Request for Information (RFI)

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POC: Magdi Azer
Chief Technology Officer
REMADE Institute

Issued By:
The REMADE Institute
150 Lucius Gordon Drive, Suite #204
West Henrietta, NY 14586

Key Dates for this Request for Proposals (RFP)	
Proposal Review Stage	Key Dates
Request for Information (RFI) Released	January 21, 2022
Requests for Information Responses Due*	February 22, 2022

*Due by 5:00 p.m. ET on the date listed.

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REMADE Institute Request for Information

Background

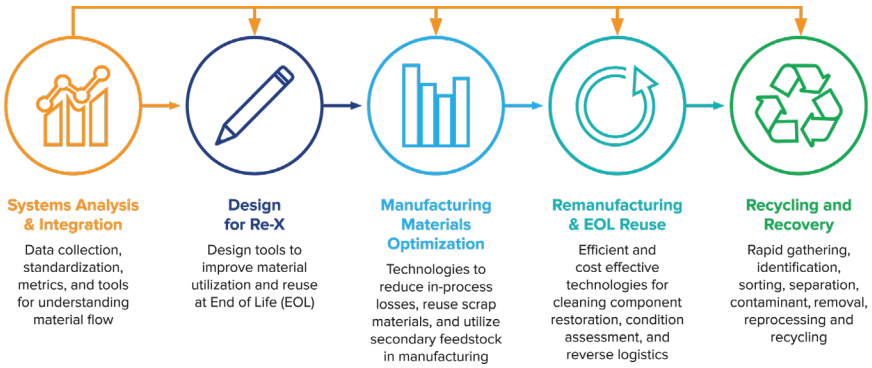
The Reducing EMbodied-energy And Decreasing Emissions (REMADE) Institute is a Department of Energy (DOE) sponsored Manufacturing USA Institute. REMADE's **Mission** is to enable the early stage applied research and development of key industrial platform technologies that could dramatically reduce the embodied energy and carbon emissions associated with industrial-scale materials production, processing, and end-of-life (EOL) disposition. This mission is well aligned to the administration's focus on mitigating the effects of climate change and the Department of Energy's focus on industrial decarbonization.

To achieve its mission, the Institute and its 130 industry, academia, trade association, and national laboratory members focus on increasing the recovery, reuse, remanufacturing, and recycling of metals, fibers, polymers, and electronic waste (e-waste). REMADE leverages up to $70 million in federal funding from the U.S. Department of Energy's Advanced Manufacturing Office (DOE-AMO) that is matched by $70 million in cost share from our members.

To date, REMADE has released five requests for proposals (RFPs) and has either funded or selected for negotiation 61 projects that will help the Institute to achieve its four **primary goals:**

- Develop technologies capable of reducing energy and emissions through a reduction in primary material consumption and an increase in secondary feedstock use in energy-intensive industries,
- Develop technologies capable of achieving "better than cost and energy parity" for key secondary materials,
- Promote widespread application of new enabling technologies across multiple industries, and
- Educate, train, and develop the incumbent and future workforce to support deployment of REMADE technologies.

To achieve these goals, the research agenda for the Institute is structured across the five (5) **REMADE Focus Areas (Nodes)** that are shown in Figure 1.



This Node framework allows the Institute to address the cross-cutting challenges that occur at each stage of the material lifecycle for the four classes of materials that are relevant to REMADE. Additional information regarding the Nodes and their technical thrust areas is provided in the Appendix A.

To measures progress toward its goals and guide its research agenda, the REMADE Institute has established **Technical Performance Metrics (TPMs)** that are provided in Appendix B. This research agenda is articulated in the REMADE Technology Roadmap, which is updated annually and complements the current R&D portfolio.

Disclaimer and Important Notes

This RFI is not a Request for Proposals (RFP); therefore, REMADE is not accepting applications at this time. REMADE may issue an RFP in the future based on or related to the content and responses to this RFI; however, REMADE may also elect not to issue an RFP. There is no guarantee that an RFP will be issued as a result of this RFI. Responding to this RFI does not provide any advantage or disadvantage to potential applicants if REMADE chooses to issue an RFI regarding the subject matter.

Any information obtained as a result of this RFI is intended to be used by the REMADE Institute on a non-attribution basis. Information collected from Section 1 will be used to help REMADE update its Technology Roadmap. REMADE will utilize the information collected from Section 2 to identify potential technology development initiatives that will support the Institute's transition toward self-sustainment. This RFI does not constitute a formal solicitation for proposals or abstracts. Your response to this notice will be treated as information only. REMADE will review and consider all responses in its formulation of program strategies for the identified materials of interest that are the subject of this request. REMADE will not provide reimbursement for costs incurred in responding to this RFI. Respondents are advised that REMADE is under no obligation to acknowledge receipt of the information received or provide feedback to respondents with respect to any information submitted under this RFI. Responses to this RFI do not bind REMADE to any further actions related to this topic.

Purpose

The purpose of this RFI is to solicit feedback from interested individuals and entities, such as industry, academia, research laboratories, government agencies, and other stakeholders to ensure: 1)REMADE's Technology Roadmap continues to address the most important opportunities and pressing challenges associated with increasing the recovery, reuse, remanufacturing, and recycling of metals, fibers, polymers and electronic waste, and 2) REMADE's strategy for self-sustainment focuses on addressing the most pressing national needs and challenges related to reducing the embodied energy and carbon emissions associated with industrial-scale materials production, processing, and EOL disposition. This is solely a request for information.

Each section is further divided into four categories: Strategy, Technology, Partnerships, and Workforce Development & Training. Respondents are free to address any or all of the sections, categories, and questions that are posed.

Section 1 - REMADE's Current Mission, Goals, and Material Classes

The four categories of questions in this section are intended to inform the REMADE Institute's annual Technology Roadmap update. The current Technology Roadmap is available at the following website: Technology Roadmap — The REMADE Institute.

Category 1.1: Strategy

1) What can REMADE do to strengthen its visibility and impact at a national level?

Category 1.2: Technology

1) Does the research agenda as identified in the REMADE Technology Roadmap effectively address the most relevant challenges, technologies, or opportunities for the **four material classes** listed above? What challenges, technologies, or opportunities are absent or underemphasized? What technologies are overemphasized?
2) Does the research agenda as identified in the REMADE Technology Roadmap effectively address the most relevant challenges, technologies, or opportunities related for the **five Focus Area (Nodes)**? What challenges, technologies, or opportunities are absent or underemphasized? What technologies are overemphasized?
3) The following questions relate to REMADE's project portfolio:
   a) Does REMADE's project portfolio effectively address the most relevant challenges, technologies, or opportunities for the **four material classes** listed above? What challenges, technologies, or opportunities are absent or underemphasized? What technologies are overemphasized?
   b) If you are currently a Member of the REMADE Institute, how have you incorporated or how do you plan to use the results/outputs from REMADE's project portfolio in your existing manufacturing operations?
   c) If you are not currently a Member of the REMADE Institute, which specific projects are you most interested in learning more about?
4) The following five questions relate to the five technology Focus Areas (Nodes) in the REMADE Roadmap.
   a) Systems Analysis & Integration: To help teams evaluate the impact of their projects, REMADE has constructed the REMADE Impact Calculator, which is a simple lifecycle assessment (LCA) tool that calculates embodied-energy and emissions impacts for projects based on changes in the amounts of primary and secondary feedstocks enabled by a project. Going forward, should REMADE expand the capabilities of this tool, or are there existing LCA tools that allow users not well versed in LCA to calculate energy and emissions impacts for projects? What other tools can REMADE develop to help companies assess the energy and emissions impacts of their work?
   b) Design for Re-X[1]: What commercial design tools does your company use today? Which design projects/tools in REMADE's project portfolio are of greatest interest to you? What other design tools would you like to see REMADE develop to help companies increase Re-X at end-of-life?
   c) Manufacturing Materials Optimization: To date, REMADE's research has focused on developing technology solutions to enable the increased use of secondary feedstocks in manufacturing. What manufacturing challenges, such as variation in the quality or properties of secondary feedstocks, should REMADE dedicate more resources to solving?

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[1] Re-X is shorthand for recovery, reuse, remanufacturing, and recycling. While not specifically called out in the above definition, sub-processes such as disassembly, sorting, inspection, cleaning, and collection should also be considered to fall within the scope of Re-X.

d) Remanufacturing & End-of-Life Reuse: According to a 2012 USITC report[2], the remanufacturing intensity[3] is 2%. What are the key barriers to increasing the remanufacturing intensity in existing remanufacturing sectors[4] or extending remanufacturing to new sectors? What research advancements could best facilitate growth in remanufacturing intensity?
e) Recycling & Recovery: As part of its research, REMADE is developing technologies related to mechanical recycling and chemical and solvent-based recycling of polymers. Are there other pathways to polymer recycling that REMADE should include in its research portfolio[5]?

5) A critical outcome for DOE is that technologies developed under the Institute public-private investment model are broadly adopted, which would help the U.S. manufacturing sector become more energy- and material-efficient and substantially reduce GHG emissions. What approaches can REMADE undertake to ensure this outcome? For example:
   a) What can REMADE do to facilitate technology transfer of Institute-funded projects?
   b) What steps can REMADE take to ensure Institute-developed technology is broadly adopted by end users?
   c) What can REMADE do to encourage further industry investment and expand industry participation?

Category 1.3: Partnerships

1) What activities being pursued by State and Federal government agencies could REMADE leverage to fulfill its mission and achieve its goals?
2) How might coordination of research efforts with other DOE initiatives help REMADE reduce energy and emissions associated with industrial-scale materials production, processing, and end-of-life (EOL) disposition and advance specific research directions REMADE is pursuing?

Category 1.4: Workforce Development and Training

1) One of REMADE's primary goals is to educate, train, and develop the incumbent and future workforce to support deployment of REMADE technologies. Do the training priorities identified in the EWD Roadmap (pp.19-21) effectively address the most relevant topics that support this goal? What other topics should REMADE consider incorporating in the EWD Roadmap, and what competency levels (awareness / practitioner/ expert) are most useful?
2) What technical training needs within the scope of REMADE are not being addressed for your organization/industry today? What is the preferred mechanism for delivering training content to meet needs (self-paced online, live virtual, in-person, combination of methods)?

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[2] USITC (2012) Remanufactured goods: an overview of the US and Global Markets and Trade 2012

[3] Remanufacturing intensity is the ratio of sales attributable to remanufacturing to total sales of new and remanufactured products.

[4] The twelve remanufacturing sectors identified in the USITC report include aerospace, heavy-duty off-road equipment, motor vehicle parts, machinery, IT products, medical devices, retreaded tires, consumer products, electrical apparatuses, locomotives, office furniture, and restaurant equipment.

[5] NOTE: The DOE's Bioenergy Technology Office and Advanced Manufacturing Office support the Bio-Optimized Technologies to keep Thermoplastics out of Landfills and the Environment (BOTTLE™) consortium.

3) Does your organization primarily rely on internal or external resources to meet your technical training needs? What external organizations do you utilize most frequently to address your technical training needs?
4) What specifically can REMADE do to encourage engagement, participation and successful outcomes by traditionally disadvantaged communities that may not have historically had access to EWD training and career advancement opportunities?

Section 2 - Opportunities to Further the Scope of REMADE's Activities

The four categories of questions in this section are intended to inform the REMADE Institute's transition to self-sustainment by identifying opportunities to further the scope of REMADE's activities to support emerging technology development needs at the end of the Institute's cooperative agreement with DOE.

Category 2.1: Strategy

1) Are there other key performance indicators REMADE should consider besides emissions, material consumption, and energy reduction (see Appendix B for a full list of the TPMs)? For other metrics, please briefly describe how these metrics would be quantified.
2) One of REMADE's Technical Performance Metrics (TPMs), to lower greenhouse gas emissions, is aligned to the administration's focus on industrial decarbonization. Are their technology development opportunities related to industrial decarbonization that REMADE should consider pursuing? If so, please identify these technology development topics and explain why REMADE should consider them.
3) Based on REMADE's mission space, are there other pressing national needs and challenges not yet represented in REMADE's mission, goals, and Focus Areas (see background section)?
4) What potential changes to REMADE's membership structure would facilitate the Institute's transition to self-sustainment and encourage long-term involvement by U.S. manufacturers?

Category 2.2: Technology

1) Should REMADE expand its scope beyond metals, fibers, polymers, and e-waste? If so, what other material classes should REMADE address, and why?
2) Should REMADE expand its mission to include development of novel energy-efficient and/or more environmentally friendly (lower GHGs) processes for producing both primary and secondary feedstocks? Why, or why not?
3) Where should REMADE focus its efforts relative to electric vehicles and solar power, which will both see increased domestic adoption in the next 10 years[6]? What new remanufacturing or recycling opportunities and challenges[7] will these products create?
4) What megatrends, such as climate change, resource scarcity, and technological breakthroughs, should REMADE proactively incorporate in its research agenda as it transitions toward self-sustainment?

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[6] NOTE: The Department of Energy currently supports the Critical Materials Institute (CMI) and the ReCell. CMI is address critical minerals that are used in clean-energy technologies. The ReCell Center is working to advance recycling technologies along the entire battery life-cycle for current and future battery chemistries.

[7] For example, since EVs use less cast aluminum than gas-powered or hybrid vehicles, how will this impact recycling technologies?

Category 2.3: Partnerships

1) In addition to REMADE's existing engagement with industry and 23 industry trade associations, what strategic partnerships across industry and non—governmental organizations (NGOs) would help REMADE were it to broaden its scope in the future? How could coordination with industry and NGOs research efforts improve approach and advance new research directions? Please be specific.
2) How should REMADE engage internationally, if at all, to achieve the goals of the Institute?

Category 2.4: Workforce Development and Training

1) What other EWD topics would you like to see REMADE address in the future, and who would the target audience be?

Request for Information Guidelines

Responses to the RFI must be submitted to REMADE@remadeinstitute.org no later than 5:00 p.m. (ET) February 22, 2022. It is recommended that attachments with file sizes exceeding 25 MB be compressed (i.e., zipped) to ensure message level. Responses must be submitted as a docx or pdf and should be 12-point font with 1 inch margins. Only electronic responses will be accepted.

Please identify your answers by responding to a specific question or category if applicable. Respondents may answer as many or as few questions as they wish.

REMADE will not respond to individual submissions or publish a compendium of responses publicly. A response to this RFI will not be viewed as a binding commitment to develop or pursue the project or ideas discussed.

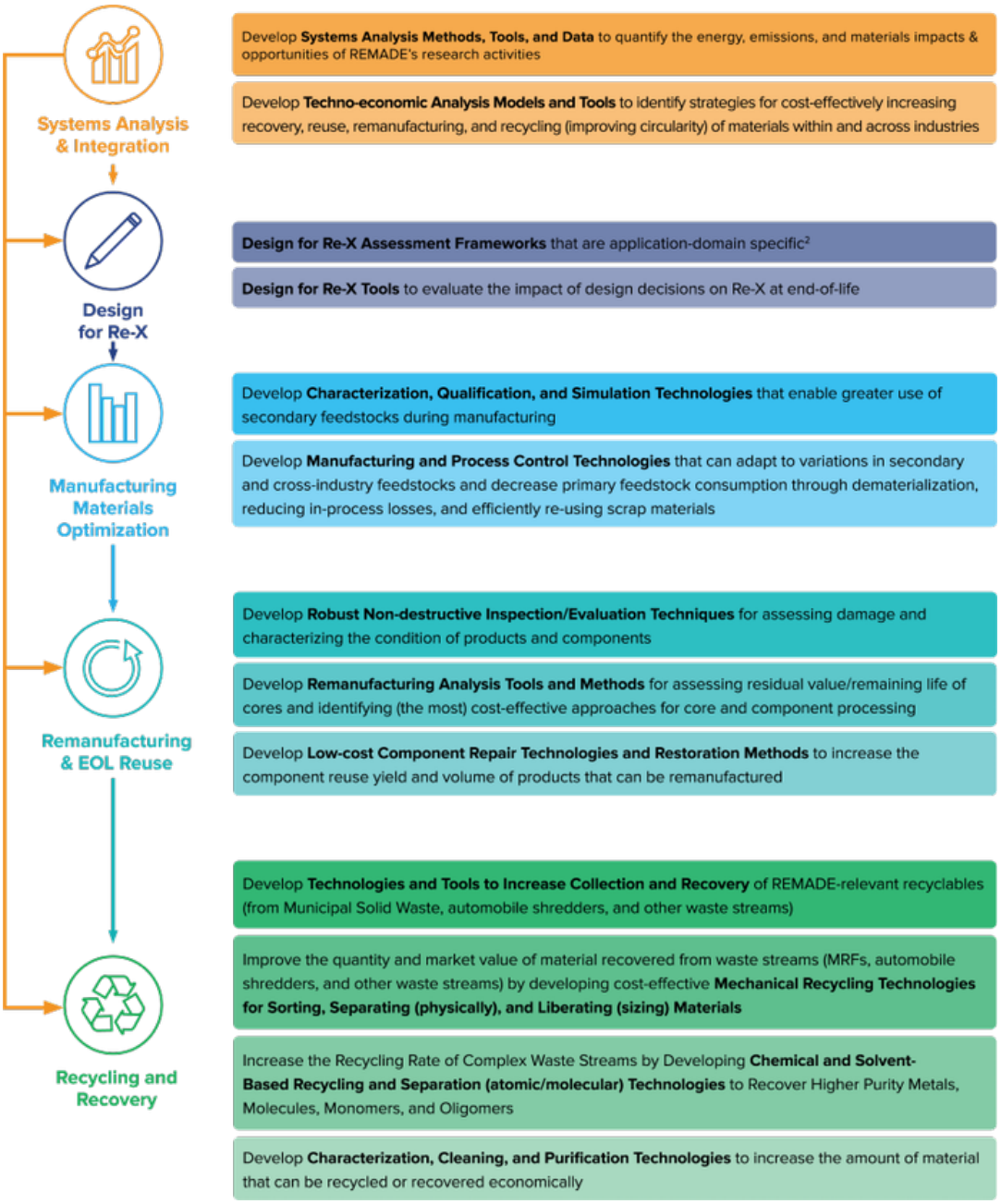
Respondents are requested to provide the following information at the start of their responses to this RFI:

- Company/Institution name;
- Company/Institution contact;
- Contact's address, phone number, and e-mail address.

Appendix A Description of the Thrust Areas for each Node

To communicate the work of the Institute more effectively to internal and external audiences and organize similar research activities within each NODE, REMADE has identified a series of Technical Thrust Areas. The thrust areas have been chosen consistent with terminology that is broadly recognized across the various industries where REMADE works.

Description of the Technical Thrust Areas for Each Node



Appendix B REMADE Institute Technical Performance Metrics (TPMs)

As part of the original charter for the REMADE Institute, the U.S. Department of Energy also developed the following qualitative and quantitative performance metrics. These metrics support the mission of the REMADE Institute and help measure progress towards the institute goals and the overall goals of the Manufacturing USA Institutes.

25% Improvement in Embodied Energy Efficiency

Demonstrate through innovative material reuse, recycling, remanufacturing and reprocessing technologies, a 25 percent (25%) improvement in embodied-energy efficiency (% change in BTU/ kg product) through first-of-their-kind demonstrations at manufacturing plants or major processes within five years of Institute operation, supporting a goal of at least fifty percent (50%) improvement in embodied-energy efficiency within ten years following initial Federal support for the Institute.

Demonstrate Potential for Cost Parity for Secondary Feedstocks and Energy Parity for Secondary Feedstocks

Develop tools and technologies to quantitatively increase energy productivity by reducing the cost of key secondary feedstocks in existing processes to at or below cost parity of primary feedstocks (modeled costs based on technologies being demonstrated) relative to the existing state-of-the-art within five years, and be on a pathway to achieve, at minimum, installed and operating cost parity for the secondary feedstocks at full scale.

Demonstrate 30% Increase in Recycling/Reuse Rate

Research, develop and demonstrate improved recycling and reuse in materials manufacturing to enable a 30% absolute increase in recycling rates of specific energy-intensive materials as a prioritized portfolio of technologies.

Demonstrate 20% Reduction in associated GHG Emissions and a 10X Reduction in Primary Feedstock Use

Research, develop and demonstrate at representative pilot scale, at least one cost effective energy intensive/dependent process that achieves a 10x reduction in primary material feedstock (kg/kg product), with improved energy efficiency (% relative to baseline), and 20% lower GHG emissions (ton CO2 eq./kg) relative to commercial state-of-the art at the relevant production rate (kg per day).

Demonstrate 30% Secondary Feedstock Increase and 30% Primary Feedstock Reduction

Demonstrate approaches to cost-effective cross-industry use of secondary feedstocks. Develop and demonstrate at minimum pilot scale at least one process with relevant and quantified operating times that enables reuse of recycled and recovered materials to serve as cost effective material feedstocks for one or more different industries.

Demonstrate 30% Reduction in Energy to Process Secondary Feedstocks

Develop tools and technologies to reduce the total energy required to process secondary materials by thirty percent (30%) relative to the existing state-of-the-art within five years and be on a pathway to achieve a 50% reduction for the secondary materials processing at full scale within 10 years.