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Chairman Bowman, Ranking Member Weber, and distinguished members of the subcommittee: I very much appreciate the opportunity to testify before you today on the promising possibilities for centering social equity and marginalized communities in the research, development, and deployment of clean energy technologies.

My name is Myles Lennon, and I'm the Dean's Assistant Professor of Environment & Society and Anthropology at Brown University. I worked for almost a decade advocating for, designing, and implementing energy efficiency programs and research in conjunction with low- and moderate-income communities of color in New York City and New York State. I then earned a doctorate in environmental anthropology. My research focuses on the social dynamics of solar energy transitions in marginalized communities, and on the partnerships and political synergies between grassroots environmental justice organizations and renewable energy corporations. My testimony today will draw from my research and from my professional experience working with environmental justice organizations on climate and sustainable energy policy.

Clean energy innovations in the form of solar and wind power, solar thermal, battery energy storage systems, electric vehicles, and microgrids can dramatically reduce the public health and occupational safety problems of our energy production system, which disproportionately harm poor and working-class communities and communities of color throughout the United States and the rest of the world. Furthermore, these clean energy innovations can dramatically reduce the anthropogenic greenhouse gas emissions that are changing the climate system in ways that also disproportionately harm those marginalized communities.

At the same time, these technologies are by no means a monolith. Depending on how they are made, where they are made, what they are made with, how they are deployed, and how they are decommissioned, these technologies have the potential to generate *new* environmental, economic, and public health problems in marginalized communities, while failing to solve these communities' *existing* environmental, economic, and public health problems.

To address this, we need multidisciplinary and interdisciplinary research that identifies how to: (1) improve existing technologies to maximize their positive impacts on the health, environment, and economy of marginalized communities while minimizing and eradicating their negative impacts; (2) transform the labor practices of the renewable energy technology industry to maximize their positive impacts on the health, environment, and economy of marginalized communities; and (3) improve the deployment of clean energy technologies in marginalized communities by strategically reducing barriers to adoption. A multidisciplinary and interdisciplinary research agenda that works toward these ends is essential to informing policies and regulations, community-based initiatives, and private sector partnerships that center equity in our broader energy transition efforts. Crucially, such research must be designed and conducted with the input of marginalized workers and communities, who can help researchers identify problems, needs, and solutions in ways that ensure that clean energy innovations and legislation directly support the people who have historically been burdened by energy production.

While there are numerous research trajectories that the Department of Energy and the federal government can support to realize the three aims that I identified above, I will now briefly outline four potential trajectories. These four trajectories are not exhaustive but instead exemplary of the many, multidisciplinary ways we can go about centering communities who have been disproportionately burdened by fossil fuels in our transition to cleaner energy. Taken together, these four trajectories cover the key facets of clean energy supply chains: renewable technology production; energy storage; renewable technology deployment/adoption; and renewable technology decommissioning.

(1) *Multidisciplinary research on the labor and environmental practices of corporations that produce renewable energy technologies*

We need multidisciplinary research on the labor and environmental practices of corporations that produce renewable energy technologies. Currently there are companies up and down renewable energy supply chains that exploit vulnerable workers, that lack basic health and safety provisions, that dump toxic chemicals in the vulnerable communities where they are located (such as silicon tetrachloride), and that use so-called conflict minerals.[1] [2] [3] At the same time, there are companies that abide by high labor and health and safety standards, that abstain from using conflict minerals, that use materials that don't harm workers such as zinc instead of cadmium in the production of solar panels, and that minimize their local environmental impact. [4] [5] But we still need much more comprehensive data on how the production of renewable energy technologies impacts marginalized workers and communities.

