

**Report of the Committee of Visitors
for the Basic Energy Sciences
Materials Sciences and Engineering Division**

to the

Basic Energy Sciences Advisory Committee

**Review of Fiscal Years
2018, 2019, 2020, 2021, 2022**

October 23 – 26, 2023

Deliberately blank page

Executive Summary

A Committee of Visitors (COV), under the guidance of the Basic Energy Sciences Advisory Committee (BESAC), reviewed the programs of the Materials Science and Engineering (MSE) Division within the Department of Energy (DOE), Office of Basic Energy Sciences (BES) for the fiscal years (FYs) 2018, 2019, 2020, 2021 and 2022. The COV was chaired by Prof. Frances Hellman. Including the Chair, nineteen members of the committee met virtually to review the management process of BES-MSE on October 23–26, 2023.

The charge to the COV was from Dr. Cynthia Friend, the chair of BESAC. The charge was: (i) For both DOE laboratory projects (Field Work Programs) and grant program, assess the efficacy and quality of the process used to solicit, review, recommend, and document proposal actions and to monitor active projects and programs. (ii) Within the boundaries defined by the DOE missions and available funding, comment on how the award process has affected the breadth and depth of portfolio elements, and the national and international standing of the portfolio elements. In addition to these standard elements, the COV was asked to comment on the diversity, equity, and inclusivity of participation in MSE programs.

The format of the review was similar to those used in the prior COVs. The COV Panels reviewed the three programmatic teams within the MSE Division plus the DOE Established Program to Stimulate Competitive Research (EPSCoR) program. An additional ad hoc panel was formed during the meeting to review the Topical Funding Opportunity Announcement (FOA) program that spans BES with a significant component within MSE.

The COV would like to thank MSE management and all the Division staff and program managers for their engagement with the COV including the advance preparation and assistance during the COV. They all provided timely answers to numerous questions, both programmatic and administrative, including those related to the use of PAMS (the DOE Portfolio Analysis and Management System). This level of participation allowed the COV process to be conducted in an efficient and productive manner.

The COV commends the MSE management and program managers for their dedication and skill. The COV found that the processes by which MSE operates, including the Topical FOAs and EPSCoR programs, are fair, efficient, and professionally implemented, and that they have implemented a noteworthy strategic planning process that enables a balanced and strategic review of all proposals. As a result, the MSE research portfolio is outstanding on a national and international scale.

The findings and recommendations of the five panel reports are compiled and presented in this report, with the full text of the findings, comments, and recommendations of each panel included as Appendices. The COV makes the following major findings and recommendations.

Major findings:

- The portfolio managed by MSE is very large, with exceptional breadth and depth and an excellent and internationally recognized scientific impact in a wide range of important scientific fields. The programs lie centrally within the BES mission to understand, predict, and ultimately control matter and energy at the electronic, atomic, and molecular levels in order to provide the foundations for new energy technologies and to support DOE missions in energy, environment, and national security. The balance of core research areas within

each of the three components of MSE is good (e.g. materials discovery and synthesis, characterization and technique development, discovery and use-inspired research, experiment and theory).

- The award process is objective and fair and has resulted in a portfolio that is world class and reflects current research priorities. The program managers' (PMs) decision processes do an excellent job of balancing the goals of scientific excellence and strategic planning, and of using holistic and thoughtful criteria for evaluations, specifically considering peer review as a vital component but one that needs to be considered in context. PMs go well beyond numerical scores to evaluate proposals holistically, to understand the nuances of reviews, and to integrate programmatic priorities in a consistent and reasonable manner while also being open to new potentially impactful areas not incorporated in existing priorities.
- Communications with the scientific community is excellent, both important and effective, and includes PI meetings, highlights, Roundtables, Basic Research Needs reports, direct feedback to individual PIs, webinars, etc., and has proven highly successful for setting research agenda including Topical FOAs, EFRC calls, etc. These communications enable an excellent combination of "top-down" and "bottom-up" approaches to setting scientific priorities. Decision letters to PIs clearly explain funding decisions. PI meetings are viewed very positively.
- MSE has a notable and important commitment to supporting diversity and inclusion across its portfolio, both of PIs and of reviewers. Listening sessions with minority serving institutions (MSIs), new targeted FOAs (e.g., RENEW, FAIR), attendance at conferences targeted to URM scientists (e.g., NSBP), and the introduction of PIER plans for future proposals all speak to proactive efforts on the part of MSE. The FAIR, RENEW and PIER plans and programs were initiated after the period of time that this COV assessed and hence will be assessed by future COVs, but are noted here as they are evidence of this commitment. Consolidated statistics on the diversity across the portfolio were difficult/ impossible to come by during the COV meeting; these would help the panel assess the depth of success as well as identify potential avenues for improvement.
- There is a strikingly low number of proposals submitted to EPSCOR by MSIs (and potentially to the core programs as well – those statistics were not available to COV).

Major recommendations:

- In light of rising personnel and other research costs and potential flat or nearly flat budgets, maintain portfolio excellence by balancing the number and size of awards.
- The demographic and institutional statistics of all submissions (including pre-proposals) to all programs, as well as awards, should be collected, beyond awarded PI demographics. This should be done in accordance with current and future government directives and in consultation with experts on appropriate wording for each category. This is not an MSE-specific recommendation but should be considered by BES/DOE.
- Workloads of MSE program managers should continue to be assessed to be sure that the appropriate level of staffing support is being provided and that the number of invited full proposals (all submissions, including Topical and targeted FOAs) is optimal to ensure a highly inclusive and world leading portfolio.

- Attention should be paid to career development of PMs, in order to assure the continued recruiting and retaining of PMs with excellent expertise and commitment. They should be provided sufficient travel budget and opportunity to visit PIs and attend conferences including international meetings to stay engaged with state-of-the-art science and to be able to assess the international competitiveness and leadership of DOE programs.
- Reviewer instructions should explicitly include a request that reviewers identify and assess *strengths and weaknesses* in all review criteria specified for a given solicitation (including Scientific Merit of the Project, Appropriateness of the Approach, Competency of Applicant, and Reasonableness of the Budget). This will provide additional valuable information to the PMs and will reduce the impact of inevitable reviewer bias.
- MSE program managers should be commended for their attention to a holistic thoughtful review process. To the extent possible, MSE (and more broadly BES and DOE) should instruct reviewers to focus on assessing likely scientific importance and proposal strengths and weaknesses beyond simple metrics such as publication venue (impact factor) and number of papers published.
- MSE should highlight the role and responsibility of BES for National Laboratory stewardship, including setting programmatic directions with intention to produce great science, laboratory workforce development, and maintenance of scientific expertise in instructions to future COVs.

Table of Contents

Executive Summary	iii
1. Introduction.....	1
2. The Charge to the Committee of Visitors.....	1
3. The Committee Membership	2
4. The Review Process	2
5. Overview of COV Panel Findings	4
6. Overview of COV Panel Recommendations, noting that some of the below are suggestions and some are focused on items that will help future COVs assess MSE.....	7
Appendix I: Charge from the Chair of BESAC, Dr. Cynthia Friend to the Chair of the COV, Professor Frances Hellman	9
Appendix II: COV Members	11
Appendix III: COV Panel Assignments	12
Appendix IV: COV Agenda	13
Appendix V: COV Panel Report Input Template	18
Appendix VI: Summary Report from MDDS Panel	20
Appendix VII: Summary Report from CMMP Panel.....	26
COV PANEL REPORT	26
CMMP Panel: Condensed Matter and Materials Physics	26
BES COMMITTEE OF VISITORS (COV)	26
Reviewing the Materials Sciences and Engineering Division	26
Appendix VIII: Summary Report from SIS Panel.....	32
Appendix IX: Summary Reports from EPSCoR Panel.....	39
Appendix X: Summary Reports from Topical FOA Panel.....	46

1. Introduction

This report documents the findings from a Committee of Visitors (COV) that was assembled under the auspices of the Basic Energy Sciences Advisory Committee (BESAC) to evaluate the processes and programs of the Materials Sciences and Engineering (MSE) Division in the Office of Basic Energy Sciences (BES). The COV met virtually over four days from October 23 – 26, 2023. This was the seventh in the series of COV reviews of the MSE Division; the first held in March 2003, with subsequent reviews in 2006, 2009, 2012, 2015 and 2018. Following the recommendation of the 2018 COV, the review cycle was extended to every five years instead of every three years, a decision with which the 2023 COV concurs. It should be noted that COV meetings during the 2020-2022 pandemic years were held virtually, and their efficiency and effectiveness was noted by MSE, so the 2023 COV met virtually as well. Overall, the 2023 COV viewed the virtual meeting as accomplishing the desired goals, while noting that discussions were somewhat curtailed by the zoom format compared to in person. The meetings were effective and efficient and enabled a number of participants to join who could not otherwise have participated in the COV.

2. The Charge to the Committee of Visitors

The charge to the COV was established in a letter from the Chair of BESAC, Dr. Cynthia Friend to Dr. Frances Hellman, who had agreed to chair the COV. The letter is attached as Appendix I. The charge was to address the operations of the MSE Division and the impact of the program during the fiscal years 2018, 2019, 2020, 2021 and 2022. The components of the Division that the COV was asked to review were:

1. Materials Discovery, Design, and Synthesis Team (includes core research areas [CRAs] Materials Chemistry, Biomolecular Materials, Synthesis and Processing Science),
2. Condensed Matter and Materials Physics Team (includes CRAs Experimental Condensed Matter Physics, Theoretical Condensed Matter Physics, Mechanical Behavior and Radiation Effects, Physical Behavior of Materials),
3. Scattering and Instrumentation Sciences Team (includes CRAs Electron and Scanning Probe Microscopy, Neutron Scattering, X-ray Scattering), and
4. Department of Energy Established Program to Stimulate Competitive Research (DOE EPSCoR) Program. (Noting that this Program is managed by MSE but is DOE wide, extending beyond not just MSE but BES).

Additionally, the COV was asked to review the Topical Funding Opportunity Announcements (Topical FOAs) that are BES-wide with relevance to and impact on MSE.

The COV was asked to focus on the following major elements: (i) For both DOE laboratory projects (Field Work Programs, FWPs) and University grants programs, assess the efficacy and quality of the process used to solicit, review, recommend, and document proposal actions and to monitor active projects and programs. (ii) Within the boundaries defined by the DOE missions and available funding, comment on how the award process has affected the breadth and depth of portfolio elements, and the national and international standing of the portfolio elements. In addition to these standard elements, the COV was asked to comment on the diversity, equity, and inclusivity of participation in MSE programs.

3. The Committee Membership

The COV membership was selected by the COV chair, Dr. Frances Hellman, in consultation with the chair of BESAC and the Division leadership. The members were chosen to represent a cross-section of experts in scientific fields relevant to the activities supported by the MSE Division. Given the size of the Division and the breadth of programmatic areas, a sizable committee was assembled. Four panel leads (one for each Division component shown above) were selected first, then the rest of the COV was selected in consultation with the panel leads, Division leadership, and BES Director Dr. Linda Horton. Attention was paid to the number and type of proposals in each of the programmatic areas, and to selecting members to ensure a balance and expertise coverage for each panel, while recognizing that cross-panel expertise is also valuable. The COV, consisting of 18 members plus the chair, was divided among the 4 panels for the reading and evaluation of the documentation. A balance was achieved between researchers who currently receive funding from MSE (15) and those that do not (4), between academic (14) and national laboratory (5) members, and including representatives from EPSCoR states (4), and had 9 women and 10 men (non-binary representation is not known).

