From Exclusion to Pathways: Reframing Research Access, Institutional Power, and Energy Justice in Clean Energy Innovation

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Abstract

This paper examines how structural inequities shape participation, legitimacy, access to funding, and leadership within clean energy research and innovation systems, with particular attention to Black researchers, Historically Black Colleges and Universities (HBCUs), Minority-Serving Institutions (MSIs), community-based organizations, and other underrepresented stakeholders. Drawing on scholarship on systemic barriers in research, academic engagement, institutional change, and energy justice, it argues that exclusion in clean energy research is not simply a diversity problem, but a design problem embedded in funding rules, institutional classifications, professional norms, and assumptions about who counts as a researcher. Using a pathways-oriented analytical framework, the paper examines four interrelated domains: funding equity and access, implicit bias and institutional practice, HBCU and MSI leadership, and energy justice and community engagement. It shows how research status hierarchies, including R1 and R2 designations, structure opportunity in ways that reinforce inequity. In response, the paper outlines recommendations centered on inclusive eligibility rules, capacity-building investments, participatory and community-engaged research models, equitable partnerships, revised review criteria, and institutional accountability. It concludes that a just clean energy transition requires not only technical innovation but also a redistribution of research power, recognition, and resources.

Keywords: clean energy research; energy justice; research equity; HBCUs and MSIs; community-engaged research
Introduction

Introduction

The clean energy transition is often framed as a technological and economic challenge, but it is also a question of who is authorized to produce knowledge, set agendas, define expertise, and benefit from innovation. Persistent disparities in research funding, institutional prestige, publication access, network visibility, and organizational capacity leave many of the communities most affected by environmental burdens and energy insecurity underrepresented in the systems intended to design solutions (Sovacool et al., 2016; Romero-Lankao et al., 2023).

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Calls for equity in clean energy research must therefore move beyond representation alone and confront the structural rules that determine who is recognized as a legitimate researcher, which institutions are treated as research-ready, and what forms of evidence are considered rigorous.

This paper asks a foundational set of questions: Who decides who is “in” and “out” of research? Why do conventional pathways privilege highly resourced universities, tenured investigators, and established publication records? What happens when community residents, practitioners, small businesses, or under-resourced faculty possess relevant expertise but do not fit the dominant mold of the academic researcher? These questions are especially urgent in clean energy, where the consequences of exclusion are both social and material. Communities facing higher energy burdens, infrastructure neglect, pollution exposure, and chronic underinvestment are often the least represented in funded research and leadership pipelines, even though they may hold the practical knowledge, relational trust, and local insight needed for more effective and just solutions (Jenkins et al., 2016; Romero-Lankao et al., 2023; Sovacool et al., 2016).

The paper argues that barriers facing Black energy researchers and other underrepresented stakeholders are not isolated obstacles, but interconnected features of a broader research ecosystem shaped by institutional classification, reviewer expectations, funding architecture, historical inequities, and implicit norms of merit and credibility (U.S. Government Accountability Office, 2025; Hultgren et al., 2024). Drawing on scholarship on universities and public action, broadening participation, energy justice, community-engaged research, and research capacity building, it develops an analysis across four domains: funding equity and access, implicit bias and institutional practice, HBCU and MSI leadership, and energy justice and community engagement.

Background and Literature Review

Defining the Research Problem: Who Counts as a Researcher?

At the center of this discussion is a deceptively simple question: What is a researcher? In conventional academic practice, the term often refers to a person formally affiliated with a university or research institute, trained in disciplinary methods, positioned to secure grants, and expected to produce peer-reviewed outputs. This definition appears neutral, but in practice, it operates as a gatekeeping mechanism. It privileges those with institutional affiliation, protected time, access to administrative support, publication histories, and social capital within established scholarly networks (U.S. Government Accountability Office, 2025; Hultgren et al., 2024). By contrast, community leaders, residents, practitioners, public-interest organizations, and faculty at under-resourced institutions may generate valuable knowledge but still be excluded from formal recognition, principal investigator roles, or funding eligibility (Castro-Diaz et al., 2024; Jenkins et al., 2016).

This mismatch matters because clean energy challenges are rarely solved by technical expertise alone. Research on community engagement and equity in renewable energy has shown that successful transitions require procedural fairness, trust, local knowledge, and meaningful participation in decision-making, not simply downstream consultation (Romero-Lankao et al., 2023; Wüstenhagen et al., 2007). Participatory research in energy justice similarly argues that co-produced and community-engaged methods are essential for bridging the gap between energy justice theory and practice (Castro-Diaz et al., 2024). When funding systems fail to recognize these forms of expertise, they limit both innovation quality and equitable impact.

