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Marketing of Campus Carbon Management: Ensuring Stakeholder Representation in Institutional Sustainability Solutions

Nathanael Huaixin Li, Virginia Polytechnic Institute and State University

Nathan is a PhD student in Engineering Education at Virginia Tech and holds a B.S. in Design Engineering with a focus in Sustainable Building Design. Using his background in design engineering, renewable energy, and sustainability consulting, Nathan is studying sustainability mindset, engineering ethics, sustainable land development, and corporate social responsibility.

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Introduction

Purpose Statement

Using a study conducted during a Senior Design project proposing how a public, medium-sized, STEM university in the mountain-west United States might decarbonize their electricity use, I show how institutional staff and faculty involved in campus climate action might better understand the assumptions that stakeholders have about their institution's intentions and progress towards climate action goals.

Research Questions

At the onset of my study, conducted within the context of a Senior Design project aiming to propose a method for The University to decarbonize[1] their electricity use, I set out to answer the following questions:

1. What concerns do people have about energy use/production overall?
2. How do people feel about the approach to energy that The University has?
3. To what extent are people aware of decarbonization?
4. Do people have a future vision of energy at The University?
5. Is this vision informed by The University's historic relationship with energy?

This paper reframes the findings of these questions in order to inform other institutions on how they might best market and present their climate goals to encourage engagement from faculty, staff, and engineering students.

Place Setting

The participants of this study hailed from a public R-1 university in the mountain west United States (denoted as 'The University'). The University focuses specifically on STEM but also claims proximity to activities that involve the natural environment like hiking, skiing, and river rafting. The school also has deep roots in supporting the United States' many energy transitions from coal, oil and gas, nuclear, and emerging technologies including solar, wind, and hydrogen

[1] For this project, we defined "decarbonization" as an annual perfect offsetting of any carbon emitted from campus electricity demand. This meant the proposed enhanced geothermal plant was sized in order to consider the renewable technologies already in the locality's grid so as to not double count what the electricity provider was doing and what The University intended to do. Scope 1 and scope 3 emissions were not considered for this project.

storage. At the time of the study, The University population consisted of over 6,000 undergraduates, 1,800 graduate students, and around 750 faculty members (30% of which were tenured/tenure-track).

The university is also located near the National Laboratory of the Rockies, which was called the National Renewable Energy Laboratory (NREL) at the time [1]. Originally founded in 1974 as the Solar Energy Research Institute, NREL predated the Department of Energy and at the time of the study was the premier place to research and discover how to, "transform the way the nation and world use energy." [2] Many scientists at NREL were also professors in energy studies across a variety of departments at The University, linking the two organizations together ideologically in addition to geographically. These proximities were self-reported by a portion of participants in this study as influential to their understandings of the school's research interests and goals, and this understand was occasionally a driver in their decision to attend The University as part of their pursuit to participate in the transition towards renewable energy technologies.

The Earth, Energy, & Environment Enigma

It is important to note that this study was conducted a year after The University underwent a significant marketing campaign celebrating its 150th anniversary. This change was notable in my interviews as it came along with the removal of what was, at the time, a longstanding slogan of "Earth, Energy, Environment." This slogan, used by The University as a representation of the past, present, and future of The University's interests and impacts, was rather seen by my participants as the "ethos" of the school; it was an all-encompassing commitment to bettering Earth, enabling a renewable energy transition, and to protecting the environment. While the marketing shift was intended to broaden the public perception of The University to include growing programs in computer science and quantitative biosciences and engineering, the removal of the slogan, to those in sustainability, saw the move as a reprioritization of the school's responsibility to climate efforts.

This sentiment was best represented by a conversation I myself overheard in our Senior Design's Sustainable Engineering Design Studio when another student proclaimed, "no wonder [The University] took the word 'sustainability' out of their logo." The word, in fact, was never spelled out in the logo, but to this student, the now-erased commitment was there. Regardless of this internal turmoil in students who both paid attention to the school's marketing tactics and aimed to combat climate change, this study suggests that sustainability-focused stakeholders (like those involved in the Sustainable Engineering Design Studio) maintained their trust in The University to not just consider its impact but actively mitigate it.

