BASIC ENERGY SCIENCES ADVISORY COMMITTEE
to the
U.S. DEPARTMENT OF ENERGY

PUBLIC MEETING MINUTES

July 30, 2020
Teleconference

DEPARTMENT OF ENERGY BASIC ENERGY SCIENCES ADVISORY COMMITTEE
SUMMARY OF MEETING

The U.S. Department of Energy (DOE) Basic Energy Sciences Advisory Committee (BESAC) convened the teleconference on Thursday, July 30, 2020 via Zoom. The meeting was open to the public and conducted in accordance with the requirements of the Federal Advisory Committee Act. Information about BESAC and this meeting can be found at https://science.osti.gov/bes/besac

BESAC Members Present:
Marc Kastner, BESAC Chair, Science Philanthropy Alliance
Kathy Ayers, Proton OnSite
Joan Broderick, Montana State University
Beatriz Roldan Cuenya, Fritz-Haber Institute of the Max Planck Society
Helmut Dosch, DESY
Thomas Epps, University of Delaware
Cynthia Friend, Harvard University
Yan Gao, General Electric Company
Julia Hsu, University of Texas, Dallas
Despina Louca, University of Virginia
Allan McDonald, University of Texas, Austin
Pietro Musumeci, University of California, Los Angeles
Monica Olvera de la Cruz, Northwestern University
Nai Phuan Ong, Princeton University
Abbas Ourmazd, University of Wisconsin, Milwaukee
Ian Robertson, University of Wisconsin, Madison
Anthony Rollett, Carnegie Mellon University
Maria Santore, University of Massachusetts, Amherst
Andrew Stack, Oak Ridge National Laboratory
Esther Takeuchi, Stony Brook University
Matthew Tirrell, University of Chicago

Designated Federal Officer:
Linda Horton, Associate Director, Office of Basic Energy Sciences (BES)

Committee Manager:
Katie Runkles, BES Program Analyst

BES Management Participants:
Bruce Garrett, Director, BES Chemical Sciences, Geosciences and Biosciences Division
Linda Horton, Acting Director, BES Scientific User Facilities Division
Andy Schwartz, Acting Director, BES Materials Sciences and Engineering Division

Thursday, July 30, 2020

BESAC Chair, Marc Kastner called the meeting to order at 10:45 a.m. Eastern Time (ET) to an audience of approximately 223 people. Kastner requested all BESAC members introduce themselves.

News from Office of Science, Harriet Kung, Deputy Director for Science Programs

Kung congratulated Horton on her appointment as the new BES Director. SC has been restructured to better align the organization to achieve strategic goals. Through the reorganization the Principal Deputy Director position was created and the Deputy Director for Resource Management was eliminated. Three offices of Engineering and Technology, Strategic Planning & Interagency Coordination, and Diversity, Inclusion & Research Integrity were created.

The FY20 SC enacted budget was $7B + $99.5M from the Coronavirus Aid, Relief, and Economic Security (CARES) Act. The FY21 President's budget request for SC is $5.838B. The House mark for FY21 is $7.05B with emergency funding of $6.25B for national labs, user facilities, and

universities to accelerate ongoing construction projects. Both the SC and the Office of Management and Budget (OMB) have determined flexibilities to address the effects of COVID-19 on research. These actions include extended deadlines, no cost extension, supplemental requests, salary continuation, reporting extensions, and cost allowances.

The DOE broad capabilities and knowledge in light and neutron sources, nanoscience centers, computational resources, and people with relevant expertise (testing, antiviral drug discovery, vaccine discovery, supply chain bottlenecks, modeling and understanding disease spread, molecular and structural biology) have been used to address the COVID-19 crisis. The National Virtual Biotechnology Laboratory (NVBL) was formed in early March 2020 to address research on COVID-19. NVBL is a consortium of 17 DOE national labs that takes advantage of DOE user facilities and is executing CARES Act funding through 3-6 month science and technology research challenges related to COVID-19. The High Performance Computing Consortium has been supporting the NVBL partnership. This consortium is an Office of Science and Technology Policy-led public/private partnership with over 40 members. The mission is to provide researchers with computing resources to address COVID-19 worldwide.

Kung closed by highlighting SC program activities: the Quantum Information Blueprint Workshop report, Fusion Energy Science Advisory Committee Long Range Plan, Impact of COVID-19 on HEP Research survey, CD-0 for the Electron Ion Collider (EIC) which will be hosted by Brookhaven National Laboratory, and the new "DOE Explains" which provides information on key words and concepts in fundamental science.

