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Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Diversity, Equity, Inclusion, and Respect in Lighting Roundtable

March 2022

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Disclaimer

DOE Solid-State Lighting Program, "DEIR Roundtable," March 2022

This report was prepared for:

Solid-State Lighting Program
Building Technologies Office
Energy Efficiency and Renewable Energy
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Comments

The Energy Department is interested in feedback or comments on the materials presented in this document. Please write to Brian Walker, Manager for Solid-State Lighting:

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Dr. Bob Davis, Pacific Northwest National Laboratory (PNNL)
Dr. Daniel Feezell, University of New Mexico
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1 Introduction

On December 7, 2021, the Department of Energy (DOE) Solid-State Lighting (SSL) Program within the Building Technologies Office (BTO) of the Office of Energy Efficiency and Renewable Energy (EERE) convened a four-hour virtual roundtable on the topic of Diversity, Equity, Inclusion, and Respect (DEIR) in the Lighting Industry, with emphasis on developing connections at the university level. Participants included more than three dozen professionals within the U.S. lighting community who had been invited to share their thoughts concerning issues and challenges on this topic.

Brian Walker, DOE SSL Program Manager, opened the Roundtable and introduced his co-host, Bernadette Boudreaux, Associate Director of Operations at the DesignLights Consortium (DLC). Eleven attendees presented overviews of DEIR efforts underway in education, associations, and industry to promote diversity in the workforce. A group discussion period followed with the goal of fostering collaboration and aligning existing efforts to improve DEIR in the lighting industry.

1.1 Primary Findings

In addition to the 11 presentations, the meeting format encouraged each of 37 attendees to participate and present his/her perspectives on critical challenges and opportunities related to higher education and DEIR in lighting. The discussions following the presentations offered a variety of valuable insights and surfaced a number of recurring themes. It was agreed that DEIR is important to the future of lighting in terms of the ideas it spurs and the industry growth and financial success it promotes. While the presentations spotlighted efforts underway to promote a diverse workforce, the current makeup of lighting professionals is largely homogenous. Progress can be made as existing efforts are leveraged, with a focus on the following priority areas (outlined in more detail in Section 2):

- Early Engagement
- Educational Initiatives
- Promotion of Lighting/Recruitment
- DEIR Outreach

1.2 Existing DEIR Activities

While there are Minority Serving Institutions (MSIs) including Historically Black Colleges & Universities (HBCUs), Tribal Colleges & Universities (TCUs), and Hispanic-Serving Institutions (HSIs) with a mission to provide underrepresented students with the support they need to achieve their academic and professional goals, lighting is not a career path that has often been promoted at these institutions. This is not to suggest that the pursuit of equity in lighting is new. There are many organizations, consortia, competitions, and programs that have been developed over the years to promote a more diverse and inclusive industry. Some examples include:

- Collaborative groups and targeted consortia, such as the National Society of Black Engineers (NSBE), Black Underrepresentation in Lighting and Design (BUILD), American Indian Higher Education Consortium (AIHEC), the Inclusive Engineering Consortium (IEC), and the DEIR Committee at the Illuminating Engineering Society (IES)
- Industry efforts, such as employee resource groups and surveys
- Centers of excellence
- Grant awards and prize opportunities, including the MSI STEM Research & Development Center (MSRDC) and the Graduate Education Minority (GEM) Fellowship, as well as several DOE efforts: the JUMP into STEM initiative, the IBUILD Innovation in Buildings Graduate Research Fellowship program, and the L-Prize competition, which features a DEI component
- Educational efforts, such as the architectural engineering programs at Tennessee State University and North Carolina A&T, the electrical and industrial engineering program at Navajo Technical University in New Mexico, plus lighting classes at TSU and Morgan State, and educational curricula available through IES
- Inclusion Across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science (INCLUDES), a National Science Foundation network focused on diversity and inclusion and broadening participation in STEM

Efforts to move forward, such as those tied to this Roundtable, will involve aligning, strengthening, and building upon the foundation of these existing initiatives, increasing their visibility and impact, discovering what may be missing from such efforts, making connections with stakeholders already engaged, sharing insights and findings, and engaging in further educational and outreach efforts, including interacting with minority-serving institutions.

2 Key Tasks

DEIR in lighting has many dimensions: products must save energy and reduce carbon emissions; quality and equitable installation of these products matters because of its tie to environmental justice; and it is critical to have a pipeline where a diverse group of young researchers feel included and heard. The section above lists existing efforts towards these goals, yet there are many roadblocks standing in the way of concerted progress (roadblocks are outlined in more detail in Section 3 and Appendix B). At the same time, many opportunities exist for engagement, educational improvements, recruitment, and promotion of DEIR best practices in the lighting industry. By working together, leveraging existing efforts, and being willing to “do the work,” many in the group expressed a belief that real progress can be made through collaboration so that organizations can participate and increase impact rather than begin individual efforts.

However, in any of these areas, it is imperative to start with the right mindset. Participants should be in the room from the beginning of an initiative, and we need to ensure we create engaged, equitable *partnerships*.

2.1 Early Engagement

As pointed out in the group discussion, everyone in society experiences lighting on a daily basis. Lighting is already an interactive experience and can serve as a great topic to talk about with young students who may not understand that they can make a career out of lighting. Hands-on activities and fun demonstrations that expose children to science, technology, engineering and mathematics (STEM) can have a lasting impact and spark interest in technical fields. A collection of lighting-specific activities for different age groups could also be created to allow early exposure to the industry. Introducing discussions along the lines of "What it means to be a lighting professional and how to become one" could lead more students to *choose* lighting as a career, rather than falling into it.