The following COV members served as the leaders for the Panels: Rachel Segalman (Materials Discovery, Design and Synthesis), John Mitchell (Condensed Matter and Materials Physics), Zhi-Xun (ZX) Shen (Scattering and Instrumentation Sciences), and Theda Daniels-Race (EPSCoR). The Panel Leads and COV chair met via zoom on a regular basis with MSE leadership in the months leading up to the COV meeting to develop the list of COV members and to develop a plan for the COV meeting including creating its agenda. An additional panel that convened on days three and four of the COV meeting was created with Frances Hellman serving as leader and panelists chosen from among the 18 other COV members to cover the important activities of Topical FOAs which span BES with a significant component within MSE. A full listing of the COV members and their panel assignments is given in Appendix II and Appendix III, respectively.

4. The Review Process

The COV assembled virtually via Zoom at 11:00 AM EDT on Monday, October 23, met for approximately six hours each day, and adjourned at approximately 4:00 PM EDT on Thursday, October 26. The agenda for the COV is attached as Appendix IV.

Prior to convening, each COV member was supplied with the link to access the MSE Division COV in PAMS that included a comprehensive set of information pertaining to the following: the COV process, the report template, the Charge to the COV, the core research activities of the Division, and a copy of the 2018 MSE Division COV report together with the response from BES. The advance briefing for the Chair of the Committee along with the documents provided to the panel leads preceding the COV were important in ensuring an effective and efficient review process. A tutorial on how to use PAMS (the DOE Portfolio Analysis and Management System) for the COV was also conducted one week prior to the COV. Additional information was also supplied to each member during the COV, including copies of the plenary presentations, a more detailed overview of each of the Division's programs, and a summary of the DOE-wide EPSCoR program, which is managed by MSE. There is a dedicated program manager in MSE who oversees the EPSCoR

program, including proposal solicitation, proposal review, award recommendations and documentation, and oversight of active awards. This MSE EPSCoR program manager works closely with other program managers across the Office of Science and in DOE technology offices, including MSE.

The full COV Agenda is in Appendix IV; the following is a summary of the daily activities. The COV began with a presentation by Dr. Linda Horton, the Associate Director of Science for Basic Energy Sciences, who provided an overview of BES and discussion of the COV charge. This was followed by an overview of the MSE Division by Dr. Andrew Schwartz. The panel members were then presented with details of the overall review process by the COV Chair, Dr. Frances Hellman, before adjourning to their panel break-out rooms.

The first day reading of the COV review material began with an overview of the team programs by the MSE Division Team Leads and the respective program managers. Each panel was given access through PAMS to an electronic set of proposal folders to evaluate the MSE Division award/decline/monitoring process.

For grants, these proposals included both awards and declinations, as well as a mix of decisions that MSE felt were straightforward and those that were less straightforward. Approximately 50-75 proposals were provided per panel, except for EPSCoR (approximately 20). It should be noted that COV panels saw the provided proposals as simply Awarded or Declined without the nuanced programmatic decision types mentioned above (this specific information was requested at one point, but it was determined by Chair Hellman in consultation with MSE leadership that the content of the available documentation was sufficient for the COV and would not be enhanced by this additional subjective information). The panels were free to request any additional materials (including documents for other projects not in the provided list) and information that they felt would help them in their evaluation process. For laboratory-based field work proposals (FWPs), the panels reviewed laboratory triennial reviews for renewals of projects as well as single-proposal reviews for new projects.

The second day was a continuation of documentation reading and included an Executive Session for all COV members to discuss preliminary findings, which the Chair briefed to BES leadership at the end of the day.

At the start of the third day BES presented an overview of the Topical FOA process used during the period under review, focusing on Topical FOA's relevant to MSE, including details of the pre-application review process that spans across the two BES research divisions. Overall there were 12 Topical FOAs during the period of review, with nearly 2000 associated pre-proposals, and almost 800 given approval to write a full proposal. Within the full proposal process (i.e. excluding pre-proposals that are not invited to move forward), there is an overall awarded/decline ration that is significantly lower than MSE overall. Because of the large number of proposals, a particular Topical FOA (Chemical and Materials Sciences to Advance Clean Energy Technologies and Low-Carbon Manufacturing) was suggested by MSE Director Schwartz and agreed on by chair Hellman as providing a good relevant example of the process,

which provides an important component of MSE funding. A separate review panel was constituted from existing COV members to review this Topical FOA process, led by Hellman; these three COV members began reviewing a selection of awarded and declined proposals. The COV members of the other four panels completed their readings and those four panels refined their findings and recommendations, including initial drafting of these.

At the start of the fourth day, in response to questions from COV members and a request from chair Hellman, BES presented an overview of DEI efforts across the DOE Office of Science, including the implementation of Promoting Inclusive and Equitable Research (PIER) Plans for all funding opportunities starting in FY23, which is beyond the reviewed period for this COV.

BES staff members provided additional information and were available throughout the week to answer COV panel questions as they arose. The COV members were tasked by the Chair with drafting panel reports that included findings and recommendations. At the end of day four, the COV Chair, panel leads, and many COV members presented each panel's findings and recommendations to BES management, MSE Division management, and the MSE Division program managers.

The reports from the panels are included in Appendix VI - Appendix X, including findings, comments, and recommendations that are specific to each sub-area within MSE. In the next two sections are a Summary of the COV panel findings and a Summary of COV Panel Recommendations.

5. Overview of COV Panel Findings

- The portfolio managed by MSE is very large, with exceptional breadth and depth and an excellent and world-wide scientific impact in a wide range of important scientific fields. The programs lie centrally within the BES mission to understand, predict, and ultimately control matter and energy at the electronic, atomic, and molecular levels in order to provide the foundations for new energy technologies and to support DOE missions in energy, environment, and national security. The balance of core research areas within each of the three components of MSE is good (e.g. characterization and technique development, discovery and use-inspired research, experiment and theory, synthesis and materials discovery).
- MSE has taken an active and systematic approach to strategic planning for each of the portfolios within the Division. There is some variability in the level of detail and specificity in the scientific directions, but the quality of all is high.
- The portfolio includes both national lab and university projects, which require slightly different processes to steward, but both are well managed and the overall quality and scientific merit of both are very high, and generally world leading. Funded PIs, both at universities and in national labs, are frequently leaders in their sub-field, and new investigators and science thrusts are added continuously by the MSE program managers (PMs) in response to the shifting scientific landscape as well as strategic priorities.

- Forefront developments in characterization science and infrastructure and in development of new materials supports the work of all major science funding agencies (NIH, NSF, DOD, DOE-EERE) and supports industrial research contributing to international competitiveness in science.
- The MSE program managers are deeply committed and highly knowledgeable about their fields, and are doing an outstanding job in reviewing, recommending, and documenting proposal actions. This is especially notable given the volume of proposal submission and the constraint of staffing.
- The award process is objective and fair and has resulted in a portfolio that is world class and reflects current research priorities. The program managers (PMs) decision processes do an excellent job of balancing the goals of scientific excellence and strategic planning, and of using holistic and thoughtful criteria for evaluations, specifically considering peer review as a vital component but one that needs to be considered in context. PMs go well beyond numerical scores to evaluate proposals holistically, to understand the nuances of reviews, and to integrate programmatic priorities in a consistent and reasonable manner while also being open to new potentially impactful areas not incorporated in existent priorities.
- The award process is efficient, and decisions are rendered in a timely manner. The process of soliciting white papers from PI's and the feedback process that follows between PI's and PMs is valuable and establishes efficiency by reducing the burden for both PIs and reviewers. PMs are commended for their work maintaining reasonable proposal decision times during staff shortages and disruptions from the Covid pandemic, and for documenting the proposal evaluation process.
- Feedback to National Lab PIs on progress reports is useful, but generally not given to university PIs.
- The Early Career Program (in both universities and national labs) is important, well handled, and has had some notable successes in supporting excellent early career scientists.
- Reviewers are well selected, with appropriate scientific expertise and from diverse backgrounds. As might be expected, the depth of reviews varies, with the vast majority found to be professional and to the point. Reviews provide both constructive criticism of proposals and highlight to the PM the value and potential novelty of the proposed work.
- Communications with the scientific community is excellent, both important and effective, and includes PI meetings, highlights, Roundtables, Basic Research Needs reports, direct feedback to individual PIs, webinars, etc., and has proven highly successful for setting research agenda including Topical FOAs, EFRC calls, etc. These communications enable an excellent combination of "top-down" and "bottom-up" approaches to setting scientific priorities. Decision letters to PIs clearly explain funding decisions. PI meetings are viewed very positively.
- MSE has a notable and important commitment to supporting diversity and inclusion across its portfolio, both of PIs and of reviewers. Listening sessions with MSIs, targeted FOAs (e.g., RENEW, FAIR), and attendance at conferences targeted to URM scientists

(e.g., NSBP), and the introduction of PIER plans for future proposals all speak to proactive efforts on the part of MSE, although these programs are not yet part of the proposals being reviewed. Consolidated statistics on the diversity across the portfolio were difficult/impossible to come by during the COV meeting; these would help the panel assess the depth of success as well as identify potential avenues for improvement.

- The Topical FOA process and resulting awards provide an excellent additional route to MSE impact on science, enabling excellent science that addresses interdisciplinary critical national needs in a timely way. The review process, including white papers, is excellent, although timing is challenging due to short timelines. The diversity of PIs in this program is notably high.
- The DOE-wide EPSCOR program managed by MSE covers a large range of scientific disciplines and mission priorities and has similar positive qualities to the rest of the MSE portfolio, including the high quality of awarded proposals. The awards are consistent with the goals of the EPSCoR program, current research priorities, and the missions of the program, division, BES, and DOE; decisions appear to take into consideration that larger institutions with greater research infrastructure may inhabit the same EPSCoR geography as smaller and/or under-resourced schools, particularly crucial for meeting the “spirit” and purpose of EPSCoR. The EPSCOR PM does an excellent job finding a broad pool of experts for reviewing, an especially challenging task for a program of such scope, and effectively and efficiently judges the quality of proposals based on detailed assessment of reviewers’ comments rather than their ranking scores. The additional review questions for the EPSCoR programs are generally helpful, but some reviewers ignore unique aspects of these programs or have expectations inconsistent with the purpose of the programs themselves. The time between pre-application response and full application due dates is sometimes as short as five weeks, which puts an undue burden on PIs without institutional support to coordinate a multi-PI proposal.
- EPSCOR funding *success rates* for MSIs (minority serving institutions: ANNHs, HBCUs, HSIs) are commensurate with the total EPSCoR program, but historically these numbers have been low, and monitoring is warranted (noting that these statistics were collected by hand for this EPSCOR review and are not collected overall in MSE). COV recognizes that the majority of MSI-serving institutions are not in EPSCOR states, and that a number of EPSCOR states have no MSIs. The recent FAIR and RENEW initiatives are steps in the right direction, although COV recognizes that the goals of the EPSCOR program are distinct from those of FAIR and RENEW. The distribution of EPSCoR funds by program (roughly 2:2:1 for Implementation, National Laboratory Partnership, and Early Career programs, respectively) is appropriate for achieving the goals of recruiting new PIs, improving research infrastructure, and supporting ambitious/high-risk multi-PI work in research-funding underrepresented states.
- The Topical FOA process has led to important strategic scientific awards and has similar positive qualities to the rest of the MSE portfolio, including very high-quality funded proposals, while meeting both foundational research goals and national strategic priorities, and is thus viewed as highly successful. The pre-proposal review process is effective and essential to enable focus on the most compelling and responsive proposals, to manage PM workload, and to limit the demand on the scientific

community (both potential investigators and reviewers). There is good balance between established world-leading PIs and likely future leaders and diversity is impressive. Short timelines are challenging.

