Request for Information DE-FOA-0003315
U.S. Domestic Wind Turbine Blade Manufacturing Innovation

DATE: April 24th, 2024
SUBJECT: Request for Information (RFI)

Description

The U.S. Department of Energy's (DOE) Office of Energy Efficiency and Renewable Energy (EERE) Wind Energy Technologies Office (WETO) is interested in obtaining information related to the current state of U.S. domestic wind turbine blade manufacturing, future domestic blade manufacturing innovation needs, manufacturing workforce development, and how recent tax incentives and initiatives affect stakeholder thinking and strategies.

Background

The Biden-Harris Administration has set ambitious clean energy goals to put America on a path to fully decarbonize our electric grid by 2035 and achieve a 100% clean energy economy with net-zero emissions no later than 2050. Wind energy—both offshore and land-based—has an especially important role to play in achieving these goals.

To achieve a fully decarbonized power sector by 2035, we need to dramatically increase the scale of wind energy deployment. Studies looking at how to achieve a carbon-free power sector and economy consistently find that 60-80% of our electricity will need to come from wind and solar, up from 15% today. In the U.S. this equates to an operating wind power capacity that is at or approaching terawatt levels, an approximately 7x increase from 2022 installed capacity. Realizing this scale of deployment by 2035 would also require a dramatic increase in the pace of deployment.

Wind energy deployment brings multiple benefits to the United States, including tens of thousands of good paying jobs, a skilled workforce, and more U.S manufacturing and supply chain opportunities.

WETO works to advance wind energy by reducing costs through research and innovation; finding solutions to environmental, siting, and land use conflicts; ensuring reliable integration with grid systems; and fostering economic development in the United States.

To effectively meet the Biden-Harris Administration's clean energy goals, production of wind turbine blades needs to be dramatically increased. Recent analysis from the Land-Based Wind

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Market Report (2023) indicate that domestic manufacturing capacity for blades saw consistent growth until 2019. However, starting in 2020, blade production capacity became insufficient to meet domestic demand due in part to supply chain disruptions and global competition.

In addition to capacity constraints and supply chain issues, domestic blade manufacturing faces challenges due to quality control issues, blade factory workforce constraints, and the ability to remain competitive. These trends have discouraged investing in long-term manufacturing research and development initiatives that could be critical to the future of the wind sector.

Addressing these challenges will enable the United States to re-emerge as an industry leader in wind turbine blade manufacturing.

An increased demand for wind energy also compounds challenges for the domestic wind turbine blade manufacturing workforce. Manufacturing wind turbine blades is largely a manual process that requires a specialized skillset, resulting in the need for proper training programs and initiatives. As wind energy deployment targets increase, the demand for wind turbine blades begins to outpace the availability of qualified workers, deepening the wind workforce gap.

To help address this challenge, WETO's Workforce Development and Education program supports the wind industry workforce in many ways, including conducting analyses to assess existing and future workforce needs, developing the wind workforce pipeline through the Collegiate Wind Competition, and ensuring relevant stakeholders have access to this information.

While the cost of labor associated with the manufacturing process is a key driver in blade production either domestically or overseas, it is not the only factor that needs to be considered. Manufacturing technological advancements are still needed to address this and other challenges affecting the workforce, to support the increased demand for wind turbine blades, and to support the growth of the wind industry.

The Inflation Reduction Act (IRA) has the potential to influence U.S domestic wind turbine blade manufacturing over time through tax credits and incentives that facilitate increased deployment of wind and wind manufacturing capacity. The IRA, which was passed into law on Aug. 16, 2022, extends and expands investment tax credits (ITC) and production tax credits (PTC) for the deployment of clean energy technologies, including wind, for a decade or more. The IRA also includes dedicated support for clean energy manufacturing. Specifically, the **Advanced Manufacturing Production Tax Credit (45X PTC)** provides manufacturing production

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tax credits for companies that domestically manufacture and sell specific types of clean energy equipment in the United States, including several key wind components, and the **Advanced Manufacturing Investment Tax Credit (48C)** supports investment in domestic clean energy manufacturing facilities designed to produce or recycle wind energy components. However, components produced in facilities that utilize this credit are ineligible to receive the production tax credit (45X PTC). Additionally, for wind project developers, the IRA provides for stackable 10% PTC or ITC bonus credits for meeting **domestic content thresholds** and for **locating facilities in energy communities**.

More detailed information around these and other Federal incentives can be found in the WETO Funding Factsheet.

These tax credits and incentives can contribute to the deployment of wind energy by encouraging development of a skilled workforce and creating domestic manufacturing jobs, increasing domestic wind turbine blade manufacturing, strengthening the domestic supply chain, and increasing prospects for U.S. competitiveness in the production of labor-intensive components such as blades.

Purpose

The purpose of this RFI is to solicit feedback from industry, academia, research laboratories, government agencies, and other stakeholders on issues related to U.S domestic wind turbine blade manufacturing. EERE is specifically interested in information on current domestic blade manufacturing challenges, future domestic blade manufacturing needs, workforce, and stakeholder strategy development. This is solely a request for information and not a Funding Opportunity Announcement (FOA). EERE is not accepting applications.

Disclaimer and Important Notes

This RFI is not a Funding Opportunity Announcement (FOA); therefore, EERE is not accepting applications at this time. EERE may issue a FOA in the future based on or related to the content and responses to this RFI; however, EERE may also elect not to issue a FOA. There is no guarantee that a FOA will be issued as a result of this RFI. Responding to this RFI does not provide any advantage or disadvantage to potential applicants if EERE chooses to issue a FOA regarding the subject matter. Final details, including the anticipated award size, quantity, and timing of EERE funded awards, will be subject to Congressional appropriations and direction.

Any information obtained as a result of this RFI is intended to be used by the Government on a non-attribution basis for planning and strategy development; this RFI does not constitute a formal solicitation for proposals or abstracts. Your response to this notice will be treated as

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information only. EERE 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. EERE will not provide reimbursement for costs incurred in responding to this RFI. Respondents are advised that EERE 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 EERE to any further actions related to this topic.

Confidential Business Information

Pursuant to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit via email, postal mail, or hand delivery two well-marked copies: one copy of the document marked "confidential" including all the information believed to be confidential, and one copy of the document marked "non-confidential" with the information believed to be confidential deleted. Submit these documents via email, if feasible. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

Evaluation and Administration by Federal and Non-Federal Personnel

Federal employees are subject to the non-disclosure requirements of a criminal statute, the Trade Secrets Act, 18 USC 1905. The Government may seek the advice of qualified non-Federal personnel. The Government may also use non-Federal personnel to conduct routine, nondiscretionary administrative activities. The respondents, by submitting their response, consent to EERE providing their response to non-Federal parties. Non-Federal parties given access to responses must be subject to an appropriate obligation of confidentiality prior to being given the access. Submissions may be reviewed by support contractors and private consultants.

Request for Information Categories and Questions

Category 1: Current State of U.S Domestic Wind Turbine Blade Manufacturing

EERE is looking to gather stakeholder insight into the current state of U.S. domestic wind turbine blade manufacturing. Obtaining a holistic view will facilitate a more complete understanding of domestic challenges faced within the supply chain, manufacturing, and quality control processes, and workforce development areas and how these challenges affect cost competitiveness and technological advancements of domestic wind turbine blade manufacturing.

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This category is intended to solicit feedback from the following stakeholders: original equipment manufacturers, tier 1 wind turbine blade suppliers, materials suppliers across the wind turbine blade supply chain, distributed wind, and land-based wind and offshore wind utility-scale wind plant developers, owners, and operators.

Where applicable, please identify distributed wind, land-based wind, or offshore wind technology application specific considerations within your response.

For purposes of Category 1, "conventional" blade manufacturing refers to the traditional process of producing wind turbine blades through initial design, material selection (fiberglass, carbon fiber, composites), molding, curing, assembly and finishing.

Challenges and Limitations

1. Please elaborate on the most challenging or prohibitive factors *external* to the manufacturing process, such as factory location, transportation/logistics, and other regional/national supply chain considerations including constraints on inputs such as materials associated with conventional blade manufacturing. Please identify any steps being taken to address them.

2. Please elaborate on the most challenging or prohibitive attributes of the conventional blade **manufacturing process**. Please identify any steps being taken to address them.

3. Please describe in detail which steps of the conventional blade manufacturing process need to change, why, and the resulting impact. Additionally, which steps would be most receptive or susceptible to change, why, and resulting impact. Please describe any steps being taken to address them.

4. Please identify and quantify issues and challenges associated with and resulting from conventionally manufactured **wind turbine blades**.

5. Please describe and prioritize those quality issues associated with conventionally manufactured wind turbine blades that are most critical to address immediately.

    a. Please identify and describe associated root causes, and current steps taken to mitigate these specific issues.

    b. Please give a rough order of magnitude of associated costs and how those costs have trended over time and with the blade/factory scale.

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6. Please describe the **near-term** limitations of current wind turbine blade manufacturing processes in reaching 30 GW/year, and **longer-term** limitations for reaching as much as 100 GW/year, in the United States. Please describe any constraints specific to blade scale or factory throughput in either scenario.

7. Please describe those aspects of conventional domestic wind blade manufacturing that are considered **risks** by your organization. Please describe the resulting risks either internally or externally to your organization. Please describe any steps taken to mitigate those risks.

8. Please describe the view within your organization of manufacturing business and technology risks and concerns, such as leakage of technology to foreign regions or competitors.

Metrics

1. Please identify and quantify the aspects of conventional wind turbine blade manufacturing processes, domestic or international, that your organization and customers would like to retain when implementing new technology development. Please provide your rationale.

2. Please identify and quantify the aspects of conventional blade manufacturing that drive decisions to invest in, build, and/or expand wind blade manufacturing facilities. Please provide your rationale.

3. Of the attributes identified above, please highlight, and quantitatively describe where domestic manufacturing may be deficient. Furthermore, please describe quantitatively, where applicable, the target values for any of these attributes that would be needed for domestic manufacturing to be considered competitive globally.

4. Please qualify and quantify the types and current level of product variability within your manufacturing footprint. Please describe to what extent that level of variability is acceptable, and how that level of acceptance is established.

Workforce

1. Please describe the current blade factory workforce (any common key attributes), how workforce demand varies through time, and the types of roles and functions available to potential hires.

2. Please describe the current challenges facing the wind turbine blade manufacturing workforce. Please describe any differences specific to distributed wind, land-based wind, or offshore wind workforce.

    a. Please describe how those challenges have trended over time and between factories in various countries.

    b. Please describe how those challenges affect blade quality and factory productivity.

3. Please describe the level of training needed for the current blade factory workforce. Please describe accessibility of this training. Please describe how training needs change based on role.

4. Please describe the main causes of employee **turnover**. In addition, please describe any steps taken to increase employee retention, and/ or incentivize jobs within the blade factory workforce. Please describe how the need for new employee training impacts blade quality and factory productivity.

5. Please describe any additional manufacturing workforce-related topics you would like to tell us about regarding the **current** state of domestic wind turbine blade manufacturing.

Impacts of Recent IRA Tax Credits and Incentives

1. Please describe how recent incentives have impacted your company's decision making on manufacturing R&D investments for **wind components**.

2. Please describe how recent IRA production and component manufacturing credits and incentives have impacted decision making when it comes to producing and/or purchasing domestically produced **wind turbine blades**.

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3. Please describe how these credits and incentives have impacted decision making on investing in new or expanded domestic manufacturing facilities.

4. Please describe how recent incentives have impacted current business practices, partnerships, and coordination with external parties within either the domestic or global supply chain.

5. Please describe what role the U.S. government should take to address **current** challenges and limitations pertaining to domestic wind turbine blade manufacturing.

Category 2: **Future State of U.S Domestic Wind Turbine Blade Manufacturing**

EERE is seeking stakeholder insight relative to the future state of U.S domestic wind turbine blade manufacturing. In addition to addressing challenges facing conventional manufacturing processes, EERE understands that further investment in innovative technologies for domestic wind turbine blade manufacturing is needed to address current manufacturing capacity limitations, support a domestic manufacturing workforce, decrease reliance on imports, and support the development of an efficient domestic supply chain.

This category is intended to solicit feedback from the following stakeholders: original equipment manufacturers, tier 1 wind turbine blade suppliers, materials suppliers across the wind turbine blade supply chain, and novel manufacturing technology innovators. As previously mentioned, DOE will keep any business-sensitive or proprietary information confidential to the greatest extent possible within the parameters of the Freedom of Information Act (FOIA). See instructions for labeling confidential information in the "Confidential Business Information" section of this RFI.

Opportunities and Risks

1. Please provide your thoughts on addressing current manufacturing challenges versus development of an innovative manufacturing process.

2. Please describe ideas for an innovative blade manufacturing process, and the estimated timeline needed for development - from concept creation to standing up commercial facilities.

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3. Please describe the best approach to innovative blade manufacturing technology development.

4. Please describe any foreseen risks that could be attributable to development and widespread adoption of an innovative blade manufacturing process.

5. Please describe any secondary impacts (positive or negative) of an innovative blade manufacturing process.

6. Please describe any specific attributes or requirements that could change based on blade production for offshore wind or land-based wind applications.

7. Please describe the advantages or disadvantages an innovative blade manufacturing process may have on the design or production of other wind turbine components.

8. Please describe the benefits of developing an innovative manufacturing technology for domestic blade production versus manufacturing abroad. What would incentivize keeping that technology and blade production domestic.

9. Please describe the likelihood of global standardization of a new innovative manufacturing technology.

10. If a new technology would primarily be implemented domestically, please describe the level of acceptance of domestic versus global product variability.

11. Please describe the potential impacts, either positive or negative, that manufacturing process innovation could have on the current supply chain or secondary markets (e.g. blade waste).

Metrics

1. Please describe the future attributes of an innovative domestic wind turbine blade manufacturing process which addresses current challenges.

2. Please define and assign potential **metrics** to those attributes that could be effectively used to measure success when considering technology and manufacturing process innovations addressing current challenges.

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3. Please define what **values** the stated metrics would need to achieve to be considered successful.

4. Please describe how domestic blade manufacturing process innovations would affect the current blade quality inspection process. Please estimate the potential cost benefit of that process innovation, associated with reduced rework and inspection costs or otherwise.

5. Please define those metrics most relevant to the **domestic** manufacturing industry, such that technological advances achieving these metrics would have **more impact domestically than globally**.

Workforce

1. Please describe the potential impact an innovative blade manufacturing process could have on the blade factory workforce. Please describe any new or removed attributes, change in demand, and change in types of roles and functions that would be available.

2. Please discuss the advantages and disadvantages of reducing the amount of labor required for blade manufacturing, through either a process change or technology innovation.

3. Please describe the potential impacts a reduction in labor resulting from an innovative blade manufacturing process would have on necessitating a higher skilled labor workforce. Please describe how this would affect or change current workforce development efforts.

4. Please describe the impact a 50% reduction in labor content would have on overall blade cost domestically, assuming no increase in cost elsewhere. Please describe how that sensitivity would change blade production outside of the United States.

5. Please describe the importance placed on workforce implications when developing an innovative blade manufacturing process. Please describe what variables attributable to the workforce could change.

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6. Please describe any secondary effects that would be taken into consideration, and any implications they would have on technology development (e.g. development of new safety protocols or standards etc.)

7. Please describe any additional manufacturing workforce-related topics you would like to tell us about regarding the **future** state of domestic wind turbine blade manufacturing.

Impacts of Recent IRA Tax Credits and Incentives

1. Please describe how recent incentives contribute to progress towards future innovative manufacturing processes. Please describe the extent to which innovation is accelerated or delayed due to these incentives.

2. Please describe how prescribed stipulations or the future expiration of recent incentives affect long term sustainability of an **innovative** blade manufacturing process.

3. Please describe how prescribed stipulations or the future expiration of recent incentives affect long term sustainability of the **current** blade manufacturing process assuming minimal technological innovation.

4. Please describe what role the U.S. government should take to address **future** innovation and R&D pertaining to domestic wind turbine blade manufacturing.

Category 3: **Funding Mechanisms, Investment, and Strategic Partnerships**

EERE is interested in gathering information to aid strategic thinking, through a well-informed understanding of technology development timeline, level of investment, and alignment of strategic partnerships needed to make a significant step change and impact to domestic wind turbine blade manufacturing.

Funded with annual Federal appropriations, EERE leverages a variety of funding mechanisms (https://www.energy.gov/eere/funding/how-do-i-apply-eere-funding) to work with industry, academia, and national laboratories. Each mechanism has associated risks, benefits, target audiences and timelines to be taken into consideration when looking at potential pathways for technology development.

In addition, strategic partnerships amongst relevant stakeholders will play a pivotal role in development of innovative technology solutions and are instrumental in driving continued

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growth and sustainability of domestic wind turbine blade manufacturing. EERE is interested in learning about how partnerships between stakeholders are established and change throughout a technology development life cycle.

This category is intended to solicit feedback from the following stakeholders: original equipment manufacturers, tier 1 wind turbine blade suppliers, and novel manufacturing technology innovators.

Technology Development

1. Please describe a typical level of investment and timeline for technology development within your organization. Please describe relevant teams, roles, and levels of involvement throughout the process.

2. Please describe both internal and external organizational risks or factors that may influence large investments in technology development. Please describe how these risks or factors are addressed or mitigated to ensure continued project success.

3. Relative to the development of a new innovative manufacturing process, please quantify and elaborate on the estimated extent of manufacturing process change that

   would be needed to make a substantial impact in domestic wind turbine blade manufacturing industry.

   a. Please elaborate on the rough order of magnitude estimate for total time and investment needed to accomplish that change. Describe how the investment scales with time and technology development progress.

Stakeholder Engagement and Strategic Partnerships

1. Please describe any challenges or limitations faced when looking for partners who would assist in development of a new innovative blade manufacturing process.

2. Please describe at what stages in the technology development teaming could occur, and what stakeholder group would be the targeted partners, their role, and contributions. Please describe how these partnerships would evolve over time.

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3. Please describe the role DOE could have in facilitating partnerships across the blade supply chain, from material and tooling suppliers to automation and logistics. Please identify any additional relevant stakeholders.

Request for Information Response Guidelines

Responses to this RFI must be submitted electronically to WindEnergyRFI@ee.doe.gov no later than 5:00pm (ET) on July 30th, 2024. Responses must be provided as attachments to an email. It is recommended that attachments with file sizes exceeding 25MB be compressed (i.e., zipped) to ensure message delivery. Responses must be provided as a Microsoft Word (.docx) attachment to the email, and no more than 12 pages in length, 12 point font, 1 inch margins. Only electronic responses will be accepted.

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

EERE will not respond to individual submissions or publish publicly a compendium of responses. 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 response to this RFI:

- Company / institution name;
- Company / institution contact;
- Respondents' roles and areas of expertise as they relate to the RFI questions;
- Contact's address, phone number, and e-mail address.

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Background and Resources

Listed below are background resources that may help inform responses.

Examining Supply-Side Options to Achieve 100% Clean Electricity by 2035 (nrel.gov)
https://www.nrel.gov/docs/fy22osti/81644.pdf

Distributed Wind Market Report: 2023 Edition | Department of Energy
https://www.energy.gov/eere/wind/articles/distributed-wind-market-report-2023-edition

Land-Based Wind Market Report: 2023 Edition | Department of Energy
https://www.energy.gov/eere/wind/articles/land-based-wind-market-report-2023-edition

Offshore Wind Market Report: 2023 Edition | Department of Energy
https://www.energy.gov/eere/wind/articles/offshore-wind-market-report-2023-edition

Workforce Development and Education R&D | Department of Energy
https://www.energy.gov/eere/wind/workforce-development-and-education

Defining the Wind Energy Workforce Gap (nrel.gov)
https://www.nrel.gov/docs/fy23osti/82907.pdf

Collegiate Wind Competition | Department of Energy
https://www.energy.gov/eere/collegiatewindcompetition/collegiate-wind-competition

WINDExchange: Education and Workforce Development (energy.gov)
https://windexchange.energy.gov/education-workforce

U.S. Wind Industry Federal Incentives, Funding, and Partnership Opportunities Fact Sheet | Department of Energy
https://www.energy.gov/eere/wind/articles/us-wind-industry-federal-incentives-funding-and-partnership-opportunities-fact

Domestic Content Bonus Credit Guidance under Sections 45, 45Y, 48, and 48E (irs.gov)
https://www.irs.gov/pub/irs-drop/n-23-38.pdf

How Do I Apply for EERE Funding? | Department of Energy
https://www.energy.gov/eere/funding/how-do-i-apply-eere-funding

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