DOE-led competitions such as JUMP into STEM and the Solar Decathlon can be leveraged to increase participation by underrepresented students. Three other DOE "challenges" in 2021 geared to undergraduates and graduates of diverse backgrounds at MSIs typified the competition approach:

- Equal Access to Healthy Indoor Air
- Resilience for All in the Wake of Disaster
- Solving Adoption for Emergency Efficiency Technologies

One winner is awarded for each challenge and eligible teams compete in a JUMP into STEM final event. Winners receive a 10-week paid summer internship at NREL, ORNL, or PNNL. In 2020, the winners were North Carolina A&T, Clark Atlanta, Syracuse, SUNY College of Environmental Science and Forestry, and Georgia Tech. Other student competitions mentioned that could see more DOE/DEIR involvement include those of IES in New York City and Los Angeles, the AEI Design Competition, and the Solar Decathlon.

Internships, especially paid internships, were mentioned many times during the roundtable as a way to prime the pipeline with minority and underrepresented students. IBUILD Fellowship Research Program, which serves to strengthen the pool of diverse graduate students capable of supporting the mission of reducing building energy usage, includes internship support through funding for travel to and from internship sites at DOE labs. Other successful R&D-related internship vehicles can be found at Sandia and Los Alamos. One participant expressed the need for manufacturers to step up and offer paid internships to minority graduates.

2.2 Educational Initiatives

Several presentations highlighted the fact that many college and university activities are ongoing to raise awareness in students about possible careers in lighting. For example, MSRDC includes

70 HBCU and MSI members and has helped to fund 58 projects for $27 million, with more than $1.5 million in funding to 118 undergrad and grad students. GEM and JUMP into STEM are also active and successful.

At the same time, the sobering fact is that only two of the 107 HBCUs in the United States have architectural engineering programs, which is the educational track that sends top lighting professionals onto their career paths. Those schools are Tennessee State and North Carolina A&T, and at present TSU's architectural engineering program involves one required lighting class (Lighting/Power Systems) and one elective. PNNL's Bob Davis just completed a semester teaching Lighting/Power Systems as a volunteer to 16 students at TSU and in the spring will teach an elective that goes into more depth about lighting. Such efforts must be replicated.

A graduate-level, elective class at Morgan State, an HBCU, resulted from a grant award led by Edward Bartholomew of Bartholomew Lighting. A goal of the class was to build up the bench of black lighting educators. Another effort, the LESA Research Center began in collaboration with Morgan State and Howard University, provided innovative methods of delivery for electrical and computer engineering programs, which led to formation of the IEC. Now the IEC includes 15 HBCUs, 3 HSIs, and 2 tribal colleges. Predominantly white institutions with an interest in interacting with minority institutions are now being added.

NSBE membership includes 5,130 "NSBE Jr. members" in grades 3-12 as well as 15,106 members at the collegiate level and another 4,014 who are professionals. NSBE features 11 areas of domain expertise—including Energy—used to stimulate interest in STEM and increase the number of black and minority students interested in engineering who then go on to apply to schools of engineering. However, four challenges face NSBE and other HBCU/MSI efforts: lack of awareness, lack of clear pathways to STEM and academic majors, lack of opportunity because so many students are first-generation-to-college, and lack of resources and funding at MSIs/HBCUs.

Another idea surfaced would be based on centers of excellence or programs at schools to teach lighting and architectural engineering. Examples included creating a center on the East Coast similar to the Lighting Design Lab in Seattle, or creating a center of excellence composed of HBCUs/MSIs or *led* by HBCU/MSI, with participation by an institution that's neither HBCU nor MSI.

There are 37 tribal colleges currently at 75 campuses in 16 states in the U.S. Tribal colleges serve the largest American Indian native populations in the country; more than 230 federally recognized tribes are represented at TCUs. TCUs are *not* positioned at present to participate in the national MSI infrastructure, which prepares students for STEM careers.

2.3 Lighting Promotion and Recruitment into the Industry

Many ideas were put forth to raise awareness of the availability of careers in lighting for underrepresented students. These included mentorships and paid internships/co-ops; on-campus recruitment; career fairs; grassroots outreach in communities through local organizations;

webinars highlighting the impact of lighting; advertised opportunities in lighting; and local lighting tours of new installations. Panels at existing gatherings of lighting professionals like conferences and workshops were mentioned as places to promote DEIR, including the NSBE Convention and a session at the SSL R&D Workshop.

Experience tells us that lighting is an attractive field suitable for a range of interests—design, theater, architecture, science and engineering, etc.—creating many available career types. The *impact* of a career in lighting needs to be emphasized; work in energy-efficient technologies will help solve many societal issues present in this country and abroad. We need people from all walks of life to understand this space and see it as the next wave of economic growth/job security. Technologies in the energy industry are continuously evolving and changing, creating ongoing opportunities for learning and growth.

2.4 DEIR Outreach

As we bring awareness to careers in lighting, we need to promote work environments that are welcoming to emerging professionals. This environment is important for retention of employees and for an equitable workspace and involves educating companies about DEIR in lighting initiatives, promoting DEIR at technical conferences, and having a presence at workshops. Such efforts could also involve awards and recognition of companies that have exhibited leadership in DEIR initiatives. Development of materials will be critical, such as a DEIR handbook of best practices for use in education.

