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

Digital Fabrication and Applications in DOE

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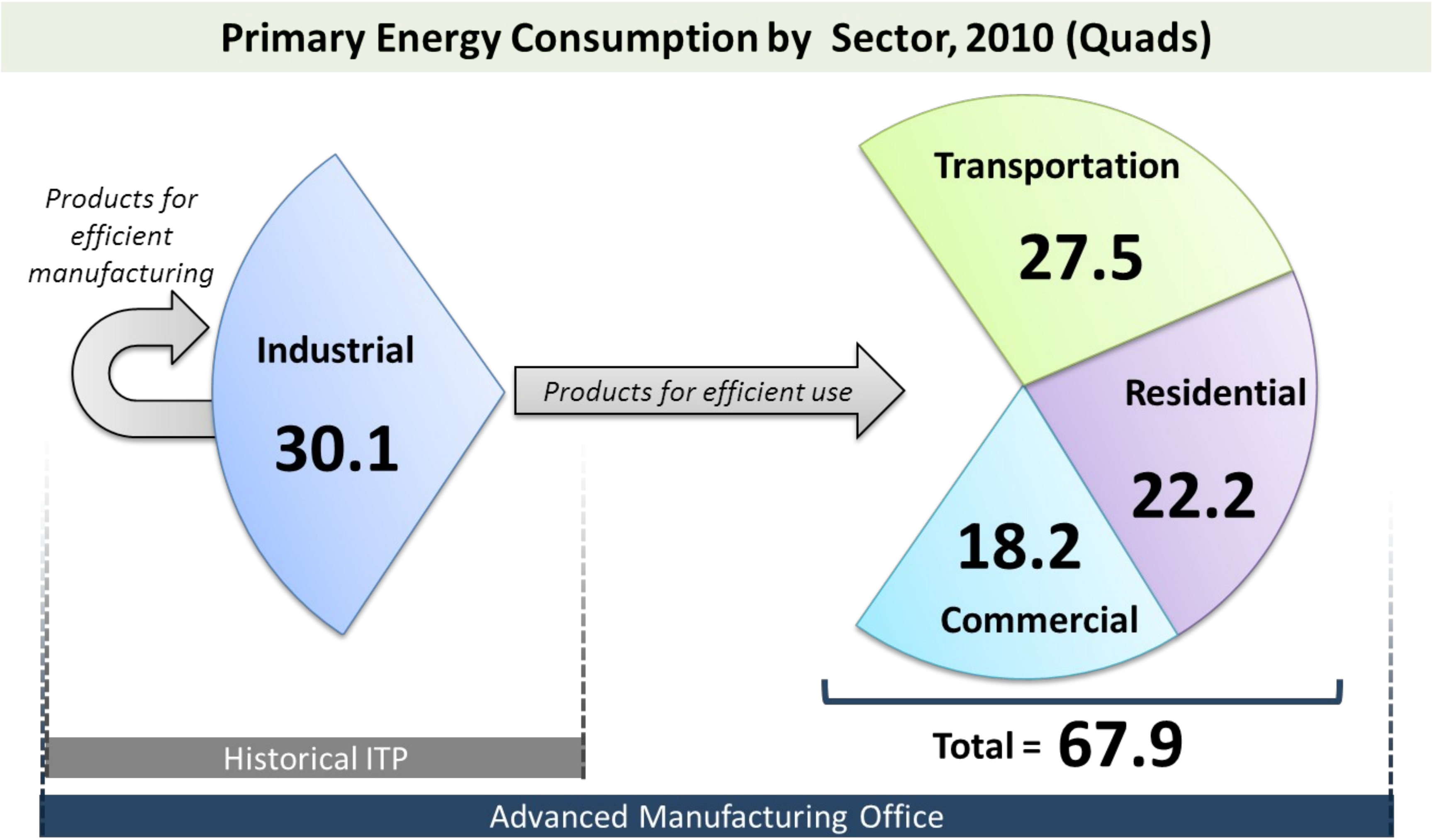
AMO aims for economy-wide lifecycle impacts



