

U.S. DEPARTMENT OF
ENERGY

Office of
ENERGY EFFICIENCY &
RENEWABLE ENERGY

Domestic Manufacturing of Infrastructure Scale Near Net Shape (NNS) Components

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November 03-04, 2022 | Technical & Business Challenges for Infrastructure NNS Components Workshop, MDF



Manufacturing Powers the U.S. Economy

AMMTO invests in manufacturing innovations to strengthen U.S. industrial competitiveness and accelerate the transition to a clean economy

MANUFACTURING

Uses roughly 33% of the nation's primary energy



Accounts for one-third of the U.S.'s greenhouse gas emissions



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



Generates 12% of the U.S. GDP and 12.5 million jobs

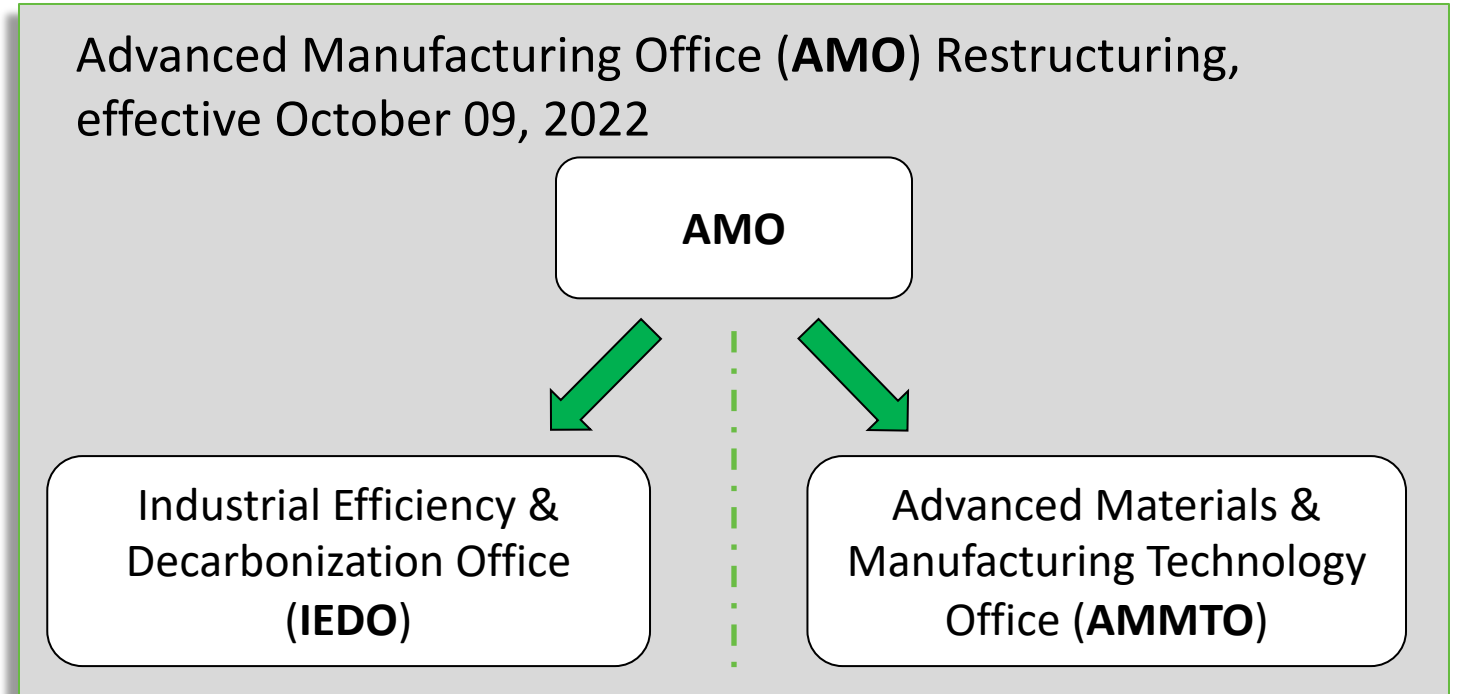


Incurs \$150 billion in energy costs annually



Overview

- ❑ Introduction to AMMTO
- ❑ DOE's Interested in NNS Manufacturing
- ❑ Purpose of workshop
- ❑ Role of Participants



About the AMO Restructure: <https://www.energy.gov/eere/amo/about-amo-restructure>

Advanced Materials and Manufacturing Technologies Office

VISION FOR THE FUTURE

A competitive U.S. manufacturing sector that accelerates the adoption of innovative materials and manufacturing technologies in support of a clean, decarbonized economy.

