Meeting Recording Announcement

This Zoom call is being recorded to be used internally and will not be released to the public. If you do not wish to have your voice recorded, please do not speak during the call or disconnect now. If you do not wish to have your image recorded, please turn off your camera or participate only by phone. If you speak during the call or use a video connection, you are presumed to consent to recording and to the use of your voice or image.

U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

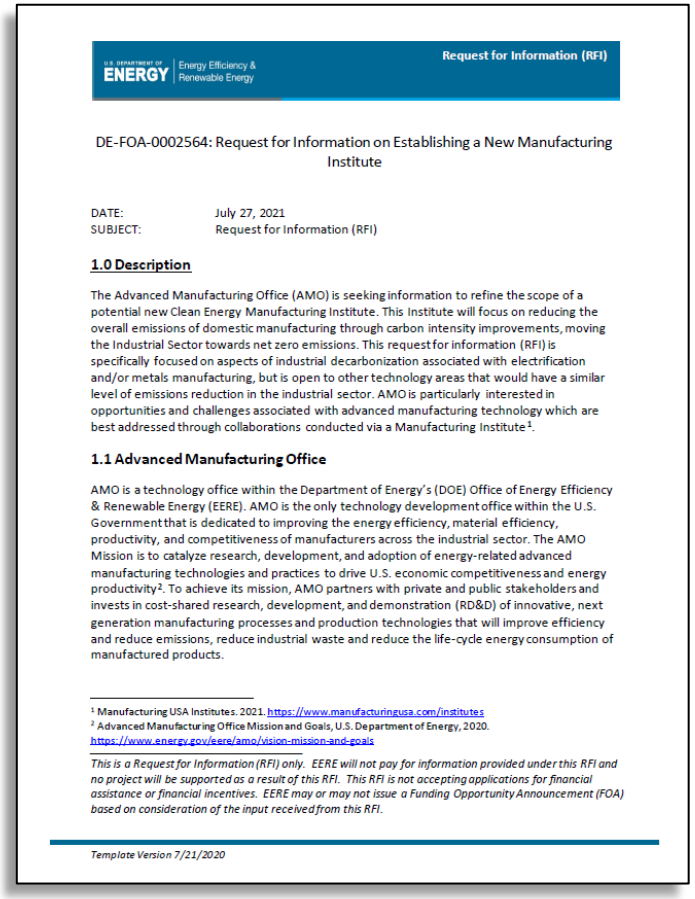
Request for Information on Establishing a New Clean Energy Manufacturing Institute

RFI DE-FOA-0002564 Webinar

U.S. Department of Energy
Advanced Manufacturing Office (AMO)

August 17, 2021 | Virtual/Remote

Introduction and Objectives



U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy — Request for Information (RFI)

DE-FOA-0002564: Request for Information on Establishing a New Manufacturing Institute

DATE: July 27, 2021
SUBJECT: Request for Information (RFI)

1.0 Description

The Advanced Manufacturing Office (AMO) is seeking information to refine the scope of a potential new Clean Energy Manufacturing Institute. This Institute will focus on reducing the overall emissions of domestic manufacturing through carbon intensity improvements, moving the Industrial Sector towards net zero emissions. This request for information (RFI) is specifically focused on aspects of industrial decarbonization associated with electrification and/or metals manufacturing, but is open to other technology areas that would have a similar level of emissions reduction in the industrial sector. AMO is particularly interested in opportunities and challenges associated with advanced manufacturing technology which are best addressed through collaborations conducted via a Manufacturing Institute[1].

1.1 Advanced Manufacturing Office

AMO is a technology office within the Department of Energy's (DOE) Office of Energy Efficiency & Renewable Energy (EERE). AMO is the only technology development office within the U.S. Government that is dedicated to improving the energy efficiency, material efficiency, productivity, and competitiveness of manufacturers across the industrial sector. The AMO Mission is to catalyze research, development, and adoption of energy-related advanced manufacturing technologies and practices to drive U.S. economic competitiveness and energy productivity[2]. To achieve its mission, AMO partners with private and public stakeholders and invests in cost-shared research, development, and demonstration (RD&D) of innovative, next generation manufacturing processes and production technologies that will improve efficiency and reduce emissions, reduce industrial waste and reduce the life-cycle energy consumption of manufactured products.

[1] Manufacturing USA Institutes. 2021. https://www.manufacturingusa.com/institutes
[2] Advanced Manufacturing Office Mission and Goals, U.S. Department of Energy, 2020. https://www.energy.gov/eere/amo/vision-mission-and-goals

This is a Request for Information (RFI) only. EERE will not pay for information provided under this RFI and no project will be supported as a result of this RFI. This RFI is not accepting applications for financial assistance or financial incentives. EERE may or may not issue a Funding Opportunity Announcement (FOA) based on consideration of the input received from this RFI.

Template Version 7/21/2020

RFI Objectives:

- Narrow the focus of new Manufacturing Institute that supports Industrial Decarbonization
- Structure the Institute to maximize impact

Webinar Objectives:

- Maximize stakeholder engagement
- Introduce the RFI topics
- Provide context for the RFI questions

DE-FOA-0002564: https://eere-exchange.energy.gov/

Agenda

- ✓ **Introduction and Objectives**
- ❑ **Request for Information (RFI) Overview**
- ❑ **Organization**
  - Advanced Manufacturing Office (DOE / EERE / AMO)
  - R&D Consortia (DOE / EERE / AMO / R&D Consortia)
  - Manufacturing USA Institutes
- ❑ **Industrial Decarbonization**
- ❑ **RFI Structure and Topics**
  - Emissions Reduction Through Electrification
  - Clean and Competitive Advanced Metals Manufacturing
- ❑ **Timeline and Next Steps**

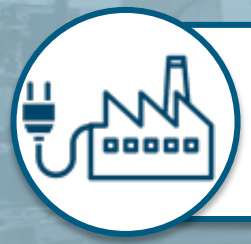
RFI Topic Overview

The Advanced Manufacturing Office (AMO) is seeking information to refine the scope of a potential new Clean Energy Manufacturing Institute (CEMI).