Methods

This study was conducted during the second half of a Senior Design project that spanned from the Fall of 2023 through the Spring of 2024, so the research design, data collection, and data analysis all occurred in the Spring of 2024. Research design included the creation of an interview protocol and set of initial research questions that were stated in the Introduction section. After creating the interview protocol, a few interviews were conducted to pilot the protocol. After this piloting phase, a survey that mimicked some of the most quantitative portions of the protocol was created and distributed through The University's daily email blast and posters hung in most of the campus' academic buildings. No revisions were made to the interview protocol.
The survey was intended to collect more data points for the analysis and included an optional question asking if respondents might be willing to participate in an interview. Many of the interviews in the latter half of the semester consisted of those who had indicated that they would be interested in an interview. In all interviews, an attempt was made to collect more responses by means of snowball sampling [3], but it is uncertain if that yielded any increase in participation.

Positionality Disclosure

As a first-year PhD student, I recognize that the methods and intentions behind this study conducted during my undergraduate degree may appear to be haphazard and missing some of the characteristics that would exhibit the 'alignment' that I have since learned about. Writing this manuscript has been both practice of learning to communicate clearly and seeing my progress over the mere two years since initial data collection as a student and researcher.

Collected Data

The survey posted on campus bulletin boards and email blasts collected 118 responses and 24 semi-structured interviews were conducted with a variety of stakeholders on campus. A majority of these interviewees were undergraduate students, but multiple graduate students, staff, and faculty members were also willing to participate. These data represented most disciplines at The University, but notably none of the self-selected participants came from The University's petroleum engineering department. As it was unbeknownst to me as a young researcher, no efforts were made to ensure that my nonprobability sampling was statistically representative [4] of The University in terms of any demographics.

The interview protocol used question types that allowed us to discuss broad topics, as well as more specific questions that homed in on the interests, backgrounds, and expertise of each interviewee, including example questions [5]. Most interviews were comfortable, and I am led to believe that this synergy was based on the topic at hand and the fact that I was not presenting myself as someone from The University's administration. Some early interviews (those with participants that I had prior relationships) potentially showed evidence of over-rapport [5], however, I aimed to use language that ensured them that they could be honest about their feelings, and sometimes underrepresented my own knowledge in the space to try to mitigate any

power dynamics. Each interview lasted just over an hour long and was conducted at a table in a quiet but public room in The University's library, so the conversations were neither very private nor oversaturated with other noise and activity.

Survey questions were aimed to assess awareness of the goals in The University's climate action plan, participants' personal relationships with energy, and to collect free responses on their opinions of renewable energy and the goals of decarbonization. An additional question was posed in the survey asking if respondents were "hoping to apply [their] professional career to efforts related to climate change." This question was included to measure whether the collected data were representative of the population as a whole or if it would be primarily composed of people who were professionally devoted to addressing climate change.

Analysis

At the conclusion of the study, each interview was revisited by listening back to the recording to analyze silences, hidden meanings, and contradictions [6]. This process of analysis then yielded notes that recorded significant quotes (those that might represent a broader trend or stance) and relevant content and themes that represented connections between participants. Content analysis included identifying the verbiage used by participants (for example, 'renewable' versus 'green' energy), their reported awareness of The University's sustainability goals (***RQ2 & 3),*** and stated interests in specific energy technologies (***RQ1***). Thematic analysis searched for participants' priorities for energy technologies (for example, efficiency, demand for critical minerals, lifespan, cost, and justice opportunities) (***RQ2***), their feelings toward decarbonization efforts through climate action (***RQ3***), and their view of The University as an entity pushing for innovation (***RQ4 & 5***). These content and thematic data were then also compared to trends that emerged from the survey data. No statistical analysis was conducted as it was outside of my expertise at the time.

Results

Environmentally minded individuals are ready to talk about their concerns

Before there is any further discussion, it is important to clarify that this study is only a representative sample of people concerned-about/involved-in environmental topics at The University. The survey only reached eight respondents who were not planning to work in climate change (fig. 1), and every interview was with someone who was generally positive about the goals of environmentalism and sustainability. Within this group, I gathered a mix of backgrounds, concerns, and hopes that I believe make the following findings more robust given that they are shared across a variety of people. I also found that my data was nearing a point of saturation for this population; by the end of the semester, I found my during-interview notes to be sparser as conversations were consistent with those that I had already reviewed. Engagement

with me was completely voluntary and no compensation was provided, so these data are skewed by the nature of these being people who wanted to talk about the topics.