Discussion

Kastner complimented Kung and highlighted exceptional efforts: the high profile of communications within the SC, to the public, and to Congress and the Administration, and the reliability of the BES planning process, having shovel-ready projects when emergency funding was available. **Kung** acknowledged and expressed appreciation for BESAC's important role in determining priorities and giving timely insight when quick pivots are necessary.

International Benchmarking Subcommittee Discussion, BESAC Members

The charge to the subcommittee is to identify key areas of mission-relevant research and facility capabilities in which U.S. leadership is most threatened, advise on modifications to existing trade-offs (balance of resources) or new ways to leverage scarce resources, and identify incentives that will retain and attract scientific talent.

The subcommittee is divided into two teams, Areas and Strategies. The Areas team will identify science areas where U.S. leadership is most threatened or critical. The Strategies Team will identify ways to retain and establish leadership in key research areas, including new mechanisms or modifications to existing mechanisms to influence outcomes. These will be broken down into the Principal Investigator level, national lab level, and agency level. The goal is to make the case for the most important areas for research and then to address strategies. Cross-cutting topics are to be determined. The cross-cutting team will be composed of members of the Areas and Strategies teams and will examine the overlap between these areas. Data collection will be the bedrock of the work. The committee will utilize reports and other critical data, determine the methodology for collecting the information, and find data to answer drafted questions.

Monthly meetings of the subgroup (August 2020 to April 2021), and of leads and the full committee (September 2020 to June 2021) will be held. Subgroups will define their roles and responsibilities, identify data sources and gather data, integrate data, develop ideas and recommendations, and draft sections of the report. The full committee will develop interim reports, consider the needs for modifying the process, and write the final reports.

Discussion

Epps advised the group to be more explicit about diversity in the presentation slides. **Tirrell** agreed to be more explicit. **Friend** likewise agreed to address the wording and explained that BES's workforce development role is different from a National Science Foundation (NSF)-type role.

Rollett suggested looking at the interaction between the French National Centre for Scientific Research (CNRS) and the university system, pointing out that France has a delocalized arrangement. Also, the Leibniz Institute, in Germany, has an interesting industry-academic partner approach that should be considered. He also suggested interviewing editorial board members of prominent journals.

Hsu recommended the Interuniversity Microelectronics Centre (IMEC) as a potential model and asked about the metrics being used to determine threatened or critical areas. **Friend** said that the Areas team would address the metrics. The first items to consider will be BESAC reports (2007 and 2015) which outlined important areas and ideas. The committee will use publications and expressed interest to determine international topics. **Shen** added that the committee will likely start with the roadmap articulated by the BES reports and expand to include newer developments. That benchmark will determine where the U.S. is leading and where there is competition. **Hsu** suggested investigating why areas are threatened; why U.S. leadership is not in place. **Friend** assured Hsu that the Cross-cut team will investigate why the U.S. is not a leader in certain areas. **Shen** requested input from BESAC concerning new areas beyond what is contained in the BES reports. **Friend** noted that once defined areas are identified broad community outreach (online Town Hall meetings) will occur.

Robertson (Ian) asked about international investments in different areas – stating that data is challenging, it is hard to determine what a given country is investing in and why they are investing in a particular area based on published data. **Tirrell** noted determining international investments is an important role for the international members of the community – to obtain information from Asian and European countries in particular. **Isaacs** added that interviews will be held with international partners concerning financial investments, cutting edge technologies, etc. The American Association for the Advancement of Science (AAAS) and the National Academies of Science, Engineering, and Medicine (NASEM) collect some data. **Friend** noted that funding modalities, program management, and outcomes are of interest, more so than exact investments. **Robertson (Ian)** expressed that it is difficult to compare countries because what is determined to be higher priority differs by country. The U.S. could have leadership in certain areas but not in all of the areas. **Friend** suggested that the committee could consider the facilities or the institutes – that would yield a qualitative gauge of investment by other countries.

Rollett reminded BESAC of the European Union (EU) initiatives, such as the Initiative for Science in Europe (https://initiative-se.eu/). **Robertson (Ian)** suggested the EU reports for highlights of areas of emphasis. **McDonald** was curious if new topics are coming from individual investigators or collaborations. He suggested looking at the amount of money directed towards graduate students.