Industrial decarbonization is critical to our efforts to achieve a carbon-neutral economy by 2050. By creating an ecosystem of collaboration through the Manufacturing USA Institutes, DOE is accelerating the development of next-generation technology, supporting good-paying American jobs, and moving us closer to a cleaner, more efficient future.

- Acting Assistant Secretary for Energy Efficiency and Renewable Energy Kelly Speakes-Backman

American innovation is needed to decarbonize the diverse industrial sector. This Institute will focus on reducing the overall emissions of domestic manufacturing through carbon intensity improvements, moving the Industrial Sector towards net zero emissions. The RFI requests input on two topic areas of interest:



Industrial Electrification

Clean and Competitive Advanced Metal Manufacturing

other technology areas that would have a similar level of emissions reduction in the industrial sector

AMO is particularly interested in opportunities and challenges associated with advanced manufacturing technology which are best addressed through collaborations conducted via a Manufacturing Institute.

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

Guiding Principles for AMO

AMO works to **increase energy and material efficiency in manufacturing,** driving energy productivity, economic growth, and decarbonization.

MANUFACTURING

- Uses roughly 25% of the nation's primary energy
- Accounts for one quarter of the U.S.'s greenhouse gas emissions
- 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

KEY 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 the **U.S. manufacturing workforce**
- Accelerate emerging and transformative technologies needed to **approach net-zero greenhouse gas emissions** in the industrial sector by 2050

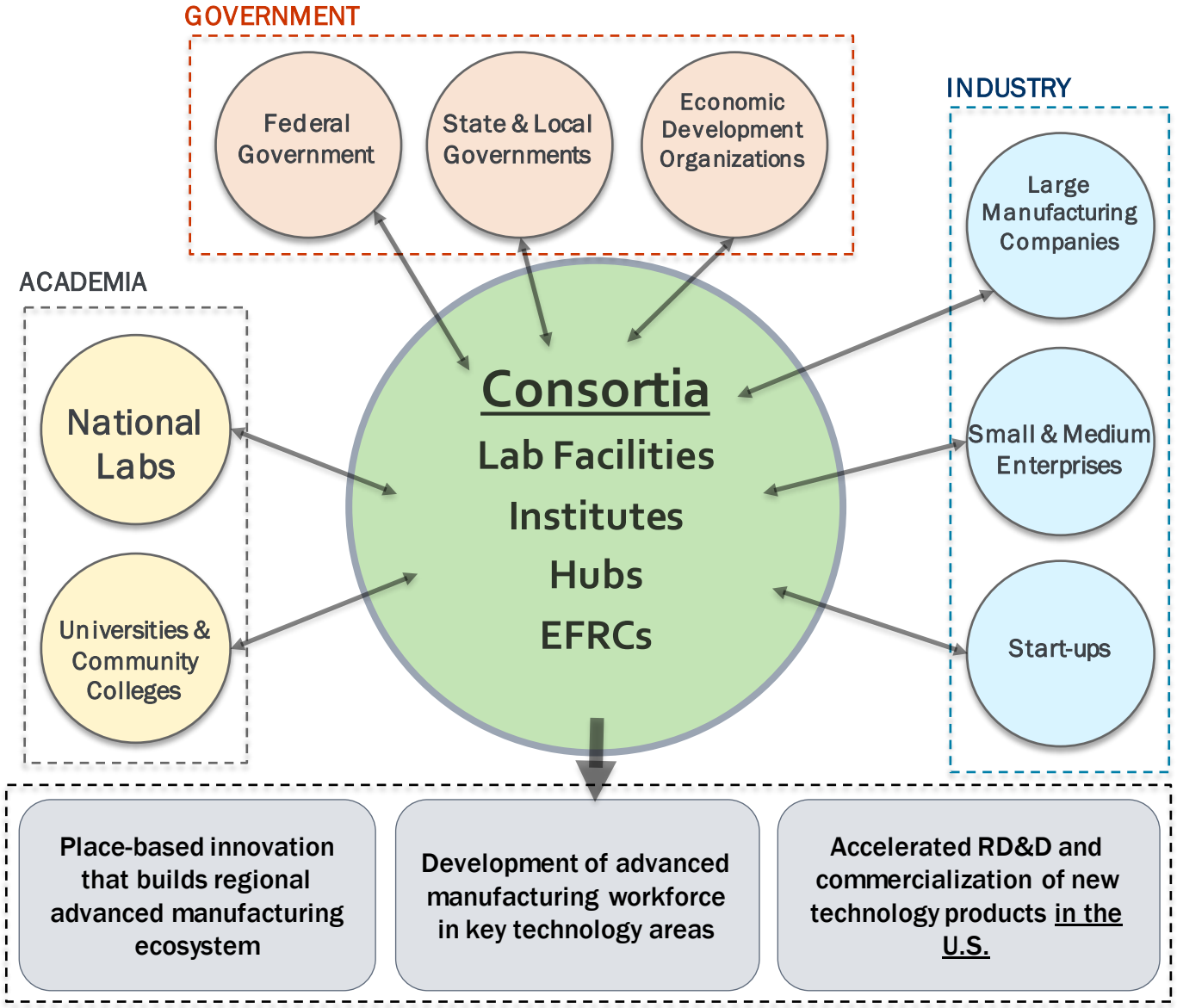
R&D Consortia

$133M | FY21

Public-private institutes and hubs designed to tackle specific technical challenges