The hierarchy of institutional status reinforces this problem. Under the updated 2025 Carnegie research activity methodology, Research 1 institutions are those that spend at least $50 million annually on research and development and award at least 70 research doctorates, while Research 2 institutions spend at least $5 million and award at least 20 research doctorates (The Carnegie Classification of Institutions of Higher Education, 2025). Carnegie also now recognizes a Research Colleges and Universities category for institutions outside the R1/R2 group that still maintain meaningful research activity. These classifications are descriptive, but in practice, they often become proxies for quality, readiness, and eligibility in grant review and partnership decisions. As a result, the prestige associated with research classification can harden into a hidden screening device that disadvantages HBCUs, MSIs, teaching-intensive campuses, and community-based organizations, even when they are closely connected to the populations and problems under study (U.S. Government Accountability Office, 2025; Hultgren et al., 2024).

Analytical Framework

This paper uses a pathways-oriented analytical framework to examine how exclusion is produced across the clean energy research ecosystem. Rather than treating inequity as the result of individual deficits, the framework focuses on the institutional rules, evaluative norms, funding structures, and partnership arrangements that shape who can enter, lead, and benefit from research. The analysis is organized across four interrelated domains—funding equity and access, implicit bias and institutional practice, HBCU and MSI leadership, and energy justice and community engagement—which together show how research power is distributed and where redesign is most needed.
Argument

1. Funding Equity and Access

Funding is one of the clearest ways in which inequity becomes institutionalized. Eligibility requirements, proposal conventions, indirect cost assumptions, expectations about prior awards, and the need for sophisticated pre-award infrastructure can all favor institutions already well positioned in the research ecosystem (U.S. Government Accountability Office, 2025).

Research on MSI participation in grant peer review further suggests that

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underrepresented institutions often face disparities in institutional resources, limited social capital, and uneven access to the review networks that shape funding cultures (Gallo et al., 2022). These disadvantages directly affect whether investigators can identify opportunities, assemble teams, prepare competitive budgets, meet compliance requirements, and manage awards after funding is secured.

For Black researchers at HBCUs and other under-resourced institutions, these burdens are often compounded by high teaching loads, limited staff support, fewer graduate assistants, a pressure to serve multiple institutional functions simultaneously (Akter et al., 2025). In such settings, the standard model of the principal investigator as a grant-specialized, publication-intensive, administratively supported academic does not reflect lived reality. Even when targeted programs exist, such as NSF's HBCU Undergraduate Program and MSI-focused opportunities, the broader funding environment continues to reward preexisting capacity rather than building it (National Science Foundation, 2026). A 2025 U.S. Government Accountability Office report further noted that HBCUs, Tribal Colleges, and MSIs have long faced barriers to securing federal research funding, despite federal recognition of their role in the research and development ecosystem (U.S. Government Accountability Office, 2025).

These patterns raise an important question for clean energy funders: are current review systems evaluating excellence, or are they rewarding accumulated advantage? If the lead institution must already look like a traditional research university, then access to resources remains tethered to historic inequities. A pathways approach would instead redesign funding around inclusion. This could include lowering unnecessary eligibility barriers, allowing community-based organizations or small businesses to serve as lead applicants where appropriate, creating planning and partnership grants, expanding proposal development assistance, revising merit review criteria to account for community relevance and collaborative design, and offering capacity-building support as a core component of grantmaking rather than a secondary afterthought.

2. Implicit Bias and Institutional Practice

If funding structures shape who can enter the research ecosystem, institutional practice helps determine whose expertise is recognized once they are inside it. Implicit bias in research systems does not always operate through overt exclusion. More often, it appears through default assumptions about competence, professionalism, objectivity, and credibility. In academic and funding settings, these assumptions can shape how reviewers interpret institutional affiliation, publication records, disciplinary methods, and communication styles. They can also influence whether collaborative work with communities is treated as rigorous scholarship or as peripheral service. Because bias is embedded in routine procedures, it often remains invisible to the people reproducing it, including researchers, practitioners, funders, institutional leaders, and community intermediaries (Hultgren et al., 2024; Gallo et al., 2022).