6. Overview of COV Panel Recommendations, noting that some of the below are suggestions and some are focused on items that will help future COVs assess MSE.

- Ensure that strategic planning for all research components of MSE continues to be updated and in some cases deepened (see further notes in panel reports).
- Given flat or near flat budgets and increasing costs of research personnel (graduate students and postdocs) and journal publication charges, assess trade-off between fewer awards and reduced buying power of each award.
- The strikingly low number of proposals submitted by MSIs to EPSCOR (and potentially to the core programs as well – those statistics were not available to COV) is concerning and requires further thought for significant and lasting progress to occur. Statistics for pre-proposals as well as full proposals and awarded proposals are important.
- Many specific suggestions to increase the fairness of EPSCOR program reviews and to increase the number of effective EPSCOR submissions from under-resourced EPSCOR institutions are suggested in that panel report and should be considered.
- The demographic and institutional statistics of submissions (including pre-proposals) to all core programs should be collected and be part of future COV considerations, beyond awarded PI demographics (the EPSCOR statistics were assessed by hand).
- Gender non-binary (and other LGBTQ+) statistics may soon be required by Congress; DOE should consider gathering this info as part of PI (and other personnel) demographics as well, specifically consulting with experts on appropriate wording beyond female, male, other.
- While PIER plans were not part of the present COV review, COV suggests that expectations and evaluation criteria for now-required PIER plans be developed in consultation with the scientific community, particularly to differentiate what DOE calls workforce development from outreach as typically expected in NSF proposals.
- Workloads of PMs should be assessed and self-assessed to be sure that the appropriate level of staffing support is being provided and that the number of invited full proposals (all submissions, including Topical FOAs) is optimal (to not miss strong proposals but not overload the PMs).
- Consider expanding the reviewer base to include historically under-represented sectors such as MSI and EPSCOR institutions and FAIR and RENEW applicants. Consider a website portal for recruiting potential reviewers (e.g., as NASA does <https://informal.jpl.nasa.gov/reviewer/Form>)
- The quality of the MSE program relies on the continued recruiting and retaining of PMs with expertise and commitment. To ensure this, consider career development for PMs, particularly but not exclusively early career PMs, such as expanding PM professional travel opportunities, including more site visits to laboratories, user facilities and user meetings, and universities, perhaps ‘micro-sabbaticals’ for PMs to spend a week or more immersed in a topic of strategic interest to the portfolio, and attendance at national conferences and smaller thematic meetings (e.g., Gordon Conferences).
- Increase feedback to university PIs on progress, similar to those for lab PIs.
- Increase communication with community about MSE strategic priorities (beyond the

web site), e.g., by webinars, presentations at major conferences, disseminating slides such as those used for the COV, PI meetings, reconstituting the BES-MSE Materials Council, hosting a colloquium series in Germantown, holding topical retreats for BES personnel with invited speakers.

- While recognizing the many values of Topical FOAs, ensure that Topical FOAs are valuable to the core strategic mission and do not negatively impact the core programs.
- Continue to improve the PAMS system to help the PMs efficiently manage their portfolio and to help future COVs effectively review the process.
- Ask reviewers explicitly *for strengths and weaknesses* in all four criteria that DOE asks about (Scientific Merit of the Project, Appropriateness of the Approach, Competency of Applicant, and Reasonableness of the Budget), which will provide additional valuable information to the PMs and will reduce the impact of inevitable reviewer bias.
- Continue attention to review criteria, and particularly to holistic review of proposals, and direct reviewers to avoid excessive attention to specific questionable metrics such as the impact factor of the journal in which the research appeared or the number of papers rather than the impact of the research itself. Different types of work result in different relevant metrics, e.g., press releases, intellectual property, and popular magazines, as well as invited talks, workshops, summer schools.
- Provide a brief justification for funded proposals and denials for Topical FOAs (into PAMS) to help manage and assess the Topical FOA program by COV.
- Continue attention to supporting high risk/high reward and novel ideas that don't align with identified strategic priorities; these may receive mixed reviews but could lead to future strategic opportunities. Notes on the assessment of awarded proposals using these types of criteria would facilitate future COV reviews and monitoring of MSE attention to these categories.
- Continue attention to balance of portfolio: discovery and use inspired research; Early Career, Mid-Career, and experienced researchers; core programs and new initiatives (e.g. QIS); high-risk/high reward projects and projects that propose incremental yet impactful advances in fundamental science; creating innovative new infrastructural capabilities and increasing infrastructural capacity to measure new materials. Notes on the assessment of awarded proposals using these types of criteria would facilitate future COV reviews and monitoring of MSE attention to these categories.
- Consider how to help user facilities support newly awarded early career scientists get the beam time they need to achieve their goals.
- Highlight in instructions to future COVs the role and responsibility of BES for National Laboratory stewardship, including setting programmatic directions with intention to produce great science, laboratory workforce development, and maintenance of scientific expertise.

Appendix I: Charge from the Chair of BESAC, Dr. Cynthia Friend to the Chair of the COV, Professor Frances Hellman



October 9, 2023

Professor Frances Hellman
Department of Physics
University of California Berkeley

Dear Professor Hellman,

The Basic Energy Sciences Advisory Committee (BESAC) has been charged by the Department of Energy Office of Science to assemble a Committee of Visitors (COV) to review the management processes for the Materials Sciences and Engineering Division of the Basic Energy Sciences (BES) program. Thank you for agreeing to chair this BESAC COV panel. Under your leadership, the panel should provide an assessment of the processes used to solicit, review, recommend, and document proposal actions and monitor active projects and programs.

The panel should assess the operations of the Division's programs over the fiscal years 2018-2022. The panel may examine any files from this period for both DOE laboratory projects and university projects. You are asked to review the following components of the Division:

1. Materials Discovery, Design and Synthesis (MDDS)
2. Condensed Matter and Materials Physics (CMMP)
3. Scattering and Instrumentation Sciences (SIS)
4. DOE Established Program to Stimulate Competitive Research (DOE EPSCoR)

You will be provided with background material on these program elements prior to the meeting. The COV is scheduled to take place virtually October 23-26, 2023. A presentation to BESAC is requested at its December 12, 2023, meeting (to be held virtually). Following acceptance of the report by the full BESAC committee, the COV report with findings and recommendations will be presented to the Director of the Office of Science.

The panel should consider and provide evaluation of the following major elements:

1. For both the DOE laboratory projects and the university projects, assess the efficacy and quality of the processes used to:

5715 Mesmer Ave, Los Angeles, CA, 90230 · (424)353-8800 · kavlifoundation.org



- a. solicit, review, recommend, and document proposal actions and
 - b. monitor active projects and programs.
2. Within the boundaries defined by DOE missions and available funding, comment on how the award process has affected:
 - a. the breadth and depth of portfolio elements, and
 - b. the national and international standing of the portfolio elements.

In addition to these standard elements, the Office of Science has requested that the COV comment on the diversity, equity, and inclusivity of participation in MSE programs.

If you have any questions regarding BESAC or its legalities, please contact Kerry Hochberger, Office of Basic Energy Sciences at 301-903-7661 or by e-mail at kerry.hochberger@science.doe.gov. Teresa Crockett, the Program Analyst for Basic Energy Sciences, will provide logistical support for the COV meeting. She may be contacted by phone at 301-903-5804 or by email at teresa.crockett@science.doe.gov. For questions related to the Materials Sciences and Engineering Division, please contact Andrew Schwartz at 301-903-3535 or by email at andrew.schwartz@science.doe.gov.

Sincerely,

Dr. Cynthia Friend, Chair
Basic Energy Sciences Advisory Committee

cc: T. Crockett
K. Hochberger
L. Horton
A. Schwartz

5715 Mesmer Ave, Los Angeles, CA, 90230 · (424)353-8800 · kavlifoundation.org

Appendix II: COV Members

BES Materials Sciences and Engineering Division 2023 Committee of Visitors Panel Membership Roster

Last Name	First Name	Affiliation
Bent	Stacey	Stanford University
Cooper	Valentino	Oak Ridge National Laboratory
**Daniels-Race	Theda	Louisiana State University
Delfyett	Peter	University of Central Florida
Eom	Chang-Beom	University of Wisconsin-Madison
Frano	Alex	University of California, San Diego
Guggilla	Padmaja	Alabama A&M University
Hartley	Scott	Miami University
Hayes	Dugan	University of Rhode Island
*,**Hellman	Frances	University of California, Berkeley / Lawrence Berkeley National Laboratory
Huq	Ashfia	Sandia National Laboratories (CA)
Kilina	Svetlana	North Dakota State University
Kumar	Sanat	Columbia University
Lau	Jeanie	Ohio State University
Liu	Andrea	University of Pennsylvania
**Mitchell	John	Argonne National Laboratory
Olsen	Brad	Massachusetts Institute of Technology
**Segalman	Rachel	University of California, Santa Barbara
**Shen	Zhi-Xun (ZX)	Stanford University / SLAC National Accelerator Lab

* COV Chair ** Panel Leads

Appendix III: COV Panel Assignments

**Basic Energy Sciences Advisory Committee
Committee of Visitors for the
Materials Sciences and Engineering (MSE) Division**

COV Chair: Frances Hellman

MDDS Panel	Materials Discovery, Design and Synthesis Biomolecular Materials, Materials Chemistry, Synthesis and Processing			
Panel Lead: Rachel Segalman	Panel Members			
	Stacey Bent	Scott Hartley	Sanat Kumar	Andrea Liu
CMMP Panel	Condensed Matter and Materials Physics Experimental Condensed Matter Physics, Mechanical Behavior and Radiation Effects, Physical Behavior, Theory Condensed Matter Physics			
Panel Lead: John Mitchell	Panel Members			
	Valentino Cooper	Chang-Beom Eom	Padmaja Guggilla	Jeannie Lau
SIS Panel	Scattering and Instrumentation Sciences Electron and Scanning Probe Microscopies, Neutron Scattering, X-Ray Scattering			
Panel Lead: Zhi-Xun (ZX) Shen	Panel Members			
	Alex Frano	Ashfia Huq	Brad Olsen	
EPSCoR Panel	Department of Energy Established Program to Stimulate Competitive Research (DOE EPSCoR)			
Panel Lead: Theda Daniels-Race	Panel Members			
	Peter Delfyett	Dugan Hayes	Svetlana Kilina	
Topical FOA Panel	Chemical and Materials Sciences to Advance Clean Energy Technologies and Low-Carbon Manufacturing			
Panel Lead: Frances Hellman	Panel Members			
	Andrea Liu	Chang-Beom Eom	Alex Frano	

Appendix IV: COV Agenda

Basic Energy Sciences Advisory Committee
Committee of Visitors for the
Materials Sciences and Engineering (MSE) Division

Virtual Meeting

October 23 -26, 2023

11am to 5pm each day (all times Eastern)

Preliminary Activities

Time	Activity	Description
October 16, 11:00 AM – 12:30 PM ET	Pre-COV Meeting (will be recorded) https://science- doe.zoomgov.com/j/1605722931?pwd=ZzJleG9idW4rc1pBSjc0bDB1eFhPd09 Meeting ID: 160 572 2931 Passcode: %d6+wsQ9	PAMS Orientation Discussion of COV logistics, expectations, and goals
Week of October 16	Background material available to COV	Uploaded into PAMS COV module

This agenda identifies COV activities (reading documentation, deliberating on findings and recommendations, drafting reports, and interacting with BES staff). Except for presentations on the first day, the times are flexible and may be modified by the COV leads as needed throughout the week.

