

## Adoption and Non-Adoption of Sustainable and Renewable Energy Integration by Administrators at Private and Public Historically Black Colleges & Universities

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### **Abstract**

*This qualitative study analyzed finance and facilities administrators' perceptions of sustainable and renewable energy integration at public and private Historically Black Colleges and Universities. Interviews were performed with 16 participants from two HBCUs, who answered questions about the adoption and non-adoption of sustainable and renewable energy integration. The data analysis results demonstrated the importance of proactively involving administrators in the decision to adopt renewable energy at HBCUs. The findings of this study confirmed that finance and facility administrators were more likely to adopt sustainable and renewable energy integration at their institutions when they were aware, exposed, and provided with information on renewable energy alternatives. Additionally, findings of this study confirmed that personal experiences and characteristics of administrators attribute to the non-adoption of sustainable and renewable energy integration at HBCUs. Leveraging renewable energy potential effectively is becoming a requirement of the 21st century, as it can provide sustainable outcomes while also mitigating the negative environmental impact of carbon fuels that exist at higher education institutions. Contrarily, assessing the institutional factors which impede renewable energy alternatives is equally crucial.*

**Keywords:** Renewable Energy Integration, Sustainability, Energy Efficiency, Historically Black Colleges & Universities

### **Introduction**

University administrators throughout the globe are assessing their carbon footprints and setting goals to be more efficient and run more sustainably (Mustafa, A et al. 2022). Researchers are now increasingly concentrating on major distributional issues related to the continuing energy transition (Qazi, et. al 2019). Filho et al. (2019) states that the potential for energy efficiency and the deployment of renewable energy integration at public and private universities is tremendous, representing viable solutions to meet institutional energy needs, without placing a significant burden on the environment. Numerous colleges and universities throughout the world have made the transition to renewable energy sources. Salvia and Schneider (2019) found renewable energy practices can range from straightforward actions with the goal of reducing energy waste to more complex ones, such as establishing research centers, developing technologies, and making buildings more energy efficient.

Decreased total energy usage is vital because it preserves natural assets, reduces emissions of greenhouse gasses, and may possibly reduce the campus energy budget (Storms, K., Simundza, D., Morgan, E., & Miller, S. 2019). By implementing renewable energy measures, institutions might be able to reduce dependence on energy. Several universities have also signed the "Universities' Declaration on Green Procurement," which confirms commitment to establishing a Green Procurement Policy and integrating into supply contracts by prioritizing whenever possible (CRUE, 2005). Adopting renewable energy as an alternative energy source can help institutions of higher education minimize the financial burden of the present economic downturn and the consequences of global warming (Kayode et al., 2019).

Curtis (2018) argues that a number of barriers have emerged that have increased non-adoption, even though many researchers have an affinity in analyzing the possibilities of integrating renewable energy on university grounds. Mustafa et al. (2022) believes adapting a university into a sustainable and carbon-neutral campus is a difficult and laborious process, and there currently exists no criteria for achieving carbon-neutrality. Gilbert & Sovacool (2016) found assumptions of renewable energy integration among university administrators and capacity in the United States may be inaccurate, limited, and inconsistent, which may point to a lack of support and non-adoption of renewable energy integration at higher education administrators. While many administrators have accepted that sustainability must reside at the foundation of institutional operations, the matter of how innovation and energy efficiency toward the institution may or may not be integrated remains an important component of examination

(Msengi, 2019). According to Kimmel et al. (2019) both public and private institutions in the United States consume a disproportionate share of energy and account for about \$14 billion in yearly energy costs.

With the many questions and concerns on renewable energy integration and the array of possible responses from various universities, it is important to understand administrator perceptions as a gauge for what information might be necessary for institutions to make informed decisions about renewable energy integration (Silk, 2014). Although administrators have adopted the idea of a "green" and "sustainable" campuses, there stands some university administrators who have actually put forth significant, well-coordinated efforts to fully adopt the integration of renewable energy at their institutions (Alam 2018). As these areas of contention remain evident, it requires administrators to proactively engage with key stakeholders to ensure resource inclusivity.

### ***Purpose of the Study***

The purpose of this study was to analyze and understand finance and facility administrators' perceptions of the adoption and non-adoption of sustainable and renewable energy integration systems at two public and private Historically Black Colleges and Universities. Although the integration of renewable energy is increasing, the barriers that higher education institutions experience in implementing sustainable initiatives exist at the administrative level itself, including a lack of sustainability governance, a lack of institutional programs that motivate staff, low levels of interest and relative comprehension (Brandli, 2015).

### ***Theoretical Framework***

The Diffusion of Innovation Theory, often known as DOI, served as the basis for this study (Rogers, 1962). Diffusion of Innovations aims to describe how an idea or product obtains traction and diffuses (or spreads) among a particular population or social system. The effect of diffusion is the adoption of a novel concept, product, or behavior by individuals as a component of a social system. In a social system, adoption of innovations does not occur overnight; rather, it is a process in which some individuals are more ready to accept an invention in advance of others. In other words, some people are more innovative than others. Individuals who accept a new invention early have distinctive traits in comparison to persons who adopt a new innovation later (Lamorte, 2019). It is vital, while promoting innovation to a target group, to have an understanding of the characteristics of the target population that will either aid or impede the adoption of the innovation in question. There exist a gap in research regarding the knowledge of renewable energy technology due to being relatively new and not having developed to its full potential (Science Direct, 2019).

### ***Review of Literature***

Adopting renewable energy as an alternative energy source can help institutions of higher education minimize the financial burden of the present economic downturn and the consequences of global warming (Kayode et al., 2019). Universities can benefit from committing to sustainability, becoming a carbon-neutral campus, investing in renewable energy integration, and setting an important example for other institutions to follow on their path to becoming more environmentally sustainable by committing to sustainability (Kimmel et al., n.d., 2019). Schools that seize these opportunities can attract potential students (Bradford 2019). Given the prominent position of academia in the vast constellation of sustainability studies and sustainability science, it is natural to look to higher education institutions as they often function in their own spatially based communities as models of or keepers of knowledge about sustainability practice (Milad Mohammadalizadehkorde and Russell Weaver 2018). Mustafa et al. (2022), found that the University of San Francisco adopted measures that included conserving water, converting to green sanitation products, integrating micro turbines to generate energy and heat on campus, and acquiring mission-driven carbon offsets. At the University of Southampton's Highfield campus, a total of 5016 photovoltaic (PV) panels were installed in order to fulfill approximately 3.76% of the annual energy requirements of the campus and have an amortization period of 5.6 years (Zhu, Wang, and Yan, 2018). Garrido-Yserte & Gallo-Rivera (2020), found that senior administrators University of Alcalá, one of Europe's oldest universities, were able to declare itself a low-carbon organization in 2010 thanks to energy efficiency programs, and it had already achieved the goals set for reduction by 2040. The institution is currently working to update its carbon footprint by integrating renewable energy fully to ensure the institution will attain its 2050 efficiency targets.

Mohammadalizadehkorde & Weaver (2018), referenced the University of South Australia's city West campus on North Terrace in Adelaide is another example of cost containment practices, with eight buildings over four levels and a floor area of approximately 30,000 m<sup>2</sup> relying on power with an insignificant quantity of reticulated gas as their primary source of energy. According to Filho (2019), 21.5% of Spanish universities have various energy efficient initiatives in place, whereas 72.5% have an administration office dedicated to sustainability. According to Ware (2018), Sumy State University in Ukraine recently constructed a solar energy facility in efforts to reduce energy cost. Universities often organize awareness and publicity campaigns and integrate sustainable practices in university contract specifications (Pacheco-Blanco and Bastante-Ceca, 2016). Several universities have also signed the "Universities' Declaration on Green Procurement," which confirms their commitment to establishing a Green Procurement Policy and integrating it to their supply contracts by prioritizing whenever possible (CRUE, 2005).

Administrators' reluctance to adopt renewable energy sources centers on a broad spectrum of factors. Gilbert & Sovacool (2016), found that assumptions of renewable energy generation and capacity in the United States may be inaccurate, limited, and inconsistent, which may point to a lack of support and non-adoption of renewable energy higher education administrators. Wang et al. (2021), states that the phrase "institutional barrier" refers to the circumstances that exist within the institution that discourage the adoption of renewable energy technologies. Brandli et al. (2015), concluded that the barriers that higher education institutions experience in implementing sustainable initiatives exist at the administrative level itself, including a lack of sustainability governance, a lack of institutional programs that motivate staff, low levels of interest and relative comprehension. The non-adoption of renewable energy initiatives can be further worsened by the fact that they go through a number of different administrators during the decision-making process, each of which may have their own, often competing, priorities at the university (Wang et al. 2021).