- Secure U.S. manufacturing leadership by executing major collaborative projects around industry's toughest challenges
- Train the U.S. manufacturing workforce in key skills for today's advanced manufacturing jobs

Consortia Model



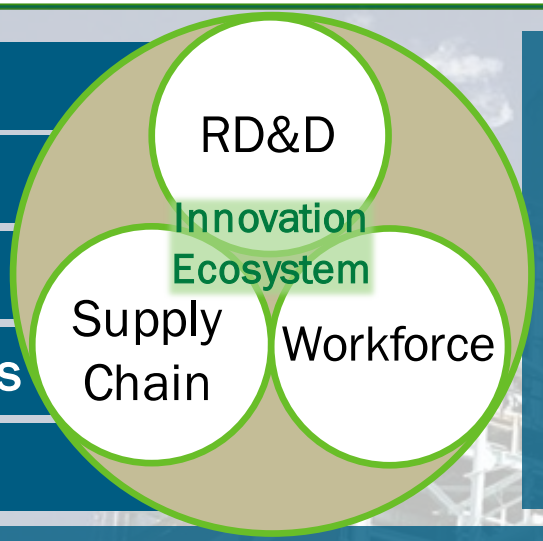
Consortia are tailored to address the RD&D needs in their technology space.

Each Consortia has:

- Clear technology focus
- TRL level suited to specific technology challenge
- Ability to address critical challenges
- A balanced portfolio of projects

AMO's Manufacturing USA Institutes

- Industry
- Academia
- States
- DOE National Labs
- Non-Profits



6 AMO Institutes participate in Manufacturing USA
- Defense (9)
- Commerce (1)

Manufacturing USA

$14M/year in federal funds for **5 years** and required **1:1** cost share

Establish a network that attracts future industry and other investments

- **Key Institute Goals**
- Improve energy and material efficiency and reduce emissions, industrial waste, and the life-cycle energy of manufactured products
- Increase the competitiveness of U.S. manufacturing
- Invest in clean and sustainable manufacturing processes and production technologies
- Facilitate the transition of innovative technologies into scalable, cost-effective, and high-performing domestic manufacturing capabilities
- Convene business competitors, academic institutions, and other stakeholders
- **Typically operate in TRL 4-7**
- Develop and accelerate an advanced manufacturing education and workforce

AMO's Manufacturing USA Institutes

Manufacturing Institutes provide shared research facilities and support the manufacturing workforce to accelerate technology development and facilitate the transfer of innovative advanced manufacturing technology to U.S industry.

PowerAmerica: wide-bandgap semiconductors
NC STATE – RALEIGH, NC

Institute for Advanced Composites Manufacturing Innovation: carbon fiber composites
COLLABORATIVE COMPOSITES SOLUTIONS – KNOXVILLE, TN

Clean Energy Smart Manufacturing Innovation Institute: smart manufacturing
UCLA – LOS ANGELES, CA

Rapid Advancement of Process Intensification Deployment: chemical process intensification
AIChE – NEW YORK, NY

Reducing EMbodied-energy And Decreasing Emissions Institute: recycling and remanufacturing
SUSTAINABLE MANUFACTURING INNOVATION ALLIANCE – ROCHESTER, NY

Cybersecurity Manufacturing Innovation Institute: energy efficient, cyber-secure manufacturing
UTSA – SAN ANTONIO, TX

AMO received FY21 appropriations to launch a seventh Institute.

Diversity, Equity, and Inclusion

It is the policy of the Biden Administration that the Federal Government should pursue a comprehensive approach to advancing equity for all, including people of color and others who have been historically underserved, marginalized, and adversely affected by persistent poverty and inequality. By advancing equity across the Federal Government, we can create opportunities for the improvement of communities that have been historically underserved, which benefits everyone.

As part of the administration's whole of government approach, AMO seeks to encourage the participation of underserved communities and underrepresented groups. **Manufacturing Institutes are highly encouraged to include individuals from groups underrepresented in Science, Technology, Engineering and Math (STEM). AMO is interested in how diversity, equity, and inclusion can be incorporated into RD&D investments to foster a productive and inclusive environment, support people from underrepresented groups in STEM, advance equity, and encourage the inclusion of individuals from these groups.**

Executive Order 13985, "Advancing Racial Equity and Support for Underserved Communities Through the Federal Government" (Jan. 20, 2021) https://www.federalregister.gov/documents/2021/01/25/2021-01753/advancing-racial-equity-and-support-for-underserved-communities-through-the-federal-government

Promoting Environmental Justice. U.S. Department of Energy. 2021. https://www.energy.gov/lm/services/environmental-justice/what-environmental-justice