Monday, October 23, 2023. (All Times Eastern Daylight Time)

Time (ET)	Activity	Description	Participants
10:45 AM	Zoom connections available		All
11:00 AM	Introductions, Welcome and Charge to the Committee	Presenter: Cynthia Friend, <i>Kavli Foundation and Chair of Basic Energy Sciences Advisory Committee</i>	All
11:15 AM	Review presentations/Q&A: <ul style="list-style-type: none"> Basic Energy Sciences welcome MSE Division overview 	Presenters: <ul style="list-style-type: none"> Linda Horton, <i>Associate Director, Office of Basic Energy Sciences</i> Andy Schwartz, <i>Division Director, Materials Sciences and Engineering</i> 	All
12:15 PM	Instructions and Review of Schedule	Presenter: Frances Hellman, <i>COV Chair</i>	All
12:45 PM	Break and move to breakout sessions	15-minute break; Return to Zoom breakout session	
1:00 PM	Panel breakout sessions: <ul style="list-style-type: none"> MDDS: Materials Discovery, Design and Synthesis CMMP: Condensed Matter and Materials Physics SIS: Scattering and Instrumentation Sciences EPSCOR: Established Program to Stimulate Competitive Research (DOE EPSCoR) 	<p>Session begins with a brief overview of the team and its programs by the team lead (10 mins + 10 mins Q/A)</p> <p>COV members begin work on reviewing material</p> <p>BES staff available in the zoom breakout room to address questions and provide assistance with PAMS</p>	COV, BES, ORISE
3:30 PM	Panel Discussions	Each panel reconvenes to discuss findings so far	COV, ORISE
4:30 PM	Check-in Meeting between COV Chair and Panel Leads (panel breakout sessions continue)	Discuss relative progress in panels and observations from discussions and panel check lists/reports; consider any course corrections	COV Chair and Panel Leads; BES leadership if requested
5:00 PM	Adjourn for the day	Zoom ends for the day; panelists can continue to work in PAMS and offline; BES staff available to address questions	

Tuesday, October 24, 2023

Time (ET)	Activity	Description	Participants
11:00 AM	Panels breakout sessions reconvene	COV members continue reading, discussing, and completing panel check lists and panel reports; BES staff available by zoom, email or phone to address questions	COV, ORISE
2:00 PM	Panel Discussions	Each panel reconvenes to discuss preliminary findings/recommendations for 3:30 report out	COV, ORISE
3:15 PM	Executive Session for Chair and Panel Leads	Discuss preliminary findings for each panel	COV Chair and co-chairs
3:45 PM	Executive Session for all COV members – report outs from panels leads on prelim. findings	COV discusses preliminary findings	COV, ORISE
4:30 PM	Executive Session for Chair and Panel Leads	Discuss if other work is needed (reading new material, bringing new eyes to old material, ...) and next steps	COV Chair and co-chairs
4:45 PM	Check-in Meeting with Chair and BES Senior Management	Brief BES Senior Management on progress and have opportunity to ask questions and obtain clarification on any issues	COV Chair, BES leadership
5:00 PM	Adjourn for the day	Zoom ends for the day, panelists can continue to work offline, BES staff available by email or phone	

Wednesday, October 25, 2023

Time (ET)	Activity	Description	Participants
11:00 AM	COV Executive Session	Discuss plan for the day – more time for additional reads to resolve any issues or move on to finalizing panel findings. Then draft panel recommendations, addressing the Charge topics. BES Presentation of Topical FOA process	COV, All BES
11:30 AM	Panel breakout sessions	Decide on panelist to read Topical FOA proposals. Topical FOA panel meets separately to read/discuss Continue reading to finalize/update panel reports; BES staff available by zoom, email or phone to address questions	COV
2:30 PM	Panel Discussions	Each panel reconvenes for discussion	COV
3:30 PM	COV Executive Session	Feedback from Topical FOA “panel” Discuss panel reports, identify key findings and recommendations	COV BES available if needed
5:00 PM	Adjourn for day		

Thursday, October 26, 2023 (Details to be updated based on prior day progress)

Time (ET)	Activity	Description	Participants
11:00 AM	Discussion of DEI and Download Clean-up (Main Zoom Room)	BES will discuss removal of downloaded files from personal computers	COV, BES
11:15 AM	Original Four Panels – Writing Sessions (Topical FOA panel convenes at 12:00 noon)	COV Members work on drafting panel reports (findings and recommendations)	COV
1:30	COV Executive Session	COV Leads discuss findings and recommendations and brief BES and MSE Leadership	COV BES AD; MSE DD/TLs
2:30	Closeout Session with COV and BES Staff (Main Zoom Room)	Presentation of key findings and recommendations by COV Leads	COV Members, All BES
No later than 4PM	Adjourn		

Appendix V: COV Panel Report Input Template

REPORT INPUT TEMPLATE

BES COMMITTEE OF VISITORS (COV) Reviewing the Materials Sciences and Engineering
Division Fiscal Years 2018, 2019, 2020, 2021, and 2022

Program: _____

Charge to the COV:

I. For both the DOE laboratory projects and the university projects, assess the efficacy and quality of the processes used to:

- (a) solicit, review, recommend, and document proposal actions and
- (b) monitor active projects and programs.

II. Within the boundaries defined by DOE missions and available funding, comment on how the award process has affected:

- (a) the breadth and depth of portfolio elements, and
- (b) the national and international standing of the portfolio elements.

I. EFFICACY AND QUALITY OF THE PROGRAM'S PROCESSES

Based on the COV's study of proposal actions completed within the past five fiscal years, please provide brief findings, recommendations, and comments on the following aspects of the program's processes and management used to:

(a) Solicit, review, recommend, and document proposal actions

Consider, for example:

- consistency with priorities and criteria stated in the program's solicitations, announcements, and guidelines
- adequate number of reviewers for balanced review; use of reviewers having appropriate expertise/qualifications; use of a sufficiently broad pool of reviewers; avoidance of conflicts of interest
- efficiency/time to decision
- completeness of documentation making recommendations

Findings: Comments: Recommendations:

(b) Monitor active project and programs

Consider, for example

- written progress reports
- principal investigators' meetings
- site visits

- interactions at topical, national and other meetings;

Findings:

Comments: Recommendations:

II. EFFECT OF THE AWARD PROCESS ON PORTFOLIOS

Taking into account the DOE, BES, and Division missions, the available funding, and information presented about the portfolio of funded science, comment on how the award process has affected:

(a) the breadth and depth of portfolio elements

Consider, for example:

- the overall quality of the science
- the balance of projects with respect to innovation, risk, and interdisciplinary research
- the evolution of the portfolio with respect to new investigators and new science thrusts
- the relationship of the portfolio to other parts of the Division
- the appropriateness of award scope, size, and duration

Findings: Comments: Recommendations:

(b) the national and international standing of the portfolio elements

Consider, for example:

- the uniqueness, significance, and scientific impact of the portfolio
- the stature of the portfolio principal investigators in their fields
- the leadership position of the portfolio in the nation and the world

Findings:

Comments:

Recommendations:

Appendix VI: Summary Report from MDDS Panel

COV PANEL REPORT Panel: Materials Discovery, Design and Synthesis

BES COMMITTEE OF VISITORS (COV)
Reviewing the Materials Sciences and Engineering Division
Fiscal Years 2018, 2019, 2020, 2021 and 2022

I. EFFICACY AND QUALITY OF THE PROGRAM'S PROCESSES

Based on the COV's study of proposal actions completed within the past five fiscal years, please provide brief findings, recommendations, and comments on the following aspects of the program's processes and management used to:

(a) Solicit, review, recommend, and document proposal actions

Consider, for example:

- consistency with priorities and criteria stated in the program's solicitations, announcements, and guidelines
- adequate number of reviewers for balanced review; use of reviewers having appropriate expertise/qualifications; use of a sufficiently broad pool of reviewers; avoidance of conflicts of interest
- efficiency/time to decision
- completeness of documentation making recommendations

Findings:

- We were provided with and read a cross-section of proposals from the Materials Chemistry, Synthesis and Processing Science, and Biomolecular Materials CRAs. These included new and renewal proposals for single- and multi-PI grants and national lab FWP's that were awarded, declined, or terminal renewals.
- Overall, we found that the proposals received and funded were consistent with the programs' stated priorities and criteria.
- The selection of reviewers was robust with a large number of reviews shown for each proposal (generally 4-6 high quality and detailed reviews/proposal). As a whole, the reviews demonstrate a clear depth in expertise. The reviewers' detailed feedback was carefully considered by the Program Managers in making funding decisions as documented in the Selection and Declination documentation.
- We were particularly impressed with the Early Career proposals overall. It was clear that the funding decisions for EC proposals from the National Labs carefully

integrated scientific reviews with broader considerations regarding the development of the labs' expertise and workforce development.

- The Selection/Declination documents provided a detailed rationale for funding decisions. It is clear that the Program managers go well beyond a numerical score to understand the nuances of the reviews and also integrate programmatic priorities in a consistent and reasonable manner while also being open to new potentially impactful areas not incorporated in existent priorities.
- We commend the Program Managers for their work maintaining reasonable proposal decision times during staff shortages and disruptions from the Covid pandemic.
- We also commend DOE staff for carefully following rigorous procedures in documenting the proposal evaluation process.

Comments:

BES has a clear role and responsibility for National Laboratory stewardship. This stewardship encompasses setting programmatic directions with the intent to not only produce great science but also with an eye towards laboratory workforce development and maintenance of scientific expertise. We would like to suggest that this role be highlighted in the instructions to future COVs as part of the prioritization setting that shapes the decisions that BES makes.