Aksenova et al. (2016), investigated the administrative barriers to implementing renewable energy projects at Northern Arizona University, a signatory to the American College & University Presidents' Climate Commitment with a goal of becoming carbon neutral by 2020. The research discovered that the external politics and priorities of university administrators were some of the most significant hurdles to achieving these energy efficiency goals (Vega-Garzon et al. 2021). Burgo et al. (2021) found that a significant number of university administrators and directors who have been directly involved in the administrative acceptance, permitting, and/or execution of renewable energy initiatives at their institutions assert the associated bureaucracy as a barrier. Additionally, a lack of communication between politicians and university administrators (state, regional, and local) was identified throughout the procurement of incentives, which is compounded by a lack of participants to facilitate proper communication (Burgo et al. 2021)

Criteria requiring a decision strategy for assessing energy options, as well as how to balance numerous elements that must be considered, must impact the adoption of REI (Budak, 2019). Shirzadi et al. (2020), states that although renewable technologies are rapidly evolving, there are still some relative constraints to overcome, such as the compatibility and availability of renewable energy sources, which can cause a lag in adoption of these technologies. There are several compatibility variables that should be considered in an renewable energy evaluation including random factors and unusual climate conditions, physical characteristics such as age and number of floors, building management incentives such as heating, ventilation, and cooling (HVAC) scheduling, and differences in how building occupants use devices such as indoor environmental controls and plug loads. The analysis of renewable energy offers crucial information that may be used for projecting future demand and formulating public policy on energy efficiency, both of which contribute to improvements in resource management (Gerald & Ghisi, 2020).

Budak (2019), found that several researchers have concentrated considerable attention on the application of the analytic hierarchy process (AHP) to the planning and integration of sustainable and renewable energy sources, which performs pairwise comparisons of decision criteria and rank decision alternatives using expert knowledge. According to Budak (2019), The AHP enables experts the opportunity to modify their assessment by means of a reassertion process and to fine-tune their assessment in order to facilitate objective decision-making. Since the AHP was initially established in the 1980s, it has been utilized in a wide variety of settings where it is required to make decisions. REI was analyzed in numerous studies identifying the most efficient and applicable source categories. For example, the AHP was used by Sindhu et al. (2016) to prioritize the complexities associated with the expansion of solar energy in India. Uyan (2013) evaluated potential locations for solar farms in Turkey using the AHP. Other research employed the AHP to identify wind observation station sites (Aras et al. 2004), distribute energy research and development resources (Lee & Mogi, 2013), and compare water heating systems (Mohsen & Akash, 2013). While AHP has served as a mechanism of criteria phasing in REI, there have been additional criteria-based frameworks to decide criteria of renewable energy such as Multi-Criteria Decision Analysis (MCDA).

Due to the increased awareness and negative consequences of environmental changes on the life cycle, the researchers, scientists, engineers, and environmentalists have all participated in developing and implementing innovative, clean, and renewable energy sources of energy to reduce greenhouse gas emissions (Aliyu & Habiballah, 2020). The increasing energy needs from renewable resources such as geothermal, solar, wind, biomass and biofuels will help to keep the pollution of the sources at the lowest level for sustainable development (Guney, 2019). According to the definition provided by the United Nations (2016), the consumption of energy is the primary contributor to climate change and is accountable for approximately sixty percent of the total global emissions of greenhouse gasses. The need for sustainable transformation and a transition to a low-carbon society is generally shared among higher education institutions, as shown by the American College and University Presidents' Climate Commitment (Second Nature 2014).

Several universities have installed photovoltaic systems to analyze their impacts and figure out how to optimize future installations (Jo et. al. 2016). The University of Utah was the first in the US to implement a community solar initiative in 2015, influencing 380 homeowners to agree to solar panel installations on their properties (About Solar, 2022).

In 2010, the University of Colorado at Colorado Springs installed a 14 kW Photovoltaic system on their Science and Engineering Facility (Jo et al. 2017). Gong et al. (2019), states that solar energy is regarded as the most promising type of sustainable energy resource due to its inexhaustible supply, universality, high capacity, and environmental friendliness. Wind electricity is a renewable and sustainable form of electricity that can be used to address the increasing demand for electrical energy (Agarwal, 2016). Carleton University received a 150,000 thousand dollar grant from the Minnesota Department of Commerce to construct the first turbine, and thus the institution profited from off charging fees and renewable energy credits to the local utility for a decade, from 2004 to 2014 (Carleton, 2020). Kadiyala et al. (2016), states the power that is extracted from the velocity of water as it passes through a turbine and is used to generate electricity is recognized as hydroelectric generation. According to Miller (2021), Berea College, located near Ravenna, Kentucky is the first higher education institution in the United States to complete construction of a hydroelectric generating plant. The small-scale demonstration project generates around half of the power used by the College on an annual basis, reducing the school's carbon impact even further (Miller, 2021).

Cornell's first hydroelectric plant, built in the Fall Creek canyon in 1904, provided green electricity to Ithaca's campus in New York. College campuses are ideal for geothermal applications since they typically have existing district energy systems, the space needed to dig boreholes into the earth's surface, a climate action strategy, and the patience necessary for a 15 to 20-year return on investment Braulik (2020), found that Skidmore College in New York installed its first geothermal heating system in 2007, which provided heat to multiple buildings on campus and resulted in a 40% reduction in the amount of energy utilized by campus heating systems. Allegheny College completed the installation of their first geothermal system in 2006, which includes 30 boreholes with a depth of 500 feet, giving heat to three buildings and lowering fossil fuel consumption for heating by 80 percent for those buildings (Snelling et al.) Storms et al. (2019), state suggest that while heating and cooling infrastructure is the most detectable utility provided by higher education institutions, some additionally provide electrical power, water and wastewater services, and telecommunications. According to Braulik (2020), the geothermal heating intensification system of the new Admissions Center at Champlain College in Virginia earned the college one of the official LEED Platinum Awards. According to Chen (2022), Cornell University, located in New York, has reduced its reliance on non-renewable energy sources by increasing its use of renewable energy sources including geothermal heat pumps.

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### **Methodology**

For this investigation, a qualitative methodology was employed. Qualitative research is conducted using a variety of respectable approaches, focuses on the context, and is emergent and developmental rather than strictly predetermined (Marshall & Rossman, 2016). A qualitative approach employs open-ended questions and allows the participants to respond more elaborately and in greater detail than is typically the case with quantitative methods. The researchers has the opportunity to respond immediately to what participants say with additional questions and clarification (Marshall & Rossman, 2016).

This qualitative study was conducted with the purpose of gaining an understanding and insight into the lived experiences of the administrators at Historically Black Colleges and Universities regarding the adoption and non-adoption of renewable energy integration. To obtain understanding of the lived experiences of study participants, a qualitative approach was more suited than a quantitative approach that looks at relationships between variables and uses statistical analysis in analyzing and reporting findings. As opposed to a quantitative study that provides experimental research data and makes claims about administrators' average for the adoption or non-adoption of renewable energy integration, this qualitative research study allowed the researchers to gain an understanding of study participants' lived experiences. The approach examines administrator lived experiences for the adoption or non-adoption of renewable energy integration

### **Site and Sample Selection**

This study focused on 2 Public and Private Historically Black Colleges and Universities (HBCUs), both of which have incorporated some level of renewable energy systems at their respective campuses. Institution A is a public historically black college and university located in an urban area. Institution B is a private historically black college and university also located in an urban area. Institution A currently has six (6) different programs that integrate renewable energy sources. These programs are geared toward improving the energy efficiency of lighting fixtures, reducing water waste, greenhouse production, improving transportation, HVAC, and building constructability. Institution B is home to three (3) different systems that integrate renewable sources of energy. Solar paneling, waste reduction using biomass and brownfield debris, and water conservation are the three programs that fall under this category. Because both Institution A and Institution B have a program to integrate renewable energy sources into their respective constitutional infrastructures, these two institutions were selected.

The sample consisted of a combination of facility and financial department administrators, supervisors, and managers from each of the two participating institutions. The researchers adhered to and placed primary emphasis on acquiring consent from department personnel working within the finance and facilities department who have more than two (2) years of experience in finance and facility operations. After finance and facilities administrative staff were identified, the researchers requested volunteers from both Institution A and Institution B. The researchers made a request to the finance and facility directors of the departments for the emails and other contact information of all division personnel who agreed to participate in the research study. The researchers contacted the participants recommended by the department head by email confirming their participation in the research study. Following confirmation by participants, 16 interview participants (9 from Institution A and 7 from Institution B) who met the sample criteria were selected for the study.

### ***Data Collection***

There were 16 administrators from both Institution A and Institution B who were interviewed to assess perceptions of the adoption or non-adoption of renewable energy integration at the respective historically black college and university. After study participants were identified, the researchers contacted them, acquired consent and explained the study. The researchers outlined specifics on how interviews would be conducted. The researchers provided assurance that participant rights and privacy would be protected throughout the duration of the interview process. The researchers clearly communicated full transparency on distributive and ownership factors with the research study.

In emails to potential study participants, the researchers communicated interview participation was optional and represented a voluntary action. Upon interview confirmation, the researchers scheduled interviews at the convenience of the participants. The researchers communicated that interviews would be scheduled on-campus, via zoom, and audio recorded. The researchers provided a zoom link via email to the participants. Participant interviews lasted no more than 90 minutes. The researchers asked a series of in-depth interview questions to each participant. Interviews were recorded through audio word processing, zoom database system, and real-time. Interview conduction tools included voice recorders, personal pen and paper, and laptop computer. Upon the conclusion of participant interviews, the researchers stored the interview data in a password protected storage drive accessible only to the researchers.

### ***Data Analysis***

The researchers were immersed in the data by reading the interview narratives multiple times. This led to profound engagement with the data (Marshall & Rossman, 2016). The data immersion provided the opportunity to reflect on the participants, events, and environment contributing to the shaping of the data interpretation. The researchers analyzed connections between categories and themes to gain a deeper knowledge of the administrator perceptions, as well as to influence the structure of the data for the purpose of interpreting the study based conclusions on the data collected. The researchers assessed adoption categories on the basis of how study participants responded to interview questions, participant theme recurrences, and participant demographic commonalities. For the purpose of assisting with the arrangement of the data that was obtained, a Qualitative Data Analysis (QDA) was employed. QDA was used to assign codes to the information gathered, with a coding system designed according to a number of topics and themes.