A perspective by Gardner, Thierry, Rowlandson, and Steinberger (2021) argues that

universities should move “from publications to public actions,” emphasizing that traditional academic roles and impact pathways are insufficient in emergency contexts and that institutions should explicitly recognize advocacy, engagement, and public action as part of academic work.

Although their focus is climate and ecological emergencies, the broader implication is relevant here: institutions construct their own norms of legitimacy. If universities and funders privilege only narrow forms of productivity or neutrality, then they also narrow who can be seen as a credible contributor to urgent societal challenges. This is especially problematic in clean energy research, where social legitimacy, community trust, and implementation pathways are central to impact. Institutional practice can therefore either reinforce or interrupt exclusion. Practices that reinforce bias include overreliance on elite institutional markers, informal networking as a substitute for open opportunity, vague expectations about who appears “ready” to lead, and evaluation rubrics that undervalue mentoring, engagement, applied research, and community-based evidence. By contrast, bias-aware institutional design would require reviewer training, transparent decision criteria, diversified review panels, recognition of multiple forms of expertise, and stronger accountability for equity outcomes. The issue is not to abandon standards, but to examine whether current standards are valid for the problems being addressed and fair to the range of contributors needed to solve them (Gardner et al., 2021; Gallo et al., 2022; Hultgren et al., 2024).

3. HBCU and MSI Leadership

These institutional norms have significant consequences for who is authorized to lead research, not just participate in it. HBCUs and MSIs are often discussed as beneficiaries of inclusion, but this framing is too limited. They should also be recognized as leaders in research design, talent cultivation, cultural competence, and problem definition. In many cases, these institutions have deep experience serving students and communities historically excluded from mainstream research systems. They are therefore not simply alternative venues for participation; they are strategic sites of knowledge production that can reshape the priorities and methods of clean energy research (Akter et al., 2025). Yet HBCU and MSI leadership is routinely constrained by structural underinvestment. Federal and philanthropic initiatives have created important opportunities, including programs designed to strengthen STEM education, support research initiation, and build broadening-participation research centers. Still, targeted programs alone cannot overcome a system in which many institutions remain comparatively undercapitalized, understaffed, and evaluated against norms developed around wealthy, doctorate-intensive universities. If underrepresented faculty must teach heavily while also mentoring students, carrying service burdens, and building administrative systems from limited resources, leadership opportunities will remain uneven unless funders and partner institutions intentionally redistribute support (Akter et al., 2025; U.S. Government Accountability Office, 2025).
Accordingly, a more equitable model would position HBCUs and MSIs not merely as subcontractors or recruitment partners, but as agenda-setters, principal investigators, and co-equal hosts of research infrastructure. This means funding

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long-term organizational capacity, supporting interdisciplinary centers, enabling faculty release time, resourcing graduate and undergraduate research pipelines, and rewarding partnership models that transfer authority rather than simply distributing tasks. It also means questioning the assumption that leadership legitimacy flows only from institution-wide prestige. In many instances, the institution best suited to lead a project is the one with the strongest community relationships, contextual knowledge, and commitment to equitable outcomes, even if it lacks R1 status (Akter et al., 2025).

4. Energy Justice and Community Engagement

Taken together, these questions of access, legitimacy, and leadership point to a broader normative issue: why representation in research matters for justice, as well as effectiveness.

Energy justice offers a useful framework for addressing that question. It is concerned not only with the distribution of energy benefits and burdens but also with procedural fairness, recognition, and meaningful participation (Jenkins et al., 2016; Sovacool et al., 2016). Recent work in clean energy and participatory research argues that equitable transitions require more than efficient technologies or well-designed policies; they require methods that treat affected communities as knowledge holders and co-producers of solutions. Community-based participatory research, participatory energy justice, and related approaches therefore challenge the traditional separation between expert and subject (Castro-Diaz et al., 2024).

This perspective is especially important when considering underrepresented and vulnerable communities that have been excluded from energy planning and clean energy innovation despite experiencing disproportionate harm. If these communities are consulted only after agendas are set, they remain outside the core of research power. By contrast, when they help formulate questions, identify metrics of success, assess implementation barriers, and interpret findings, research becomes both more democratic and more actionable. Literature on renewable energy project engagement underscores that trust, context, and procedural inclusion affect project acceptance and equity outcomes. The same principle applies to research systems themselves (Castro-Diaz et al., 2024; Romero-Lankao et al., 2023; Wüstenhagen et al., 2007).