Industrial Decarbonization

THE U.S. INDUSTRIAL SECTOR

manufacturing | agriculture | mining | construction

ACCOUNTS FOR

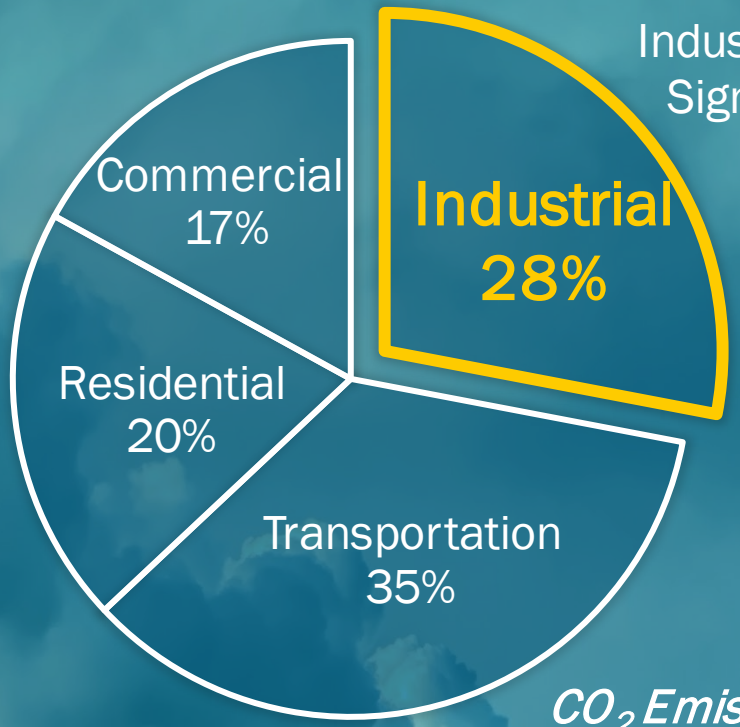
32% of the nation's primary energy use

28% of CO_2 emissions

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

15% CO_2 emissions increase

Industry Contributes Significantly to CO_2 Emissions



CO_2 Emissions By Sector

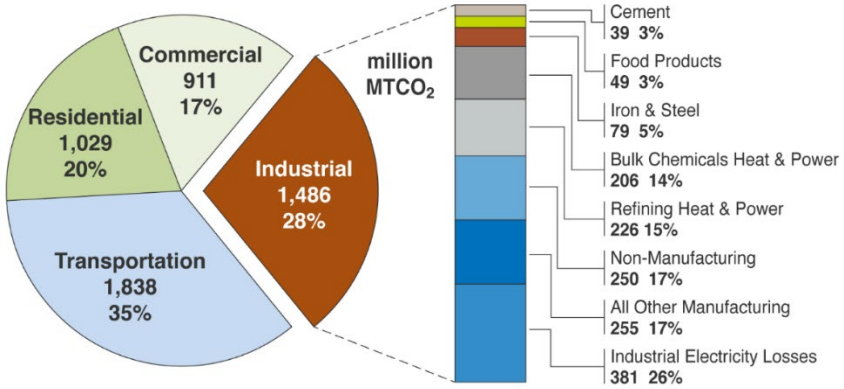
Technological advances in manufacturing will be critical to enabling decarbonization for other sectors.

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

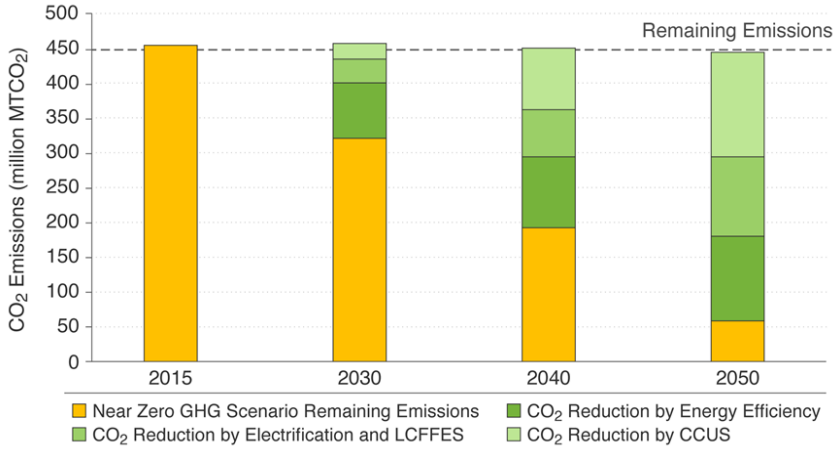
EIA, *Annual Energy Outlook 2020 with Projections to 2050.*

Industrial Decarbonization Institute Topics

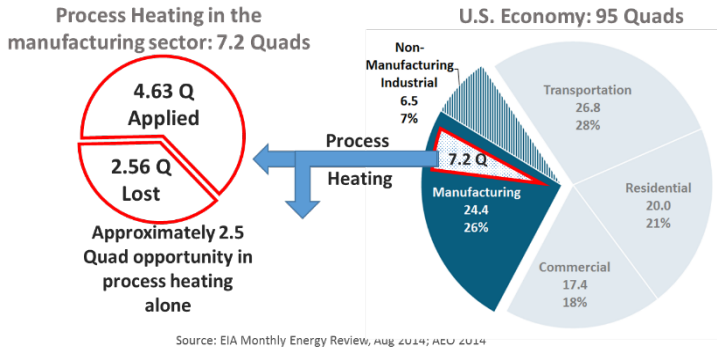
- The industrial sector is diverse and there are numerous approaches to decarbonize.



U.S. primary energy-related CO_2 emissions by economic sector (left pie chart) and a breakout by industrial subsector (right stacked chart) in 2015. Data source: EIA 2020



CO_2 emissions reduction potential across the decarbonization pillars for the U.S. iron and steel, chemical manufacturing (select chemicals) , food manufacturing (select food products), refining, and cement sectors for the near zero GHG scenario. Data source: AMO Industrial Decarbonization Roadmap, in draft.



Energy use and loss in the US Manufacturing Sector. Data source: EIA Monthly Energy Review

- AMO aims to prioritize industrial decarbonization strategies that are within the scope of its Mission and to establish an Institute in a manner that has the largest impact.
- The RFI includes questions for two Institute concepts:
  - Electrification of Industrial Processes
  - Decarbonizing Metal Manufacturing

RFI Goal

- The goal of this RFI is solicit information to aid in refining the scope of a Clean Energy Manufacturing Institute for Industrial Decarbonization.
- Two focus areas are of particular interest are:
  - Electrification of Industrial Processes, and
  - Decarbonization of Metal Manufacturing.
- AMO is interested in feedback on what approaches, sub-sectors, cross-cutting challenges, or other focus areas are best suited to be addressed through a Clean Energy Manufacturing Institute.