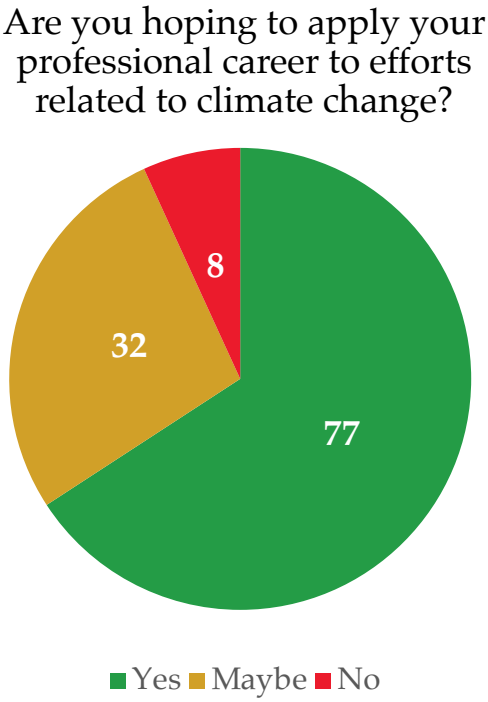

Figure 1: Pie chart showing survey respondent career applications of climate change

Electricity use is frequently on the minds of respondents

Most respondents and interviewees had a daily relationship with energy. Amongst survey respondents, this is portrayed in Figure 2. When asked about how often respondents thought about their personal energy use (from 1 - Never, and 10 - All the Time), a histogram of responses shows that a majority of responses (n = 71, 60%) fall within the ranges of 5 to 8. While no qualitative data was collected in the survey to better contextualize these data, this implies that most respondents consider themselves as thinking of their energy use more often than the average person, but not so often that it is something influencing their every decision. In the case of the single respondent that answered '10,' when interviewed, they confirmed that they thought of their own energy use on at least an hourly basis, but this was swayed by their own academic pursuits in studying energy as an undergraduate.

Interview participants all thought about energy often, but within this group, there was split between the way that participants considered energy use. Many spent a lot of time considering what I coded as their 'mundane' energy use: aspects like lights, plugs loads, and heating. The other group is what I coded as 'systems thinking;' these participants would clarify that they feel it is more harmful for us to have the individual shouldering the burden of industrial and corporate

issues. In both groups, energy use was a driver of daily decisions. Most interviewees were also able to answer this question rather quickly; this could be a result of the inclusion of the question in the survey, but I would elect to believe that for most of the participants these are not uncommon trains-of-thought given the self-selective nature of the study and the depth of conversations.

I also noticed that nobody talked about their own energy burden [7], [8]; no responses indicated that the daily consideration of energy was about comfort or survival, but rather energy use was a function of social/environmental responsibility and waste mitigation. There was also not an overwhelming amount of interviewees that indicated that cost of energy was a motivating factor, but when people did mention costs, it was typically because they were the one listed to pay the energy bill in their household. I find it hard to believe that there were no people at The University were experiencing energy burden as recent studies suggest that up to 25% of US household pay more than 5% of their income on energy bills [9], so if I were to recollect data for another similar study, more purposive sampling [3] should be used to gain representation from those experiencing energy burden.