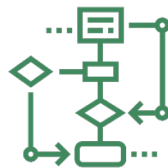
MISSION

Advance energy-related materials and manufacturing technologies to increase domestic competitiveness and build a clean and prosperous economy.

MAJOR PROGRAM ACTIVITIES



**SECURE AND SUSTAINABLE
MATERIALS**



**NEXT GENERATION MATERIALS &
PROCESSES**



**ENERGY TECHNOLOGY MANUFACTURING
AND WORKFORCE**

Advanced Materials and Manufacturing Technologies Office:

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

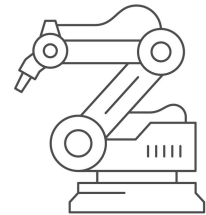
Near Net Shape (NNS) Manufacturing

Fabrication of a semifinished components with geometry *similar* to the end product

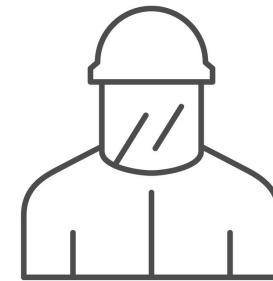
- Less material, lower embodied energy
- Fewer processing steps
- Increased geometric complexity
- Fewer parts, less joining
- Increased throughput
- Unique mechanical performance
- Reduced cost



