

Request for Information (RFI) on Public Feedback on AMMTO Wide Bandgap Power Electronics Strategic Framework

DATE: January 16, 2025

SUBJECT: Request for Information on Wide Bandgap Power Electronics Strategic Framework

Description

This is a Request for Information (RFI) issued by the U.S. Department of Energy (DOE) on behalf of the Advanced Materials and Manufacturing Technologies Office (AMMTO). The intent of this RFI is to solicit feedback from affected stakeholders on the draft AMMTO *Wide Bandgap Power Electronics Strategic Framework* that accompanies this RFI.

Background

The mission of DOE is to ensure America's security and prosperity by addressing its energy, environmental, and nuclear challenges through transformative science and technology solutions.¹ AMMTO's mission is to inspire people and accelerate innovation to transform materials and manufacturing for America's energy future. AMMTO programs support research, development, and demonstration of next-generation materials and innovative manufacturing technologies to increase U.S. industrial competitiveness and energy resiliency.

Power electronics are essential to the conversion and control of electrical power in U.S. critical infrastructure. As this infrastructure—including grid-integrated power, industrial manufacturing, transportation, and digital networking and communications—brings more innovative technologies online to meet changing market demands and improve energy security and resiliency, it also places significantly higher performance demands on power electronics technologies. Silicon power electronics have been relied on for decades to meet infrastructure's power conversion and control needs, but these intensifying performance requirements have surpassed what traditional Silicon power electronics can offer.

Wide bandgap semiconductor (WBG) power electronics offer a replacement that has the potential to address U.S. infrastructure's changing needs of the 21st century. To achieve this potential, technological innovation is needed across the entire PE system—at the material level, in the devices that allow these high-performance materials to function, and in the packaging that builds these devices into end-use applications.

¹ U.S. Department of Energy, "Mission." Accessed December 2024. <https://www.energy.gov/mission>.

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AMMTO seeks to support the U.S. WBG power electronics industry by funding research, development, and demonstration projects, and supporting studies and analyses, that aid in the commercialization of advanced materials and assist in overcoming manufacturing scale up challenges. AMMTO also seeks to strengthen the WBG power electronics innovation ecosystem by convening stakeholders, supporting public-private partnerships, and investing in education and workforce development resources. The AMMTO *Wide Bandgap Power Electronics Strategic Framework* aims to establish a vision, goals, and pathways for the U.S. domestic WBG power electronics industry to overcome key technical challenges within the next decade. As a result, AMMTO will use this framework to collaborate with industry to make improvements and possibly develop a more detailed, targeted roadmap for WBG power electronics manufacturing.

Purpose

AMMTO is seeking input on its draft strategic framework, to improve its accuracy and value to the power electronics industry. This RFI outlines the information AMMTO is seeking from the public to inform the development of the framework, and responses to this RFI will be used as input to update it. Both the RFI responses and the draft framework will be used by DOE to help inform key decisions concerning the future of the AMMTO Power Electronics program and its impact. AMMTO is specifically interested in feedback on the initial version of the power electronics strategic framework that accompanies this RFI.

Disclaimer and Important Notes

This RFI is not a Notice of Funding Opportunity (NOFO); therefore, the Office of Energy Efficiency and Renewable Energy (EERE) is not accepting applications at this time. EERE may issue a NOFO in the future based on or related to the content and responses to this RFI; however, EERE may also elect not to issue a NOFO. There is no guarantee that a NOFO 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 NOFO 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 nonattribution 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 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

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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.

Responses should not include any information that is considered protectable, proprietary, or sensitive for any reason including but not limited to confidential business information or protected personal information.

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 or on a flash drive, 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 Nonfederal 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 nonfederal personnel. The government may also use nonfederal personnel to conduct routine, nondiscretionary administrative activities. The respondents, by submitting their response, consent to EERE providing their response to nonfederal parties. Nonfederal 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.

Category A: Overall Roadmap Structure/Content

1. Are any of the challenges or innovation pathways in the strategic framework presented incompletely or inaccurately? If so, please provide specific recommendations on how to correct the inaccuracies.
2. Are there any emerging trends or technologies in power electronics that the strategic framework should address, but currently does not?
3. Are there gaps in the deployment of complete power electronics system that are not addressed in the strategic framework? If so, what are those gaps and which applications they relate to?
4. What are the biggest uncertainties or risks the power electronics industry faces in the next 5–10 years that should be reflected in the strategic framework?
5. What are the most significant barriers to scaling domestic manufacturing for power electronics, and does the strategic framework sufficiently discuss them? If not, what

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details should the strategic framework include and what are the most appropriate sections to include them?