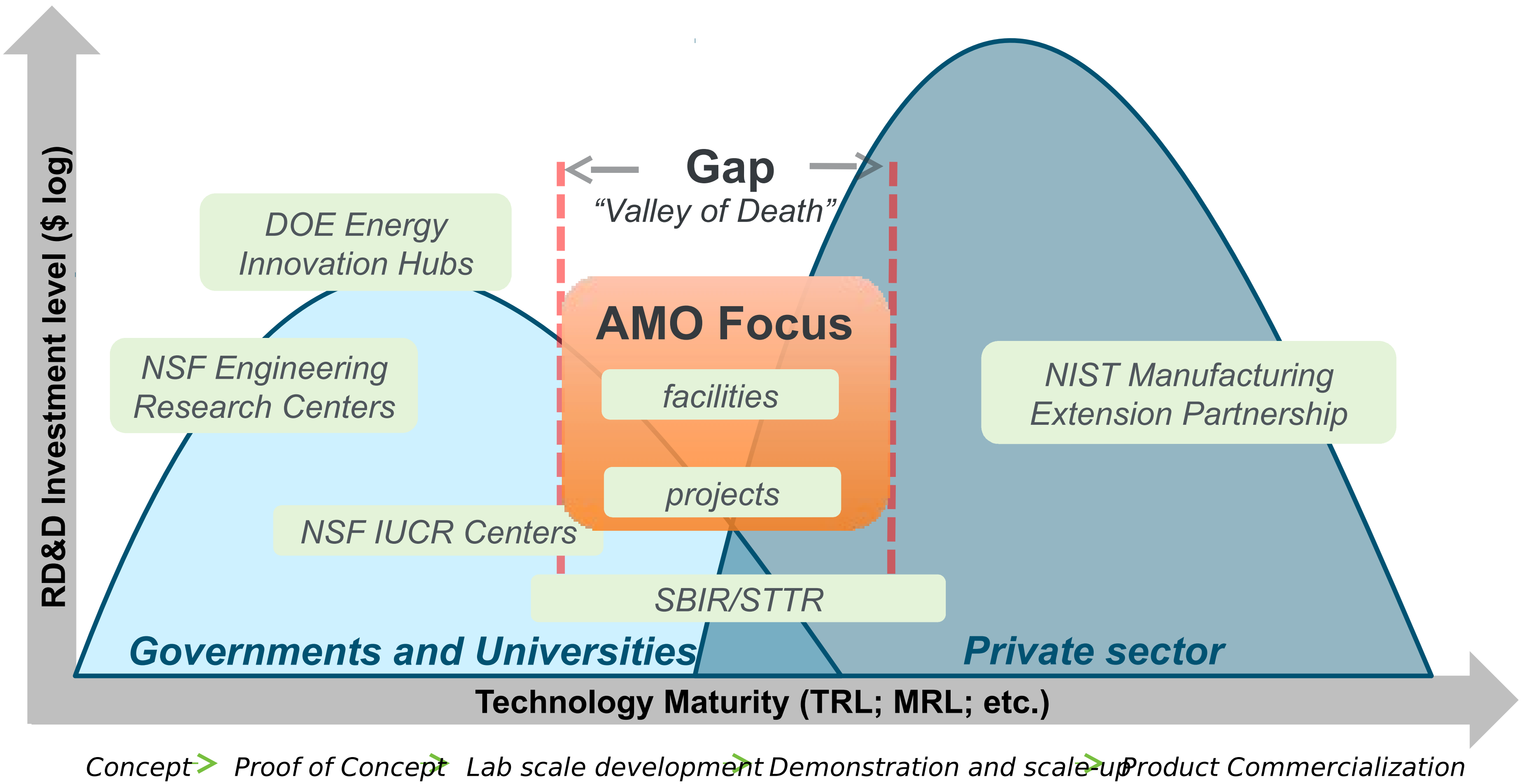
Source: US EIA Annual Energy Review 2010, Table 2.1a. http://205.254.135.24/totalenergy/data/annual/pdf/sec2_3.pdf

EERE & the Advanced Manufacturing Office

Advanced manufacturing challenges are common to multiple clean energy technology production systems.