Stack expressed interest in what has or has not worked well among nanoscience centers, Energy Frontier Research Centers (EFRCs), and Energy Innovation Hubs (Hubs). There is an opportunity to ask broader questions about the optimum team size, research topics that make a good EFRC grant versus a single investigator grant, etc. **Tirrell** stated that while Stack raised an astute point, there is not a one-size fits all strategy. **Stack** suggested the committee look at National Lab core programs as they tend to be moderately sized teams. **Isaacs** added that the EFRCs and the Hubs are different modalities, not just different sizes. The Hubs have annual goals and deliverables whereas the EFRCs are focused on longer-term basic energy research needs. The type of research in the laboratories is quite different, it is driven towards its mission – energy science.

Ayers recommended looking beyond publications for metrics such as talking to scientific advisory boards. She noted that helpful guidelines and questions exist for different modalities.

Roldan Cuenya recommended the committee make connections with the European Research Council and Academia Europaea. In general, there are clear funding differences between Europe and the U.S. For example, in Germany, when the COVID Recovery Act came scientists were asked for topics, other than Coronavirus, that should be funded to help the economic recovery of the country.

Dosch reminded the committee to keep three points in mind: 1) avoid a snapshot of the field, 2) consider people as well as funding structures, and 3) avoid silo thinking. **Friend** stated that workforce

development is where people come in. Accessing early career scientists is difficult and the committee has considered talking to graduate or undergraduate students. The committee will also look at the future trajectory; ideas for addressing that in a systematic and reasonable way are welcomed.

Shen asked BESAC and the community for input on achieving an inflection point of areas in the field, determining trends in the literature (increasing or decreasing acceptance rates), and how to obtain dynamic information. **Tirrell** expressed that a virtual forum may work well for obtaining advice from early career researchers.

Hsu commented that data should also be obtained from Asia including China, the Riken Institute, South Korea, and India. **Friend** asked for specific suggestions for how to obtain that information. **Hsu** suggested making personal connections in the country. For example, China and Taiwan have Academia Sinica; South Korea has government funded institutes.

Ourmazd stated that metrics must be considered with a lot of thought and care. He asked about the process to exploit, nurture, and support unanticipated developments. **Friend** commented that he raised good points. Having the concept with well-established priorities will help in that response.

Several suggestions were sent via chat: **Ager** asked if the committee was considering forward-looking topics such as emerging areas in which the U.S. may not be poised to lead. **Mavrikakis** offered the example in Scandinavia where money goes to students as opposed to Principal Investigators for a fixed amount of time – worth exploring further for expanding in the U.S. **Witherell** asked how BES can help ensure that U.S. science does not lose a generation of scientists as universities cut back on faculty appointments. And **Falcone** recommended a larger effort be undertaken to understand how international cooperation and collaboration could impact U.S. leadership and competitiveness in the future.

Kastner dismissed BESAC for a break at 12:30 p.m. and reconvened the meeting at 1:00 p.m.

Office of Basic Energy Sciences Update, Linda Horton, Associate Director, Office of Basic Energy Sciences

Horton congratulated Kung on her appointment as SC Deputy Director for Science Programs and shared some key leadership accomplishments made by Kung. She also extended best wishes to Jim Murphy on his retirement as Director of the Scientific User Facilities Division and recognized some of his key accomplishments. She noted Aaron Holder is a new program manager in the Computational and Theoretical Chemistry Program and that there are several vacancies in BES.

The FY20 BES appropriation is $2.213B (2.2% over FY19). The funding is distributed among Research Programs, Scientific User Facilities, and Construction. Special Funding Opportunity Announcement awards have been announced for Energy Frontier Research Centers, the Fuels from Sunlight Hub program, the Early Career Research program, and EPSCoR National Lab Partnerships. Awards are to be announced for Quantum Information Science (QIS) Centers, Artificial Intelligence/ Machine Learning (AI/ML) for User Facilities, Materials and Chemical Sciences Research on Critical Materials, and Materials and Chemical Sciences for Direct Air Capture of CO2.

The President's Request for BES funding in FY21 is $1.935B; the FY21 House Mark is $2.242B, including a slight increase in funding for research and a decrease for projects relative to the FY20 appropriation. All upgrades to the six facilities identified as important to U.S. leadership were funded in FY20 except for the Linac Coherent Light Source-II (LCLS-II), which received its last planned funding in FY19.