Related to several of the other thematic areas, it was clear that the science, art, and business of lighting practice are all important. This practice affects diversity, equity, inclusivity, and respect. For example, a handbook like that noted above would help inform current lighting professionals across the value chain, and an understanding of perspectives from diverse stakeholders can be helpful—from manufacturing, to design/bid/specifying, to installations, to operations.

3 The Path Forward for DEIR in Lighting

Work on all these key tasks has been initiated in the past and those working for DEIR in lighting shared their experiences, successes, and challenges. Many participants identified similar obstacles in their efforts towards equity. In the realm of education, “barriers to access” is a primary concern. Many of these barriers are resource issues, including a lack of time and money. Another roadblock is that many DEIR efforts begin and then stall out, sometimes because of a lack of ownership—*everyone expects someone else to own the problem*.

Barriers or challenges were identified in all key task areas, beginning with lack of awareness of careers in lighting from K–12 and then on through the undergraduate and graduate level. Lack of funding and other resources at MSIs/HBCUs is also a primary barrier that inhibits the ability to create and maintain educational tracks in lighting. Many of these institutions are new to the engineering space and faculty at these institutions typically have a heavy time commitment in the

classroom, leaving little time to develop new courses. At the emerging professional level, recruitment and retainment are issues. Knowing how to connect with and accommodate new hires is key.

Although the goals of the group are far-reaching and there are obstacles to overcome, it was agreed that by leveraging existing efforts and working together, progress toward a diverse, inclusive, and equitable lighting industry will be accelerated. Many participants expressed enthusiasm for a DEIR in Lighting Working Group to tackle the key tasks. Further, the use of a social media platform such as LinkedIn to connect with and share information with others with aligned interests was supported. All participants were encouraged to start taking action in their own organizations and communities. Connecting these multiple activities and efforts will help bring a diversity of perspectives and opportunities to the lighting industry, promoting innovation and sustainable growth.

Appendix A: Presentations

Ledum Nordee, Field Application Engineer, ABB; Director, Energy Special Interest Group, National Society of Black Engineers (NSBE)

Nordee stated that he has been involved with the NSBE for the past 15 years, with his first exposure as a junior in high school. The native of Nigeria and naturalized U.S. citizen provided background on NSBE, which was founded in 1975 and is one of the largest student-governed organizations based in the United States. NSBE supports and promotes the aspirations of collegiate and pre-collegiate students and technical professionals in engineering and technology.

He provided an outline of NSBE membership, which includes 5,130 "NSBE Jr. members" in grades 3-12 as well as 15,106 members at the collegiate level and another 4,014 who are professionals. He described 11 areas of domain expertise—including Energy—used by NSBE to stimulate interest in STEM and increase the number of black and minority students interested in engineering who then go on to apply to schools of engineering. He called attention to one domain in particular—Women in Science & Engineering or WISE—because of a lack of women engineers of color, something that WISE attempts to correct.

Nordee spoke about the four challenges to channeling black and minority students into engineering careers:

- Awareness (ill-equipped educators; lack of grassroots mobilization; underrepresentation)
- Access (unclear pathways to declaring an academic major within STEM; enrollment vs. retention)
- Opportunity (inconsistent quality of K-12 preparedness; first-generation black college students; familial responsibilities)
- Resources (economics, whether tools or time; MSI/HBCU capacity and underinvestment)

He then described challenges involved with a recent engagement effort with DOE/BTO regarding the Jump into STEM competition as well as a Solar Decathlon student/faculty pairing, the IMPEL BTO incubator, and a NSBE-DOE internship. He provided an example: while there was interest among students for Jump into STEM (a team of six students started, and four finished), Nordee came to realize the students did not have access to all the resources required. There were struggles with lack of expertise in architectural engineering and the modeling of entire buildings as well as lighting. So this first year of participation uncovered the lack of resources the students are facing.

NSBE has made a strategic plan to graduate up to 50,000 engineers of color by 2025, a goal made possible by a coalition of engineers and organizations like NSBE and the Society of Hispanic Professional Engineers (SHPE). NSBE has identified pre-higher-education involvement as the missing ingredient (K-12, community colleges, and youth resources like YMCA). The

higher-ed pipeline needs to be fed and then once students of color are there, they need to be given the resources to be competitive.

One final piece: students need to feel comfortable and fit in with the companies hiring them, but they sometimes aren't feeling that way within the environment, which leads them to ultimately leave.

Tanya Hernandez, Vice President, Government & Industry Relations, Acuity Brands

Tanya Hernandez opened her remarks by stating that she felt fortunate to be following Ledum Nordee because the pipeline of new minority talent is important. Tanya stated that Acuity Brands believes that the organization works best with a "diversity of people and thought." About three years ago, before the death of George Floyd, Acuity was organizing employee resource groups to guide leadership and the Acuity workforce. These included:

- The Women's Network
- PRIDE (People Respecting Identity, Diversity, and Equity)
- MAGIC (Minorities Amplifying Growth, Inclusion, and Community)
- A DEI (Diversity, Equity, and Inclusion) Council

Hernandez highlighted MAGIC because it was spearheaded by African American women at Acuity "to foster a supportive, nurturing environment to help minority associates realize their full potential." Topics include mentorship, mental health, and awareness of available company benefits. The DEI Council is responsible for overall strategy and a three-year roadmap of initiatives. A DEI survey conducted at Acuity in early 2021 identified 41% of associates as people of color, with 17% in management; 40% were women with 23% in management.