6. Are there any cross-industry connections to create or strengthen that would be especially valuable to accelerate innovation and adoption of WBG power electronics?
7. What impact could improvements in device or module simulation and design tools have on the ability to commercialize and scale up any of the technology pathways mentioned in the strategic framework?
8. Are the recommendations for standardization and the establishment of industry-wide guidelines appropriately focused and sufficiently detailed? If not, please provide specific recommendations on additional areas needing standardization, as well as input on what additional detail would improve the recommendations on standards and guidelines.
9. How can the strategic framework encourage more effective collaboration among industry, government, and academia in pre-competitive research?

Category B: Power Electronics Application Areas

1. For any of the specific application areas, are there any promising WBG power electronics technologies that could address needs or improve performance in those applications that have been overlooked? If so, please provide detail on these technologies, including the key breakthrough or improvement they offer, key challenges to their commercialization and adoption, and potential solutions. Please provide references to support your suggestions.
2. For any of the solution pathways described in this section, are their specific timeframes (e.g., 2–5 year [yr], 5–7 yr, 7–10 yr, 10+ yr) within which these pathways are likely to yield significant breakthroughs or impacts? What is the level of uncertainty on these timeframe estimates?
3. Are there any specific regulatory hurdles or market barriers that the strategic framework should address more directly to facilitate faster innovation and market entry?
4. Are new federal policies needed to facilitate market entry of next-generation power electronics?

Category C: Wide Bandgap Materials and Devices

1. What materials, manufacturing, and technology innovations are needed to extend gallium-nitride devices to the 900–1,200 volt range? When could these devices become commercially viable: 2–5 yr, 5–7 yr, 7–10 yr, 10+ yr?
2. What materials, manufacturing, and technology innovations are needed to extend silicon-carbide devices to 6.5 and 10 kilovolt+ voltage classes? When could these devices become commercially viable: 2–5 yr, 5–7 yr, 7–10 yr, 10+ yr?

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3. What is the commercial feasibility of superjunction devices in silicon carbide? What innovations are needed to achieve or accelerate commercialization?
4. 4. What is the commercial feasibility of insulated-gate bipolar transistor devices in silicon carbide? What innovations are needed to achieve or accelerate commercialization?
5. 5. Beyond silicon-carbide metal-oxide-semiconductor field-effect transistor / junction field-effect transistor and gallium-nitride high electron mobility transistor, which material system and device structure (WBG or ultra WBG) will be the next to emerge as a commercially viable power switch? When could these devices become commercially viable: 2–5 yr, 5–7 yr, 7–10 yr, 10+ yr?

Category D: Packaging and Passive Devices

1. Are there any promising innovations in passive components or packaging materials and methods that could improve WBG performance, efficiency, lifetime, or lower costs that were not mentioned in this section? If so, please detail these technologies, including the key breakthroughs and/or improvements they offer, key challenges to their commercialization and adoption, and potential solutions. Please provide references to support your suggestions.
2. What is the largest barrier to adoption of soft magnetic composites into advanced passive components for power electronics? What are the most promising ways of overcoming this barrier?
3. What material, design, or manufacturing innovations are needed to enable wider adoption of double-sided cooling technologies?
4. Are there any major innovations in heterogeneous integration of power electronics components and modules with traditional microelectronics that could bring significant performance or improvements to the industry? If so, what are they and what are their current challenges to development and adoption?

Category E: Techno-Economic and Life Cycle Analyses for WBG Power Electronics

1. What gaps currently exist in existing data for understanding the lifecycle impacts of WBG power electronics? Lifecycle impacts include embodied energy, embodied carbon, total material use, and so on of WBG devices and systems.
2. What information, or estimates (e.g., energy savings) related to WBG power electronics technologies that life cycle assessment analysis could provide would be most useful in fostering increased adoption of WBG technologies?
3. Are there any cross industry connections to be created or strengthened that would be especially impactful in increasing or updating the understanding and awareness of the techno-economic and lifecycle impacts of WBG power electronics compared to silicon-based power electronics?

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Category F: Education and Workforce Development for the WBG Power Electronics Industry

1. Does the strategic framework adequately address the power electronics workforce needs? If not, what additional education or training programs should be considered?
2. What specific skills and or competencies are most critical for the future WBG workforce?

Request for Information Response Guidelines

Responses to this RFI must be submitted electronically to AMMTOPowerElectronics@hq.doe.gov no later than 5:00 p.m. (Eastern Time) on Friday, April 11, 2025. Responses must be provided as attachments to an email. It is recommended that attachments with file sizes exceeding 25 megabytes be compressed (i.e., zipped) to ensure message delivery. Only electronic responses will be accepted.

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

Please provide the following information at the start of your response to this RFI:

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

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