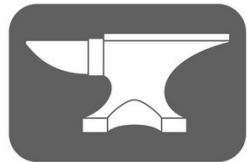
Casting



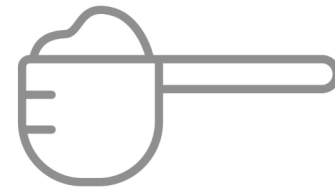
Additive
Manufacturing



Other, Hybrid

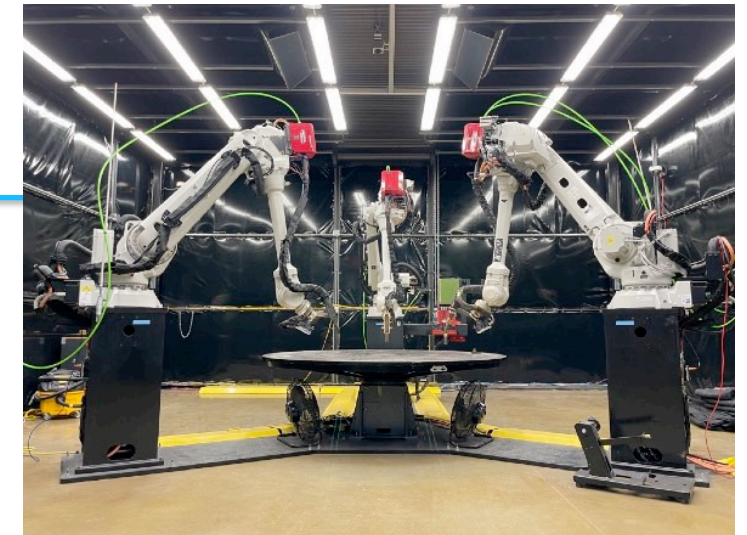
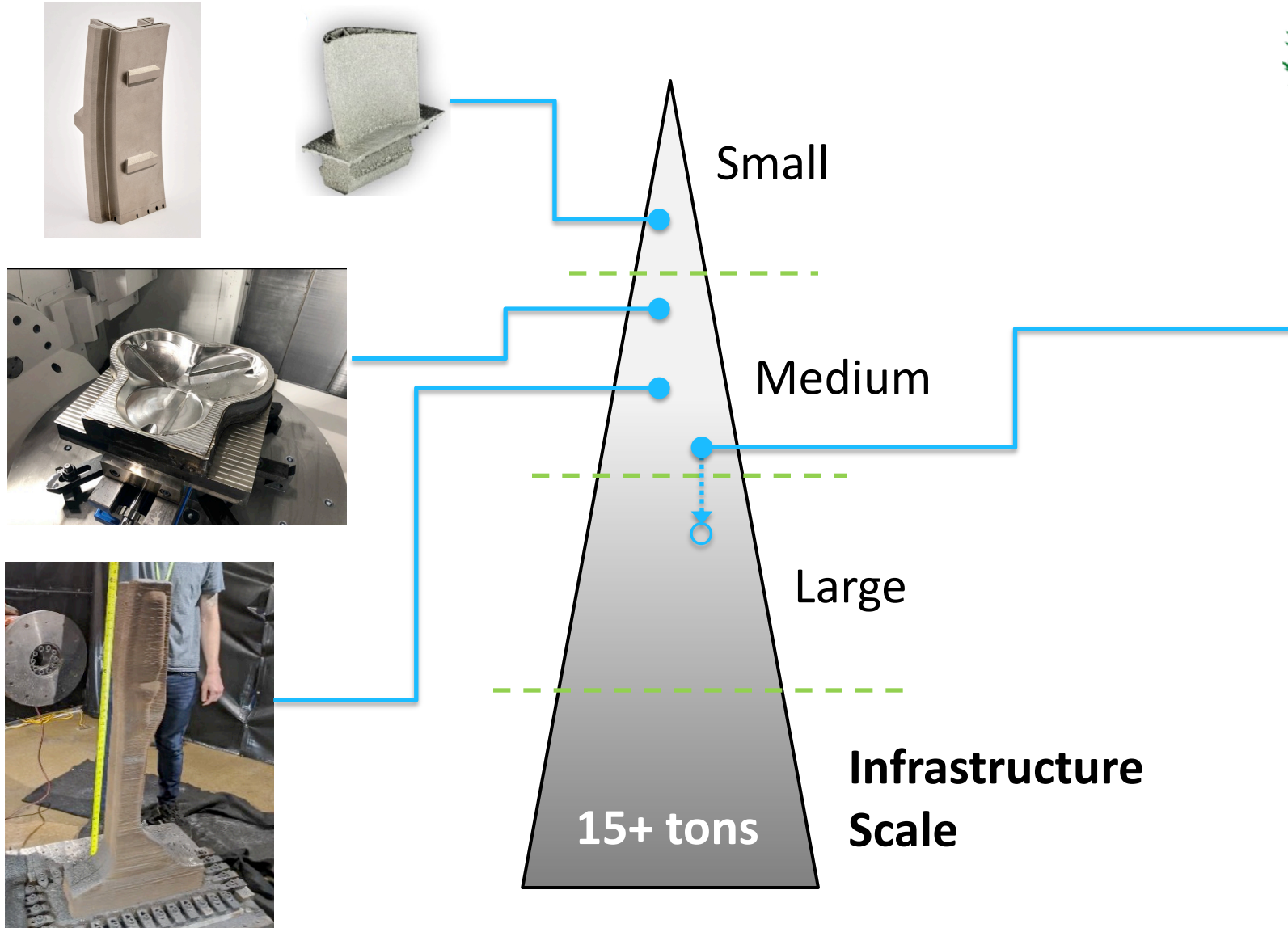