Hernandez stated, "It doesn't matter how good the pipeline is if inclusion and respect are missing. We have to get to a place where we normalize support, mentorship, and sponsorship of people of color in these spaces. Also, normalizing of diverse qualifications and skill sets is so important to everybody's bottom line. If you keep looking in the same place for your talent, you will keep finding the same people." She said that too many assumptions are made about abilities based on skin color and this fact calls for culture change and normalization.

Peter Hugh, Lighting Designer and Chair, Illuminating Engineering Society (IES) DEIR Committee

Hugh provided historical context for IES in terms of lighting science, R&D, and standards. The DEIR Committee at IES was chartered in January 2021 to recommend DEI practices within the organization. Members include liaisons from the IES Board, including the sitting president and chair of the Ethics Committee. All members were vetted to assure their sincere interest in DEI. A first step included surveying the IES, which confirmed a predominantly white male membership. The committee identified programs that will need DEI adjustment, such as awards and education. The committee also has input on the process of hiring a new IES executive director.

The DEIR Committee at IES has already become an inspiration and resource for other lighting organizations seeking similar change, such as the International Association of Lighting Designers (IALD) and Women in Lighting + Design (WILD). Immediate IES goals include:

- Hiring a DEI consultant to assist the committee with ongoing programs and recommendations.
- Upgrading the committee role to serve as a liaison between IES and other associations.
- Developing guidelines for all IES technical committees regarding the screening of new members and reviewing programs, including awards, education, and research (applying light-level research to more diverse populations, etc.).

In the longer term, the DEIR Committee will seek to expand its size to reflect the scope of the need and invest in the future of IES. The committee will also seek to develop recommendations on education reforms and investment into socio-economic and diversity-based institutions—engaging the power of manufacturers in this effort.

A brief discussion break followed. Comments:

- There was a recurring theme of "barriers to access" for education and for getting into the workforce. The pipeline seems so important and there are so many barriers. As Peter (IES) mentioned, we have funds and mentorship that can help. Then once the barriers are overcome, how do you make people feel like part of the group and wanting to stay? Bernadette cited this as a reason for this roundtable, that together we can have more impact in sharing as a group what we can do to remove such barriers.
- One attendee wondered how scope should be limited when it comes to lighting. There are barriers at K-12, at undergraduate, and at graduate/professional. Where do we focus? Do we look for opportunities from middle school to professional? Bernadette agreed and said DEIR Roundtable planners knew there had to be a focus, and theirs is on minority-serving institutions (MSI)—the university level—because of access within the group to this space.
- Brian Walker added that "the edges aren't clean; the problems aren't clean." He said the issues would be captured for now and addressed down the line. Candor was paramount in this gathering.
- Another attendee said that programming associated with cultural change will be very important because some people don't recognize that the limitations are in place. Raising awareness for those who don't see the limitations is paramount in the mission.

Edward Bartholomew, Principal, Bartholomew Lighting and IES member

Bartholomew described his lighting firm as a "just and equitable lighting design practice." He said you can't pick and choose your clients, but you can infuse your practice with powerful

values. Workplace diversity is important and so is keeping people there and including them in projects and decision making.

After the death of George Floyd in 2020, Bartholomew said he was invited to a number of panels and sought to gather black lighting designers for communication. He founded Black Underrepresentation in Lighting and Design or BUILD, a welcoming, open type of organization. He also serves on the IES DEIR Committee, the DLC Industry Advisory Committee, and others. He said, "It's important to be in the room. It's amazing the things you can catch once you're in the room." He added that sometimes changing culture means raising your hand and saying, "What if we looked at this in a different way?"

Bartholomew described his recent experience co-teaching a graduate-level, elective class at Morgan State, an HBCU, which had received a grant from the Nuckolls Fund for Lighting Education. A goal of the class was to build up the bench of black lighting educators and so several were invited to present to Bartholomew's Morgan State class (Zendra Hines, Mia Jean-Sicard, Nelson Jenkins).

He concluded by speaking about lighting activism and raising awareness about the inequalities of lighting and how lighting can be more equitable. Communities of color are "overlit" for surveillance and suppression. He talked about his work with the International Dark Skies Association and other groups to develop a practice that's kinder and promotes quality lighting in black and brown minority communities.

Bob Davis, Chief Lighting Research Engineer, Pacific Northwest National Laboratory (PNNL)

Bob Davis provided perspective by pointing out that many of the top people in the lighting industry have degrees in architectural engineering and came from either Penn State or the University of Colorado/Boulder. He showed pie charts bearing out that 67.5% of students at CU/Boulder are white and 1.6% are black; at Penn State the split is 65.5% and 4.3% and at another school noted for lighting, the University of Kansas, the split is 70.4% white and 4.2% black. He noted that he was on the faculty of CU/Boulder for nine years, until 2007. Around 2000 there was a major effort to diversify—but the pie chart shows a lack of success.

Upon investigation, Davis realized that only two of the 107 HBCUs in the United States have architectural engineering programs: Tennessee State and North Carolina A&T. NCA&T has 80.8% black students and 5.7% white; TSU is 74.8% black and 12.1% white. Seeking to implement a pilot program, he contacted Tennessee State and asked if they needed help with lighting instruction—at present, their architectural engineering program involves one required lighting class (Lighting/Power Systems) and one elective. Davis just completed a semester teaching Lighting/Power Systems as a volunteer to 16 students at TSU and in the spring will teach an elective that goes into more depth about lighting.