How to read and respond to RFI questions

- Questions are grouped into categories with description meant to provide context for the following question(s).

Example:

Category 3 Institute Benefit

The object of this category is to solicit information on the potential benefits of establishing an Institute, as a public-private partnership, to advance industry topics of importance to the DOE Mission. Responses should focus on the impact that an Institute could have beyond that of private industry alone.

C3.1 What are potential quantitative impacts of a Manufacturing Institute targeting a given topic area? Consider impacts on energy efficiency, life-cycle energy benefits, U.S. productivity, U.S. manufacturing base, economy, energy infrastructure, greenhouse (GHG) emissions, and/or related environmental impacts in manufacturing or use.

- What impact can an Institute have in 5 years, and beyond?

- Please explicitly identify the question(s) being responded to by using the applicable number (e.g., C1.1, C1.2, ….C13.1) at the start of the response

- Questions that fall under a question number are meant to guide the response to the above question

RFI Question Categories

General Questions

1. Institute Scope
2. Institute Organization
3. Institute Benefit
4. Education and Workforce Development

When answering questions in Categories 1-4 please indicate which Decarbonization Topic you are referring to

- Topic 1: Electrification of Industrial Processes
- Topic 2: Decarbonization of Metal Manufacturing

Questions Addressing Electrification of Industrial Processes

5. Institute Scope and Organization around Key Areas
6. State of Technology
7. Benefits of Industry Electrification

Questions Addressing Decarbonization of Metal Manufacturing

8. Productivity and Competitiveness
9. Energy Efficiency and Energy Intensity
10. Material Performance and Alloy Development
11. Decarbonization and Environmental Justice
12. Transition and Adoption of New Technologies
13. Disruptive Technology

Categories Details: General Questions

General Questions

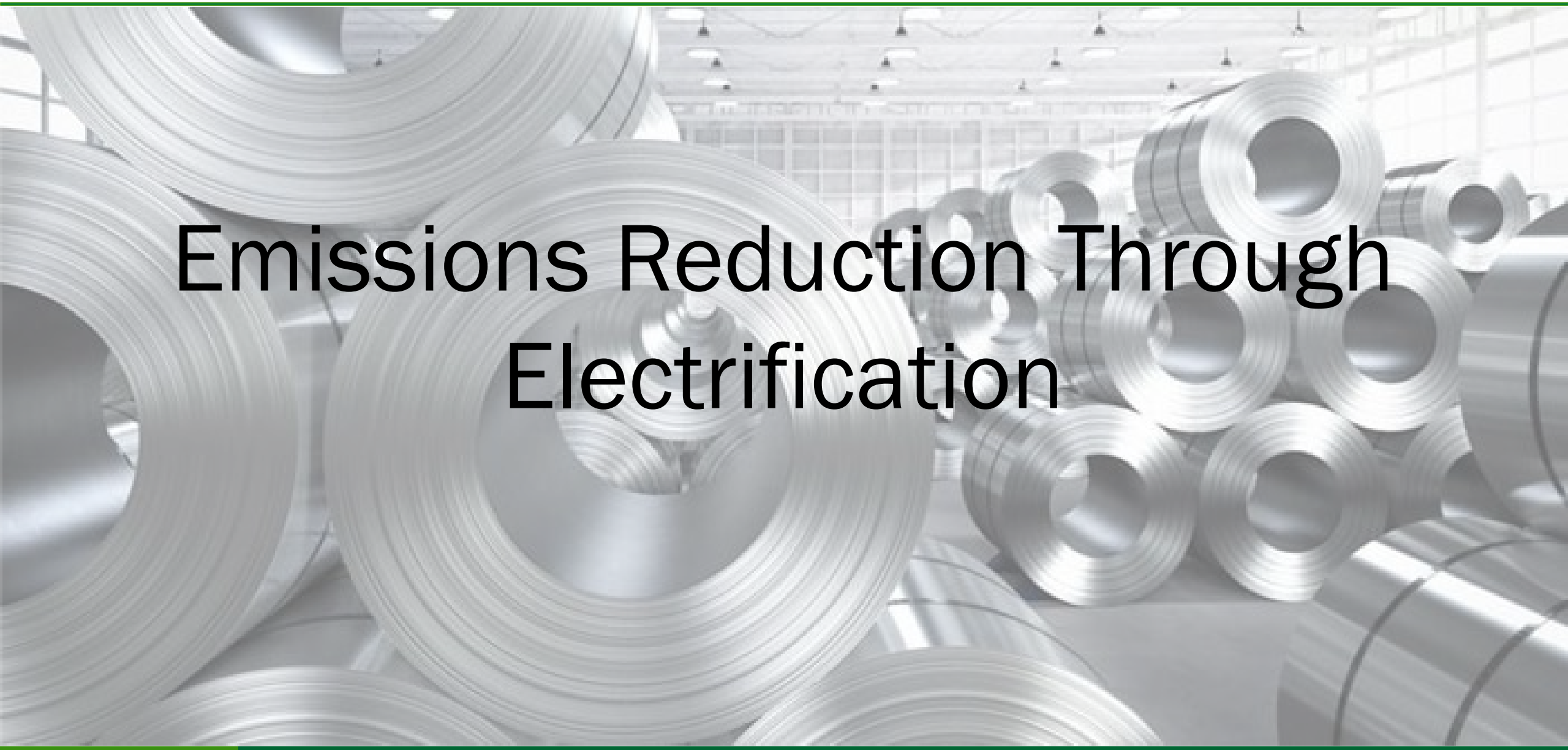
1. **Institute Scope:** The objective of this category is to solicit information on the scope of a potential Institute, as a public-private partnership, to advance industrial decarbonization. Responses should focus on the contributions that an Institute could make beyond that of private industry alone.