Recommendations:

- Each CRA provided slides summarizing their strategic plans and programmatic priorities. These slides very clearly delineated changes in the programs' directions in a way that is hard to do in the very compressed space available in the Open Call FOA. To better explain programmatic priorities to potential new PIs, we recommend making some of this information available on the programs' websites, in webinars, and in presentations by DOE staff at PI meetings and other venues.
- As noted above, the Selection/Declination statements were detailed and thorough and are very clearly time consuming to prepare. It may be possible to reduce the Program Managers' workloads by streamlining these documents, perhaps by reducing the length of the proposal summaries.

(b) Monitor active project and programs

Consider, for example

- written progress reports
- principal investigators' meetings
- effective interactions between program managers and PIs

Findings:

- The PI meetings, besides providing a mechanism to evaluate the PIs' research, give a great opportunity for the funded PIs to hear the success stories from their peers. The quality of the research presented makes these meetings some of the top workshops in the field.
- The feedback given to the national lab team leaders on the progress reports is very useful. This formal feedback is generally not given to university PIs.

Comments:

The value of the PI meetings is also to facilitate collaborations among PIs and identify challenges and new directions in the research area.

Recommendations:

- We resonate with the past COV report that the feedback to National Laboratories on annual reporting is very helpful. We realize that BES plays an active role in laboratory stewardship, and this is not necessarily possible in academic programs. Still, we feel that if DOE could provide academic PIs with written reports when their productivity is low, or if the project is veering away from the strategic goals of the program, it might better shape the program. We suspect that such informal feedback is provided at PI meetings or in other live settings, but perhaps more formal feedback would benefit project outcomes.
- We recommend *in-person* PI meetings be resumed in all cases. We have found that virtual meetings are less effective than in person meetings, both for information sharing and also for PI/program manager discussions and feedback.
- We encourage program managers to continue to attend national meetings and to actively engage with PIs in these settings.
- We also encourage program managers to attend smaller thematic meetings (e.g., the Gordon Research Conferences) that directly focus on topics core to the program. These meetings are an opportunity for the PMs to meet the broader communities working in sub-fields of critical importance both to broaden participation and also hear longer, deeper dives than are possible at large national meetings.

II. EFFECT OF THE AWARD PROCESS ON PORTFOLIOS

Taking into account the DOE, BES, and Division missions, the available funding, and information presented about the portfolio of funded science, comment on how the award process has affected:

(a) The breadth and depth of portfolio elements

Consider, for example:

- the overall quality of the science
- the balance of projects with respect to innovation, risk, and interdisciplinary research
- the evolution of the portfolio with respect to new investigators and new science thrusts
- the relationship of the portfolio to other parts of the Division
- the appropriateness of award scope, size, and duration

Findings:

- BES-MDDS continues to fund cutting edge, extraordinarily high-quality science across the range of Materials Discovery, Design and Synthesis areas and particularly excels in funding innovative efforts to develop new energy-relevant materials.
- The funded programs address the full range of DOE priorities while also maintaining an appropriate balance of innovation, risk, and fundamental strength.
- BES-MDDS has embarked on an effort to carefully articulate strategic programmatic priorities and use these to formally help shape the portfolio while also continuing to fund great science in *all* energy-related materials design areas. The relationship of these priorities to BES priorities and also to breaking edge versus areas reaching scientific maturities is very well documented.
- There are an impressive number of new investigators in all 3 programs (Materials Chemistry, Synthesis and Processing Science, and Biomolecular Materials), particularly from new, not previously funded institutions.

Comments:

Recommendations:

- The Powerpoint slides we were shown regarding programmatic priorities were excellent and more illustrative than the relatively short phrasing possible in the FOAs and websites. We suggest that MDDS use these slides in PI meetings and webinars to educate their potential PI community. This may help encourage greater participation in new scientific emphasis and bring in new PIs.
- We applaud the degree to which the programmatic priorities and lab stewardship priorities are used to carefully balance the portfolio. We encourage continuation of this obviously important set of considerations in the selection and declination processes. We suggest that sharing the importance of such

considerations with the PI community would greatly benefit the scientific endeavor.

(b) The national and international standing of the portfolio elements

Consider, for example:

- the uniqueness, significance, and scientific impact of the portfolio
- the stature of the portfolio principal investigators in their fields
- the leadership position of the portfolio in the nation and the world

Findings:

- The significance and impact of the Materials, Design and Synthesis (MDDS) portfolio within BES Materials Sciences and Engineering Division is superb. The funded projects in all three programs in BES-MDDS emphasize understanding of materials design and synthesis. The BES-MDDS programs fall centrally within the BES mission to understand, predict, and ultimately control matter and energy at the molecular level.
- The program includes many PIs of very high stature in their respective disciplines within the materials sciences and engineering field, as well as many early career researchers representative of the evolving breadth of the field and new investigators of a wide range of seniorities from a broad range of institutions.
- The program managers are doing an excellent job of recognizing innovative proposals and long-term impact of the funded research.

Comments:

Recommendations:

- We strongly encourage MDDS to continue to evaluate research holistically with an emphasis on fundamental impact rather than simple metrics (e.g., name of the journal and the number of publications).
- Given increased costs of performing research at universities (including recent large increases in the cost to fund graduate students and postdocs across the US), BES should develop a strategy on how to build the best portfolio within the evolving cost constraints. With the capacity to fund fewer researchers per dollar, BES will need to consider how to balance single-PI versus multi-PI, university versus national lab, and new versus continuing projects.
- The portfolio is currently very competitive internationally. Looking forward, several trends have been identified in the report by the BESAC Subcommittee on International Benchmarking, which we expect will help shape some future priorities within BES-MDDS.

Comments on diversity, equity, and inclusivity of participation in MSE programs.

Findings:

- We commend DOE staff for considering DEI issues at all stages of the process, from proposal solicitation, to evaluation, to decisions. We were particularly impressed by recent outreach efforts including the participation of BES in important conferences with large under-represented minority representation to broaden participation in the proposal process. We are also very interested in the new RENEW and FAIR programs and look forward to seeing the impact these programs have on the portfolio.

Comments:

Recommendations:

- While PIER plans were not a part of the proposals evaluated as part of this COV, we commend DOE on better articulating DEI priorities and making them a formal part of the proposal process. We look forward to clarification of DOE expectations, particularly on differentiating workforce development from outreach.
- We note that the collection of demographic data through PAMS is currently problematic, which makes evaluating DEI efforts difficult. This issue was clearly recognized by DOE staff. We encourage them to continue looking for ways to improve reporting rates from award performers.

Appendix VII: Summary Report from CMMP Panel

COV PANEL REPORT

CMMP Panel: Condensed Matter and Materials Physics

BES COMMITTEE OF VISITORS (COV)
Reviewing the Materials Sciences and Engineering Division
Fiscal Years 2018, 2019, 2020, 2021 and 2022

I. EFFICACY AND QUALITY OF THE PROGRAM'S PROCESSES

Based on the COV's study of proposal actions completed within the past five fiscal years, please provide brief findings, recommendations, and comments on the following aspects of the program's processes and management used to:

(a) Solicit, review, recommend, and document proposal actions

Consider, for example:

- consistency with priorities and criteria stated in the program's solicitations, announcements, and guidelines
- adequate number of reviewers for balanced review; use of reviewers having appropriate expertise/qualifications; use of a sufficiently broad pool of reviewers; avoidance of conflicts of interest
- efficiency/time to decision
- completeness of documentation making recommendations

Findings:

- Based on its review of proposal packages, the panel finds that the award process is objective and fair, that the PM decision process is well-supported from the reviews, and that decisions lead to proposals that keep the portfolio at world-class levels and that reflect current research priorities in condensed matter science.
- Reviewers are uniformly well-suited for the reviews and come from diverse backgrounds. As might be expected, the depth of reviews varies, in our view the vast majority are professional and to the point. Reviews provide both constructive criticism of proposals and highlight to the PM the value and potential novelty of the proposed work to condensed matter science.

Comments:

- The size of the portfolio reveals that PM workload as measured by number of projects to manage, proposals to review, etc. is staggering. According to data provided to the panel, in FY18-22, CMMP processed 1180 white papers and 678 proposals. In addition, CMMP participated in evaluating 1857 preapplications and approximately 800 full proposals for the topical FOAs. BES has addressed previous COV concerns over excessive PM workload by hiring additional staff and providing expanded travel budgets. This has been an important and welcomed step.
- The panel commends CMMP for providing leadership training experiences for newer staff.
- Despite these positive actions, the panel remains concerned about both workload and professional development among the staff. The panel wonders if CMMP takes full advantage of detailee programs or whether additional detailees can be onboarded to reduce workload without increasing long-term staffing commitments.

Recommendations:

- Program managers are encouraged to provide as much rigorous detail as possible in declination notifications to PIs, especially those where programmatic priorities are weighted heavily.
- To maintain quality and consistency, the panel recommends that PMs receive ongoing feedback and training on decision-making and best practices for documentation of decisions to ensure transparency and fairness in the process.
- CMMP PMs should find new ways to broaden its base of potential reviewers, emphasizing diversity across multiple axes. The panel sees considerable opportunity space to expand the reviewer base in historically under-represented sectors of the academic research community, i.e., MSI, EPSCOR states/institutions, as well as FAIR and RENEW pre- and full proposal submitters. Reciprocally, this widened contact may lead to a desirable increase in proposal submission from under-represented research institutions. PMs could also explore mechanisms to recruit beyond this limited community. For instance, BES could take inspiration from NASA by providing a website portal for recruiting potential reviewers. (see, for example, <https://informal.jpl.nasa.gov/reviewer/Form>)

(b) Monitor active project and programs

Consider, for example

- written progress reports
- principal investigators' meetings
- site visits
- interactions at topical, national and other meetings;

Findings:

- Annual feedback to progress reports submitted by laboratory programs (as well as EFRCs and similar programs) is a valuable element of active portfolio management. The panel found that for lab FWP annual report feedback that areas of comment focus largely on promoting synergy among members of a project or among projects within a lab MSE portfolio, and to a lesser extent productivity. It seems there is some variation from PM to PM on the assessment of what is satisfactory or unsatisfactory productivity (# of papers, publication venue, etc.), though this may reflect differences in the scientific fields of the projects being reviewed.
- CMMP has many effective and well-received vehicles for communicating with its PI community, including biannual Principal Investigator Meetings, highlights, annual report feedback to FWPs, webinars, etc. The variety and number of such contact mechanisms speaks to the importance both the CMMP and its project leads place on communication, input, and feedback as means to ensure scientific quality and programmatic impact; the panel commends CMMP for this emphasis.
- The CMMP portfolio does an outstanding job of collecting community input via multiple routes, including Roundtables and Basic Research Needs reports, ad hoc input via proposal submissions, Principal Investigator Meetings, and the like. This approach has proven highly successful for setting research agenda, for example Topical FOA, EFRC calls, etc.