Research on renewable energy supply chains conducted in close consultation with these workers and communities can help us determine how to incorporate good labor, health, and environmental justice standards in the production of clean energy technologies. While such research could potentially inform ambitious policy to transform and regulate renewable technology production, it can also inform fairly straightforward and commonsensical innovations in clean energy deployment at the federal level. For instance, the federal government could develop procurement guidelines on any DOE-funded solar or wind project that prioritize the

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[1] Mulvaney. 2013. Opening the black box of solar energy technologies: exploring tensions between innovation and environmental justice. Science as Culture 22 (2), 230-237
[2] Mulvaney. 2020. *Solar Power: Innovation, Sustainability, and Environmental Justice.* Berkeley: University of California Press.
[3] Church and Crawford. 2018. Green Conflict Minerals: The fuels of conflict in the transition to a low-carbon economy. International Institute for Sustainable Development
[4] Mulvaney. 2020.
[5] Silicon Valley Toxic Coalition. 2019. Solar Report Card: 2018-2019

procurement of solar and wind technologies that are made with safer and less toxic materials and under safe and supportive working conditions. Such guidelines could loosely be modeled on the Silicon Valley Toxic Coalition's solar scorecard.

(2) R&D that will accelerate production innovations to minimize the human rights violations and environmental degradation affiliated with battery energy storage systems

We need R&D that will accelerate production innovations that could severely minimize the human rights violations, labor exploitation, and environmental degradation affiliated with battery energy storage systems. Battery energy storage systems are essential to harnessing the power of solar, wind, and other intermittent energy sources, but most battery systems are made with lithium and cobalt, which are extracted from the earth in ways that severely harm the health and environment of poor communities in a handful of poor countries, often under violent and exploitative conditions that include unequivocal human rights violations. In the so-called lithium triangle in Chile, Argentina, and Bolivia, lithium is extracted with brines that deplete the scarce water resources of poor communities and cause droughts.[6] In the Democratic Republic of the Congo (DRC), cobalt mining causes lung disease and heart failure among deeply impoverished workers, many of whom are children who toil in cruel and dangerous conditions.[7]

But scientists and industry have made remarkable progress in developing batteries that don't use lithium and cobalt, including large-scale storage systems made with the element vanadium, and rechargeable zinc-ion batteries, which rely on zinc instead of lithium. These still-nascent technologies have tremendous potential to curtail the labor and environmental burdens of energy storage production on vulnerable communities. For instance, the vast majority of the vanadium redox battery's components can be recycled in stark contrast to lithium batteries,[8] reducing the e-waste of storage technologies, which disproportionately burdens marginalized communities. There are also large, unmined deposits of vanadium all over the US, presenting an opportunity for domestic jobs that would be protected by this country's occupational safety and health laws—a promising alternative to the human rights violations of cobalt mining in the DRC, for instance. Vanadium is neither a panacea for environmental injustice nor flawless; the point here is that we need to continue to develop battery storage innovations in ways that purposefully reduce and eradicate the burdens that storage technologies place on marginalized communities. Put differently, our battery storage R&D agenda must prioritize innovations that can address the labor exploitation of energy storage supply chains.

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[6] Symington. 2019. Lithium-ion batteries: Positive and negative rights impacts. *Human Rights Defender* 28(1).

[7] Sovacool. 2021. When subterranean slavery supports sustainability transitions? power, patriarchy, and child labor in artisanal Congolese cobalt mining. *The Extractive Industries and Society* 8(1): 271 -293.

[8] Weber et al. 2018. Life Cycle Assessment of a Vanadium Redox Flow Battery. *Environmental Science & Technology* 52(18): 10864–10873.

(3) Social science research on the social dynamics of community-based renewable energy programs in marginalized communities