2. **Institute Organization:** The objective of this category is to solicit information on the potential for strategic structuring and organization to foster collaboration through a Manufacturing Institute.

3. **Institute Benefit:** The object of this category is to solicit information on the potential benefits of establishing an Institute, as a public-private partnership, to advance industry topics of importance to the DOE Mission. Responses should focus on the impact that an Institute could have beyond that of private industry alone.

4. **Education and Workforce Development:** The objective of this category is to solicit information on education, workforce development, and training needs of the new and incumbent workforce facing each topic area. The deployment of any new technology and the growth of any manufacturing industry requires a supply of workers skilled in the unique aspects for producing, installing, and using that technology. This includes developing a diverse and inclusive pipeline in education and workforce. To ensure that any new innovations are not hampered by workforce needs, we seek input from stakeholders on the most important workforce challenges and the most promising education and workforce developments that could address them.

Topic Area 1: Electrification of Industrial Processes



Emissions Reduction Through Electrification

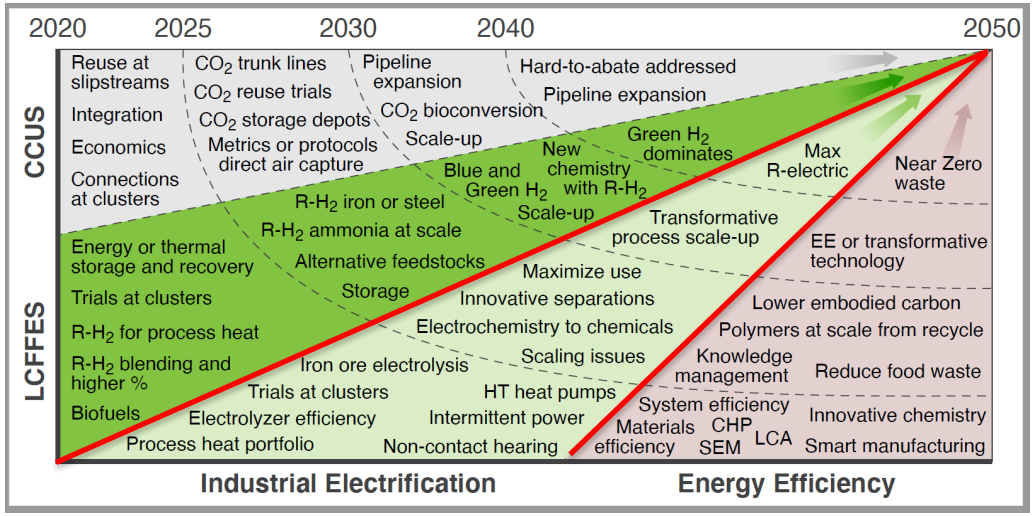
Industrial Electrification Institute - Overview

Institute Need

- 32% of GHG emissions from the industrial sector result from process heating
- By replacing fossil fuels with electricity and electrically-derived fuels and reducing thermal demands via process development, most of these emissions can be avoided.

This Institute topic would aim to address challenges facing the electrification of the industrial sector, with the goal of significant industrial decarbonization by 2030.

Institute Scope



Objective

Industrial Electrification can **reduce industrial emissions** by:

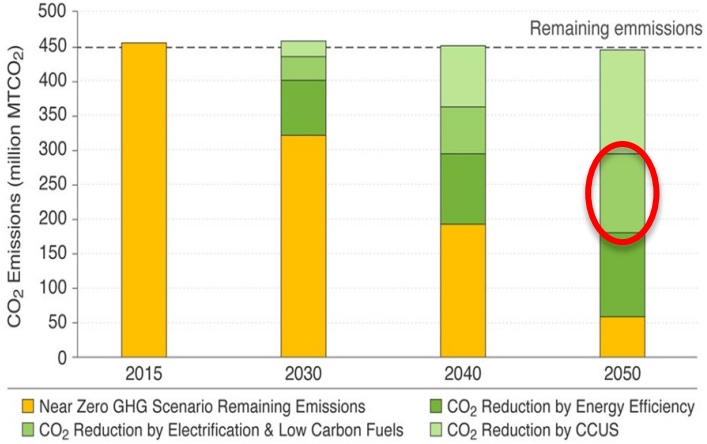
- Using electric-based heating to replace burning of fossil-fuels
- Developing electrically-driven processes to replace thermally-driven manufacturing processes
- Drive up efficiency of electrical manufacturing processes

Technology Focus Areas could include:

- Electrification of industrial processes
- Materials for more effective/efficient electrification
- Scale-up and design for integration into manufacturing processes
- Life Cycle Assessment (LCA) tool and methodology development

Opportunity

Electrification and use of low carbon fuels and feedstocks could reduce GHG emissions from industry by over 100 million MT of CO_2e by 2050.



Structure of RFI – Industrial Electrification Institute

4.0 Background

- Industrial Decarbonization
- Electrification of Industrial Processes
- Decarbonization of Metal Manufacturing

Institute Structure / Organization

Technical Scope / Impact

5.0 Request for Information Questions

General Questions

1. Institute Scope
2. Institute Organization
3. Institute Benefit
4. Education and Workforce Development

Questions Addressing Electrification of Industrial Processes

5. Institute Scope and Organization
6. State of Technology
7. Benefits of Industrial Electrification

Questions Addressing Decarbonization of Metal Manufacturing (Categories 8-13)

Topic 1 Specific Questions

Questions Addressing Electrification of Industrial Processes

5. Institute Scope and Organization around Key Areas:

This category intends to further define the scope and organization of a potential institute to maximize effectiveness and impact.