LCLS-II will experience a performance baseline deviation (cost and schedule impact) due in part to COVID. The Advanced Photon Source (APS-U) is maintaining its critical path but there could be COVID impacts. Other projects are in pre-construction stages and have not experienced significant COVID impacts, except for the LCLS-II-High Energy (HE) project which was recently approved for long lead-time procurements (CD-3a). Two pre-CD-1 major items of equipment (MIE) are the National Synchrotron Light Source II (NSLS-II) Experimental Tools-II (NEXT-II) and Nanoscale Science Research Center Recapitalization (NSRC-Recap).

FY21 BES priorities include Critical materials (+$25M), AI/ML (+$10M), Polymer upcycling (+8.25M), Next-generation biology (+$3.75M), Microelectronics (+$25M), QIS ($72M) and Exascale computing ($26M). Facilities-related research activities include strategic accelerator technology (+$6.25M), and data analytics and machine learning for data-driven science ($10M).

Four new BES reports are on AI/ML for user facilities, next-generation transformational manufacturing, upcycling of polymers, and solar fuels. New topics of research coordination activities include cross-cutting activities in polymer upcycling within the SC; the DOE Plastics Innovation Challenge; the Research and Technology Investment Committee (RTIC); and the interagency Semiconductor Leadership R&D Working Group. International workshops of interest to BESAC include the U.S./Germany Workshops on Artificial Photosynthesis, of which the first was held in June 2020 (virtual), U.S.-U.K. Catalysis Workshops planned for October 2020 (virtual), and the U.S.-U.K. and U.S.-Japan Energy Storage Workshops, both of which are being planned.

Discussion

Roldan Cuenya inquired if the U.S. facilities were investigating remote access possibilities for users. **Horton** confirmed that the facilities received additional funding through the CARES Act to help support extraordinary expenses associated with COVID-related research. Some of that investment went into expanding remote access to several beamlines to allow COVID research.

Neutron Subcommittee Report Presentation and Discussion for approval of the report, Robert Birgeneau, University of California-Berkeley; David Robertson, MURR Reactor at Missouri

The charge to the subcommittee was to assess the scientific justification for a domestic high-performance reactor-based research facility. This initiative is based on the NAS report, "Reducing the Use of Highly Enriched Uranium in Civilian Research Reactors" (2016) and the American Physical Society (APS) Panel on Public Affairs (2018) report "Neutrons for the Nation." Six framing questions on the science case, other facilities, applications, spallation sources, High Flux Isotope Reactor (HFIR) upgrade paths, and fuels development guided the activity.

Three options considered in the report are to: 1) continue to operate the HFIR "as is" with the existing pressure vessel, 2) replace the pressure vessel of HFIR and coordinate the replacement with the conversion of HFIR to low enriched uranium (LEU) fuel to facilitate a single shutdown, and 3) perform a "scoping study" for a green field research reactor optimized to perform neutron studies. The committee does not recommend Option 1. The committee recommends pursuing Option 2 immediately because the replacement of the HFIR pressure vessel will remove the significant risk of failure and result in important capabilities. The committee also recommends pursuing the study in Option 3 in parallel with Option 2.

HFIR is the sole western hemisphere producer of isotopes for industry, national security, and precision medicine. HFIR currently makes Californium 252 – used in mining/ minerals/ oil industry and by the nuclear power industry and the nuclear navy; Nickel 63 – used as an electron source in field-deployable ion-mobility spectrometry systems; and Actinium 227 (parent isotope) to produce Radium 223 – used in nuclear medicine. The report highlights other potential nuclear isotopes for medical therapy. In isotope production, HFIR is utilized to make the heaviest elements used to discover new elements in the periodic table (elements 114, 115, 117, and 118). In materials irradiation, HFIR holds the western hemisphere record for number of displacements per atom (DPA) per year generated in steels – important for determining how existing and new materials will behave in nuclear power plants and fusion reactors.

Discussion

Epps indicated there is a dearth of beamline time and an opportunity to re-establish that leadership role. Having more powerful sources and access to beamlines is critical and impacts basic science as well as areas of biology and soft matter that have had a commercial impact (vaccines, virus studies, drug delivery).

MacDonald emphasized that neutron scattering still plays an essential role in uncovering the structures of materials with complex magnetic order. That is one place where the reactor and spallation source work hand-in-glove.