Comments:

None

Recommendations:

- The panel notes that while the lab FWPs receive substantive annual feedback on progress, that a similar level of reporting back to university PIs occurs less frequently. As part of active management for all programs in the portfolio, PMs are encouraged to make available annual one-on-one meetings with university PIs to discuss performance evaluation and/or concerns. The panel realizes this represents an additional workload but strongly feels this is of benefit to the project leads, the PM, and the CMMP portfolio as a whole.
- The panel wonders if BES could consider instituting periodic 'office hours' where PIs can visit with their program manager informally to discuss new scientific results, new opportunities and ideas, etc. It is recognized that this would be an additional workload burden and therefore leave the choice of implementation to the PMs.

- In the interest of transparency to lab FWP leaders it is recommended that MSE provide some guidelines to lab POCs of their expectations for satisfactory progress against quantitative metrics, where appropriate. Also, the panel suggests that CMMP continue to evaluate their portfolios holistically, i.e., going beyond publications-related metrics.
- The panel encourages expanded travel opportunities, including more site visits both to laboratories and to universities with significant CMMP footprints. MSE, and perhaps more broadly BES, should consider the possibility of instituting occasional ‘micro-sabbaticals’ for PMs to step away from regular duties and to spend a week or more immersed in a particular topic or topics of strategic interest to the portfolio.

II. EFFECT OF THE AWARD PROCESS ON PORTFOLIOS

Taking into account the DOE, BES, and Division missions, the available funding, and information presented about the portfolio of funded science, comment on how the award process has affected:

(a) The breadth and depth of portfolio elements

Consider, for example:

- the overall quality of the science
- the balance of projects with respect to innovation, risk, and interdisciplinary research
- the evolution of the portfolio with respect to new investigators and new science thrusts
- the relationship of the portfolio to other parts of the Division
- the appropriateness of award scope, size, and duration

Findings:

- The CMMP portfolio is extremely large and broad, comprising four distinct but thematically related branches with both experimental and theoretical activities supported. The panel strongly feels that this breadth is an essential strength of the CMMP portfolio that should be embraced and nurtured.
- The panel commends CMMP and indeed all MSE for undertaking a systematic approach to portfolio strategic planning. The product of this activity is a set of current and future priorities for each of the branches of the team (ECMP, TCMP, PBM, MBRE) in the form of a ‘quad chart.’ However, the panel finds some variability among the branches in the level of detail and specificity presented on the scientific directions.

Comments:

- The panel strongly feels that strategic planning should continue as an integral and ongoing part of the CMMP team. A regular cadence to this process is essential to ensure continual scrutiny and potential refreshing of the portfolio's scientific priorities.
- In the ECMP 'quad chart,' considerable emphasis is placed on microelectronics as a forward emphasis in the portfolio. While ECMP can certainly contribute to this field, the panel expresses some concern that one topic carries this much weight vis-a-vis other possible priorities.

Recommendations:

- The panel recommends that CMMP continue to pursue these approaches and consider refreshing some key BRN reports that are approaching 10 years (e.g., BRN on Quantum Materials from 2016). We also suggest exploring additional formal and/or informal mechanisms for gaining community input into priority research directions. For instance, reconstituting the BES-MSE Materials Council, hosting a colloquium series in Germantown, or holding topical retreats for BES personnel with invited speakers.
- The panel encourages the team lead to make sure that all four branches under CMMP have clearly defined scientific visions for their strategy beyond high level aspirations.
- CMMP is encouraged to explore additional avenues, beyond listing these on the website, for disseminating their strategic priorities to the community; perhaps through webinars, presentations at major conferences, slides such as those provided to the COV panels, etc.

(b) The national and international standing of the portfolio elements

Consider, for example:

- the uniqueness, significance, and scientific impact of the portfolio
- the stature of the portfolio principal investigators in their fields
- the leadership position of the portfolio in the nation and the world

Findings:

- The portfolio of CMMP demonstrates exceptional breadth and depth, which is a testimony to the PM commitment to excellence.
- Spanning both national lab and university projects, the overall quality and scientific merit of CMMP projects is considered by the panel to be very high and in many cases world leading.
- Funded PIs are frequently leaders in their sub-field, and new investigators and science thrusts are added continuously by the PMs in response to the shifting scientific landscape as well as strategic priorities.
- The panel especially calls out the ECRP as a success story.

Comments:

- Despite the many successes, breakthroughs, and innovations of the portfolio, except for a recent one-time 6% uptick in FY 2022, the budget has been largely constant over the past 5 years. The consequent loss of buying power is anticipated to present challenges to the future effectiveness of core CMMP programs (e.g., increased stipend costs due to graduate student unionization).

Recommendations:

- Recognizing that new funding frequently responds to shifting priorities that require targeted Topical FOAs, we encourage CMMP where possible to carefully consider the balance between support for these funding vehicles and core programs, the erosion of which presents a clear and present threat to the well-being of U.S. condensed matter leadership.

Comments on diversity, equity, and inclusivity of participation in MSE programs.

Findings:

- CMMP has a commitment to supporting diversity and inclusion across its portfolio. Listening sessions with MSIs, prioritized FOAs (e.g., RENEW, FAIR), and attendance at conferences targeted to URM scientists (e.g., NSBP) all speak to proactive efforts on the part of MSE through SC to deliver on this commitment.
- Consolidated statistics across the portfolio were difficult or impossible to come by during the COV meeting. Having these available would help the panel assess the depth of success as well as identify potential avenues for improvement.

Comments:

- Although not part of this COV review, the introduction of PIER plans for future proposals is a welcome addition to the portfolio and will help to formalize the commitment at the project level.

Recommendations:

- The panel advises that CMMP, or BES more broadly, formulate and share their expectations and retrospective evaluation criteria for PIER plans well ahead of triennial reviews, renewal proposals, etc. to set expectations on both sides.

Appendix VIII: Summary Report from SIS Panel

COV PANEL REPORT

SIS Panel: Scattering and Instrumentation Sciences

BES COMMITTEE OF VISITORS (COV)
Reviewing the Materials Sciences and Engineering Division
Fiscal Years 2018, 2019, 2020, 2021 and 2022

I. EFFICACY AND QUALITY OF THE PROGRAM'S PROCESSES

Based on the COV's study of proposal actions completed within the past five fiscal years, please provide brief findings, recommendations, and comments on the following aspects of the program's processes and management used to:

(a) Solicit, review, recommend, and document proposal actions

Consider, for example:

- consistency with priorities and criteria stated in the program's solicitations, announcements, and guidelines
- adequate number of reviewers for balanced review; use of reviewers having appropriate expertise/qualifications; use of a sufficiently broad pool of reviewers; avoidance of conflicts of interest
- efficiency/time to decision
- completeness of documentation making recommendations

Findings:

- The program managers are highly knowledgeable about their fields, and are doing an outstanding job in reviewing, recommending, and documenting proposal actions. This is especially notable given the volume of the proposal submission and the constraint of staffing.
- The projects are very consistent with the priority themes of the program in x-ray and neutron scattering, and electron and scanning probe microscopy.
- The program managers are doing an outstanding job of getting high quality reviewers. The number of reviewers (3 – 5) solicited for each proposal is sufficient to make an informed decision. The majority of the proposal reviews are detailed and insightful, with the minority being brief.
- The decisions, taking into account the quality and context of the reviews, are generally consistent with external reviews. Proposers often get a chance to respond to negative comments by the reviewers, which helps with making an

informed decision. The nuances of what is being said in the reviews are documented. The system is fair.

- The process is efficient, and decisions are rendered in a timely manner.
- The process of soliciting white papers from PI's and the feedback process that follows between PI's and PMs is seen as a valuable starting point and establishes efficiency by reducing burden for reviewers.

Comments:

Recommendations:

- The committee enthusiastically praises the hard work, commitment, and professional quality of the program managers and DOE-BES MSED leadership in designing and executing this world-class science and infrastructure program.
- We recommend continuing the process of improving the PAMS system to help PMs efficiently manage their portfolio.
- Continue to use a holistic approach rather than numerical scores as the most effective way to identify the best science. To help PMs to make a decision, in addition to merits and appropriateness already exist, may consider adding a category of "weakness" to the question to reviewers. In this holistic process, the importance of quality program managers is amplified.

(b) Monitor active project and programs

Consider, for example

- written progress reports
- principal investigators' meetings
- site visits
- interactions at topical, national and other meetings;

Findings:

- Given the volume of the proposal submission, and the constraint of staffing, the program managers are doing an outstanding job in managing the programs and projects. The program managers are highly informed about the research in their portfolios, and scientific productivity (e.g., publications) is closely monitored.
- PI meetings and written progress reports are the main mechanism of monitoring active projects at universities. For the labs, there is frequent communication (e.g., monthly calls) between lab manager and program management at DOE-BES MSED. Research highlights are periodically selected and communicated, commensurate with the publications. Site visits are used for triannual lab reviews.
- The PI meetings are currently used as a mechanism to encourage exchange of best practice, discuss latest development and foster collaborations. PIs are strongly supported to pursue their best ideas and a long-term vision.

- Excellent communication between program managers on active projects across different portfolios.

Comments:

- The overall budget trend for SIS is very concerning, being flat for the last five years. The tool development underlying much of the science development is a critical component of the BES program. SIS program managers understand the importance of institutional memory and sustained support for tool development and important but difficult problems. They are doing a good job within the budget envelope, but the budget issue should be addressed.
- The focus of the SIS program naturally bridges between program managers and the scientific community because research tends to be concentrated at user facilities. This provides a powerful pathway for engagement.
- Discovery class science should be a key feature for the BES program. It is important to balance between discovery class science and use-inspired science. Careful balance should also be considered between core programs such as SIS and new initiatives, for example QIS.
- As technology improves, we encourage more flexibility in modalities in organizing meetings with PIs.

Recommendations:

- The program managers should be given more opportunities to meet/travel to continue engaging the community. For SIS, travel to international facilities is also important. User meetings are great venues for engagements. COVID interrupted this travel during the review period but also opened opportunities for participation in virtual meetings.
- Using the number of publications in “high-profile/high impact factor” journals as a metric to judge success of a project should be strongly discouraged. A balanced approach should be taken in evaluating the contribution of work in scientific journals vs press releases, intellectual property, and popular magazines. Publication and archiving of data, especially negative results in open/citable databases (such as failure to confirm a hypothesis or synthesis samples) should be incentivized. Peer reviewed publications and quality of publications, especially thorough scholarly papers, should be emphasized.

II. EFFECT OF THE AWARD PROCESS ON PORTFOLIOS

Taking into account the DOE, BES, and Division missions, the available funding, and information presented about the portfolio of funded science, comment on how the award process has affected:

(a) The breadth and depth of portfolio elements

Consider, for example:

- the overall quality of the science
- the balance of projects with respect to innovation, risk, and interdisciplinary research
- the evolution of the portfolio with respect to new investigators and new science thrusts
- the relationship of the portfolio to other parts of the Division
- the appropriateness of award scope, size, and duration

Findings:

- There is a good match with priority research directions and funded projects. The overall scientific quality of the portfolios is excellent, with reasonable balance among the three priority areas - x-ray scattering, neutron scattering and electron/scanning probe microscopy.
- New technique development is highly valued, including the development of new instruments or new measurements (i.e., sample environments, analysis methods) using existing instruments.
- A reasonable rate of turn-over maintains community continuity and stability while bringing in fresh ideas. Stable funding is particularly important for tool development and its matching with science.
- We note that most ideas being pursued by PI's are inspired by the BRNs also generated often by the same community of PI's. This results in a good match with priority research direction in funded projects. One should be mindful of unintended consequences in discouraging out of box ideas as being considered as "non-strategic".
- Innovative projects are being funded through the open FOAs, the Topical FOAs, and lab-specific FOAs.
- The early career program has allowed the influx of junior researchers in the field and as a result PM's have exposure to a lot of new ideas from these junior researchers allowing PMs to actively encourage junior researchers to submit proposals.