Forging



Powder
Metallurgy

AMMTO Investment in NNS Manufacturing



Multi-agent coordinated deposition

Weight: ~5,000 lbs

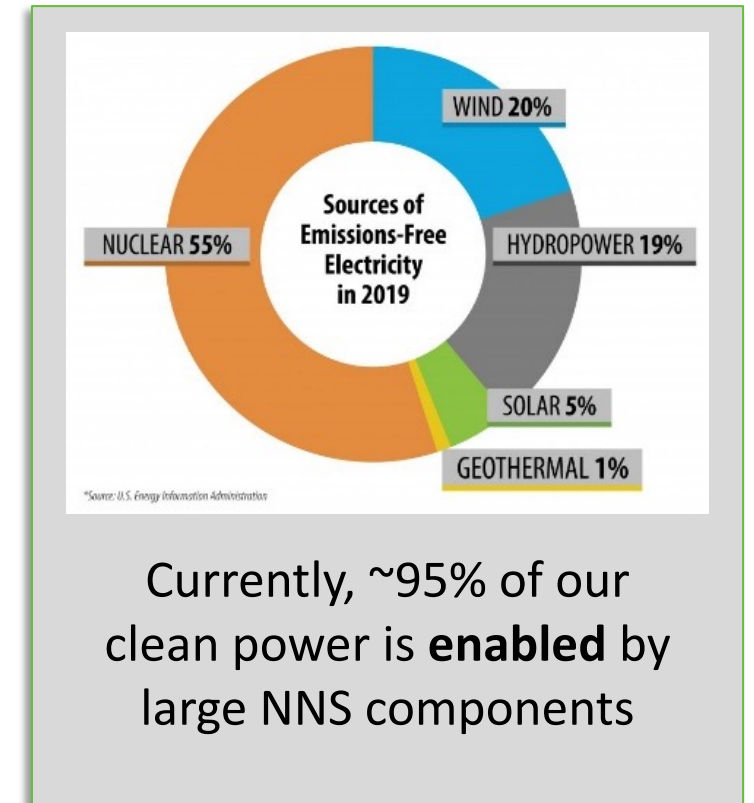
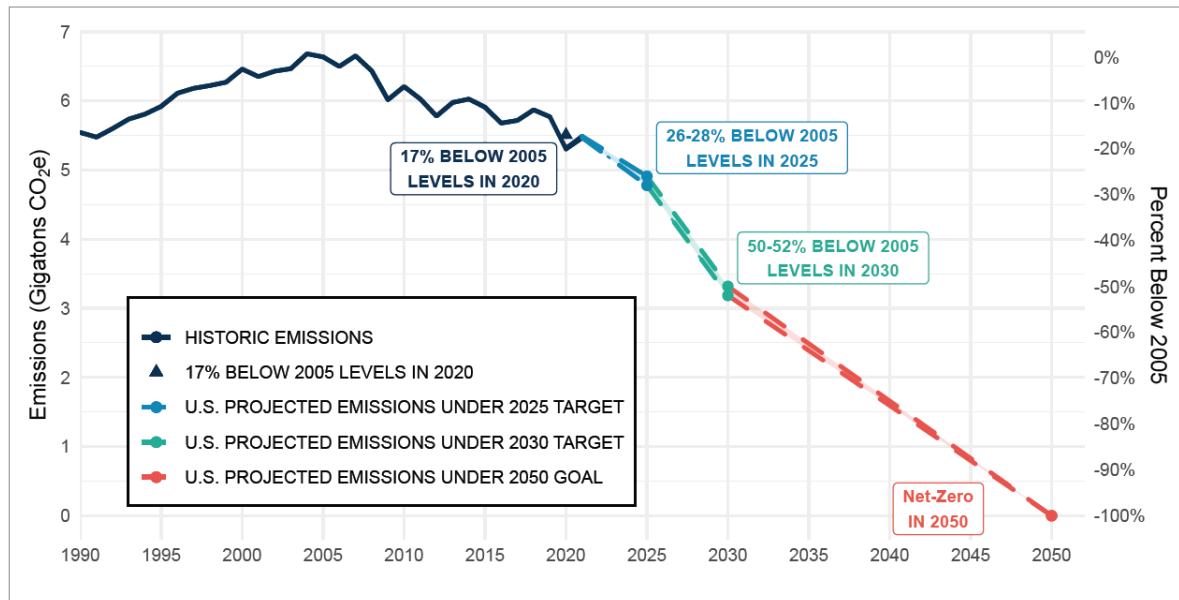
Deposition: ~ 100 lbs/hr

Build Volume: ~ 7.5ft D x 6ft H

Clean Power Generation

United States has set a goal of **100% clean electricity by 2035**

- Crucial foundation for net-zero emissions by 2050.



Estimated annual carbon-free capacity needed, 2021 through 2050: 60 – 70 GW/yr

The Long-Term Strategy of the United States: Pathways to Net-Zero Greenhouse Gas Emissions by 2050, November 2021

<https://www.whitehouse.gov/wp-content/uploads/2021/10/US-Long-Term-Strategy.pdf>

Securing America's Clean Energy Supply Chain



Executive Order
on America's
Supply Chains

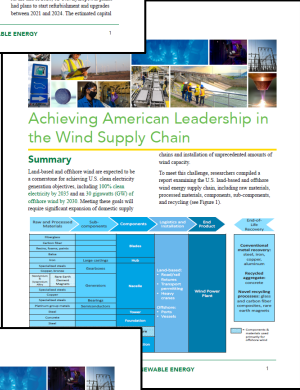
FEBRUARY 24, 2021



Achieving American Leadership in the Hydropower Supply Chain

Summary
In 2019, hydropower accounted for 10.7% of U.S. renewable electricity generation and 7.2% of total electricity generation. While the existing U.S. supply chain effectively supports the nation's hydropower fleet—the fourth largest in the world, it is challenged by the need to replace aging equipment, maintain the fleet and facilities, upgrade, and meet development and research needs to sustain and expand the fleet and facilities. This report examines the U.S. electricity supply chain.