He said that the experience showed to DOE and PNNL the value of this pilot project; he added that he is looking for other opportunities for new courses as well as internships, guest lectures, joint proposals, and industry engagements.

Fredericka Brown, AAAS Science and Technology Fellow, BTO

Fredericka Brown discussed DOE efforts to inspire the next generation of building scientists through STEM, GEM, IBUILD, and JUMP (Join the discussion/Unveil innovation/Make connections/Promote technology). The effort involves online competitions to promote ideation and diversity; they are geared to undergrads and graduates of diverse backgrounds in diverse U.S. colleges and universities. 2021 saw three challenges open for competition:

- Equal Access to Healthy Indoor Air
- Resilience for All in the Wake of Disaster
- Solving Adoption for Emergency Efficiency Technologies

One winner is awarded for each challenge and eligible teams compete in the Jump into STEM final event. Winners receive a 10-week paid summer internship at NREL, ORNL, or PNNL. In 2020, the winners were North Carolina A&T, Clark Atlanta, Syracuse, SUNY College of Environmental Science and Forestry, and Georgia Tech.

BTO also participates with NREL and the GEM Consortium in a fellowship program to increase participation in building science for underrepresented groups—African Americans, American Indians, and Hispanic Americans. In this program, GEM fellows were partnered with BTO and NREL mentors on key BTO priorities to drive down emissions and improve energy efficiency in buildings through tech-to-market strategies, lighting innovations, AI, energy justice, and thermal energy storage.

BTO seeks to prepare future building technology professionals in a number of ways, including the IBUILD Fellowship Research Program, which serves to strengthen the pool of diverse graduate students capable of supporting the mission of reducing building energy usage. IBUILD benefits to fellows include:

- Research and educational support for research within their institution.
- Professional communication development delivering oral presentations, writing research papers, and participating in IBUILD webinars.
- Mentoring from professionals in support of career exploration.
- Networking with IBUILD fellows, mentors, and other building tech researchers.
- Internship support through funding for travel to and from internship sites.

The first 8 IBUILD research fellows were welcomed in the fall of 2021.

Brian Walker, Manager, Solid State Lighting Program

Brian Walker provided a DOE perspective, stating that diversity has many dimensions as it applies to the Department of Energy. Products have to save energy and reduce carbon emissions; quality of these products matters because of its tie to environmental justice, as stated by Edward Bartholomew; and DOE cares about a pipeline where young researchers feel included and heard.

Walker stated that the Solid-State Lighting Program began in 2005 and has had considerable impact through research projects that result in patents and products on the market, energy saved, and emissions and energy costs avoided. But there's still a long way to go—LEDs represent less than 50% of the market and their adoption has lagged in less-affluent communities. DOE can help address DEIR problems through meetings and partnerships, public inputs and plans, and cost-shared projects. He provided the example of the L-Prize to bring new ideas in lighting. Part of that new thinking involves how products are made and where they're deployed, making sure these things are done in an inclusive way. Innovation and inclusion aren't afterthoughts in the L-Prize competition; they're baked in and core to the effort to do something new in lighting.

Walker concluded by saying that the goal of efforts like the DEIR Roundtable is to "figure out what we're going to do going forward regarding inclusion and respect and making sure that all of our solutions are promoting equity to the greatest extent possible."

A brief discussion break followed. Comments:

- A challenge is not knowing about networks and opportunities like those mentioned by Edward Bartholomew and Bob Davis—who do students talk to if they want to participate? How do they learn about the opportunities?
- We have to think about our designs and their impact on communities (environmental justice).
- Mentorship helps a student understand educational possibilities and career potential, especially at an early stage—someone to relate to at a cultural, socio-economic level.
- DEIR is important to everyone's bottom line, up to and including saving the planet. Diversity of thought and diversity of experiences will get us there.
- At what point (K-12 through college) do you do lighting-specific programming with diverse students? When will you get traction? Bernadette said that such connections should be made with students as early as possible in K-12.

Alex Thomé, Director of Research Development, MSI STEM Research & Development Consortium (MSRDC)

Thomé began by speaking of a phone meeting earlier in the day with Lockheed-Martin, which was passionate about the topic of diversity and inclusion. He said it hopefully reflected a "tidal wave of energy."

He stated MSRDC was created eight years ago to promote innovation in diverse talent. Many MSIs don't have the infrastructure to promote or even manage their research, so MSRDC seeks to facilitate rapid research awards to MSIs, helping with grant applications, etc. The consortium focuses on three areas:

- *Research advocacy* that recognizes and promotes to the federal government the value of HBCUs and MSIs and pushing the value of these schools to the national ecosystem.
- *Research development* that facilitates relationships among government funders and researchers and funders and increases the competitiveness of MSIs.
- *Research administration* in the form of project management, monitoring and compliance, and review and oversight.

MSRDC includes 70 HBCU and MSI members and has helped to fund 58 projects for $27 million, with more than $1.5 million in funding to 118 undergrad and grad students. Partners include DoD, NASA, DHS, the Department of State, and many others, including $1.8 Million in DOE projects. MSRDC currently has an active project with EERE/SETO, working toward decarbonization by 2035 and net-zero emissions by 2050.

Dan Feezell, Professor of Electrical and Computer Engineering, University of New Mexico (R1 HSI/MI/MSI)

Dan Feezell began by providing background on UNM, which has an enrollment of about 23,000 students, with more than 50% of undergrads Hispanic and about 6% Native American. There is a high percentage of first-time college and non-traditional students. It's a Hispanic Serving Institution (HSI), a Minority Institution (MI), and a Minority Serving Institution (MSI).