For a call for papers centered on pathways in clean energy research, this has two implications. First, rigorous work should include studies that investigate exclusion not only within universities but across the broader ecosystem of utilities, local governments, financial institutions, philanthropic organizations, and intermediary bodies. Second, solutions-oriented scholarship should welcome methods that integrate qualitative and quantitative evidence with participatory design, community partnership, and institutional analysis. Such an approach does not weaken rigor; it better aligns rigor with the social realities of energy transition (Castro-Diaz et al., 2024; Jenkins et al., 2016).

Recommendations and Implementation Pathways

This section translates the paper's central argument into action. It outlines recommendations for funders, universities, research partners, and ecosystem leaders that can broaden access, redistribute authority, and build durable capacity for more equitable participation in clean energy research. Together, these implementation pathways emphasize that inclusion requires not only new opportunities but also changes in how legitimacy, leadership, and research excellence are defined and supported.

The central challenge is not simply to identify barriers, but to redesign the pathways through which people and institutions enter, lead, and influence clean energy research. A pathways framework should therefore operate at multiple levels simultaneously. At the funding level, agencies and foundations should broaden eligibility, simplify early-stage access, create planning and seed opportunities, and treat capacity building as part of excellent research design rather than as a charitable supplement. At the review level, evaluators should assess community relevance, partnership equity, and implementation potential alongside technical merit and prior productivity. At the institutional level, universities and research centers should expand definitions of scholarly contribution, invest in proposal development support for under-resourced faculty, and reward work that advances public impact, community partnership, and equity. At the ecosystem level, lead institutions should share authority, budget control, authorship, and decision-making with HBCUs, MSIs, community-based organizations, and practitioners (Castro-Diaz et al., 2024; Akter et al., 2025; U.S. Government Accountability Office, 2025).

Several actionable strategies follow from this framework. First, funders should pilot inclusive principal investigator models in which community-based organizations, public-interest intermediaries, and smaller institutions can lead or co-lead projects when they demonstrate contextual expertise. Second, partnership solicitations should require evidence of equitable governance rather than symbolic inclusion. Third, targeted investments should support faculty release time, grant administration infrastructure, and research development at HBCUs and MSIs. Fourth, calls for papers and conference processes should explicitly welcome mixed-methods, community-engaged, and practice-based contributions that examine institutional barriers and test pathways for change. Fifth, data collection and accountability mechanisms should track not only who receives funding, but who sets agendas, leads teams, and benefits from downstream recognition. Finally, mentorship and network development should be treated as infrastructure for equitable participation, not optional professional development (Akter et al., 2025; Gallo et al., 2022; U.S. Government Accountability Office, 2025).

Importantly, solutions must avoid reproducing deficit narratives. The problem is not that underrepresented researchers or institutions lack promise; it is that the system often mistakes historical concentration of resources for proof of greater merit. A pathways approach, therefore, shifts the question from whether underrepresented actors are ready to lead to whether the system is willing to recognize and resource the leadership already present (Akter et al., 2025; Gallo et al., 2022).

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Conclusion

Clean energy research cannot achieve equitable outcomes if the structures that define expertise, opportunity, and legitimacy remain exclusionary. This paper argues that exclusion in clean energy research is not merely a matter of underrepresentation but the result of pathways shaped by funding architecture, institutional classification, prestige hierarchies, professional norms, and incomplete models of who counts as a researcher (Gallo et al., 2022; Hultgren et al., 2024). By situating that argument within a broader literature on research access, institutional change, and energy justice, and by analyzing it across four domains—funding equity and access, implicit bias and institutional practice, HBCU and MSI leadership, and community engagement—the paper shows how inequity is reproduced across the research ecosystem.

Reframing the problem around pathways rather than deficits opens a more productive agenda for research and action. It invites scholars, funders, and institutional leaders to redesign how access is structured, how leadership is recognized, how partnerships are built, and how research excellence is evaluated. The recommendations outlined here point toward implementation pathways that broaden eligibility, strengthen institutional capacity, support equitable governance, and center community-engaged forms of knowledge production. If the clean energy transition is to be both effective and just; it must expand not only through access to technologies but also through a redistribution of knowledge-making power. In that sense, the future of clean energy innovation depends as much on institutional redesign as on scientific discovery (Castro-Diaz et al., 2024; Jenkins et al., 2016; Sovacool et al., 2016).

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