Ourmazd asked about the impact of new algorithms on extracting information from data and experimental modalities as a consequence of advances in AI. **Birgeneau** indicated that was implicit and probably played a more important role in discussions of the Spallation Neutron Source (SNS). Spallation source advances have been made possible because of advances in data handling. **Rollett** stated there has been some effort to address AI/ML in neutron facilities, such as in the Basic Energy Sciences Roundtable on Producing and Managing Large Scientific Data with Artificial Intelligence and Machine Learning.

Takeuchi sought elaboration on the green field alternative design (Option 3). **Birgeneau** explained that there many reactors operating well on LEU, but HFIR fuel assembly is idiosyncratic. The uncertainty is connected with the geometry of HFIR and what would be the best fuel, including manufacturability and cost issues.

Dosch asked about compact accelerators as a future strategy, and suggested that the comparison between x-rays and neutron capabilities could be amplified in the report. **Birgeneau** explained that the section on the interface between x-rays and neutron sources was informational. **Robertson (David)** addressed the compact reactors question and said there are good examples in the reports of multi-neutron capture isotope production products. Thermal fluxes are necessary, well over 10^{15} neutrons/cm^2/sec, for those to work; the smaller sources do not come close to that. To make something that takes 2-3 neutron captures requires a very intense, steady-state thermal neutron source. **Birgeneau** said that compact accelerators are not a strategy for U.S. neutron scattering at this time. All facilities, including neutron facilities, are getting progressively better with time. Improvements are not because of source improvements but because of instrumentation improvements.

Louca commented that compact sources seem common in Europe and Japan, but not in the U.S., and for many people small sources is an unfamiliar concept. HFIR has been a valuable tool for decades and it must be saved. Even if there are 10 synchrotron sources, neutrons are still necessary.

Robertson (David) wanted BESAC to appreciate that in addition to neutron flux HFIR provides for making radioisotopes. The infrastructure that the DOE has next to the reactor is critical and difficult to reproduce in a dispersed model of small instruments. For example, at the University of Missouri Research Reactor (MURR) there are a number of neutron scattering instruments available to the community. However, it is impossible to offer the kind of support that is provided at SNS and HFIR. In a dispersed model of small compact sources at universities there would be a lack of experts to conduct and design experiments and to create the instruments.

Rollett asked about the advantages of Option 2. **Birgeneau** explained that Option 2 will significantly improve materials and radiation capabilities, allow a dramatic increase in the number of beamlines, and add an additional guide hall. For neutron scattering this will represent an improvement in the spectrometers. **Robertson (David)** added that one of the most important things to consider in isotope production is the ability to take targets in and out of the reactor while at power. HFIR is unique in its capability to produce isotopes, especially in the nuclear medicine community. If these are successful, there will need to be an increase in capacity and an ability to shuttle targets in and out of the reactor while at power, which essentially means either additional pneumatic or hydraulic tubes.

Robertson (Ian) inquired if university reactors could play a role in increasing interest in, and knowledge about, HFIR. **Robertson (David)** responded that MURR can be used to prescreen samples and down select what will make the optimum beam time at SNS, HFIR, or the NIST Center for Neutron Research (NCNR). MURR has had a NSF Integrative Graduate Education and Research Traineeship (IGERT) for a number of years training individuals in neutron scattering and instrument development. Universities have a role to play in the research reactor community; students can make mistakes at university sources which is an important part of their education.

Robertson (Ian) said that university reactors have time available and mistakes are less costly but the question is if universities should be included in the discussions about future generations and enticing people towards neutron scattering. **Epps** explained that adding universities into the conversation could

depend on the field. For example, in soft materials, a single experiment might take 21 days on a university reactor. That is the antithesis of bringing excitement to new researchers. That timescale might not be compatible with biological lifetimes. The lack of support for the user experience (e.g., data analysis) makes it difficult to do some things at university sources. **Birgeneau** pointed to other challenges such as high background, cryogenics, and technical support. **Dosch** expressed skepticism that training the next generation on new developments and technologies is a task for universities. He stated that all facilities must take on the role to train people by developing summer schools and training programs. It is the task of the neutron community, including all large-scale facilities, to develop schemes so the next generation becomes familiar with the developments in this technology.

Kastner called for a vote to accept the Neutron Subcommittee Report. BESAC members unanimously accepted the report. Kastner thanked the committee for their work.

Birgeneau requested comments or questions be directed to him. **Kastner** added that a one-page document will be created for Congressional staffers.