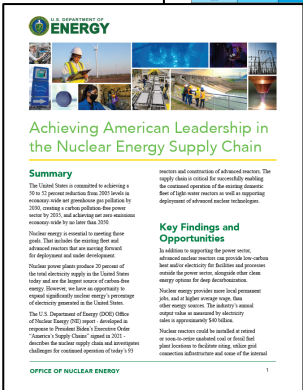
Key Findings and Opportunities
The report identifies several key U.S. hydropower supply chain challenges and opportunities to help develop the grid and create jobs and economic opportunity for U.S. workers. A combination of manufacturing and operations-related challenges in the U.S. supply chain are likely to impede the U.S. hydropower supply chain's ability to meet demand for new hydropower capacity. At the end of 2020, 42 U.S. hydropower plants had plans to invest in new equipment and components between 2021 and 2024. The estimated capital



Achieving American Leadership in the Wind Supply Chain

Summary
Land-based and offshore wind are expected to be a significant portion of the nation's electricity generation portfolio through 2050, with offshore wind projected to be a significant portion of the nation's electricity generation portfolio through 2050. Meeting these goals will require significant expansion of domestic supply chain and installation of equipment because of wind energy.

Key Findings and Opportunities
To meet this challenge, stakeholders compiled a report examining the U.S. land-based and offshore wind supply chain, including raw materials, processed materials, components, sub-components, and recycling (see Figure 1).



Achieving American Leadership in the Nuclear Energy Supply Chain

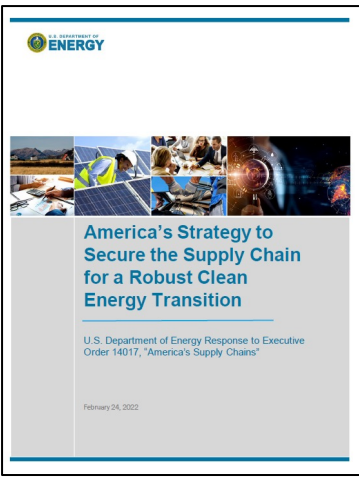
Summary
The United States is committed to advancing a 10- to 20-gigawatt nuclear fleet through 2050 to meet its energy needs and provide grid stability by 2035, and advancing new advanced nuclear reactors by 2035, and advancing new advanced nuclear reactors by 2035.

Key Findings and Opportunities
Nuclear energy is essential to meeting these goals. This includes the existing fleet and advanced reactors that are being licensed for deployment and under development.

Large steel castings/forgings and generator windings for large units are very difficult or impossible to source domestically and have very long lead times

The United States is not competitive for producing offshore wind components such as large forgings and castings

Projected significant domestic/global demand for large forged components to support the nuclear industry, with limited domestic suppliers.



America's Strategy to Secure the Supply Chain for a Robust Clean Energy Transition

U.S. Department of Energy Response to Executive Order 14017, "America's Supply Chains"

February 24, 2022

EO 14017

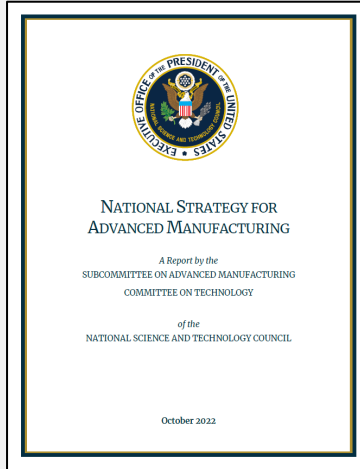
Tech Specific Deep-Dives

DOE comprehensive strategy

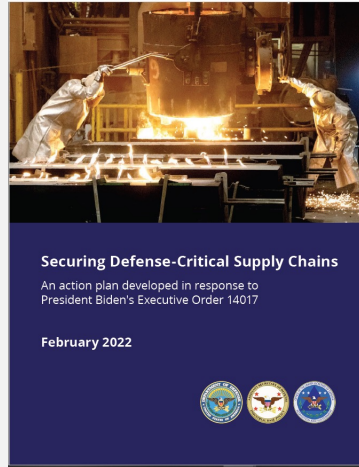
Securing America's Clean Energy Supply Chain