We need social science research on the social dynamics of community-based renewable energy programs in low-income communities and communities of color. These communities face numerous barriers to adopting renewable technologies including a lack of disposable income, lack of home ownership (renters cannot make decisions about installing renewable energy in their homes), and buildings in poor physical condition or less-than-optimal conditions for renewable energy upgrades. Community-based renewable energy initiatives, such as community solar programs and Solarize campaigns, reduce these barriers by aggregating demand for clean energy and/or generating community-owned energy infrastructure (as opposed to a private solar photovoltaic system on an individual's roof, for instance). More specifically, community solar programs allow community members to purchase electricity produced by a designated number of solar panels in a shared solar array installed on a community facility (as opposed to their homes), and enable them to receive an electric bill credit for electricity generated by the shared array. This allows people to both save money on their electric bills and benefit from solar even if they are unable to install it on their roofs. Similarly, Solarize campaigns enable communities to bring down the cost of solar through community-based solar purchasing pools that leverage local social networks to achieve economies of scale. Research suggests that these initiatives are most successful when everyday community members play an active role in aggregating demand by directly enlisting their friends, families, and neighbors to participate.[9] But we need more research on these social dynamics to develop stronger community based programs that empower marginalized people to lead their communities toward clean energy—especially in light of the expansion of these programs over the last few years.

How can these programs optimally incentivize community participation? How can community members tailor outreach to different segments of their social network? What messaging and communication tools reach particular target demographics? What social practices lead to tipping points in adoption? What other economic or environmental benefits can communities secure in leveraging economies of scale? These are some of the many questions that social science research can address to improve the design and development of community-based renewable energy programs in marginalized communities. This research can also build on DOE's Solarize Guidebook from 2014 and NREL's report on Solarize campaigns in 2019, delving into more specifics with regard to race, class, and gender, and comparatively evaluating community solar programs, which are far more complex than Solarize campaigns and must work in tandem with state legislation or electric utilities.

(4) Public health, engineering, and social science research to document and improve the health, safety, and efficacy of renewable energy technology recycling

We need public health, engineering, and social science research to document and improve the health, safety, and efficacy of renewable energy technology recycling. By 2050, there could be

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[9] Cook et al. 2019. Up to the Challenge: Communities Deploy Solar in Underserved Markets. NREL.

80 million metric tons of solar panels that are no longer working,[10] which will demand that we ramp-up our solar recycling capacities to ensure that solar does not contribute to the e-waste crisis plaguing poor communities throughout this country and the world. But solar recycling can cause health and safety problems for vulnerable workers through, for instance, exposure to copper, silver, tin and lead,[11] and there is a dearth of data on the problems and opportunities for safe, quality jobs in the solar manufacturing industry. Specifically, we need: (1) better exposure assessment tools for assessing worker exposure to toxic materials; (2) research on the health impacts of solar recycling on workers, and (3) R&D to improve the engineering controls and environmental performance of solar manufacturing plants so as to simultaneously increase the amount of solar technology that is recyclable and improve the health and safety of solar recycling. Washington State, which recently passed a law requiring that solar manufacturers finance the takeback and recycling of solar panels, presents fertile ground for pursuing these lines of inquiry; the state could possibly be a central site for interdisciplinary research to identify how to build a sustainable and healthy renewable energy recycling infrastructure that supports and protects marginalized workers.

To reiterate, the four trajectories that I proposed are not exhaustive but instead exemplary of the many, multidisciplinary ways we can go about centering communities who have been disproportionately burdened by fossil fuels in our transition to cleaner energy.

Thank you. I look forward to answering your questions.

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[10] Heath et al. 2020. Research and development priorities for silicon photovoltaic module recycling to support a circular economy. *Nature Energy* 5: 502–510.

[11] Deign. 2020. “5 Research Priorities for Making Sure More Solar PV Materials Get Recycled.” Greentech Media. https://www.greentechmedia.com/articles/read/6-research-priorities-to-make-sure-more-pv-gets-recycled

Myles Lennon
Short Bio

I am an environmental anthropologist, Dean's Assistant Professor of Environment & Society and Anthropology at Brown University, and a former sustainable energy policy practitioner. My research has been supported by the U.S. National Science Foundation, the Ford Foundation, and the Wenner-Gren Foundation. I hold a B.A. in Development Studies from Brown University and a Ph.D in environmental anthropology from Yale University. My research and scholarly objectives are informed by my experience as a sustainable energy practitioner and advocate in New York for almost a decade.