Comments:

- SIS, which is largely focused on instrumentation and its application to science, has additional portfolio considerations related to building infrastructure capability vs. infrastructure capacity. Quite often, the most groundbreaking science is done on routine instruments while new techniques operate comparatively in niche areas. Therefore, it is critical that programs find an appropriate balance between driving new capability and increasing capacity,

supporting a portfolio that is leading in both areas. Examples of capability-building include the design of new instruments and new measurement techniques, while examples of capacity-building include high-throughput instrumentation, real-time analysis, samples environment and decision-making software, and expanding the number of experiments on oversubscribed instruments.

- For facility-based programs, one may consider whether one can jointly award funding and beamtime. The same could be considered for extremely high-risk projects on new facilities.
- For extremely high-risk projects developing/using qualitatively new tools and facilities, different review criteria may be considered.

Recommendations:

- Program managers should continue to balance high-risk/high reward projects with projects that propose incremental yet impactful advances in fundamental science.
- Consistent with prior note on the need of quality program managers, career development of program managers plays an important role in the overall health of the scientific portfolio and should continue as a priority.

(b) The national and international standing of the portfolio elements

Consider, for example:

- the uniqueness, significance, and scientific impact of the portfolio
- the stature of the portfolio principal investigators in their fields
- the leadership position of the portfolio in the nation and the world

Findings:

- DOE-BES has the largest portfolio of strong and sustained support in the fields of characterization and technique development, and its science and infrastructure in this area supports the work of all other major science funding agencies (i.e., NIH, NSF, DOD, DOE-EERE) as well as robust industrial research that contributes to international competitiveness in science and technology. The discovery science with these novel tools supported by the SIS program is a significant component of this strength.
- The outstanding scientific quality of the portfolios is in no small part due to the quality of program management and the program managers.
- The BRN reports play an important role in shaping the direction of the portfolio and resulting advancement of the fields. We encourage this process to continue.

- Many of the forefront developments in neutron, x-ray, electron, and optical scattering, spectroscopy, and imaging have resulted from the research supported by the SIS portfolios.
- World class researchers are funded across the various portfolios. They have won many prestigious awards and are disproportionately recognized as high-level leaders via fellowships in major scientific societies, membership in the National Academies of Sciences or American Academy of Arts and Sciences, and service on influential advisory committees in government, industry, and academia. Younger researchers are on the path to this level of leadership. The SIS program also trains the next generation of graduate students and postdocs in this research area.

Comments:

- Infrastructure investment is key to our ongoing scientific competitiveness, and the U.S. is currently benefiting scientifically, technologically, and economically from investments made over the preceding decades. However, other regions of the world have recently accelerated their investment, equaling and in some cases exceeding the quality of infrastructure available in the U.S. Maintenance of our competitive advantage will require continued, significant investment.

Recommendations:

- Discovery class science and related tool development is the foundation for many of the use-inspired science initiatives. A strong portfolio is critical to the longer-term health and international competitiveness.

Comments on diversity, equity, and inclusivity of participation in MSE programs.

Findings:

- MSE has increased its emphasis on DEI over the past several years including modifications to the proposal requirements to reflect this emphasis.

Comments:

- The wide program undertaken by the office of science and also BES-MSE to improve DEI is commendable. We feel this is a great start to strive towards inclusiveness and the introduction of new programs like FAIR and RENEW going forward along with the requirement of PIER plan for proposal again will make progress towards a more diverse pool of workforce in the science programs. Given these new programs were established after the years that we were asked to review, we cannot make any specific comments about these programs.

- The experience of the panel is that PMs are very responsive to inquiries by the scientific community. However, the panel did not review specific evidence of this responsiveness and recognizes that experiences may differ across the scientific community.
- Scientists with funded projects through SIS often have to apply for beam time, making a double hurdle to cross to successfully complete a project. Addressing this challenge may provide an opportunity for outreach, especially for the underrepresented groups or universities.

Recommendations:

- We are impressed with the activities that have been initiated so far to be more inclusive. We recommend that BES-MSE continue to collect statistics of various demographics and continue with their efforts of all of the initiatives they have undertaken and expand these as more data become available.

Appendix IX: Summary Reports from EPSCoR Panel

COV PANEL REPORT

EPSCoR Panel: Department of Energy Established Program to Stimulate Competitive Research

BES COMMITTEE OF VISITORS (COV)
Reviewing the Materials Sciences and Engineering Division
Fiscal Years 2018, 2019, 2020, 2021 and 2022

I. EFFICACY AND QUALITY OF THE PROGRAM'S PROCESSES

Based on the COV's study of proposal actions completed within the past five fiscal years, please provide brief findings, recommendations, and comments on the following aspects of the program's processes and management used to:

(a) Solicit, review, recommend, and document proposal actions

Consider, for example:

- consistency with priorities and criteria stated in the program's solicitations, announcements, and guidelines
- adequate number of reviewers for balanced review; use of reviewers having appropriate expertise/qualifications; use of a sufficiently broad pool of reviewers; avoidance of conflicts of interest
- efficiency/time to decision
- completeness of documentation making recommendations

Findings:

- The Committee finds that considered proposals are consistent with priorities and criteria stated in the program's solicitations.
- The PM is doing an excellent job finding a broad pool of experts in many different fields for reviewing proposals, an especially challenging task for a program of such scope.
- The Committee recognizes that the PM is appropriately following protocol and analyzing reviews for accuracy, oftentimes via a deep-dive comparison of reviewers' comments versus statements within the proposal. The PM's judgment of the quality of proposals and recommendations for funding are fairly supported by reviewers' expertise based on both critical and admiring opinions of reviewers, rather than their ranking scores.

- Decision letters clearly explain and document the EPSCoR funding decision.
- The PM efficiently operates solicitations, peer reviews, and funding actions. As a result, the final funding recommendations are done in an acceptable timeframe of 4-6 months based upon the selected number of proposals examined by this COV.
- While the additional review questions for the EPSCoR programs are generally helpful, some reviewers seem to ignore many of the unique aspects of these programs or have expectations inconsistent with the purpose of the programs themselves. For example, for the National Laboratory Partnerships program, some reviews noted a lack of previous co-authored publications between the PI and the national laboratory collaborators as a problem.
- The time between pre-application response and full application due dates for the Implementation program was seven weeks in 2019 but only five weeks in 2021. This narrow window puts a serious burden on lead PIs, putting those without institutional support to coordinate such a sprawling multi-PI proposal at a disadvantage.

Comments:

- The committee encourages the PM to continue closely analyzing proposals vs. (particularly outlier) reviews, and in doing so, take special note of the enthusiasm and critical notes of the reviewers toward the work as opposed to the raw scoring.
- Relying exclusively on ad hoc reviews instead of panel reviews likely results in some reviews with unreasonable conclusions. Panel discussions do not always result in consensus, but they provide opportunities for reviewers to hear why their conclusions may or may not be valid from the perspectives of the other reviews. The committee encourages the PM to consider using panel meetings/discussions not only for the renewal process, if possible.

Recommendations:

- Across all BES programs, but especially EPSCoR, identify institutions that experience an above-average rate of declined proposal submissions. The committee encourages the PM to continue pro-actively* expanding upon avenues of communication, between the DOE and these institutions/PIs, that fairly, appropriately, and consistently inform these parties of available DOE-based resources by which to improve their funded research portfolios.

*Specifically, many EPSCoR institutions are under-resourced, compared to non-EPSCoR schools, with respect to established grants offices and associated personnel. Newer PIs and those with emerging research programs may be unaware of or simply inexperienced with where and how to find DOE funding opportunities. Thus, the Committee strongly encourages the PM to explore

means beyond the traditional government funding agency suggestion to PIs to “just check the website,” Although, as discussed with the PM, recent informational DOE webinars have been well-attended, the subsequent impact of these webinars in terms of submitted and ultimately successfully funded proposals, particularly with respect to under-resourced institutions, could be improved upon.

- Several reviewers noted a lack of previous co-authored publications between PI and national lab participants. The reviewers should be encouraged to not necessarily emphasize this measure in their consideration of the proposal, and instead, use the strength of the letter(s) of collaboration as a primary metric. This program is, at least in part, aimed at establishing new collaborations rather than simply supporting existing ones. The committee advises the PM to provide more extended instructions to reviewers to clearly address these issues.
- The standard review question that asks about “the research environment and facilities” should be adjusted, if possible, for the National Laboratory Partnerships program to make it explicitly clear that reviewers should focus on the combined facilities and resources of the national laboratory and the home institution and how this partnership will facilitate work that would otherwise not be possible. These points can also be highlighted in the extended instructions to reviewers.
- The committee supports the effort of the PM on expanding the pool of reviewers for EPSCoR proposals to be done in the context of peer review from peer institutions. In other words, the diversity of reviewers must be considered in order to ameliorate possible implicit bias, particularly where non-EPSCoR reviewers are asked to evaluate less-resourced states, schools, and new EPSCoR PIs.
- While the Committee finds the number of reviewers (3-5) and their level of expertise in a specific field or across different disciplines are adequate, having a minimal number of 4 reviews (instead of 3) would be beneficial for the review process, in particular, for the highly interdisciplinary programs, such as EPSCoR. Having 4 reviewers also helps to avoid the situation when one reviewer (out of three) is an outlier and skews the overall results.
- The Committee suggests including Current and Pending Funding Report to the pre-proposals (whitepapers) to prevent PIs from writing and submitting full proposals that will not be funded due to overlapping support.
- Whenever possible, ensure that ample time (2 months) is given between pre-application response dates and full proposal deadlines for the Implementation program to give equal opportunity to less-resources applicants.
- Consider expanding upon outreach activities, including but not limited to new PI webinars, identification of and initiating contact with cognizant sponsored program officers (where available), travel support and PM release time for on-site visits, PM contributions to regional outreach/research events.

(b) Monitor active project and programs

Consider, for example

- written progress reports
- principal investigators' meetings
- site visits
- interactions at topical, national and other meetings;

Findings:

- Numbers of published papers and conference presentations reported as products of awarded grants have noticeably declined during pandemic and post-pandemic years (2020-2022). The PM handled these changes appropriately and reasonably, supporting the continuation of grants taking into consideration the circumstances and constraints on research activities PIs/co-PIs have been facing due to the pandemic.
- Pandemic-mandated travel restrictions have drastically limited the PM's ability to travel for the purposes of site visits and/or outreach events during the review window, but the panel is pleased to see that these activities are resuming.