Feezell listed the challenges facing an R1 MSI, which include a lack of internal funding for teaching and graduate assistance-ships—this means such funding must come through research grants. Attracting top graduate students is difficult because of competition with other better-resourced schools. Low tuition to make an education affordable to NM residents results in aging equipment and facilities. Departments are starved for cash, making hiring of top-level faculty difficult. All of these factors create a need for funding opportunities dedicated to research and education activities to make an MSI more competitive.

He identified a few opportunities:

- Dedicated MSI opportunities to fund grad students and equipment, the example being a DoD HBCU/MI program that provides equipment grants and student support every other year. No cost share is required.
- MSI Centers of Excellence established at DoD with examples in materials science quantum information technology.
- Undergrad and grad student fellowships and internships at DOE labs for MSIs—dovetails with Fredericka's presentation on IBUILD and GEM.

- Targeted opportunities for SSL/BTO-related faculty start-up packages in the range of $200-700K as begun by the U.S. Navy and National Science Foundation.
- Opportunities for collaboration between MSIs and DOE labs, such as Sandia, LANL, BNL, and NREL.
- Non-competitive, pre-negotiated awards for MSIs, such as MSRDC as discussed by Alex.

Feezell said the MSRDC process needs to be fast, simple, efficient, non-competitive, and of significant benefit to the agency and MSI. His own experience has been that he found the proposal process confusing—proposal prep was time consuming and confusing; he received an MSRDC grant in July 2020 and still hasn't received funding. As a result, he offered the following suggestions for process improvements to MSRDC and other non-competitive awards:

- Universities and applicants need to be alerted of potential opportunities by agencies.
- Timelines for funding need to be improved.
- The SOW and RFP stages need to be streamlined and simplified.
- Proposal length should be reduced to five pages.
- Proposal review time should be reduced since the project has already been vetted by the agency.

Al Kuslikis, Sr. Associate for Strategic Initiatives, American Indian Higher Education Consortium

Kuslikis positioned the AIHEC, saying that tribal colleges are very small, very young institutions at an early stage of developing energy- and engineering-focused academic and research programs — and will benefit from partnerships within this huge ecosystem described in the Roundtable. There are 37 tribal colleges currently at 75 campuses in 16 states throughout the United States. Tribal colleges serve the largest American Indian native populations in the country; more than 230 federally recognized tribes are represented at TCUs. New tribal colleges are emerging all the time, but TCUs are *not* positioned to participate in the national MSI infrastructure, which prepares students for STEM careers.

Navajo Technical University in NM is the only tribal college with accredited engineering programs (electrical and industrial engineering) and a four-year program in advanced manufacturing.

Five North Dakota TCUs have formed a partnership with North Dakota State University to offer a 2+2 program in engineering, providing a great model for regional colleges and universities to partner in engineering with smaller tribal colleges. In addition, 12 tribal colleges are participating in an engineering working group that provides pre-engineering programs as a strategy for building academic programming in engineering for as many students at TCUs as possible.

AIHEC goals include:

1. Establishing a career pathway for American Indian and Alaska Native engineers and technicians.
2. Pursuing research, development, and manufacturing project opportunities that address U.S. and tribal nation priorities. (Kuslikis noted overlap with the work at DOE in promoting energy independence and food-water-energy security for tribal nations.)

He concluded by noting a range of STEM activities, such as course and curriculum development that is broadly accessible online so it doesn't need to be stood up at individual colleges; professional development for faculty; networked best practices for engineering activities at middle and high schools; R&D projects with tribal enterprise partners, industry, and national labs; and student internships at national labs—one of the most effective tools for getting students on a career path through internships can be found at Sandia and Los Alamos. Partnerships are the bottom line.

Kenneth Connor, Inclusive Engineering Consortium (IEC) and former faculty member, RPI

Connor described the IEC as a "super-department model for multi-university, electrical and computer engineering (ECE) collaboration." The "super-department model" is multi-institutional, shares resources and support, achieves success through diversity, and forms equitable partnerships. He reiterated what had been reported earlier—resources for MSIs are limited, so the answer is partnerships that share resources and make better things happen. He showed a slide representing the 15 HBCUs, 3 HSIs, and 2 tribal colleges in the IEC. Predominantly white institutions with an interest in interacting with minority institutions are now beginning to be added.

Connor said IEC began at the LESA Research Center as a collaboration with Howard University and Morgan State. Interesting methods of delivery for electrical and computer engineering programs resulted. Other HBCUs took notice and NSF funding was provided. The effort went so well that IEC was formed.

Connor said the focus of IEC continues to be on ECE. He identified the heavy teaching and advising loads for educators as a primary barrier for MSIs—there's very little time to be creative. But working collectively, such issues could be addressed.

He showed a list of the bachelor's degrees awarded to African Americans by school, and North Carolina A&T topped the list with 154, with Morgan State third at 137. He pointed out that NC State is a much larger school but produced only 53.

He concluded by saying that IEC seeks a level playing field with all participants fully engaged and equitable partners from day one, with everyone contributing and all voices heard. This includes industry participation as a full partner and not just an occasional player.

Bernadette Boudreaux, DLC

Bernadette said that the idea of a DEIR Roundtable began in a conversation with Brian Walker about getting HBCUs and TCUs more engaged in lighting. They set a goal to bring MSIs together in a "lighting incubator" to share information and solicit input from key stakeholders. Bernadette also proposed an effort for 2022 to involve MSIs and TCUs in a virtual forum that includes industry representatives as well as the minority institutions to understand their needs and expose them to opportunities in lighting. Similarly, the DEIR Roundtable could be used as a springboard for tangible efforts to engage these communities and improve the pipeline of future lighting professionals.