The researchers also categorized codes through highlighting recurring themes from participant interview responses using a variety of colored highlighters. Journaling notes and taped interviews were transferred into digital files on the computer and then imported into the QDA software tool NVivo. The application enabled the importation of text documents, assisting in the detection of recurrent themes, and assisting in the building of network diagrams for the purpose of providing visual representations of the data (Marshall & Rossman, 2016). Data interpretation refers to the act of obtaining a knowledge of data and putting it into conclusions. During this stage of the analysis process, the researchers drew conclusions determined from the linkages of the themes, patterns, and categories that have emerged within the data.

### ***Trustworthiness***

When conducting qualitative research, it is difficult to achieve the components of transferability and confirmability since qualitative research does not employ tools with known metrics. Aside from that, the findings may be trustworthy since the data will remain consistent in the short term. However, due to policy changes and the implementation of new initiatives, the numbers will very probably alter over time. The credibility of the study was dependent on the character of the participants, who in this instance were facilities administrators working at public and private HBCUs. Study participants were in the best position to shed light on the real dynamics of African American leadership in the higher education sector. In the course of the research process, each and every research project is required to incorporate ethical issues and protocols. For this reason, ensuring that the research was conducted in conformity with ethical standards and criteria was crucial. Concerns around confidentiality and informed consent were addressed in this study. Prolonged interaction with participants aided in establishing rapport and gaining their trust (Erlandson, Harris, Skipper, Allen, 1993).

Credibility was strengthened by sustained participation. Dependability was achieved by ensuring that the research process was logical, traceable, and transparent in terms of documentation, so that the study's readers fully understood the process used to conduct the research. According to Lincoln and Guba (1985), transferability refers to the ability to generalize the research study's findings. Transferability requires the researcher to provide rich and thick descriptions to the readers so that anyone attempting to transfer the findings to their own site can judge the level of transferability themselves. The researchers provided a detailed description of descriptive data, such as the context in which the research was conducted, its setting, sample, sample size, sample strategy, demographic, socioeconomic, inclusion and exclusion criteria, interview procedure, changes in interview questions based on the iterative research process, and interview guide excerpts.

### **Limitations**

The following limitations represented factors related to administrators' perceptions regarding the adoption or non-adoption of renewable energy integration at HBCUs that are beyond the scope of this study. Limitations included competency within the renewable energy sector; awareness of advantages of renewable energy integration, lack of state and federal financial investment, and shortage of knowledgeable staff.

### **Qualitative Findings / Discussion**

The data analysis yielded a number of conclusions concerning administrators' perspectives of the adoption and non-adoption of sustainable and renewable energy integration at the two public and private Historically Black Colleges and Universities. Overall, the researcher's results indicated a collection of key themes that emerged from the interview responses and were reported under each research question. The predominant themes were driven mainly by study findings of other researchers aiming to understand the perceptions of finance and facility administrators in critical decision-making capacities.

The interpreted findings were summarized as institutional Cost Savings, Electric Vehicles, LED Bulb Conversion, Disadvantages and Administrator Ambivalence, Administrator Participation in Renewable Energy Initiatives, Seeing Results of Renewable Alternatives, Early Adoption of Renewable Energy, doubtfulness despite success, Energy Expenditures and Hardware Modernization, Administrative Awareness of Renewable Energy, Apprehension and Unwillingness to Adopt Energy Alternatives, EV Charging Stations, Wind Optimization and Process Complexities and Awareness of Decarbonization and Fleet Electrification. The study's findings converged into four main categories indicated by the research questions, in which the themes appeared. They are as follows: (a) administrator perceptions of advantages; (b) administrator characteristics (innovator, early adopter, early majority, late majority, and laggard) toward trialability and observability; (c) administrator attitudes toward institutional sustainability; and (d) differences between public and private administrator perceptions on the complexity and compatibility towards the adoption and non-adoption of renewable energy integration on their campus.

### **Research Question 1**

This question asked: How does administrator perceptions of advantages influence their adoption and non-adoption of renewable energy integration at Historically Black Colleges & Universities? The first subject that emerged was institutional cost savings. A majority of administrators mentioned cost savings as the primary driver supporting the adoption of renewable energy. Others concluded how cost-effective renewable alternatives such as solar energy and switching to LED lighting could prove to be.

Theme 1: Institutional Cost Savings. Both finance and facility administrators mentioned cost savings as the primary driver supporting the adoption of renewable energy. Administrators additionally concluded how cost-effective renewable alternatives such as solar energy and switching to LED lighting could prove to be. Participants stated that they believed that renewable energy initiatives such as LED lighting and HVAC system alternatives could drive down energy cost while increasing light bulb longevity.

Allen, who was classified as an Innovator on the DOI model, highlighted the cost benefits that solar paneling facility roofs had on decreasing utility cost. Allen discussed how the institution was currently paying over \$100,000 dollars in utility bills and how adopting renewable energy integrations such as solar paneling were cost effective when compared to traditional forms of energy utilization. Allen stated, "I would say we talked about it, we had meetings about it. I brought renewable energy up many, several times in our departmental meetings. I brought up the idea of having solar panels placed on campus because of our high utility bill. We pay over \$100,000 a month. So we put solar panels and I'm wondering if the government will help pay for it. If we can implement solar, we can make a significant reduction in our utility bills. And plus it's environmentally friendly as well."

Jeffrey, a CFO classified as an early adopter by the DOI framework, believed integrating renewable energy was cost effective. As a key decision maker at the institution, Jeffrey suggested that HBCUs across the country use renewable energy alternatives to reduce reliance on natural resources. With dwelling natural resources, he felt energy alternatives was a cost savings and effective means of meeting energy needs. Jeffrey offered, "Yes, I do believe we can save money by moving to renewable energy."

I often see a lot of scenarios whereby the university can benefit. You know, HBCUs obviously have limited resources. I think there's a nationwide problem with that. That being said, any way that we can save our institution some additional dollars from renewable energy, in my mind, is the way to do that. We'll be decreasing the use of a lot of natural sources. I feel like in a way we can save a significant amount of money. We should be looking at not just our institution, but all HBCUs that can benefit off of these savings opportunities.”

Alisha, categorized as an early majority within the diffusion of innovation framework, responded optimistically in response to the advantages in saving money and implementing cost containment strategies associated with renewable energy integration and sustainable practices. Alisha strongly believed that renewable energy initiatives such as LED lighting and HVAC system alternatives could drive down energy cost while increasing light bulb longevity. She was willing to adopt renewable energy. She was able to provide practical examples of how renewable energy could benefit the institution through LED integration and HVAC alternatives. Regarding advantages of renewable energy integration and energy cost savings at HBCUs, Alisha said, “Yes, it can save money for HBCUs. For instance when we started changing to LED lights from regular lights. We haven't seen the results yet, but we're going to see it. I know personally at home when you change from the regular life of Led Light, that's, that saves energy. We could also end up using different types of HVAC alternatives that can help save money as well, so just different things that we can look at that can save us, it'll really help us in the long run financially.

Josh, a laggard from Institution B, expressed his view on the financial benefits of renewable energy integration, saying that he didn't see any distinct advantages stating, “I don't think it could give us a cost of savings. I'll say based on the area that we're in and the reason I say that is because um even though we do, if we do have renewable energy to do a cost of savings, I don't think it's going to help because the utilities were with, it's nearly impossible for us to save some money. So we're trying to do whatever it takes to lower the cost. But I think it's slim to none to be honest.

Theme 2: Transportation Electrification. Most participants believed electric vehicles had clear advantages over gas vehicles for a variety of reasons. Participants believed their institutions should shift to more environmentally friendly transportation practices. Sarah, an early adopter within the DOI framework, expressed enthusiasm for establishing EV charging stations on campus in addition to being concerned about fluctuating fuel prices from gas vehicles. When asked about the transition from gas to electric vehicles, Sarah said: I most definitely think electric vehicles are a good idea. To be honest, one thing with electric vehicles, you don't have to worry about the fluctuation of gas prices. That is very beneficial to the school. The good thing is we could provide more access to charging stations at the school for everyone who has an electric car. I was talking to a friend of mine. He was saying that he was in a local area, and he hadn't let his vehicle charge and it stopped on him. He had to get someone to get him to the nearest place to charge it because he had a Tesla.”

While Sarah offered valuable insight on the theme of transportation electrification, other study participants also reflected information regarding electrifying campus vehicles. Carla felt transitioning from gas to electric vehicles could reduce weekly fuel costs and eliminate the stress associated with erratic fuel cost projections. Carla expressed her ideas by saying “I guess electric vehicles may be better. For one obvious reason, you don't have to keep paying for fuel. We know how gas prices change from day to day. One day they could be up and one day they can be down. So I guess the school having electric vehicles could have an advantage over gas. I mean it is a good idea, you know? We also don't have to worry about constantly saving for fuel. “

Other study participants provided information regarding the environmental benefits associated with the electrification of the campus fleet. Ashley believed that gasoline-powered vehicles produce harmful emissions and waste energy. Ashley, a member of the early majority, expressed her views by stating “Honestly, I do believe there is an advantage with the electric vehicles. Personally, I'm really thinking about getting into an electrical car rather than a gas car. This in turn will help save lots of energy. Gas cars cause a lot of pollution in the air which can be harmful to the ozone layer. “

Three participants discussed advantages of transportation electrification, which provided administrators perceptions of advantages required for the adoption of renewable energy integration and institutional sustainability. Sarah proposed that the university adopt vehicle electrification by installing electric charging stations on campus for electric vehicles that could potentially be used by external individuals, thereby creating an additional revenue stream for the institution. Carla believed electrifying campus vehicles would alleviate concerns regarding fluctuating fuel costs. Ashley saw transportation electrification as a positive yielding ozone decarbonization and institutional energy savings. She said, “I do believe there is an advantage with electric vehicles. Personally, I'm really thinking about getting into an electrical car rather than a gas car. This in turn will help save lots of energy. Gas cars cause a lot of pollution in the air which can be harmful to the ozone layer. Everybody is moving from gas to electric vehicles. Even energy companies are providing incentives for going with electrical vehicles.”

Theme 3: LED Bulb Conversion. In relation to their day-to-day roles and responsibilities, participants indicated that departmental effectiveness and performance were a top priority. Although study participants fell into varied adopter categories, each saw the conversion from fluorescent bulbs to LED bulbs as encompassing significant advantages to the sustainability of the institution. When questioned about the importance of energy efficiency in his department, Josh said, "I say it will be important, especially if we're on a break. I feel like it's best off to reduce the power down to save energy and save money. The bills are no joke. I just feel like if we're on a break, I feel like it's more important just to reduce the power off well in our department but not the whole university cause you know the kids are still in the dorms. But I say in our department, just turn off the power and just to save some energy, save money."

Melody, an early majority, previous role dealt specifically with utility bills and energy demand at the institution. She saw clear advantages of LED conversion and spoke about how the department had begun converting to LED lights. Melody said "To be honest, we've already converted to LED lights from fluorescents. So yes, I do believe that LED bulbs have an advantage. That's something that we worked on in several of the buildings at our institution. I used to look at those utility bills in the position I had before this position. That part of my job has been passed on to someone else, so I haven't seen a utility bill since. Although I don't deal with the lighting area, I haven't heard any negativity or backlash since we changed over from the other light bulbs."

Amber, a late majority member, was unsure of the cost associated with LED bulb conversion. She believed the department should assess energy-saving measures such as LED lighting. While renewable energy was not a part of her general expertise, she felt advantages would be beneficial for the institution to save energy. She stated, "I haven't heard much on renewable energy or LED lights. To be honest, I don't know how that works or if it works. I don't know the cost that's associated with it even if it does work. Even with that, I think that we should explore all avenues to conserve energy. That's what I think it comes down to. I don't know. That's not my area of expertise but if it's a resource that we could use or benefit from to better conserve energy, I support it."

Theme 4: Disadvantages and Administrator Ambivalence. Participants in the late majority and lagging categories acknowledged several disadvantages and reluctance to adopt renewable energy. Personal experiences, according to Josh and Kimberly, influenced aversion to transportation electrification. Participants suggested high utility bills, fuel-up duration vs. recharging duration, and becoming stranded and immobilized on the highway because of a shortage of charging stations were disadvantages.

Josh, a laggard from institution B, expressed skepticism regarding advantages of electrifying campus vehicles. He cited instances of how charging throughout the night might result in excessive energy bills at the institution. When asked about the transportation electrification advantages at his institution, Josh stated, "Well based on what happened to my cousin and her experience, I would say there is no real advantage. She is paying more with the electric cars she has. So when it comes to gas, it probably takes 10 minutes to, well, five minutes to fill up your tank based on her experience with her electric car. She said it takes her at least an hour to two hours to recharge. That all depends on how many powers she has left in her car when she gets back home. Then on top of that, she has to charge it overnight at her home and that raises her utility bills because she used that much power for the car."

Kimberly, a late majority administrator of facilities at institution A, dismissed the notion of electrifying campus vehicles. She further addressed being stranded highways due to the availability of charging stations for electric vehicles. Kimberly said, "That's a tough one for me to answer. It's because it's still fairly new to me and new to us as administrators. The idea of not having to use gas is a great thing. But then comes, how do you adequately charge it without being stranded on the highway? That being said, it's not enough information to just say let's get an electric car with."

Table 1

RQ1: Corresponding Themes and Categorizations

*RQ1: Corresponding Themes and Categorizations*



Research Questions	Corresponding Themes & Categorizations	Construct & Constraints
How does administrator perceptions of advantages influence their adoption and non-adoption of renewable energy integration at Historically Black Colleges & Universities?	Institutional Cost Savings	Relative Advantage Compatibility
	Transportation Electrification	
	LED Bulb Conversion	
	Disadvantages & Administrative Ambivalence	

The corresponding themes shown in Table 1 resulted from administrator perceptions of advantages influence their adoption and non-adoption of renewable energy integration at Historically Black Colleges & Universities. The category related to institutional cost savings was supported by cost-saving expressions such as "didn't want to waste money" and "utility bill rates." The category related to electric vehicles was supported by expressions such as "potential advantages" and "fuel efficiency." The category related to LED bulb conversion was supported by expressions such as "lower energy bills" and "outdated lighting." The category related to administrative ambivalence and unclear advantages was supported by expressions such as "I'm not too sure about renewable energy."

**Research Question 2**

This question asked: How do administrator characteristics (innovator, early adopter, early majority, late majority, and laggard) toward trialability and observability influence the adoption and non-adoption of sustainable and renewable energy integration on their campus? When assessing how trialability and observability influenced adoption and non-adoption of sustainable and renewable energy integration, four themes emerged. The emergent themes were administrator participation in renewable energy initiatives, seeing the results from renewable alternatives, early adoption of renewable energy, and doubtfulness despite success. Before deciding whether to adopt an idea, process, or system, several participants in the research study shared perspectives on the value of observing and testing out new energy initiatives on campus.

Participants from Institutions A and B described factors that influenced decisions to adopt new and sustainable initiatives for integrating renewable energy.

**Theme 5: Administrator Participation in Renewable Initiatives.** Administrator participation in renewable initiatives was the first recurring theme among many participants, who recommended that in order for sustainable and renewable energy to be successfully implemented, administrators must participate in trial periods early on, with a readiness to test and observe verifiable advantages and disadvantages of sustainable energy outcomes.

Participant Marsha from institution B, an early adopter within the diffusion of innovation framework, would participate in the institutional trial phase of energy planning. She felt it was important for the institution to assess the cost of implementing strategies at the institution. She felt long term cost savings should be a major consideration in the adopting energy innovations at the institution. She said, "I would participate early on. When you know what the actual cost of energy is, for example, the utility bills and things like that here at the college and I'm just gonna throw a hypothetical number out there. Let's say that utilities are running you \$500,000 a year or something like that. That's a lot of money that could be invested into this renewable energy. Sure enough, you may have to spend a little bit more up front, but over the long run in the long haul, eventually you'll recoup that money because that utility bill will decrease. And again, like I stated in the beginning, those will be dollars that could be used in other areas of the institution."

For Amber, availability of federal renewable energy incentives would influence her participation in planning phases. She recognized the benefits of converting to renewable energy to the institution. She said, "That's not in my area of responsibility. However, if I had to help the university in planning to implement such programs, I wouldn't have a problem doing that. I know that it's a great need. I know that it would be a great benefit for the university to do so. So, if I'm charged with that responsibility, I would gladly participate, gladly help with the planning and research to provide whatever information is needed in order to help the university. That's one of the roles of the facilities risk manager, providing savings as it relates to insurance cost. Saving money for an HBCU or any university is high on my list, especially when the resources are there and available."

Avery advocated the institution had initiated renewable energy planning, with several large renewable energy and microgrid companies coming to campus. These companies would assist the institution in planning and developing a campus wide renewable energy strategy. Avery said, "Yes, I would indeed participate early on in the process. In

fact, we currently have several of the largest renewable energy and microgrid companies in the world coming to the campus in the next few months to help us with planning. They will be helping us around utilizing everything associated with renewable energy on campus. They'll also be showing us how to manage those systems. It will be a very extreme process."

**Theme 6: Seeing the Results from Renewable Alternatives.** Several participants expressed interest in integrating sustainable energy initiatives at the institutions. Many were eager to implement after first observing effective outcomes at other higher education institutions.

Participants wanted to see progress toward more sustainable and successful renewable energy integration strategies implemented given earlier successes evidencing practical benefits.

Jeffrey, an early adopter member and chief financial officer, described the benefit of the institution adopting renewable energy integration. Although openly supporting environmentally conscious initiatives, Jeffrey felt time was needed for initiatives to demonstrate worth before other individuals would become accepting. When asked about benefits of early adoption of renewable energy, Jeffrey stated, "Yes, I think it is beneficial. In my personal opinion, the more evidence, the better. Sometimes it probably takes a little time for initiatives to fully show themselves as being positive before people on board. I can see why some HBCUs may take that approach. Hey, this may be a good idea but because of the logistics, we probably need to wait and see the results before we fully accept the idea."

Avery, a research participant from institution B, perspectives differed from Jeffrey. Avery emphasized the importance of accepting science and prototypical analysis of renewable energy integration. Avery responded, "I don't know that we have to see the results. I think the science says, you know, if you do A, you're, you're going to get B. I also think we have to make renewable energy a part of our student entrepreneurial process to build prototypes, improving things on a small scale. It always helps to have proof on that scale, but I don't think we have to implement something before we actually believe in the results that we're going to achieve."

Sarah, a late majority participant from institution A, preferred to observe outcomes to see how the integration of renewable energy benefited other institutions before supporting adoption. She spoke about the role of the government in providing needed resources for the institution to transition to renewable energy. She said, "It's very important to see the results. I feel like it doesn't necessarily have to be at an HBCU. You can even use this research at other schools that have discovered renewable energy to see how we can make it beneficial to us based on the resources that we do have in place now from an implementation standpoint. We have to see where we can start forming what we will need to fully implement renewable in the long run. You know, there may be resources we have to get from the federal government. There are things out there available for us to access and achieve using renewable. A lot of federal governments are trying to get into using renewable energy and as far as state governments as well."

**Theme 7: Early Adoption of Renewable Energy.** Following favorable trial phase results, several participants subscribed to utilizing renewable energy as an alternative source of energy. Participant age was not a factor in early adoption of renewable energy integration. Participants believed that adopting renewable energy integration earlier yielded significant benefits for their respective institutions.

Melody came to the conclusion that renewable energy should be adopted after seeing results. She said that she wouldn't be against the early adoption of renewable energy unless there was clear evidence that it wouldn't yield cost savings. Melody said, "Do I conclude renewable energy should never be implemented after proven results? I'm going to say no. I think I'm answering the question correctly. I do not feel that it should not be implemented. You know, I would have to see evidence on why it shouldn't be implemented. For me to change my mind to change my answer, and it could change, clear evidence would have to be brought up that proved different. Like evidence saying it's going to cost the school millions of dollars to save \$100 in 20 years. You know, I don't think that would be a positive."

Participant Joselyn from institution A, who joined Melody as an early adopter, believed adopting renewable energy earlier during the trial phase would benefit the institution. She felt if Historically Black Colleges and Universities delayed adopting beneficial alternatives, they might compromise positions towards the forefront of innovation. Joselyn stated, "Renewable energy could definitely be beneficial if it was adapted earlier rather than later during the early phases. Sometimes waiting too long to do something puts you behind? Well not saying it puts us behind, but we kind of miss out on some of the benefits that we could have been gaining or getting from if we had been at the forefront of that. That also includes the city and state. There's a lot of things that we don't know that can help benefit us if we would try earlier on. With some of the programs in the sense that people give us, we always miss out on it and then end up taking the cost hit because we waited so long to be involved in something."

Alisha, an early adopter from institution A, discussed the benefits of early adopting renewable energy sooner rather than later. She spoke about energy and utility companies providing initiatives to transition away from conventional energy systems to energy produced from renewable sources. When asked about adopting renewable energy earlier on rather than later, Alisha stated, "I mean, the earlier we can adopt renewable energy, the earlier we can get

involved in it. I think it is more beneficial, especially if it's an affordable way for us to implement it. I know some companies offer energy initiatives and incentives for you to transition to renewable energy. As long as we can financially gain from it as far as energy savings and being greener as they say, I guess the terminology, then yes, I do think we should look into it.

Theme 8: Doubtfulness despite Success. Despite beneficial findings, two participants remained doubtful. Josh, a laggard from institution B, opposed renewable energy adoption after proven success. Josh said,

“I think so. I think we should at least look at it. Well, yet again, we still should look further into it. Well, I think so honestly, I think, yeah, it should. But, at the same time. It just depends because the utility we have in Jackson may not allow for it.”

Kimberly, a late majority member from institution A, did not see the importance of adopting renewable energy after realizing successful results at her institution. She felt renewable energy strategy might be effective for some university departments but not cost effective for the entire institution. She wanted additional evidence on the cost savings for the entire university. She said, “Well, how important is it really in the grand scheme of things? The idea of renewable energy is important, not to me though. The idea of it is important in the right department and I would hope that that department would implement it fairly. Well, once they see it works for the organization. Don't delay in implementing something that can help the organization. So it's important but not directly involved with me. Again, I have enough on my plate. I'm not thinking about anything extra even though it may be important to the university. My role wouldn't be important in that anyway.”

Table 2

RQ2: Corresponding Themes and Categorizations

Research Question	Corresponding Themes	Construct & Constraints
How does administrator characteristics (innovator, early adopter, early majority, late majority, and laggard) toward trialability and observability influence the adoption and non-adoption of sustainable and renewable energy integration on their campus?	Administrator Participation on Renewable Energy Initiatives	Innovators (2.5%) Early Adopters (13.5%)
	Seeing the Results from Renewable Alternatives	Early Majority (34%)
	Early Adoption of Renewable Energy	Late Majority(34%)
	Doubtfulness Despite Success	Laggards (16%)

The corresponding themes shown in Table 2 resulted from administrator characteristics (innovator, early adopter, early majority, late majority, and laggard) toward trialability and observability influence the adoption and non-adoption of sustainable and renewable energy integration on their campus. The category related administrator participation on renewable energy initiatives was supported by expressions such as “I would be able to participate” and “I would have to wait to see if it works first.” The category related to observing the results from renewable was supported by expressions such as “I would have to wait to see if renewable energy works first.” The category related to early adoption of renewable energy was supported by expressions such as “the earlier we can adopt renewable energy, the earlier we can get involved in it.” The category related to doubtfulness despite success was supported by expressions such as “Well, how important is it really in the grand scheme of things?”

Research Question 3

This question asked: How does administrator attitudes toward institutional sustainability influence their adoption or non-adoption of renewable energy integration at Historically Black Colleges & Universities? Administrator attitudes toward institutional sustainability (sustainability, technology, and innovation) were expressed from adoptive and non-adoptive participants. Study participants shared perceptions on a variety of factors such as sustaining legacy, deferred maintenance with HVAC systems, solarizing facility roof panels, decreasing energy bills, and thermochemical conversion alternatives. Most participants held favorable opinions about the sustainability of institutions which influenced decisions to adopt renewable energy. In response to question 3, four themes were identified. Emergent themes were energy expenditures and hardware modernization, administrator

cognizance of renewable energy, importance of sustainability, and apprehension & unwillingness to adopt despite proven results.

**Theme 9: Energy Expenditures and Hardware Modernization.** Participants felt the adoption of renewable energy alternatives had a direct impact on monthly energy expenditures, energy utilization, and hardware longevity and modernization. One of the interview questions sought to ascertain whether heat pump intensification, a renewable energy HVAC alternative, could reduce campus energy costs to yield sustainable outcomes for the institution. Allen, an innovator from Institution B, felt positive about the institution utilizing heat pump intensification as a sustainable alternative due to deferred maintenance.

He discussed the longevity of HVAC systems and forecasts for potential energy bills. Allen had prior financial experiences related to energy savings in facilities, which explained a positive attitude toward implementing renewable energy. Allen stated, "I definitely think it's a good idea. We've just recently installed a more efficient HVAC system at our institution. It costs the institution more than \$1 million dollars. It cost that much so we could sustain the system. For as long as possible. It's important to keep your HVAC system as long as possible and reduce the wear and tear as much as possible. Anything that will help prolong the life of that HVAC system and reduce utility bills, that's a big plus and that should always be looked at."

Joselyn, a mid-level facilities manager at institution A, voiced concerns regarding the institution's awareness of heat pump intensification as well as solar paneling as an alternative to reduce heat and fuel cost. She supported the adoption of solar energy because of the monthly electrical savings and how funds could be more efficiently reapportioned to address other financial disparities at the institution. She felt laggard behaviors could negatively affect the institutional legacy by failing to adapt and lagging behind other institutions that have adopted renewable energy. Joselyn said, "Of course it could lower our bills. I actually pay the energy bill. I pay the atmosphere bill. I pay the water bill. If we were using renewable energy and converted over like a lot of universities have decided to do, we wouldn't have to pay \$200,000 on light bills every month. Intensifying heat pumps probably would cut down on the cost of heating and fuel that is used to Heat and use the boil rooms. I'm sure a lot of that will happen in the future. We can then take that money and put it into something else that the university may need help with. We will then keep up with the other schools. It will also help build and keep up with the legacy we have created so we'll be able to look back 30 years from now and say where we came from and where we're going and where we're still trying to get to."

Marsha from institution B, an early adopter and senior finance administrator, saw the value in integrating renewable energy alternatives that could help the institution become more cost efficient. For example, with more energy efficient funds allocated from heat pump intensification could be allotted and distributed throughout the institution. Marsha said, "Yes, I think it can. It would definitely reduce cost. Anything that will reduce spending, I am for. You can always reduce your fixed assets in situations like when pertaining to utility bills. It will allow for funds to be utilized in different areas. I'm going to stick with that statement."

Sarah, a senior finance administrator from institution A, described the inefficient operation of the current HVAC systems at the institution. Sarah said, "Yes, heat pumping the HVAC system would be very important to sustainability. Because we are an older university, some of our buildings do have older HVAC units. During certain times of the year, it gets really cold. It's a certain temperature that has to be outside for temperature inside our facilities to turn on or turn off heat. For example, it can be cold outside, but it hasn't got cold enough for the heat to come on inside the office. So, things like that, I think it will be very important and sustainable for the university."

**Theme 10: Administrative Awareness of Renewable Energy.** Participants varied across adoption categories as innovators, early, and late majority members from the diffusion of innovation framework. Participants representative of early adopters and late majority were not entirely aware of renewable energy, but were receptive to further study. Participants assessed as innovators exhibited adoptive characteristics and willingness to integrate renewable energy without observing the phenomenon or engaging in trial periods. Even with limited understanding of alternatives, when indeterminate about renewable energy alternatives, innovators believed a more energy efficiency energy system would be beneficial to sustaining the operations.

Kimberly, a member of the late majority, spoke of limited understanding of energy efficiency that could be gained from recycling and thermo chemical conversion. However, she had become aware of the involvement of other institutions. Kimberly believed energy efficiency and recycling was beneficial to the institution. She said, "I would say so like other renewable energy sources. I would think that there would be some benefits to help us with our buildings if we were to do it. Without knowing the specific terminology, I would like to get recommendations from others who are more familiar with the process. I personally hear about people doing energy efficient things at their schools all the time and how it has kept it up. I think it would be beneficial."

Amber, another member of the late majority, admitted not understanding operational savings related to the HVAC system. She felt she did not have sufficient knowledge to assess the efficiency and economic benefits of alternative energy sources. She said, "Do I believe heat pump intensification can reduce campus facility energies cost? Heat pump intensification, I really don't know what that is. I don't know enough about it to know for sure if it could help

facilities cost or not. That's not my area of expertise to speak on. I would have to do a little more research to be able to speak to it accurately so I can't speak to it at this time.”

Marsha, an early adopter from institution B, said she would need to know more about what solar energy was all about. She said that they would have to figure out how these solar energy operates. She said that PWIs don't waste their time on new ideas that don't work, HBCUs shouldn't be any different. She said, “In my personal opinion, I think it would but I would need more information on what it entailed. I would need to see how those solar energies work and they must work.

The reason I say that is because if you have PWI using such equipment, they're not going to waste their time or too much of their energy or anything that's not going to be beneficial to them. So my thing is, it's not like we're copying, but you have to pay attention to your environment. If PWIs are making such changes, there's got to be a benefit. As HBCUs, let's not get on the bandwagon at the end, let's get on board during the middle. That way we can benefit from such technologies. I think all institutions should take part in participating in such.” Avery, an innovator who manages energy operations at Institution B, stated that using solar panels on facilities could help reduce consumption of energy. He identified difficulties associated with modifying older buildings with solar panel assemblies. When asked about innovative alternatives such as solar reducing energy consumption at his institution, Avery stated, “I think solar power can be a contributor to sustaining the campus. One of the challenges that many colleges face such as ours is that they were formed in the 1880s. We have a lot of historic buildings that are not easily equipped for solar panels because of the age of the buildings and the architecture. Right now, we have about 40 buildings on the campus. For those facilities that can sustain solar, I think that's an important first step.”

Allen, an innovator from institution B, was an avid supporter of solar energy systems. He described problems with hail storms and insurance rates and working together with local utilities in the immediate vicinity. He spoke about the cost of retrofitting facilities to more energy efficient outcomes and the necessity for collaborating with the municipal energy authorities. He responded, “Solar panels? Yes! Yes, I'm a big supporter of solar panels. The only thing to possibly worry about is hail storms. We often get hail storms here in the area. I would need to know the upfront costs or the monthly cost. I would think insurance and property insurance costs will go up. There has to be a lot of rewiring and electrical work done. There has to be cooperation with Jackson Energy Authority to make this whole initiative work. There also has to be funding from the federal government as well as local and state governments.”

Melody, an early adopter from Institution B, opposed solar panels for facility roofs instead suggesting solarizing the windows. Melody expressed there may be some process implications for varying floors throughout the building. She said, “Yes and no. I wouldn't recommend solar panels for historical buildings, I would recommend solar windows instead. You know, it depends on the level of the technology that would be solar. You're looking at three story buildings, four story buildings, and five story buildings. How do you solarize a roof that will be efficient for 3, 4, 5 floors. I don't know, it's probably possible but I don't see how that would happen. How can the sun provide heat to me on the first floor? Also, the roof is on the 5th floor. Solar windows may be something that would be sustainable for the college. I'm just thinking about the layout in particular as well as every building and every floor. All of our buildings have multiple floors. It depends on the level of technology and what part of that innovation package. On the other hand, it could be very cost effective for the college.”

Theme 11: Importance of Sustainability. Several research study participants shared perspectives on the importance of sustainability at HBCUs. For several administrators, HBCU sustainability is the most important factor. Participants were passionate about the institutional historical significance and the effect it had on African Americans. Sarah spoke about HBCUs having a significant historical and future role for African Americans. She stated that it was critical to develop a community in order to teach and inspire students. She believes that when students go out into the world and meet individuals who look like them, they should feel good about where they come from. She stated, “Sustainability is very important. HBCUs have an important place in history and an important place in the future for African Americans. It's nice for us to be able to have a place that's for us by us. It's very important to have a community to also be able to teach and encourage students. When students go out into the world where there are people that look like them, they're able to compete as well. So it's very important.”

Amber, from Institution A expressed the same perspective on sustainable energy as Sarah. Amber stated that sustainable energy was important. She didn't believe in establishing a project solely to show that the institution has anything current. She stated that cost must be considered while introducing renewable energy and sustaining the institution. She suggested that if the institution does not properly prepare for sustainable outcomes, it will lag behind other institutions. Amber said, “Sustainable energy is very important to me. I don't believe in starting a project just to say now we have something that's up to date. If you cannot sustain what you just install, then you've done nothing. You've actually put us further behind. So sustainability is very, very important. If you're going to upgrade, if you're going to put these things in place, you do have to build in the cost of sustaining those improvements. Otherwise you're still stagnant, you're still behind the curve ball. So sustainability is the most important piece to progression, innovation or improving a situation. In my opinion, without sustainability you cannot move the needle.”

Avery, an innovator from institution B, discussed area conversations about the importance of sustainability and how institutions assess the outcomes that result from it. He stated that recent conversations were increasing and intensifying the attention on the fact that the institution should base all decisions on what the institution adopted and utilized renewable energy. He said that how the institution managed the integration of renewable energy was critical. He forecasted that interest in sustainable and renewable energy integration will increase from subtle to urgent.

Avery said, "I would say just moderately, but I think that the recent discussions will accelerate and elevate that focus in that we should make all decisions based on what we purchase, how we use it, how we dispose of it in a way that we can actually measure the effect of sustainability. I think it's going to go from moderate interest to more serious interest. Academically, students who are able to speak sustainability are going to be more valuable when they go out, whether they're going to be chemists or accountants or entrepreneurs. I don't think it's been extremely high on the list of priorities, but I believe it's going to accelerate very quickly."

Allen, an innovator from institution B, discussed the importance of sustainability and the impact it will have on future generations. He spoke about sustainable energy practices as a way of combating other unrelated institutional cost constraints relative to inflated travel expenses, and low student enrollment and retention. In relation to renewable energy integration and institutional sustainability, Allen stated, "Sustainability is very important. Our enrollment has gone down and we're looking at every way to cut expenses. We are expensive under the microscope. Anything over \$2500 is reviewed and requires approval from managers and department heads. We are in the process of cutting down on all travel expenses so we can sustain and be there for our next generation of students. We're taking steps to operate courses that are in demand so that we can sustain. Our enrollment cannot go down any further. We're doing whatever we can to stay relevant and be here for the next generation of students."

Carla, an early adopter from institution a, discussed the significance of technology and how it has a major impact on the institution's sustainability. She expressed how technology had a major impact on society and the importance of being at the forefront of innovation. She stated that it was important for HBCUs to become informed to increase institutional sustainability by being aware of current generational trends." Carla stated "Technology is ruling the world now. I do think that it's very important to be on top of new technological advances. Having the latest upgraded technology is what the world is going along with nowadays. It's going to only keep advancing. As new generations that come along, they're going to be hip to technology because they could have just went to a high school. I feel that HBCUs should be on board with that to keep up and provide the best for what a child has been brought up on. Like back when people were raised with typewriters and whatever that they had in place. Just like then, we started implementing new technology and started to improve over time." Considering the fact that institution A is a public HBCU and institution B is a private HBCU, the administrators' responses from the two institutions revealed similar parallels in attitudes towards innovation, technology, and sustainable energy alternatives."

Theme 12: Apprehension & Unwillingness to Adopt despite Proven Results. Several responses from respondents indicated they were either apprehensive of renewable energy alternatives or unwilling to adopt despite proven trial periods, observable results, and general knowledge. Participants from institution A and B from the late majority represented this theme, with one being the only laggard from institution B. Josh, laggard from institution B, opposed solar energy as an alternative energy source for the institution. He expressed that solar energy presented operational and day-to-day inconsistencies based on the accounting system. Josh stated, "I am not such a fan of solar power. I don't really feel like we need it so I would say no. It's like one day solar could help the school and the next day it probably wouldn't work. It's not measured in days. So I would say I don't think solar energy would help sustain our school."

Amber, late majority from institution A, was unaware of how solar could help the institution be sustainable. She expressed hearing about the benefits of solar energy, but was not personally aware of the benefits it could provide to her institution. She argued if solar alternatives possessed the bandwidth to handle current power loads at the institution. She said, "I Heard a lot of talk about solar power and, and that it's a great resource to reduce energy costs. I personally don't know a lot about it. I don't know if it really works though."

Table 3  
RQ3: Corresponding Themes and Categorizations

Research Questions	Corresponding Themes & Categorizations	Construct & Constraints
How does administrator attitudes toward institutional sustainability influence their adoption and non-adoption of renewable energy integration at Historically Black Colleges & Universities?	Energy Expenditures and Hardware Modernization	Sustainability
	Administrative Awareness of Renewable Energy	Innovation
	Importance of Sustainability at HBCUs	Technology
	Apprehension & Unwillingness to Adopt Energy Alternatives	Cost Containment

The corresponding themes shown in Table 3 resulted from administrator attitudes toward institutional sustainability influence their adoption and non-adoption of renewable energy integration at Historically Black Colleges & Universities. The category related to energy expenditures and hardware modernization was supported by expressions such as “We will then keep up with the other schools" and "It will also help build and keep up with the legacy we have created." The category related to administrative awareness of renewable energy was supported by expressions such as “That’s not my area of expertise to speak on” and “ I would have to do a little more research to be able to speak to it accurately so I can't speak to it at this time.” The category related to the importance of sustainability at HBCUs was supported by expressions such as “Sustainability is very, very important” and “Sustainable energy is very important to me.” The category related to apprehension & unwillingness to adopt energy alternatives doubtfulness was supported by expressions such as “I don't think solar energy would help sustain our school.”

Research Question 4

This question asked: What are the differences between public and private administrator perceptions on the complexity and compatibility towards the adoption and non-adoption of renewable energy integration on their campus? The fourth research question investigated differences between institutions A and B participant perceptions of the complexities of renewable energy integration on campus. The study assessed perceived compatibility of renewable energy at each institution.

Participants were asked about the placement of electric charging stations on campus, the location of windmills, and the conversion of the existing automotive fleet from gas to electric and hybrid. Innovators from institution B supported renewable energy integration, and provided cost-effective options and sustainable outcomes for positions. Most participants who were early adopters and early majority members were receptive to renewable energy integration at the institution. Late majority participants were skeptical about adopting energy initiatives after trial periods when results were both apparent and positive. The laggard in the study did not support any energy alternatives, arguing energy alternatives would be too complicated or incompatible with the institutional administrator framework.

Theme 13: Electric Vehicle (EV) Charging Stations. The first emerging theme about administrator’s thoughts on EV Charging station compatibility was derived from their responses to interview questions. The researchers interviewed participants from both institutions A and B to determine the compatibility differences with installing EV charging stations on campus.

Ashley, an early adopter facilities manager from institution A, discussed her support of electric vehicle charging stations at her institution, as well as government incentives for individuals who decided to convert to fuel efficient vehicles sooner rather than later. She expressed that local and state energy companies were offering up tax incentives for institutions looking to shift to green transportation. She advocated for charging stations further suggesting she saw the cost benefits of charging her personal vehicle at home. Ashley stated, “Yes, I feel that is compatible. Right now, everybody is moving from gas to electric vehicles. Like I said, I myself am looking into moving to the electric vehicle and that word c for places where I can charge the vehicles. Also, energy companies are providing incentives for going with electrical vehicles. Even if you have that in your own home, they only charge for seven hours and the charging price is only \$20 which is good. I'm all in for saving any kind of money.

Sharon, an early adopter from institution B, stated saw charging stations possibly being a benefit at her institution. She stated she would not implement it too quickly due to the local municipality lacking supporting resources, but

was open to the practical benefits of charging stations provided to the institution. “I mean, it possibly could work. I would not do it right now because it's just not available in our area. But I mean, I think it could work. I mean, we could do it if it was practical and needed. Maybe so.”

Alisha, an early adopter facilities administrator from institution A, expressed her support of charging station locations on campus. She also expressed having a trial phase process before fully adopting the installment of charging stations. She expressed the institution not having enough land to place the charging stations and the process being tedious to implement. Alisha said, “That would be some variables in that transition. I'm just thinking of looking around where we are now with our current fleet. Basically, we would have to make sure we have an area for charging ports and that in itself would have to go through a process phase in process to see if it could work. It would be a lot to it. As of right now we don't have the land, unless the university has the land in the area that we can add on which I just don't see in my mind. It'll have to be under test. It will be a test basically.”

Jeffrey, a member of the early majority and chief administrative officer (CFO) from institution A, spoke in favor of the country's transition to a more carbon-neutral environment. Jeffrey discussed how it was only a short amount of time before the institution needed to make an urgent choice about putting EV charging stations on campus.

Jeffrey communicated, “As I think back to that earlier question about electric vehicles, I actually do think that that's something that probably needs to happen rather quickly. I think we're going more and more in that direction as a country. I think we're seeing more electric cars, not less. In this particular market, I think it's just a matter of time before we need to get into that game with some of these charging stations on campus.”

Melody, an early adopter from institution B, was enthusiastic about electric vehicle charging stations compatibility on school grounds. She was supportive of the insertion of electric vehicle charging stations. She spoke about a local gas station that was going out of business and believed it would be an advantageous location for an EV charging station because of its geographical proximity and the upsurge in electric car purchases from local consumers. Melody stated, “I think that is the direction that the world is going. I really think that to be the case. I'm glad you brought that up because we're getting ready to remove gas tanks at one of our recent purchase facilities that was once a store. They had gas pumps before and they are not in use now because there's a different purpose for that location. You just set off a light bulb in my brain. I was thinking that would be a perfect spot for a charging station for electric vehicles. I'm sure there's some in the area. You may think that because, you know most HBCUs are located in the rural downtown areas or in the low income areas that maybe those people don't have electric vehicles. But then again, they're becoming more and more popular.”

Sarah, late majority from Institution A, spoke in favor of campus-wide electric vehicle charging stations. She believed charging stations could potentially be accessible to area residents. She proposed conducting a campus survey to determine the amount of students who drove electric vehicles. Sarah stated, “I think charging stations would be compatible. It also depends on how many electric cars that are being driven on campus. I think it would be good to do a survey, if possible, of students and see how many electric cars were operated by students to see how beneficial that would be to put electric charging stations on campus. For where we located, it would be good for just the downtown area to have. I can't think of anywhere downtown where we have electric charging stations except the one near the outskirts of the city limits. I think this works if we can show how many students will be using the charging stations. We could also make it accessible to residents outside the university as well as for other systems to use. It's something to look into and see how it would be beneficial to us.”

Avery, an institution B innovator, supported the installation of charging stations on campus. Avery considered transportation quantities and how the integration of EV charging stations would benefit both faculty and students significantly. He believed students who presently own electric vehicles and the inconvenience of charging their vehicles through dorm room windows due to the lack of accessible campus EV charging stations. Avery concluded, “Yes, absolutely. For two reasons, one, we can control the purchase of vehicles for the campus fleet. Currently, we have about 30 vehicles in the campus fleet and, we as a staff can determine if it makes sense to convert those to electric vehicles. On a wider scale, we have to be ready to support the students and faculty and staff who may purchase their own electric vehicles. If you think about 1000 students living in dorms, they can't produce their own E V charging stations. They can't run an extension cord out their dorm window to go down and charge their car. The institution really has to take responsibility for developing the infrastructure that allows students to have the choice to purchase an electric vehicle. Students should know where they live and are going to have access to EV charging that they're going to need.”

Allen, another innovator from institution B, also supported compatibility of EV charging stations. He stated that he had never seen charging stations, further suggesting there was an absence of charging stations in the area. He stated the installation of charging stations could benefit students and faculty members at the institution. Allen communicated, “Yes, they could be compatible. Now that you brought that up, that's actually a good thing to do. I don't I've have never seen an electric vehicle here on campus. That's all because we don't have charging stations. We could possibly offer charging stations and tell students or faculty members you can charge them here on campus if they bring their electric vehicle.”



Josh, a laggard, opposed the compatibility of electrical charging stations for electric vehicles on campus. He was unable to articulate particular justifications for his reservations to the notion of the installation of EV charging stations on campus. Josh said, “Well, I would say no on that one. I don’t know why. I don’t know but I just feel like I just don’t see it thus far. So I would just say no. Um, I just don’t see it or how it could work on campus.”

**Theme 14: Wind Optimization and Process Complexities.** The second theme emerged in replies to interview questions which involved administrators’ perceptions of the complexities of harnessing wind and process complexities. Sharon, a member of the early majority, felt that the installation of windmills was not too complex. She noted that the presence of considerable amounts of wind in the vicinity might support driving the narrative forward. Sharon stated, “I don’t think it’s too complex. I really don’t think anything is too complex. I don’t know if it’s practical for the area of the country that we’re in. But, I mean if I was living along coastal areas, it would be great. If we had a lot of wind, it could possibly work.”

Amber, late majority from Institution A, considered benefits and drawbacks to windmill integration. She was slow to adopt windmill integration and required additional evidence and observation before accepting the complexities of windmill integration.

Amber stated, “I don’t know if we’re ready for that. I don’t know a whole lot about the windmill and its possibility of conserving energy. I do know that it could be a benefit, but I think there are some challenges also associated with it. We need to do a little more research to know for sure if it’s something that can sustain the needs of the campus with the number of buildings that we have or that we have to power. I mean maybe some of our smaller buildings or some of our smaller facilities could benefit from it. Whether it would benefit the campus overall, that’s the question that has to be researched.”

Jeffrey, a member of the early majority, stated he supported the installation of windmills and believed in the cost savings it could provide to the institution. He stated that the university had recently purchased some land that could possibly support the locality and placement of windmills. Jeffrey stated, “I would say yes. I can see it saving energy. I also can see it being a complex process just because of what it takes to implement. To my knowledge, our HBCU recently acquired some land. We acquired between 25 to 35 acres. I guess with this windmill integration, we could put a windmill in that space and that could somehow power the campus.”

Josh, a laggard, supported refraining from installing windmills on campus to save energy due to complexities with turbine placement. Josh stated, “I think it will be too much. Number one, we don’t know where we’re going to place a windmill like they do in other communities. That’s going to be a challenge trying to figure out where we’ll put the windmill at. Number two, I don’t think that’s going to help save energy.”

Avery, an innovator, explained how windmill integration was not a difficult procedure that could be implemented on campus. He identified existing collaborations with institutions that had installed windmills on campus in an effort to reduce energy consumption and utility costs. He discussed the economic viability of windmill installation and varying wind trends required for adequate windmill output. He expressed how predictability of wind factors had a direct relationship to the amount of wind walls in the desert. Avery communicated, “I don’t know that it’s too complex. In our partnership with Arizona State University, they do have some rooftop and other smaller scale windmill renewable energy initiatives going on. I think the question always becomes, are you located in an actual location that produces enough wind to make it economically viable? I would say this area is not an exceptionally windy location. I’m from West Arizona, near California. You drive through the desert, you see these massive wind walls that are placed where you have a very predictable wind that can give you a return on investment. There could be some small scale projects. I think sometimes it checks the box to say yes, we’re using wind energy to the extent that it might be reasonable, but I don’t think it’s going to be a major contributor to the overall reduction of carbon based fuels.”

**Theme 15: Awareness of Decarbonization and Fleet Electrification.** Study participants described institutional compatibility to decarbonization of campus transportation. Most participants understood the need to transition from fuel-based to electric cars. Kimberly, a late majority from institution A, expressed skepticism about the institution’s capacity to transition from fuel to electric vehicles. She had not observed benefits of electrification to decarbonized vehicles. When questioned on the compatibility of converting to electric transportation from gas, Kimberly stated, “I just don’t know. We don’t know enough about the benefits just yet. We’re struggling to keep these regular cars going. I don’t know what the electric cost would be. I know initially the electric car cost more, but it is supposed to go down. So in that regard, it may be a good idea if that’s truly what happens. Pay the big price upfront and maintain vehicles when price goes down. Only if it goes like that, I would agree to it. If they don’t go like that, we’re going to be in a world of hurt.”

Allen, an innovator, supported the feasibility of electrifying campus fleet boasting the many benefits associated with decarbonization. He felt such a strategy would decrease dependency on gas and local utilities. Allen said, “Yes. Going electric is the right direction for the institution. That makes us less dependent upon gas and less dependent upon local utilities. I believe electric vehicles are the future. Give it another 20 to 30 years, I believe

most of the cars out there will be electric think it's the future of transportation. We need to be in step up with the future to remain relevant.”

Jeffrey, an early majority member, opposed transitioning to electric vehicles. He required additional information on the relationship between electric cars and EV charging stations before deciding to adopt fleet electrification. He acknowledged not being aware of fleet electrification as well as it being outside his scope of work. Jeffrey stated, “At this particular point, I would say no to transition. We're probably not equipped to do that at the moment. Mainly, because when we just talked about these charging stations, I think we need to figure out a way to see what's all involved. This is not my area of expertise. From my limited knowledge of how these electric vehicles work, you really need to have the charging stations in place to keep them on the property. Right?”

Sharon, a finance administrator from institution B, felt unsure on the benefits of fleet electrification. She stated the institution had low-range vehicles on campus that were minimally used. “I would have to say, I don't know. Well you know, we do have those that are used short range here on campus. I say I have to give that up. Maybe, in the near future. I'm sorry, I can't give you a definitive answer.”

Sarah, a member of the late majority from institution A, supported the institution converting campus vehicles to electric. She stated the electrification would be beneficial to security staff. She suggested that fleet electrification would provide cost benefits to the institution by reducing the amount of gas cards required for campus vehicles. She said, “I think it would be compatible, especially for our fleet vehicles that we currently have for staff and security personnel. It would be great to have. It would be ideal to have all those electric vehicles. It really would be useful to eliminate buying gas cards that we have to purchase. I think it would save a lot of money so it would be beneficial. That's where the charging stations would come into play because you'll have university vehicles that would be electric. So therefore, charging stations would be needed. It would also be a good advertising tool and technique for recruiting potential students who have electric vehicles. To have that type of availability would be very advanced, especially here in downtown Jackson. We currently don't have one in the downtown tax area, so that would be great.”

Carla, among the early majority, discussed the institution possibly transitioning to electric vehicles. She was not convinced if the institution was currently willing to embrace the notion of fleet electrification. She stated there was a mass production of electric vehicles but remained uncommon in the region. She expressed the institution having more important needs other than electrifying campus vehicles. Carla stated, “I don't think charging stations are compatible at the institution right now. Electric cars are being made every day but still a bit uncommon. We see all the things that are happening around it like we see it and it's going on, but I still don't really feel like our campus is ready to transition into that. I feel like it's possible but we have other things that we could improve and put more work towards than electric cars.”

Sheila, a member of the early majority from institution A, felt electrifying campus fleet was compatible for the institution. She stated previous instances where the institution had installed charging stations for electric vehicles, but was unaware if charging stations remained operable. Sheila stated, “I think changing to electric vehicles is compatible. Once upon a time, we actually had electrical charging stations that were hooked up outside. I think they were placed there only for demonstration purposes. This was many years ago.”

Table 4  
RQ4: Corresponding Themes and Categorizations

Research Questions	Corresponding Themes	Construct & Constraints
What are the differences between public and private administrator perceptions of complexity and compatibility towards the adoption and non-adoption of renewable energy integration on their campus?	EV Charging Stations	Innovation
	Wind Optimization and Process Complexities	Relative Advantage
	Awareness of Decarbonization and Fleet Electrification	Complexity Compatibility Innovator (2.5%) Early Adopter

		(13.5%) Early Majority (34%) Late Majority (34%) Laggard (16%)
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The corresponding themes shown in Table 4 resulted from the differences between public and private administrator perceptions of complexity and compatibility towards the adoption and non-adoption of renewable energy integration on their campus. The category related to EV charging stations was supported by expressions such as “Yes, I feel that charging stations are compatible” and “I would not do it right now because it's just not available in our area.” The category related to wind optimization and process complexities was supported by expressions such as “I can see it being a complex process just because of what it takes to implement” and “I do know that it could be a benefit, but I think there are some challenges also associated with it.”

The category related to awareness of decarbonization and fleet electrification was supported by expressions such as “This is not my area of expertise” and “It would also be a good advertising tool and technique for recruiting potential students who have electric vehicles.”

**Conclusion**

This qualitative phenomenological study analyzed finance and facilities administrators' perceptions of sustainable and renewable energy integration at public and private Historically Black Colleges and Universities. Interviews were performed with 16 participants from two HBCUs, who answered questions about the adoption and non-adoption of sustainable and renewable energy integration. The data analysis results demonstrated the importance of proactively involving administrators in the decision to adopt renewable energy at HBCUs. Administrators further stated that awareness of renewable energy alternatives and various degrees of trial periods are crucial and regarded as quality assurances for administrators looking to integrate sustainable and renewable energy at their respective institutions. Implications of this research study highlight the importance of HBCU administrators being aware of government incentives, possessing administrative competence, having the latitude to perform energy studies, and fostering institutional sustainability.

Participants examined the ambiguities and limitations associated with the integration of sustainable and renewable energy within their individual roles and departments. However, the majority of participants acknowledged enthusiasm with their experiences with sustainable and renewable energy alternatives. Many participants felt motivated to participate in renewable energy efforts after becoming aware of current initiatives involving renewable energy at their institutions. Participants in the study discussed the inevitable fact of sustainable and renewable energy integration being an environmental factor in higher education that will soon be a need within the next several years. Another outcome mentioned by participants was technological innovation barriers, as administrators described why they would not accept technological advancements represented within renewable energy alternatives. Participants' reasons for non-adoption included the time required to charge electric vehicles, placement of windmills, solar panel malfunctions, and institutional culture barriers. Finance and facility administrators face difficult problems on a daily basis in order to reconcile budgets, maintain the security of all students, meet with financial supporters of the institution in order to increase funding amounts, and adopt efficient and sustainable methods for the institution.

Based on the study, the majority of participants believed that HBCU administrators are willing to implement sustainable and renewable energy integration. In comparison to most literature, it suggests that HBCU administrators and universities are unwilling or slow to adopt sustainable and renewable energy. The findings suggest that HBCU administrators will adopt sustainable and renewable energy integration after successful trial runs, proven technical solutions, early participation in renewable energy initiatives, increased awareness of renewable energy alternatives, and a thorough understanding of institutional limitations associated with aging software, hardware, and facility infrastructures. University administrators at HBCUs may increase the sustainability of their institutions through the implementation of renewable energy in stages. Such efforts by finance and facilities administrators would effectively influence the decision-making process at public and private Historically Black Colleges and Universities to adopt or not adopt sustainable and renewable energy integration.

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