AMO RD&D Focus: Bridging the Gap

AMO Investments leverage strong Federal support of basic research by partnering with the private sector to accelerate commercialization



Foundational Technologies

AMO invests in "**foundational technologies**"

A **foundational technology** has a high economic and energetic impact relative to the technology development cost. Foundational technologies are broadly applicable and pervasive across many industries and markets.

Example foundational technology areas include ***but are not limited to***:

- Low Cost Carbon Fiber Composites
- Low Cost, Lightweight Metal Structures
- Manufacturing of Biobased Products
- In-Situ Metrology and Process Controls
- Multimaterial Joining
- Microwave (MW) and Radio Frequency (RF) for Advanced Manufacturing
- Sustainable Nanomaterials
- Membrane Technology
- Wide Bandgap Semiconductors
- Additive Manufacturing for Clean Energy

Additive Manufacturing

Additive manufacturing, commonly known as "3D Printing," is a suite of emerging technologies to fabricate parts using a layer-by-layer technique, where material is placed precisely as directed from a 3D digital file.

Additive manufacturing can[1]:

- reduce energy intensity and waste
- enable remanufacturing
- support innovative designs
- create agile supply chains
- reduce time to market


Photo courtesy of Oak Ridge National Laboratory

1http://www1.eere.energy.gov/manufacturing/pdfs/additive_manufacturing.pdf

National Additive Manufacturing Innovation Institute

The **National Additive Manufacturing Innovation Institute (NAMII)** is a public private partnership created through an interagency collaboration between the Departments of Defense, Energy, Commerce, NASA and NSF to **accelerate the adoption of additive manufacturing technologies** in the U.S. manufacturing sector and **to increase domestic manufacturing competitiveness.**

- The goal of the institute is to bridge the gap between basic research and technology adoption.
- The National Center for Defense Manufacturing and Machining (NCDMM) was selected for the $30M in award government funding, matched with nearly $40M cost share.
- As of today: over 70 members, 10 Additive machines entrusted to NAMII, first project call closed end of Jan.

Oak Ridge National Laboratory Manufacturing Demonstration Facility

Supercomputing Capabilities

Spallation Neutron Source

Additive Manufacturing

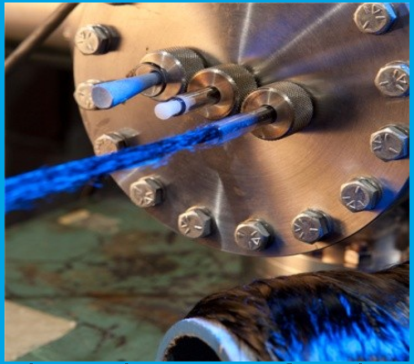
Arcam electron beam processing AM equipment

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.

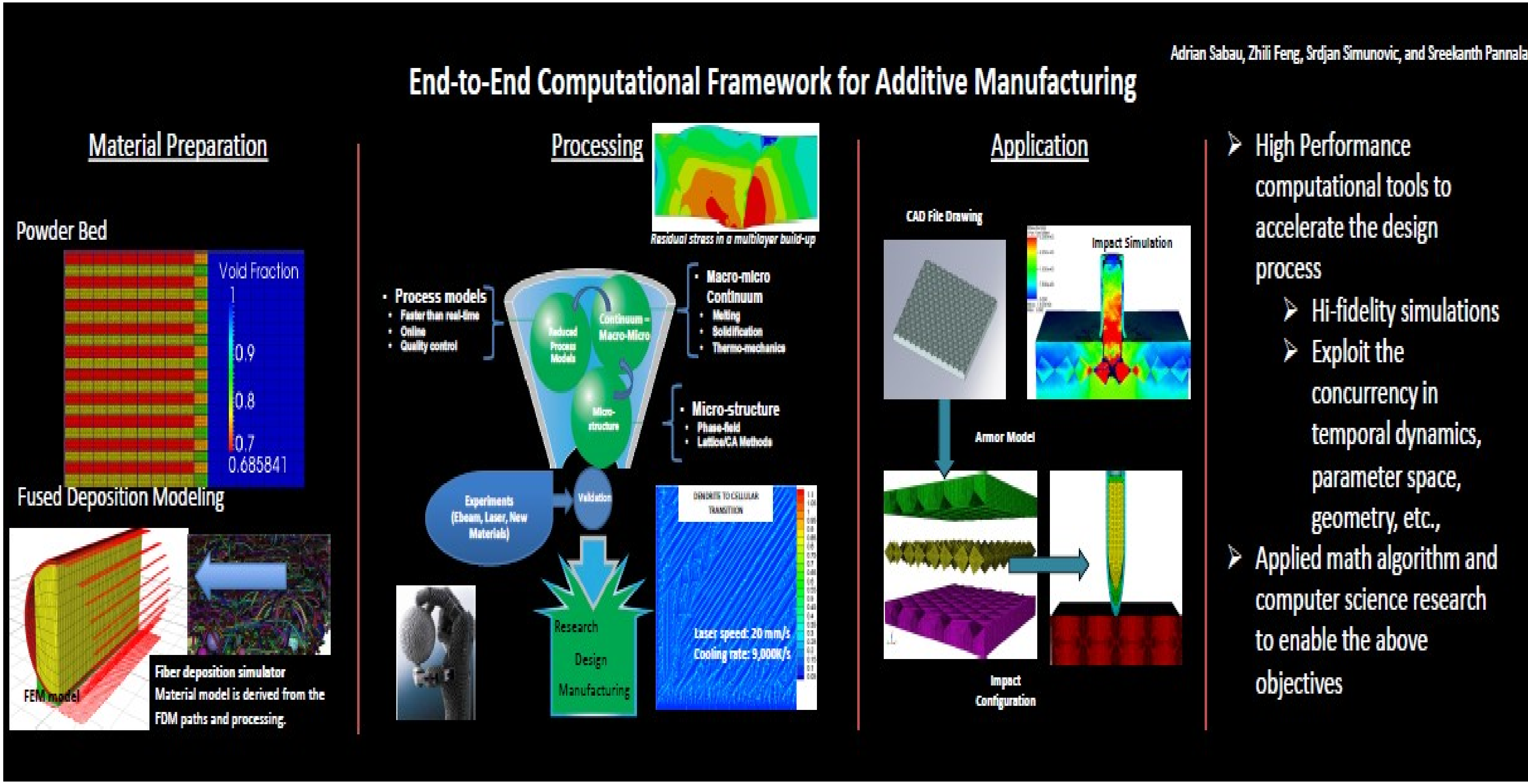
Carbon Fiber

Exit end of Microwave Assisted Plasma (MAP) process, jointly developed by ORNL and Dow



Program goal is to reduce the cost of carbon fiber composites by improved manufacturing techniques such as MAP, which if scaled successfully could reduce carbonization cost by about half compared to conventional methodology.

Beyond…



Courtesy of ORNL

U.S. DEPARTMENT OF ENERGY

Nuclear Energy

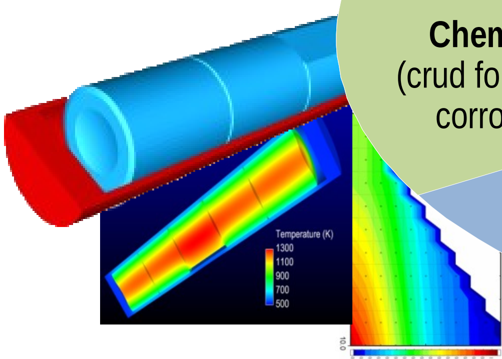
Nuclear Energy ModSim Hub –
Building a Virtual Version of an Operating Reactor to Address Important Challenges

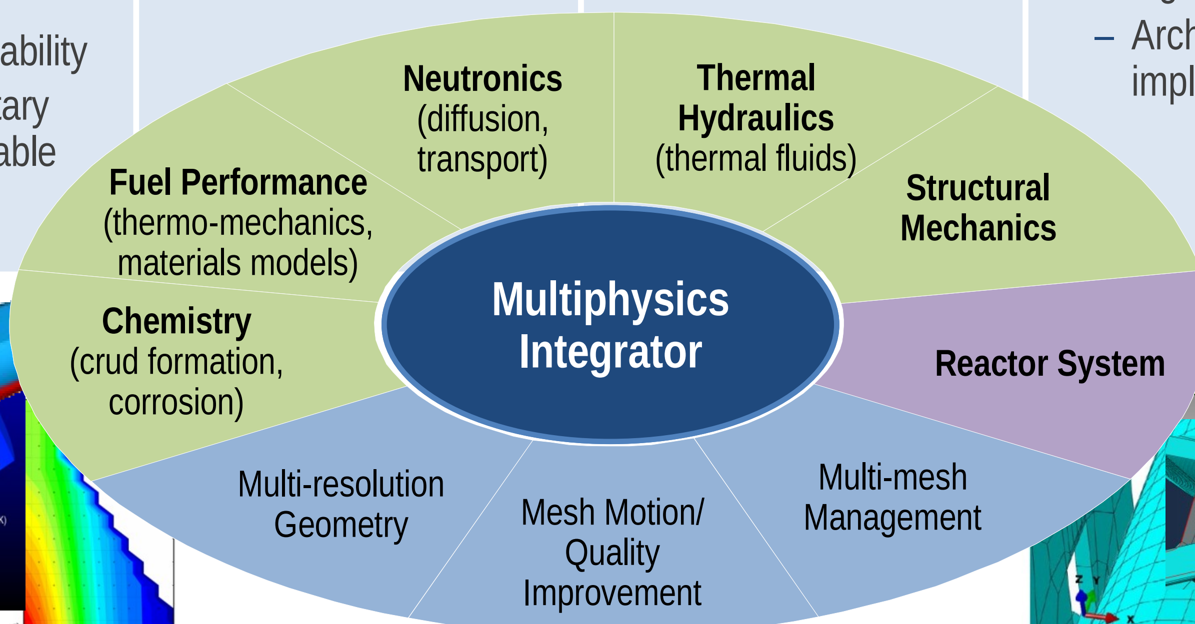
- Flexible coupling of physics components
- Toolkit of components
  - Not a single executable
  - Both legacy and new capability
  - Both proprietary and distributable

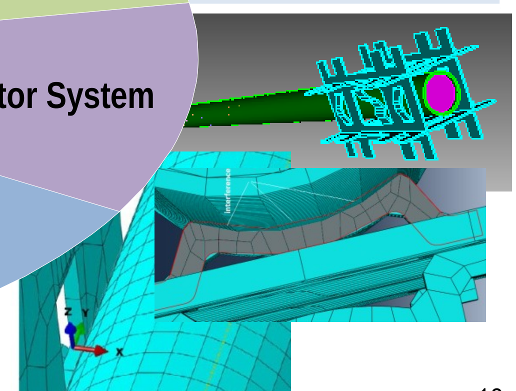
- Attention to usability
- Rigorous software processes
- Fundamental focus on V&V and UQ

- Development guided by relevant challenge problems
- Broad applicability

- Scalable from high-end workstation to existing and future HPC platforms
  - Diversity of models, approximations, algorithms
  - Architecture-aware implementations







And Beyond?

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