Appendix B: Group Collaboration Notes

Following the invited presentations, Bernadette facilitated open discussion among all attendees, with notes captured on Google Jamboard. Attendee inputs are summarized in the following sections.

Active DEIR Initiatives

Discussion began with Bernadette summarizing the current themes for minority engagement as explained by the speakers, which she categorized as:

- Industry efforts, such as employee resource groups and surveys.
- Movements toward collaboration via targeted consortia (such as IEC and NSBE), centers of excellence, and the TCU movement.
- Funding through grant awards and prize opportunities; grants for research including MSRDC and also JUMP, GEM, IBUILD, and the L-Prize.
- Early engagement through pre-college programs; it's important to convey to young people (beginning in middle school) the many pathways they can take toward a career in lighting and what's available in the industry.
- Educational efforts, such as the Morgan State lighting class, TSU lighting class, and IES educational curricula. JUMP, GEM, and IBUILD fit here as well because they're bridges to DEIR targeted at students.

Further discussion on initiatives:

- The National Science Foundation INCLUDES network has not been mentioned. It focuses on developing networks of stakeholders in higher education, the research community, and industry around broader participation in STEM. Different areas of STEM involve different INCLUDES networks—everything we're talking about is already covered in an INCLUDES network that's NSF-funded.

Question for discussion: How do we better align the existing DEIR efforts?

- Participants must be in the room from the beginning of an initiative.
- Make sure we create engaged, equitable partnerships.
- No need to reinvent the wheel—make connections with an existing NSF/INCLUDES network of engineering stakeholders who are all engaged in broadening participation.
- Start talking, info sharing
- Make a greater effort at networking.

- Provide opportunities for MSIs to engage with DOE labs.
- Borrow from and expand upon existing models to create centers of excellence or programs at schools to teach lighting and architectural engineering. Examples:
    - Lighting Design Lab in Seattle—create something like that on the East Coast.
    - Centers of excellence real-world examples: 1) center composed of HBCUs/MSIs or 2) center *led* by HBCU/MSI with participation by an institution that's neither HBCU or MSI.
- Forums and panels like the NSBE Convention and the session at the SSL R&D Workshop.

Question for discussion: How do we increase visibility/impact?

- Models that have worked to bring new blood into the lighting industry: 1) workshops (IALD India working with manufacturers) for students who aren't currently in lighting at all—they could be in architecture or electrical engineering … lighting designers went onsite to work with students to create lighting solutions for different parts of the campus; 2) "Lights in Alingsas" Swedish model bringing together professors, manufacturers, lighting designers, and people interested in lighting all going on a two-day retreat to work on hands-on lighting solutions for the city.
- Companies need to market DEIR in their companies.
- Create a dedicated DOE (or other organization) publication or webpage that can promote ongoing DEIR initiatives and post recognition of firms that are 'doing the work.' This creates incentive and brand recognition for those firms and their initiatives.
- Hand out awards for businesses that promote DEIR.
- STEM pathway activities.
- Request sponsorship from firms and offer recognition as an incentive (such as logos on marketing materials). This increases visibility within those firms and with competitors.
- Look at career recruitment.
- Early exposure to lighting.
- Need paid internships where manufacturers can "put their money where their mouth is."
- Mentorship is critical.
- Focus on job fairs.
- "Equity" is the overall goal—how do we build successful models of people who made a career in lighting and apply that model to people of color?

- Lack of bandwidth at HBCUs/MSIs/TCUs—why not share courses? Lighting is too small a discipline at many schools, but for example, a Va. Tech professor develops a course and shares it with other institutions via remote learning.
- Emphasize grassroots engagement—HBCUs and MSIs would welcome a lighting engineer to speak virtually; it's a matter of volunteering to do it.
- There needs to be a plan for long-term engagement with institutions, establishing networks and curricula.
- Put plans in place in case Build Back Better comes to fruition and funding becomes available.
- Understanding the importance of lighting to our lives and health has the capacity to get people interested at a different level. Black and brown people aren't typically engaged in this way.
- Create DEIR tracks at conferences (DOE, IALD, IES, DLC) to provide updates on latest developments and opportunities. IES and IALD have just begun this process—groups are starting to talk.
- Manufacturer perspective: Career recruitment is an important component; lighting is getting more technical with LED and IoT.
- Language options—teachers, presenters, mentors who are bilingual/multilingual.
- The young generation is looking at social media to see what an employer looks like. Many companies aren't making sure diversity is included in their recruitment. Make sure manufacturers recruit in the right places and include diversity.
- Some organizations have tried but not gained traction with DEIR in lighting at the university level—how do we make lighting more interesting and relevant within existing majors? The lighting area is broad enough that a lot of backgrounds can play in it. Making lighting appealing has been a struggle.
- Lighting is sexy! We should be marketing the industry's many facets to students—controls, design, equipment—market ourselves!
- Focus on the idea of "equity," which is different from "equality." We need to go to where people are. Employers need to do more to make people feel welcome. Some universities get people hired over and over because they've "got the formula down." But can employers make sure all new hires (not just the most polished) get what they need to thrive in the organization? Not easy but there needs to be effort put into training and welcoming minority groups.