Comments:

Recommendations:

- Consider expanding travel support and PM release time for on-site in-person or virtual visits to facilitate the current and future success of active projects and programs.

II. EFFECT OF THE AWARD PROCESS ON PORTFOLIOS

Taking into account the DOE, BES, and Division missions, the available funding, and information presented about the portfolio of funded science, comment on how the award process has affected:

(a) The breadth and depth of portfolio elements

Consider, for example:

- the overall quality of the science
- the balance of projects with respect to innovation, risk, and interdisciplinary research
- the evolution of the portfolio with respect to new investigators and new science thrusts

- the relationship of the portfolio to other parts of the Division
- the appropriateness of award scope, size, and duration

Findings:

- The EPSCoR program covers a large, complex number of scientific disciplines and program mission priorities. The Committee found that awarded proposals have significant innovative ideas and potential impacts on many different disciplines and technological applications, ranging from hydrogen production, discovery of novel topological semiconductors and spin-controlled molecular systems for quantum computing, and development of novel biocatalytic systems for energy conversion.
- The breadth of awards is consistent with the goals of the EPSCoR program, current research priorities, and the missions of the program, division, BES, and DOE.
- In the previous review period, the EPSCoR program co-funded several awards to PIs in EPSCoR jurisdictions that went through general (i.e., non-EPSCoR) solicitations. There have been no such arrangements since FY2018, as all EPSCoR funds have been allocated to the Implementation, National Laboratory Partnership, and Early Career programs. This reflects an improvement in the quality of proposals submitted to EPSCoR-specific solicitations and thus also reflects the significant efforts the PM has made to inform and encourage more eligible applicants to take advantage of these programs.
- The distribution of EPSCoR funds by program (roughly 2:2:1 for the Implementation, National Laboratory Partnership, and Early Career programs, respectively) is appropriate for achieving the goals of recruiting new PIs, improving research infrastructure, and supporting ambitious/high-risk multi-PI work in underrepresented states.

Comments:

- Some reviewers note that proposals that depend on beamtime are more high-risk because of the competitive nature of beamtime proposals. This is not only a problem at the review stage but also at the award stage, as productivity does of course depend on securing the necessary beamtime. Should EPSCoR consider a proposal track for light sources and other DOE user facilities, especially the most competitive facilities? Should the DOE consider this possibility more broadly beyond the EPSCoR program, and/or consider “bundling” funding and beamtime awards?

Recommendations:

(b) The national and international standing of the portfolio elements

Consider, for example:

- the uniqueness, significance, and scientific impact of the portfolio
- the stature of the portfolio principal investigators in their fields
- the leadership position of the portfolio in the nation and the world

Findings:

- The EPSCoR program has a strong track record of supporting new PIs through the National Laboratory Partnerships and Early Career programs who then receive support through the Implementation program and/or general (i.e., non-EPSCoR) solicitations. This demonstrates the strength of the research portfolio particularly with respect to identifying emerging talents.
- With laudable discernment and judgment, the PM appears to hold both highly resourced and under-resourced institutions to a standard commensurate with their respective current infrastructure as well as propensity for growth. This provides opportunities for under-resourced institutions to expand their research to the national and international levels.
- The distribution of the EPSCoR portfolio among EPSCoR states is very well balanced. All EPSCoR states have at least one active award, and only four states (MT, NE, RI, WY) are more than one standard deviation above and one state (PR) below the mean when considering number of awards normalized by population. The committee considers this as a good accomplishment, taking into account high quality and innovation level of awarded proposals.
- Recent site visits also demonstrate the PM's commitment to reaching out to states underrepresented in the current portfolio to facilitate high quality proposals from these regions.

Comments:

- Award decisions generally appear to have been made while taking into consideration that larger institutions with greater research infrastructure may inhabit the same EPSCoR geography as smaller and/or under-resourced schools. This is particularly crucial for meeting the "spirit" and purpose of EPSCoR. The panel encourages the EPSCoR program to continue these efforts to ensure equitable use of funds.

Recommendations:

- We encourage the PM efforts to continue commitments to reaching out to states underrepresented in the current portfolio.

Comments on diversity, equity, and inclusivity of participation in MSE programs.

Findings:

- Funding success rates for MSIs (minority serving institutions: ANNHs, HBCUs, HSIs) can be regarded as commensurate with the total EPSCoR program, but historically these numbers have been low, and improvement is warranted. On this note, the Committee recognizes that the recent FAIR and RENEW initiatives are steps in the right direction.

Comments:

- From external historical reasons to resulting infrastructure limitations, MSIs have experienced the catch-22 of supporting more (excellence) with less (money).

Recommendations:

- One important problem to address is the strikingly low number of proposals submitted by MSIs. The reasons for these low submission numbers are more complex than simply pointing to the current institutions and their PIs. Thus, open and honest consideration of the root, rather than only the current status of this challenge, must be taken into consideration for significant and lasting progress to occur.

Comments on PAMS and the COV procedures

Recommendations:

- It would be helpful if the proposals, reviews, and award/declination decision notices could be packaged together as a single PDF.
- Similarly, it would be helpful if all progress reports and PM comments for a given award could be packaged together.
- Reviewer affiliations – both in the context of each review and aggregated to allow for consideration of demographics – are important for the panels to have.
- Statistics such as total numbers of proposals and awards vs. those specifically for MSIs are necessary for panels to consider DEI. Additionally, the panels only see statistics for full proposals and awards; statistics for pre-applications are also important.

Appendix X: Summary Reports from Topical FOA Panel

COV PANEL REPORT

Topical FOA Panel:

BES COMMITTEE OF VISITORS (COV)
Reviewing the Materials Sciences and Engineering Division
Fiscal Years 2018, 2019, 2020, 2021 and 2022

I. EFFICACY AND QUALITY OF THE PROGRAM'S PROCESSES

Based on the COV's study of proposal actions completed within the past five fiscal years, please provide brief findings, recommendations, and comments on the following aspects of the program's processes and management used to:

(a) Solicit, review, recommend, and document proposal actions

Findings:

- The comprehensive scope of all seven topical areas aptly showcases the nice balance embodied by the call. A pertinent question that arises is the distribution of FOA priorities. Significantly, the preproposal process plays a pivotal role in ensuring an equitable distribution of these priorities. It's crucial to overlay FOA priorities with MSE objectives to achieve a cohesive alignment.
- The programmatic priorities are set both in a "top-down" approach and a "bottom-up" approach. The former is guided largely by priorities set by the current administration, while the latter is governed by workshops and Basic Research Need reports.
- In some reviews, there was a noticeable discrepancy between the score given by the reviewers (e.g., Good, Very Good, Excellent) and the actual content in the review. For instance, some reviewers qualified a review as "Very Good" but were highly skeptical of key elements in the proposal. Nonetheless, the program managers were very thorough in their assessment of the reviews, making sure they captured the essential components of the review rather than the score.
- The program managers did an excellent job of carrying out the review process efficiently, especially noteworthy is the fact that these processes are subject to very tight timelines, delineated by Congressional appropriations processes which can be uncertain.

- Excellent documentation on the rationale for the decision was provided for declined proposals, but no such documentation was found for funded proposals.

Comments:

- The short timelines of these FOA processes may affect the quality of proposals submitted.

Recommendations:

- Some awareness should be given to the possibility that PIs who participate in Basic Research Needs reports and workshops also compete in these calls, potentially leaving out new ideas from people who are in their early career or have not participated in the relevant field of research recently.
- In order to ensure that reviewers provide the most useful information to the program managers, consider adding a prompt that explicitly asks for “Weaknesses” and “Opportunities” in the proposal, in addition to the current list of 4 criteria (Scientific Merit of the Project, Appropriateness of the Approach, Competency of Applicant, and Reasonableness of the Budget).
- Remove the “Good, Very Good, Excellent” categories and replace them with “Do Not Fund, Fund, Must fund”, which emphasizes the pertinence and relevance of the proposal within an FOA call, instead of a subjective categorization.
- To mitigate the short timeline problem, consider advertising areas of possible strategic interest before FOAs are approved by Congress.
- Provide a brief justification for funded proposals to the COV.

(b) Monitor active project and programs

Findings:

- Since we only received projects awarded in the last year, we only evaluated progress reports from university labs (no national labs), given that universities had their first report due before this COV meeting (but the national labs did not). Nonetheless, the annual reports we observed are consistent across other BES funding structures, and provide a comprehensive description of progress made within the funding every year.
- The review process for FOA-funded proposals is not different from other funding mechanisms (i.e., they are handled within specific programs).

Comments:

Recommendations:

- None made under these circumstances.

II. EFFECT OF THE AWARD PROCESS ON PORTFOLIOS

Taking into account the DOE, BES, and Division missions, the available funding, and information presented about the portfolio of funded science, comment on how the award process has affected:

(a) The breadth and depth of portfolio elements

Findings:

- The quality of the funded proposals is excellent. The proposals differ from the usual portfolio. While still focused on basic research, the questions addressed in the proposals are substantively directed towards the 7 topic areas covered by the FOA. Because of this, the funded research addresses a critical national need to develop clean energy and sustainable manufacturing. The panel therefore regards the FOA as a clear success.
- The balance of the portfolio is excellent, at least for the 15 proposals examined by the FOA subpanel, in terms of number of PIs on the project, theory vs. computation vs. experiment, the 7 topic areas within the FOA. Essentially all of the projects are interdisciplinary due to the subject matter of the FOA. The projects funded vary significantly in award size and scope but are appropriate to the proposals.

Comments:

- These proposals required more careful consideration of programmatic considerations and relevance to the FOA than the usual calls for proposals. Much of this balance was achieved during the review of preproposals, each of which was reviewed by 3 PMs.
- Additional balance was achieved by decisions on whether to fund proposals that fell in the middle, since those that reviewed extremely well were funded while those that reviewed very poorly were not funded. The PMs did an excellent job but because of the importance of balancing the portfolio, the FOA required significant effort on their part.

Recommendations:

- It would be worthwhile to consider how to reduce the workload on PMs for special FOAs like this.

(b) The national and international standing of the portfolio elements

Findings:

- The scientific quality of the portfolio is excellent, and it is unquestionably unique due to the program area of the FOA. It is not easy to compare stature of PIs with those in core FOAs since the topic areas are not as highly studied in academia. However, these topics are extremely important and the FOA may nudge more academic researchers to work in the area. Most of the funded researchers are leaders on the relevant topic and the remainder are highly likely to become leaders due to the funding.

Comments on diversity, equity, and inclusivity of participation in MSE programs.

Findings:

- The diversity of the reviewers is impressive, with 19% of the 406 reviewers being women. No statistics were provided on the number of reviewers who belong to URM or are from MSIs.
- The diversity of the funded PIs is likewise excellent. Of the 53 awards resulting from the call, 20 were led by women, 33 by early to mid-career scientists or engineers, 6 were led by PIs from MSIs, and 2 were led by URM. 11 of the awards were made to institutions in EPSCoR states and 3 of them to institutions that had not previously been funded by BES. Altogether, the 53 awards were made to institutions in 29 states.

Comments:

Recommendations: