Anchored but Excluded: Identifying and Overcoming Systemic Barriers to HBCU Participation in Regional Energy Innovation Systems

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Abstract

Earning a doctorate is widely treated as a pathway out of inequity, yet for Black scholars in the energy fields the degree alone is far from sufficient—and their exclusion carries costs well beyond the academy. Drawing on a bibliometric analysis of 24,740 energy-related articles and U.S. Department of Energy grants across three metropolitan regions, paired with 28 interviews, we document persistent underrepresentation in research output and funding alongside structural, institutional, and interpersonal barriers facing Historically Black Colleges and Universities (HBCUs) and Minority-Serving Institutions (MSIs). Because innovation is regional and relational, excluding these anchor institutions weakens metropolitan innovation ecosystems and steers the benefits of public clean-energy investment away from the communities that most need them. Closing these gaps requires treating research-capacity building as an economic development strategy—through sustained capacity investment, reformed grant review, intentional mentorship, and partnerships that ensure marginalized communities share in the clean-energy transition.

Keywords: clean energy equity; HBCUs and minority-serving institutions; regional innovation systems; inclusive economic development; workforce development; anchor institutions; urban competitiveness

1. Introduction: A Problem Hidden in Plain Sight

The transition to a clean-energy economy is reshaping cities, labor markets, infrastructure, and regional development—yet the institutions positioned to benefit are not equally represented. This study asks a single question: what systemic barriers limit the participation of Black energy researchers and HBCUs/MSIs in regional energy innovation systems, and what reforms would create more equitable and effective research ecosystems? The question reaches well beyond higher education, bearing directly on metropolitan competitiveness, workforce development, and community wealth creation.

We frame the inquiry through regional innovation systems and cluster theory, which treat innovation as the product of universities, firms, and laboratories linked by proximity within a region rather than the work of isolated individuals (Cooke 1992, 2001; Porter 1998, 2000). Conventional wisdom holds that advanced education resolves inequity; our evidence contradicts it. Even Black researchers with doctorates in engineering, physics,

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and chemistry encounter systematic obstacles—sometimes overt, but more often the cumulative dynamics of funding networks, infrastructure, and tacit knowledge that quietly determine who advances. Viewed regionally, this is not a private career problem but a structural feature of how innovation ecosystems are built, and thus a legitimate object of urban and economic policy.

Why Cities Should Care

Excluding HBCUs from regional energy innovation systems forfeits local expertise, inclusive workforce pathways, and the chance for marginalized communities to benefit from clean-energy investment; because HBCUs are key community anchors, investing in their research capacity strengthens regional innovation and inclusive urban growth (Taylor and Luter 2013). The disparities are not marginal—HBCUs and MSIs account for as little as 0.7 percent of energy research output in some major regions, a level of exclusion that represents real innovation capacity left unbuilt.

2. Historical Context and Approach

The modern U.S. energy research system was forged during World War II and the Cold War, when federal investment built national laboratories and channeled extramural funding to research-intensive universities, cementing their regions as innovation centers. Black institutions were largely excluded—an exclusion that was statutory as well as cultural. The First Morrill Act (1862) endowed the land-grant universities that became today's energy research leaders, while the Second Morrill Act (1890) extended land-grant status to HBCUs but required a state match that segregated Southern governments withheld. The consequences persist in funding and in the workforce: Black workers comprise only about 8.5 percent of the STEM workforce (National Science Foundation 2024), and as Table 1 shows, HBCUs received roughly 1 percent of DOE and NSF grant dollars between 2000 and 2020—a pattern an independent 2025 analysis confirms, finding HBCUs have averaged under 1 percent of federal R&D funding despite representing about 3 percent of four-year institutions (Partridge, Santos, and Sheppard 2025).

Federal Agency	Grants to HBCUs ($ mil)	HBCU Share of Total (%)
Dept. of Energy (DOE)	242	1.1%
Dept. of Defense (DOD)	56,900	10.0%
Nat. Science Fdn. (NSF)	662	0.9%
Environmental Prot. (EPA)	23	1.4%

Table 1. Federal research grants awarded to HBCUs relative to all universities, 2000–2020.
Source: Adapted from Advancing Equity in Energy Research (Patterson et al. 2025). Dollar figures in millions.

Our study combined two methods across three regions chosen because each contains both HBCUs (or MSIs) and research-intensive Primarily White Institutions (PWIs) within one innovation system: Atlanta, Miami, and the combined Charlotte–Raleigh-Durham

region. A bibliometric analysis, built on established definitions of the scope of energy research and development (Dooley 2000; Archambault et al. 2009), collected 24,740 energy-related articles published in 2010–2022 by authors at these institutions, paired with DOE grants from 2020–2022; this let us identify researchers without snowball sampling and match-pair Black and non-Black researchers at the same institution. We then conducted 28 semi-structured interviews (19 Black, 9 non-Black) across PWIs, HBCUs/HSIs, and federal laboratories. The match-pair design is essential: where peers in the same setting report markedly different experiences, the difference cannot be attributed to the formal institutional environment alone.

3. Findings: Layered and Largely Invisible Barriers

3.1 Disparities in research output and funding

Underrepresentation in the regional research record is stark and consistent. HBCUs and MSIs produced only 5.8 percent of energy journal articles in the North Carolina region, 11.4 percent in Miami, and just 0.7 percent in Atlanta. DOE grant shares track closely, and dollar shares fall lower still—evidence that the grants HBCUs do win tend to be smaller (Table 2). Crucially, the capacity is not absent: institutions such as North Carolina A&T State, North Carolina Central, and Florida International show real, growing capacity. This implies that a blind, across-the-board funding increase would not translate quickly into output, whereas targeted, capacity-aware investment would.

Region	HBCU/MSI Share of Journal Articles	HBCU/MSI Share of DOE Grants (count)	HBCU/MSI Share of DOE Grant Dollars
Charlotte–Raleigh-Durham, NC	5.8%	4.2%	1.3%
Atlanta, GA	0.7%	1.4%	0.7%
Miami, FL	11.4%	11.7%	8.4%

Table 2. Regional shares of energy research output and DOE grants held by HBCUs/MSIs.

Source: Adapted from Advancing Equity in Energy Research (Patterson et al. 2025). Journal output covers 2010–2022; DOE grants cover 2020–2022.

3.2 Infrastructure constraints at HBCUs—and persistent barriers within PWIs

Interviews revealed why the gaps persist. HBCU researchers described chronic shortfalls: little or no research budget, long waits to replace basic equipment, startup packages a fraction of those at PWIs, no pre- or post-award support staff, and teaching loads of two to four courses per semester against zero to one at peer PWIs. Some reviewers, interviewees reported, rejected proposals on the assumption that an HBCU "would not have the capacity to conduct the proposed research," even when applicants held federal grant records in the millions. Yet strong infrastructure did not eliminate inequity: Black researchers at PWIs described a system in which "money only flows to

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certain people"—those already in established networks—while new faculty struggled to find collaborators or mentors. One who had worked at both summarized the bind: "At HBCU, you are underfunded. At PWI, you are treated differently."

3.3 Recognition, mentorship gaps, and network exclusion

The most common theme among Black interviewees was a denial of professional recognition: a tenured associate professor mistaken for a graduate student; colleagues called "lucky" to have been hired during a diversity initiative; an idea dismissed in a meeting only to win assent when a white colleague repeated it minutes later. Because nearly all Black interviewees reported such episodes while their matched non-Black peers did not, the pattern is systemic rather than incidental. Black women described an added layer, navigating what two called the "old boys' club" amid acute retention problems—and research documents that women and minority instructors receive systematically lower student evaluations (Williams 2007; Chavez and Mitchell 2020; Heffernan 2022). Compounding this is unequal access to tacit knowledge—which journals and grants carry weight, how to cultivate program officers—that normally transfers through mentorship but fails those who cannot find a mentor of similar background. Tellingly, the response was adaptation: many built networks at other institutions—harder, self-constructed pathways that underscore the structural rather than individual nature of the barriers.

4. Systemic Implications for Cities and Regions

Read through the regional innovation lens, these findings describe an "odd triangle": PWI researchers network mainly among themselves, federal-lab researchers struggle to penetrate PWI networks, and HBCU researchers struggle to reach federal labs. Because innovation diffuses through such relationships, severing them fragments the ecosystem and slows the spread of knowledge—and the disadvantage compounds, since reviewers reward demonstrated track records, so funded institutions win still more while those long denied funding fall further behind (the "Matthew effect"; Merton 1968). The stakes are sharpest for the communities these institutions anchor: HBCUs and MSIs sit in neighborhoods that bear disproportionate energy burdens, so shutting them out of research capacity shuts their communities out of the transition's upside—the jobs, the local firms, the chance to shape technologies to local needs. Cities seeking equitable growth should therefore treat research-capacity building not as a diversity initiative but as core economic development that keeps public clean-energy dollars compounding within the region rather than leaking past the communities that need them most.

5. Recommendations

Closing these gaps will not happen through grants alone. We group recommendations into three domains, each aimed at durable capacity rather than isolated projects.

- **Research.** Commission longitudinal studies of how research capacity develops at under-resourced institutions over a 10–15-year horizon, and map regional

innovation networks to show where HBCUs are connected to—or severed from—PWIs, federal labs, and industry.

- **Policy.** Expand DOE and other federal capacity-building programs; establish regional clean-energy innovation hubs that require verified HBCU participation rather than nominal inclusion; and reform grant review to assess institutional potential, not prior funding history alone, which structurally disadvantages institutions long denied the chance to build a record. Customizing federal mentor-protégé and national-laboratory partnership programs would directly address the network exclusion documented here.
- **Institutional.** Invest in the unglamorous foundations of capacity—pre- and post-award administration, shared infrastructure, faculty development, and mentorship networks connecting Black researchers across institutions. PWI–HBCU partnerships should require verified capability-building by the under-resourced partner, and institutions should formally credit the disproportionate DEI service that otherwise becomes its own barrier to advancement.

6. Conclusion

As federal clean-energy investment accelerates, the question is no longer whether regions will innovate, but who will participate. For Black energy researchers and the institutions that anchor their communities, the path remains shaped by subtle, cumulative barriers built into regional innovation systems over more than a century. Fully integrating HBCUs and Black researchers into regional energy ecosystems is essential not only for equity but for maximizing the returns of the transition: inclusive innovation is not a constraint on growth but a prerequisite for sustainable urban development and resilient regional economies.

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