Basic Research Needs for Transformative Manufacturing Workshop Report, Cynthia Jenks, Argonne National Lab

The committee's charge was to identify basic science research priorities that would accelerate innovation and transform future manufacturing. Manufacturing makes up 12% of the U.S. gross domestic product, offers 13 million jobs, and consumes 25% of the total energy use in the U.S.

The workshop consisted of six panels on precision synthesis, processing and scale-up science, system integration science, sustainable manufacturing, digital manufacturing, and cross-cutting themes (multiscale modeling, interfaces, characterization, artificial intelligence, etc.). Three plenary talks focused on transformative manufacturing and DOE-BES user facilities, manufacturing with micron-scale devices (scale-up in the real world), and processing structure in metals (structure-function processing relationships).

The five Priority Research Directions (PRDs) developed are in the areas of precision synthesis, predictive multiscale modeling, operando visualization, sustainability and energy efficiency, and system-focused co-design. Currently there is a brochure on the BES website and the workshop report is in preparation. A factual document will also be provided in the final draft.

Discussion

Hsu asked about scale-up science in the PRDs. **Jenks** stated that scalability crosses multiple PRDs. For example, the precision synthesis PRD incorporates scale-up and multiscale modeling examines issues of scale-up.

Takeuchi stated that there is a strong linkage of research with manufacturing and the interaction of industry and research is critical. BES needs to embrace some of the ideas in the report and pursue some of the science to address important questions; this will ensure a significant advantage. The full report will be valuable to the research community as well as industry.

Robertson (Ian), referring to comments about the formation pathways, asked if there was any discussion of applying perturbations to the system to force it to go in an unusual direction. For example, a deviation of direction may yield a product or material that has better properties. **Jenks** indicated there was a small bit of discussion on that topic; such perturbations could have huge influences. Certainly, perturbations that occur in manufacturing processes could lend new opportunities for science.

Epps asked if there was discussion of techno-economic analysis and its application to manufacturing processes. **Jenks** said there were discussions on the importance of techno-economic analyses. There are opportunities for interactions between researchers and the Advanced Manufacturing Office and outcomes for different manufacturing processes. Making sure that the community is aware of developments and interactions with industry will help basic scientists better understand the pain points from a techno-economic analysis.

Committee of Visitors for Chemical Sciences, Geosciences, and Biosciences (CSGB) Announcement, Bruce Garrett, Basic Energy Sciences

The charge, in this seventh CSGB COV report, is to look holistically at the processes of the Division. CSGB has a budget of ~$360M, receives between 700-750 proposals per year, approves more than 500 progress reports, and evaluates approximately 700 pre-applications (white papers). The COV will review proposal decisions from FY17 to FY19 solicitations. The COV will have three panels on fundamental interactions, photochemistry and biochemistry, and chemical transformations. The virtual meeting will take place September 8-11, 2020.

Committee of Visitors for Energy Frontier Research Centers (EFRCs) and Energy Innovation Hubs (Hubs) Program Announcement, Andy Schwartz, Basic Energy Sciences

This third EFRC-Hubs COV is charged with evaluating proposal, award, and management processes in the programs. The team is matrixed across BES. The FY20 budget for the EFRCs is $115M/year, for the Hubs is $24M/year (Batteries and Energy Storage) and $20M/year (Solar Fuels). There are currently 41 active EFRCs and two Hubs – Batteries and Energy Storage hosted by the Joint Center for Energy Storage Research (JCESR), and Fuels from Sunlight hosted by the Joint Center for Artificial Photosynthesis (JCAP), which is completing its second five-year term in 2020. Following JCAP, the Solar Fuels Hub program will continue with the Liquid Sunlight Alliance (LiSA) and the Center for Hybrid Approaches in Solar Energy to Liquid Fuels (CHASE). The FY20 EFRC-Hubs COV will have a Hub Panel and an EFRC panel. Panelists are being recruited now and the virtual meeting will be held October 13-16, 2020.

Discussion

Kastner asked about the timing of the reports and if BES staff will review the reports for factual errors. **Garrett** said that a lot of the material is already written. **Schwartz** added that the prior COVs were available within ~3 months. **Horton** indicated that BES staff will review the COV reports. **Friend** expressed that if the Portfolio Analysis and Management System (PAMS) were not in place these virtual COV panels would be impossible.

MacDonald was curious about the ways innovative ideas have come forward from COVs. **Horton** explained that the charge for all COVs is the same, however, COVs themselves have been innovative in their recommendations to BES.