6. State of Technology:

The objective of this category is to solicit information on the need, implementation, and impact of advancing technology enabling industry electrification and decarbonization.

7. Benefits of Industry Electrification:

The objective of this category is to solicit information on the potential impact of rapid decarbonization and electrification of the industrial sector.

Topic Area 2: Decarbonization of Metal Manufacturing

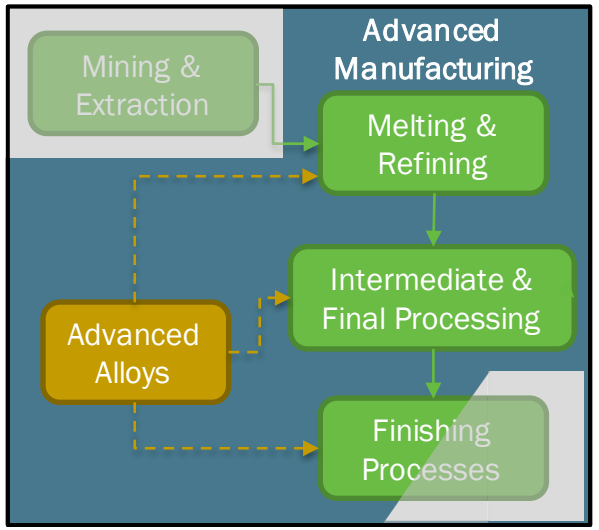
CCAMM Institute - *Notional* Overview

Institute Overview

Mission: Develop and deploy technologies that reduce the **carbon intensity** and improve **manufacturing productively** of the U.S. metals industry to **increase economic competitiveness** and build a **clean economy**.

Vision: U.S. **global leadership** in the manufacturing of metals and alloy development to achieve **carbon neutrality** and sustain a **domestic supply chain** of strategically/economically important alloys.

Institute Scope



Advanced Manufacturing:

- Reduce carbon intensity
- Improve energy efficiency
- Improve productivity

Advanced Alloys:

- Energy production applications
- Energy intensive applications
- Enabling applications
- Strategic/economic importance

Objective(s)

Innovative Manufacturing - Technical solutions to improve energy efficacy, reduce carbon intensity, and ensure economic competitiveness of the U.S. metals manufacturing sector.

Improved Performance - Expanded design space and operational envelope through improved alloy performance to allow for increased efficacy in energy production, energy intensive applications, and applications of strategic importance to the DOE.

Technology Adoption - Accelerate development and certification of materials/processes to realize the benefits of emerging technologies.

Opportunity

Metals industry:

- accounts for ~**11% of the GHG emissions** from the U.S manufacturing sector (2019)
- accounts for **~10% of the total U.S. energy consumption** (2019)
- is large with a presence in **all 50 states** and **directly employs** more than a half million people.

Develop **enabling technologies** to support **onshoring** of production necessary for a **domestic supply chain** that will support the transition to **Industry 4.0**.

Structure of RFI – CCAMM Institute

4.0 Background

- Industrial Decarbonization
- Electrification of Industrial Processes
- Decarbonization of Metal Manufacturing

Institute Structure / Organization

Technical Scope / Impact

5.0 Request for Information Questions

General Questions

1. Institute Scope
2. Institute Organization
3. Institute Benefit
4. Education and Workforce Development

Questions Addressing Electrification of Industrial Processes (categories 5-7)

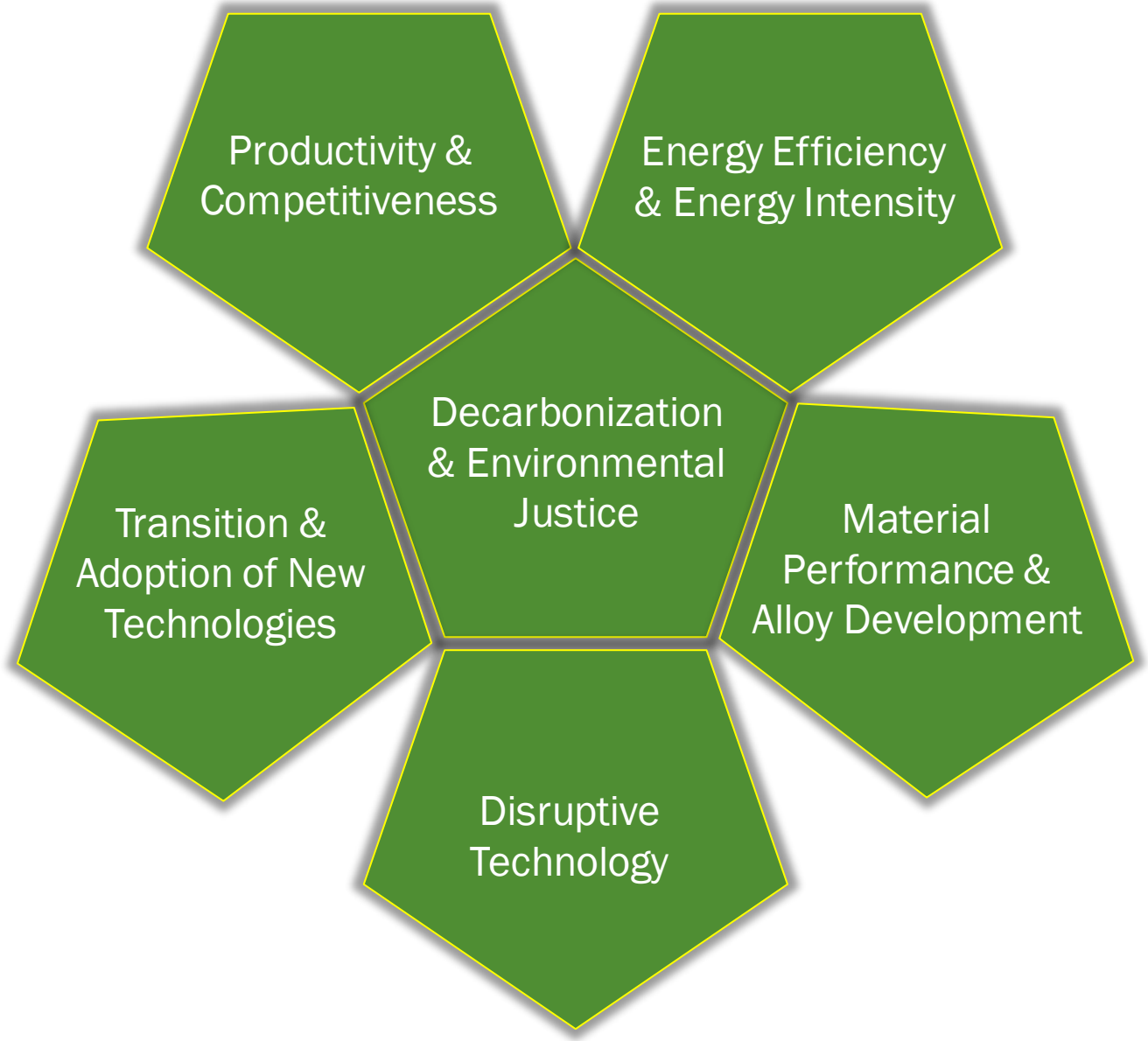
Questions Addressing Decarbonization of Metal Manufacturing

