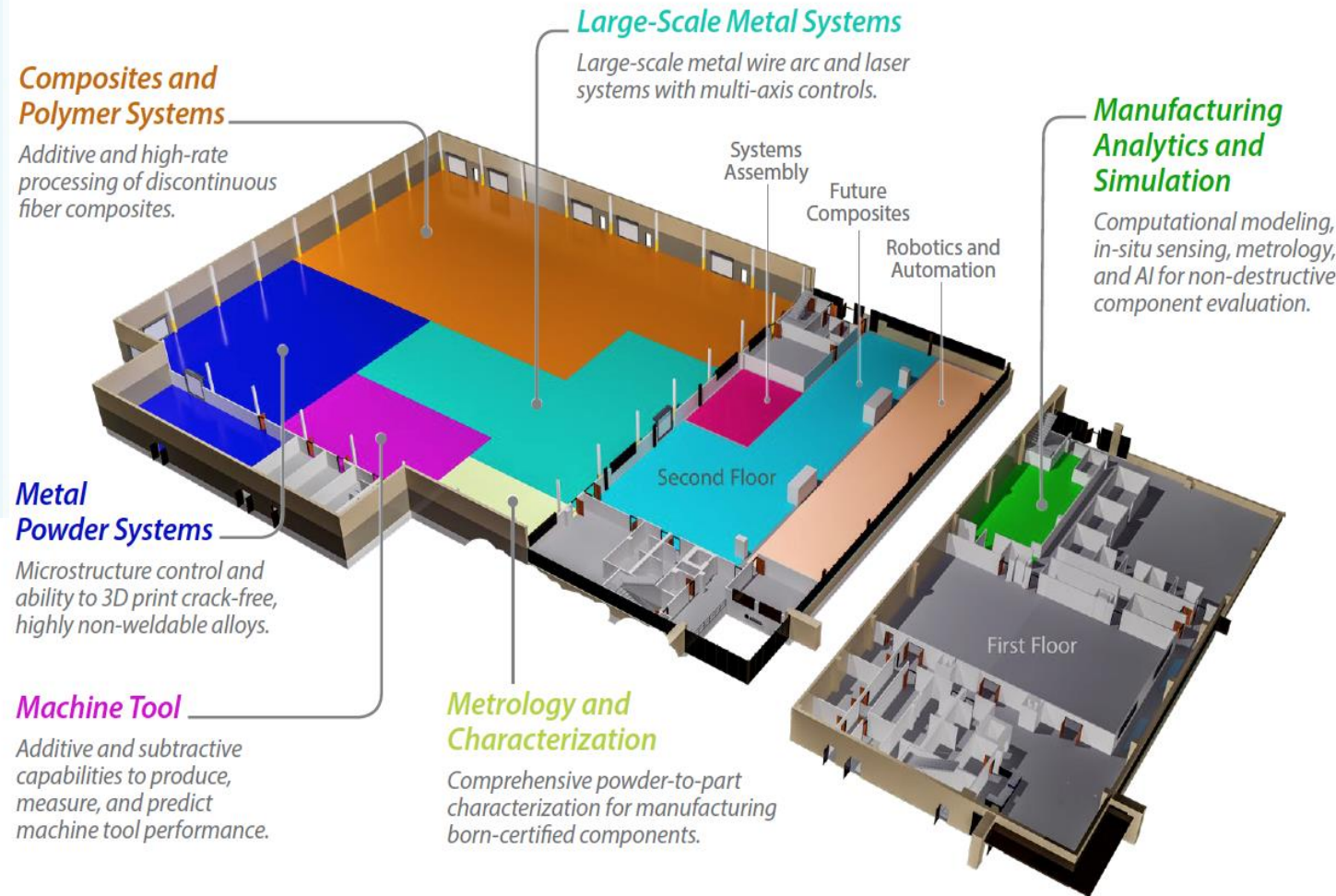
Manufacturing Demonstration Facility

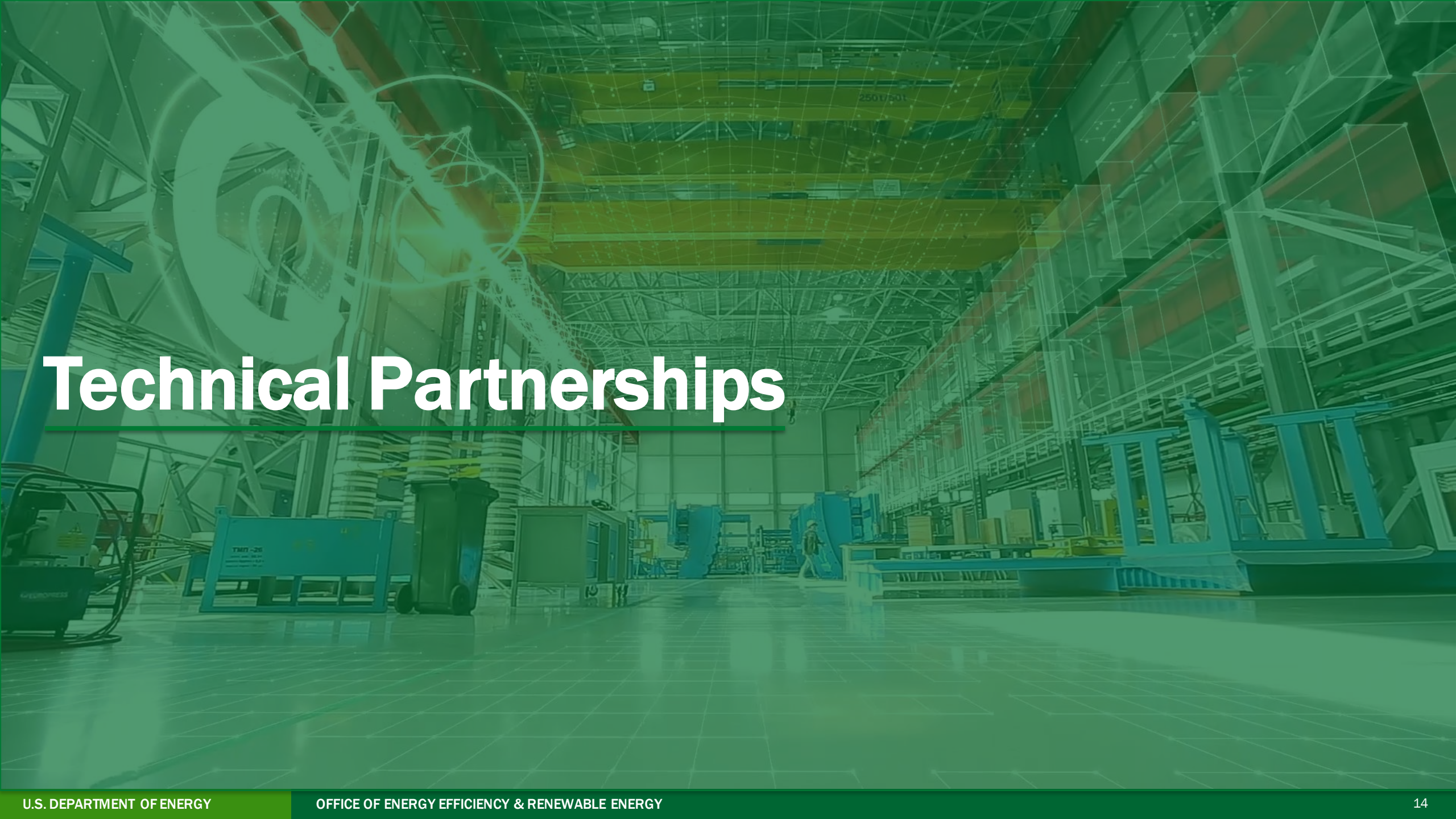
Open-door, manufacturing-focused user facility at Oak Ridge National Laboratory

- Facilitates adoption of advanced manufacturing technologies that improve energy and material efficiency, productivity, and competitiveness
- Provides industry with affordable and convenient access to infrastructure, tools, and expertise

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Additive and subtractive manufacturing
Advanced materials
Composites recycling and recovery
Controls and analysis
Automation
Modeling and characterization
Systems development





Technical Partnerships

Spotlight: AMO's Technical Assistance Efforts



Public /private partnerships to help manufacturers and industrial organizations set and achieve long-term energy intensity reduction goals



Education and training for the current and future manufacturing workforce



No-cost tools and resources for manufacturers to improve energy efficiency and competitiveness



End-user support, stakeholder engagement, and technical services for the industrial sector

**PROGRAMS
INCLUDE:**

**BETTER
PLANTS**

**INDUSTRIAL
ASSESSMENT
CENTERS**

**50001 READY
& SEP 50001**

**COMBINED HEAT & POWER
TECHNICAL ASSISTANCE
PARTNERSHIPS**

Better Plants

Public-private partnerships to help manufacturers and industrial organizations set and achieve long-term energy intensity reduction goals through:

- Technical assistance and in-plant training
- Access to National Laboratory resources, software, and instrumentation
- Specific programs for small- and medium-sized manufacturers with USDA and NIST

Better Plants is targeting energy-intensive companies to help improve competitiveness.



235+
partners

3,200+
plants

67 energy & water
goals achieved

> \$8B cumulative energy
cost savings

> 1.7 quadrillion
Btu saved



Industrial Assessment Centers



NO-COST ENERGY ASSESSMENT FOR SMALL- AND MEDIUM-SIZED MANUFACTURERS

- 31 centers at universities across the country.
- Students gain unique, hands-on assessment training and knowledge of industrial systems.
- Assessments typically identify >\$130,000 in potential annual savings opportunities.

19,000+
assessments

144,000+
recommendations

~\$45,000 per assessment
per year in
energy savings, productivity
enhancements, water use,
and waste reduction

>50% graduates' first job
includes energy efficiency
as a primary responsibility

>40% of graduates
spend their
career in energy efficiency
compared to 28% of peers

AMO Education and Workforce Development Programs

COMMUNITY COLLEGES

UNDERGRAD

GRADUATE

WORKFORCE

INNOVATORS

Energy Storage Internship Program

Power Electronics Traineeships
Virginia Tech | University of Tennessee - Knoxville

Better Plants
Program

Lab-Embedded
Entrepreneurship
Program

AMO R&D Consortia Education and Workforce Development Efforts

Technical Partnerships Engagement

Enhanced Preparation for
Intelligent Cyber-manufacturing
Systems (EPICS) | Georgia Tech

MS and MENG in
Advanced Manufacturing for Energy
Systems | University of Connecticut

Robotics Internships

Industrial Assessment Centers

Build4Scale

Technology
Commercialization
Fund

Technologist in
Residence Program



TRANSFORM

Future of manufacturing and AMO's research priorities to be informed by TRANSFORM Workshop over next 3 days

Transformative

Resilient

Adaptive

Nimble

Sustainable

Smart

Flexible

Optimal

Robust

Model-based