U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

DE-FOA-0002161: Request for Information (RFI) on "DRAFT Research and Development Opportunities Report for Windows"

DATE: June 1, 2020
SUBJECT: Request for Information (RFI)

Description

The United States (U.S.) Department of Energy (DOE) Building Technologies Office (BTO) is seeking input from the public about its DRAFT Research and Development Opportunities (RDO) Report for Windows. In particular, BTO is interested in feedback on planned technical objectives, technical targets, tools, and overall research and development (R&D) activities and estimates of program impacts.

Background

In 2019, buildings accounted for 39.2% of total U.S. primary energy use, with electricity use accounting for 71.1% of building primary energy use. Much of this energy was used to maintain the indoor environment so that building occupants were comfortable. The building envelope consists of transparent and opaque elements that serve as a controllable barrier to maintain the indoor conditions regardless of undesirable external conditions. The envelope also allows the movement of light, air, and other transfers with the external environment that may be beneficial to occupants. The building envelope can be managed to leverage desirable external environmental conditions and mitigate the influence of undesirable conditions reducing the need for space conditioning and artificial light. As a result, lighting and heating, cooling, and ventilation equipment use less energy.

The U.S. Department of Energy (DOE) Building Technologies Office's (BTO) Emerging Technologies (ET) program supports R&D for technologies, systems, and software tools that can contribute to reductions in building energy use. ET funding is distributed competitively through solicitations (i.e., Funding Opportunity Announcements), which in general are open to applications from industry, academia, national laboratories, and other entities. The RDO report focuses on R&D for windows and window system technologies and aims to provide guidance for BTO's investments in developing the next generation of high-performance, affordable, cost-competitive windows, as well as integrated daylighting and shading technologies, in partnership with industry and researchers. Furthermore, the RDO report addresses areas for DOE investment in software and design tools that translate sophisticated and complex physics into easy-to-use energy performance and optimization methods used by industry and other stakeholders for implementation activities that go beyond DOE's direct area of responsibility.

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Windows are generally responsible for around 10% of energy use in buildings, but impact about half of the end uses. Window energy impacts are highly variable, and are affected by climate, building vintage, window and glazing characteristics, window/wall ratios, and other factors. However, windows have a much greater impact on occupant comfort, and on peak electricity and natural gas use. Comfort is a major concern in cold climates, where poorly insulated windows create extreme radiant discomfort and generate cold drafts from air dropping across the surface of the glass. Many occupants report that it feels as if the windows are open or have very large edge gaps. In hot summers, occupants in the perimeter zones of buildings with static glass optical properties may be uncomfortably warm even with conventional blinds and shading installed. In addition, accounting for daylighting to consistently provide comfortable indoor lighting can be a challenge in all climates throughout the year on any sunny day and for other bright sky conditions. Highly insulating and dynamic solar control technological solutions can solve these problems in all residential and commercial buildings independent of climates, and have the potential to save more than 4 quads of energy.

Purpose

The purpose of this RFI is to solicit feedback from industry, academia, research laboratories, government agencies, and other stakeholders on BTO's windows R&D and its future directions and priorities. To clarify these, BTO developed the RDO report, which is structured around four key areas. The RDO report identifies opportunities and challenges, technology development, integration, and implementation. BTO is requesting feedback on each of these areas. BTO is also requesting feedback on planned technical objectives, technical targets, tools, and overall R&D activities and estimates of program impacts. BTO will not develop a FY20 Funding Opportunity Announcement (FOA) based on the feedback from the RFI. This RFI includes guidance on how to provide feedback that will inform updates to the RDO report itself, and ultimately, the strategic direction of the portfolio moving forward.

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.

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 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

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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.

Proprietary Information

Because information received in response to this RFI may be used to structure future programs and FOAs and/or otherwise be made available to the public, **respondents are strongly advised to NOT include any information in their responses that might be considered business sensitive, proprietary, or otherwise confidential.** If, however, a respondent chooses to submit business sensitive, proprietary, or otherwise confidential information, it must be clearly and conspicuously marked as such in the response.

Responses containing confidential, proprietary, or privileged information must be conspicuously marked as described below. Failure to comply with these marking requirements may result in the disclosure of the unmarked information under the Freedom of Information Act or otherwise. The U.S. Federal Government is not liable for the disclosure or use of unmarked information, and may use or disclose such information for any purpose.

If your response contains confidential, proprietary, or privileged information, you must include a cover sheet marked as follows identifying the specific pages containing confidential, proprietary, or privileged information:

> **Notice of Restriction on Disclosure and Use of Data:**
> Pages [List Applicable Pages] of this response may contain confidential, proprietary, or privileged information that is exempt from public disclosure. Such information shall be used or disclosed only for the purposes described in this RFI DE-FOA-0002161. The Government may use or disclose any information that is not appropriately marked or otherwise restricted, regardless of source.

In addition, (1) the header and footer of every page that contains confidential, proprietary, or privileged information must be marked as follows: “Contains Confidential, Proprietary, or Privileged Information Exempt from Public Disclosure” and (2) every line and paragraph containing proprietary, privileged, or trade secret information must be clearly marked with double brackets or highlighting.