8. Productivity and Competitiveness
9. Energy Efficiency and Energy Intensity
10. Material Performance and Alloy Development
11. Decarbonization and Environmental Justice
12. Transition and Adoption of New Technologies
13. Disruptive Technology

Topic-Specific Questions

Refine Institute Technical Scope:

- Strategic Balance
- Alloy Families
- Value Chain
- Cross-Cutting
- TRL / MRL
- Leverage other DOE and non-DOE efforts
- Impact



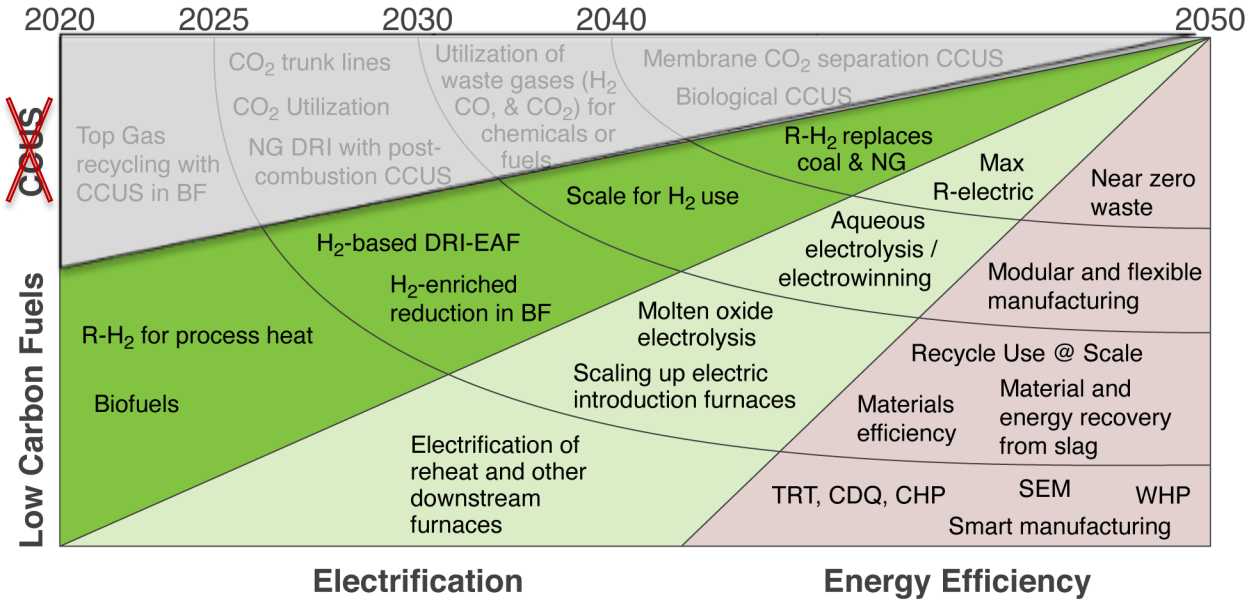
To **realize the carbon reduction benefits** in the metals sector technologies must be **both clean and competitive**

Bounds of Topic 2

Information is **not** being requested on:

- Mining and extraction
- Carbon capture and storage (CCS)
- Use of by-products or co-products **in other industries**
- Collection and sorting of secondary feed stock

Topics and timelines are for illustrative purposes only, and **not** intended to influence the responses to the RFI



Administrative Information

RFI Section 6.0, *Request for Information Response Guidelines*

- **RFI released**: July 27, 2021
- **RFI response period closes**: September 23, 2021 at 5:00PM (ET)
- **RFI Location**: EERE Exchange, https://eere-exchange.energy.gov/
- **Response Limit**: 20 pages
- Additional Information and Requirements

Responses to RFI must be submitted electronically to:
Decarb-Institute@ee.doe.gov

May respond to as many or few questions as you wish

Identify the question being responded to (e.g., C.1.1, C1.2, ...C13.1)

Thank You

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Advanced Manufacturing Office

Questions pertaining to the RFI must be submitted to the following address:

Decarb-Institute@ee.doe.gov