Large steel castings/forains and generator



National Strategy for Advanced Manufacturing October 2022



Securing Defense-Critical Supply Chains February 2022

Executive Order (EO) 14017 on America's Supply Chains, February 24, 2021: https://www.whitehouse.gov/briefing-room/presidential-actions/2021/02/24/executive-order-on-americas-supply-chains/?utm_source=link

Securing America's Clean Energy Supply Chain, February 2022: <https://www.energy.gov/policy/securing-americas-clean-energy-supply-chain>

Securing Defense-Critical Supply Chains, An action plan developed in response to President Biden's Executive Order 14017, February 2022: <https://media.defense.gov/2022/Feb/24/2002944158/-1/-1/1/DOD-EO-14017-REPORT-SECURING-DEFENSE-CRITICAL-SUPPLY-CHAINS.PDF>

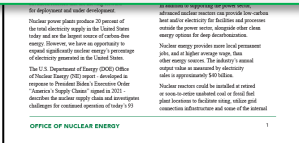
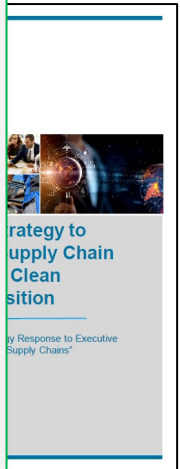
National Strategy for Advanced Manufacturing; October 2022: <https://www.whitehouse.gov/wp-content/uploads/2022/10/National-Strategy-for-Advanced-Manufacturing-10072022.pdf>

industry, with limited domestic suppliers.

EO 14017

Tech Specific Deep-Dives

DOE comprehensive strategy



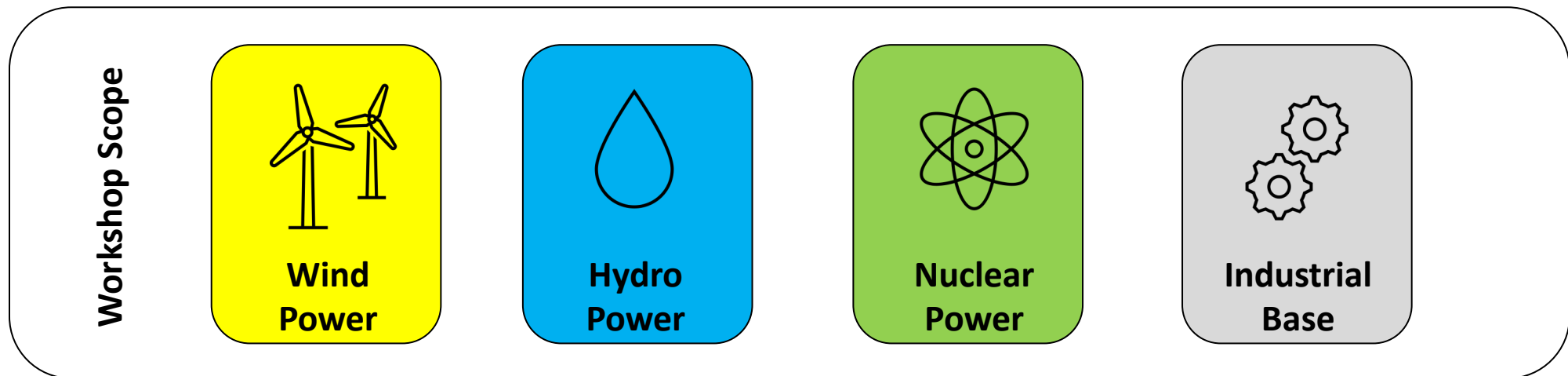
Workshop Objective(s)

(1) Gather information in support of a briefing to Congress on:

*.....the potential for developing and commercializing novel manufacturing processes and methods capable of producing **large** metallic near net shape components.*

.....summary of research, development, demonstration, and commercialization needs

(2) Gather information to support AMMTO strategic planning & identify impact opportunities



Role of Participants

Actively Engage:

- Contribute to discussions
- Identify challenges
- Proposes solution
- Network / make contacts
- Remain in communication
- Bring up additional topics

Think about addressing national needs

Topics:

- ✓ Technical
- ✓ Business / Economic
- ✓ Supply Chain
- ✓ Strategic
- ✓ Workforce
- ✗ Not Policy

*Your input will inform decision makers
and impact outyear planning*



Thank you

For additional information
and to subscribe for updates:

[manufacturing.energy.gov](https://www.manufacturing.energy.gov)