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

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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: Opportunities and challenges

(1) Please provide feedback on how BTO has characterized the current window market, past successes, and barriers to pursuing high-performance windows.
   a. Commercial fenestration lags behind the residential sector in low-e glass and high-performance frames market penetration. What activities should DOE pursue to address this?
   b. What activities, beyond system-level approaches, should DOE pursue to support the integration of high-performance windows in low energy and zero energy buildings?

(2) Please provide any additional input on key opportunities and challenges that are important for BTO to better understand, and how that information and data should alter BTO's planned R&D activities.

Category 2: Technical development

(3) Please provide feedback on the following technologies and objectives that will offer improved comfort and enable more affordable, high-performance windows (RDO report, Section 3, pages 21 to 35).
   - Highly insulated windows
     - Thin triple-pane windows
     - Vacuum-insulated windows
     - Advanced materials that enable substantially reduce thermal conductance for window frames.
   - Dynamic solar control and daylighting
     - Low-cost, fast-switching dynamic glazings with aesthetically pleasing colors
     - Automated interior and exterior shading attachments
     - Facade technologies that can help increase natural daylight into spaces while minimizing thermal loads
   - Advanced facades
     - Window integration with electric lighting and building control systems
     - Control systems that are designed to support automated window systems and are fully compatible with building energy management systems

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(4) Please provide feedback on the detailed discussion of the R&D objectives in the RDO report for the technologies outlined in question 3.
(5) What additional areas should BTO focus on?

Category 3: Technical targets

(6) Technical targets for installed price premiums and energy performance are developed for each of the technical focus areas using a model of building energy use from the current year through 2050. These targets are articulated in Tables 5, 8, and 11 in the RDO report.
   a. *Technical targets, including price premiums and energy performance:* Are these targets achievable in the timeframe specified (by 2030)? If not, what specific areas of R&D or downstream technical support activities would have the greatest potential to increase the probability of achieving the targets? Should BTO establish technical targets beyond 2030? If so, please articulate what future year(s) should be added or used instead and provide a supporting explanation with relevant references.
   b. *Baseline technology cost and performance data sets and assumptions:* Are these assumptions reasonable? If not, please provide alternative assumptions and supporting sources. Are the baseline data consistent with windows currently in new and existing buildings? If not, please provide alternative data that can be used to update the assumptions.

Category 4: Integration

(7) Holistic (systems-level) building design can lead to greater investment in high-performance windows by reducing HVAC capacities and the extent of HVAC distribution systems, thus reducing capital costs while increasing comfort. These changes can also result in energy savings from improved thermal management. What window R&D activities can encourage holistic design and retrofits?
(8) Dynamic window systems can provide demand flexibility that enables buildings to respond to electric grid needs, which can reduce peak electricity demand and might reduce electricity prices and enhance utility bill savings. These technologies might also enhance resilience during power outages. The Windows and Opaque Envelope GEB report details the technology opportunities specifically relevant to providing demand-side flexibility with windows and opaque envelope technologies. The GEB technical report complements the Windows RDO report. What R&D activities, beyond continued work on dynamic windows themselves, are needed to support grid-interactive windows?
(9) What other areas should BTO address in this category?

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Category 5: Implementation

(10) BTO has collaborated with national laboratories to develop expert tools (Section 2.4 of the RDO report) that enable industry to design windows to meet thermal performance requirements with desired optical characteristics more quickly and with lower engineering costs, when compared to the time and costs of iteratively building and testing physical prototypes.
   a. Please provide feedback on the usefulness of the existing tools. Is there a need to expand their capabilities? If so, what changes should receive the highest priority?
   b. Is additional capability needed for integrated window systems, and if so, what exactly would help industry pursue innovative facade systems?

(11) Are there any data, analyses, or information that BTO should act on or be aware of that will accelerate industry's investment in higher-performing window systems and their implementation?

(12) What specific technical activities should BTO pursue that would encourage increased window replacement rates?

(13) In Table 14 of the RDO report, several examples of possible stakeholder implementation activities are presented. Please provide feedback on these examples, including new approaches that can be pursued both independently and potentially in collaboration with BTO.

(14) Are there any additional considerations DOE should be aware of to support implementation or other technical activities that are needed but have not been mentioned?

Category 6: Stakeholder engagement and feedback mechanisms

(15) BTO and its national laboratories periodically conduct workshops to present research results and to seek input from stakeholders. In addition, BTO:
   - Conducts an annual peer review of funded window R&D projects that is open to all stakeholders;
   - Routinely participates in energy rating organization public meetings, such as those held by the National Fenestration Rating Council and the Attachments Energy Rating Council; and
   - Participates and presents at various industry trade association meetings and at standards organization meetings.

   Please provide comments and feedback on the effectiveness of these activities and suggestions of other ways that BTO can engage with stakeholders.

Category 7: Other feedback

(16) Please provide any other feedback related to the BTO windows R&D program.

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Request for Information Response Guidelines

Responses to this RFI must be submitted electronically to BTO_Windows_RDO@ee.doe.gov no later than 5:00pm (ET) on July 20, 2020. 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 10 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. Within the report, topics, barriers, and initiatives are numbered; please include these when responding. Respondents may answer as many or as few questions as they wish.

BTO 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, but not required to provide the following information at the start of their response to this RFI:

- Institution name and website
- Institution type (e.g., university, utility, nonprofit organization, small business, etc.)
- Windows stakeholder type (e.g., researcher, manufacturer, advocacy group)
- Institution contact name and email address

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