Hsu requested examples of implemented COV recommendations. **Garrett** said COVs using the PAMS tool is one example. The 2014 COV report to CSGB underpinned the need for a strategic plan for the Division.

Comments on the Office of Science, Chris Fall, Director, Office of Science

Fall discussed use-inspired basic research, benchmarking, and the DOE COVID-19 response. The DOE is standing up QIS, AI/ML, and Microelectronics efforts. These have an obvious economic impact and economic opportunity. Fall wants to protect SC's role in basic, discovery research, but also wants to give thought to where this is going – the flow of ideas from discovery to useful products.

Benchmarking is of interest around the world. Investment in benchmarking is an opportunity for technology leadership, economic development, and national security. But there is also a general focus on intellectual property and who is benefiting from it. If some of the IP issues were occurring in other sectors they would be called theft or spying, but in basic research the assumption is that everyone is participating for the good of all. The focus on intellectual property has lots of consequences in international competition and commercialization. The DOE is tightening expectations; if something will eventually be manufactured or commercialized the DOE expects that to be manufactured in the U.S.

There is acceptable and healthy tension in the system between basic and applied research. In the collaboration space, the DOE has been a model for a long time (EFRCs, Hubs, and the new QIS Centers). There is a lot of power and opportunity in the collaboration models, such as external buy-in, public/private partnerships, as well as contributions from state and local government and universities.

Buy-in is something that the DOE explicitly wrote into the QIS Centers; these QIS Centers span the entire Office of Science. Fall believes strongly that the DOE has to continue to make room for new ideas and new talent.

COVID-19 is a great story, operationally, about the DOE's and the labs' response to COVID. Light sources, biology capacity, and computational capacity have continued operations with the justification of the need to be available for COVID research. Fall and the SC Associate Directors are talking regularly, including with a formal cross-office team, to consider the implications of COVID on construction projects and programs and rebaselining them. SC must understand the impact of continuing with efforts as Congress directed. As to the impacts of COVID on extramural research, the DOE has been actively generating options, been liberal with deadlines, and supported the people. The DOE understands and sees it as an obligation to do what is possible for people and to work with Congress to get additional appropriations and additional authorities to make sure careers are not derailed because of COVID.

From the COVID crisis, two compelling ideas have come to light: 1) the national labs as a response element in a crisis, and 2) the biotechnology capacity of the labs. It was not obvious to Congress or many people that the DOE science and technology labs have the capability to respond. Legislative proposals are being considered to modify the process of providing funding to work on a national crisis like COVID. In the recent Congressional response, appropriators actively questioned why the DOE would be doing work on COVID – stemming from a misunderstanding of the DOE's capabilities. During the COVID crisis, the DOE labs' biotechnology capacity was uncovered. Congress has voiced some intriguing proposals about biotechnology and pandemic responses. For example, the DOE does not have a biotechnology lab that can work in the biosecurity, next generation bioeconomy in a focused way. The DOE has demonstrated its capacity to marshal these resources in a crisis in a whole-of-complex, bottom-up collaboration. However, the model of collaboration chosen will bring questions to address – practical questions. The DOE has a model for how to spend the money and how to coordinate people against a problem. While the management model has worked well, it is being studied for its application in the long term. Fall, on behalf of the DOE leadership, closed by thanking BESAC members for their contributions and service to BESAC, DOE, and the country.

Discussion

Stack asked if the traditional division of funds between research and operations will remain the same. **Fall** said that the traditional split is applied across the entire Office of Science. Individual program offices may have an adjustment of those percentages depending on their current projects and program needs.

Friend requested that Fall elaborate on retaining and attracting talent in the context of international competition. **Fall** responded that the solutions vary, but in some cases grants are extended for students and post-docs and there is flexibility with new faculty. He explained that this is an opportunity for the DOE to consider new ways of attracting talent. Fall has asked the SC team to consider if it can be a buffer for researchers, or if there is an opportunity to create dual appointments. The depth of all the problems has not been studied, but SC can offer flexibility right now; SC can have the conversations with Congress. There will be equivalent problems on the university side with basic research, agendas that are not going to get completed, and scientists who will not reach the goals they proposed; there will have to be some understanding when they apply for another grant.

Public Comment session

None.

Kastner adjourned BESAC at 4:42 p.m.

Respectfully submitted,
Tiffani R. Conner, PhD, PMP, AHIP

ORISE/ ORAU
August 14, 2020