- Possibly get more DOE/DEIR involvement in long-existing student design competitions related to lighting (Thompson Light Fixture Design Competition, IES NYC and LA, AEI Design Competition, Solar Decathlon, etc.).

Question for discussion: What resonated with you?

- DEIR includes MSI, HIS, TCU, and HBCUs.
- Not sure where or how we limit the scope?
- There is a network to navigate through.
- We need mentorship at an early stage that's relatable.
- Guest lecture opportunities.
- DEIR is important to the success of lighting.
- Seeing the work in 'real life.' Invite students to see a recently completed project and emphasize that they can do it, too!
- Teach a course together.

Question for discussion: What is missing?

- If they become available, use Build Back Better funds to address lighting injustice in minority communities, including community lighting education.
- Advocates and allies.
- Are we thinking of LGBTQ+, people with disabilities—is this about *all* diversity?
- A playbook of best practices.
- Support and retention.
- A transparent feedback loop.
- Ideas need to be scaled.
- Lack of bandwidth at HBCUs/MSIs/TCUs—everyone overworked for not enough money.
- Financial shortfalls that make it impossible to attract top faculty and grad students.
- Environmental justice and lighting activism.
- A roadmap.
- Coordination between organizations as well as resource sharing.

- Lack of access, support and retention, and feedback in industry.
- Too few non-competitive awards.
- Lack of student funding.
- LED lighting not being adopted in underrepresented communities.

Question for discussion: What does ongoing HBCU/TCU/MSI engagement look like? How do we promote lighting and its opportunities to future graduates? How do we help graduates transition to potential hires in the lighting industry?

- We are building upon existing efforts—the ideas here today aren't just "blue-sky thinking." Concrete plans will emerge, and inputs here will form the basis of what the group could accomplish going forward.
- Many of us are leaders in our organizations and can go back to them *now* and implement best practices large and small and share ideas with the larger group.
- Other institutions could access Morgan State model of creating a centralized lighting resource. Scale up lighting education inexpensively by offering accessible virtual learning across universities.
- So many lighting designers come from the theater world. Are we limiting ourselves by concentrating on engineering programs? As well as drafters (trades).
- Do we need to add community colleges and trade schools to the engagement initiative? Can trade schools add courses in lighting manufacturing? (Yes! TCUs often fit this category.)
- Highlight exciting new tech related to lighting manufacturing, such as IoT, horticultural, agricultural, germicidal.
- Subsidize lighting credential/educational efforts.
- University lighting workshops.
- Match new/younger lighting professionals with older mentors. Mentorship is harder if you are from a minority group. Can we make this easier?
- Lighting is a totally hands-on educational delivery approach that everyone experiences on a daily basis. It's a great topic to talk about with kids and we need to collect a playbook of best practices and a list of fun demonstrations and activities. An introduction to, "What it means to be a lighting professional and how do I become one?" But who collects the resources? IES? SSL?
- We need a sound marketing strategy defining the broad value of lighting design, manufacturing, etc. as a real and profitable field that brings societal value. Then tweak

the model explaining why manufacturers should hire people with certain backgrounds and experiences.

- Highlight opportunities in lighting.
- Long-term engagement.

Question for discussion: How can we encourage HBCU/TCU/MSI engagement?

- Webinar series.
- Community engagement.
- Connecting the full circle of lighting.
- Grass-roots engagement.
- Focus on all aspects of the lighting industry.
- Highlight the impact of lighting on daily life (health, $$, etc.).

Question for discussion: What are the roadblocks?

- The scale at individual MSIs may be small.
- Funding.
- The need to streamline the process for awards.
- TCUs are new to the engineering space.
- There is no broadly accessible pathway.
- Heavy teaching loads as discussed earlier.
- Competition between higher education institutions may impede adoption of the kind of outside classes discussed here.
- Time!
- A big roadblock is that everyone expects someone else to own the problem—there were various discussions about why DOE or IES isn't "in charge" of this new effort. We can't wait for someone to claim ownership; the burden must be shared collectively.
- Lack of infrastructure.
- Some people believe that this should not happen.
- Access to information/a central repository.

- Need to pay educators and organizers for their efforts on panels, boards, and working groups. The bandwidth is challenging for a single person to participate.
- Assign champions to some of the ideas already put forth—paid internships, etc. (frustration that there are many of these meetings, but nothing happens).
- DOE has an information-sharing monthly call to discuss a "subject of interest"—inclusion of DEIR would be "an attractive proposal."
- Prioritize the long list of ideas generated; a follow-up meeting would be worthwhile within a six-month timeframe.

Question for discussion: What are next steps for this group?

- Have a track at workshops and conferences or at least promote there.
- Summarize a list of action items and prioritize.
- Share contact information and, potentially, today's presentations.
- Leverage social media, for example by starting a LinkedIn group to keep people engaged; have attendees mention this meeting in their social media to attract other industry partners; circulate a list of potential hashtags. BUT what do we link back to? (This is listed as an immediate action item.)
- Include an email or sign-up form on social media to get more boots on the ground.
- Develop a summary report on this Roundtable for distribution.
- Schedule bimonthly meetings for this group, with each meeting addressing a specific, prioritized subtopic; send out a list of topics, let people scrutinize it and choose.
- Use common resources like these presentations at lighting conferences or develop a new presentation explaining the problems identified and ask for help solving them.
- Go back to your organization with all this information and then share with this group what happened.
- Attend the Lighting R&D Workshop, especially the session on "Next Generation Lighting Professionals." Follow up with a link to the workshop.

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