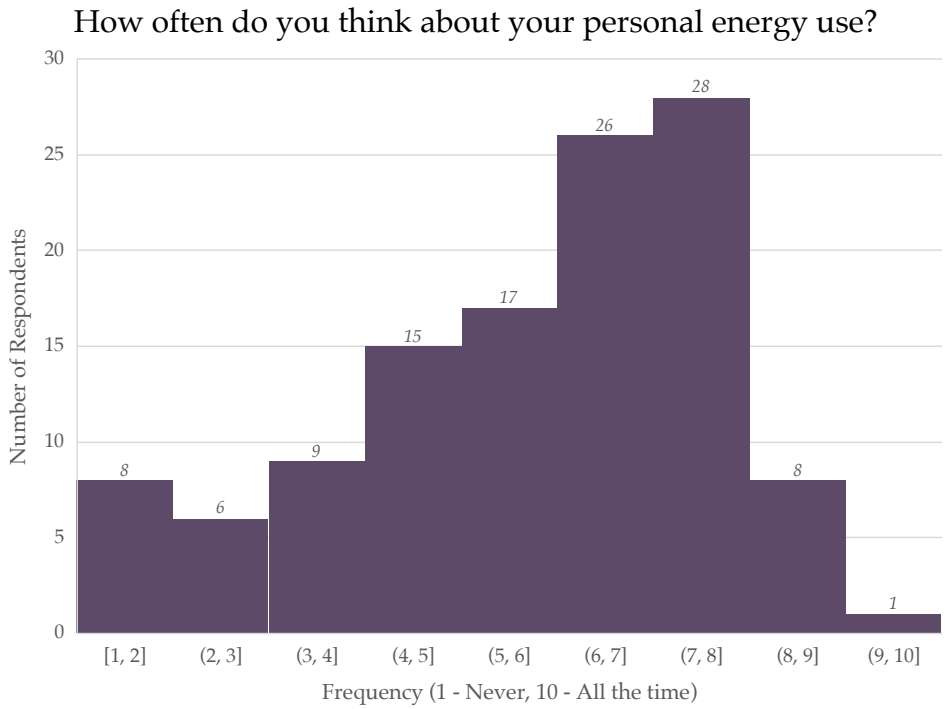

Figure 2: Histogram showing the distribution of respondents' frequency of thinking about their own energy use

Language and verbiage used

In general, I found that most interviewees used the term 'Renewable Energy' when discussing non-carbon-based technologies. Other interviewees used 'Green Energy' or 'Clean Energy.' I worried that my personal use of the word 'renewable' swayed these data, but in reviewing the

recordings of those that did not also use the term, it seemed that ‘green’ or ‘clean’ were the terms that they tended to use regardless of what I said. Given this, I would suggest that **institutions should choose a single term (‘renewable’, ‘clean’, or ‘green’) to use across all writing and marketing of climate action plans** and to not labor over choosing which word best represents their goals and beliefs.

I also investigated whether the term ‘decarbonization’ was in alignment with the rest of The University’s stakeholders’ mental model of the word (see footnote 1 for the working definition of decarbonization in this project). Overall, people did not seem to be jarred by my use of the word, but I did find it to be consistently misaligned with what people interpreted ‘decarbonization’ to be. In general, there was a clear difference in the ideas of ‘net-zero carbon’ and ‘decarbonization’. ‘Net-zero’ was represented by the offsetting of emissions, while existing carbon-based systems would remain in operation. An example of ‘net-zero’ could be the pairing of natural gas burners and carbon capture, utilization, and sequestering systems. For others, decarbonization embodied the eradication of carbon-based systems. In the case of our project, it would have been more accurate for The University to present the development of our renewable energy systems as a ‘net-zero’ effort rather than a ‘decarbonization’ effort since new generation was *in addition* to existing systems and not in their stead. As long as an institution is in good faith standing with its stakeholders, I feel that there is little risk in using the term ‘decarbonization’ for any action that lowers the school’s carbon footprint. **Institutions should understand that personal definitions of the word ‘decarbonization’ might vary person-to-person, and choosing a specific term may lead to cognitive dissonance for some stakeholders**.

Innovation and its relationship with the energy transition

In most interviews, including some with those that were already energy professionals/ students, they were not aware of concentrated solar power (CSP) nor enhanced geothermal system (EGS) technologies. After providing simple explanations using analogies and diagrams, they became excited about the technologies, and some even started to evaluate potential problems in it. On the other hand, wind and solar PV technologies are unanimously understood at least at the conceptual level.

Many people associated The University as being an innovator or at the forefront of research and extrapolated those feelings to our project. In interviews five and 16, I asked participants to rate both society and The University on a scale from 0 to 100 where 100 is entirely renewable and 0 is entirely carbon-dependent in energy production. In both cases, the interviewees ranked The University to be further along in the energy transition than the rest of society (no specific region or country was mentioned). Since wind and solar are gut reactions for people when imagining renewable energy and widely understood technologies, it does not feel innovative, even if there is work needed to be done to improve both technologies. As a result, large preferences were

shown towards the plans that used CSP or EGS, which embodied The University participating in innovative solutions. **For other institutions that wish to be seen as cutting edge,** it might be important for them to think beyond the sun and sky to follow through their advancement of both campus and climate infrastructure. Technologies like vertical-axis wind turbines, geothermal heating/cooling, large-scale storage, thermal batteries, hydrogen storage, and nuclear were discussed across my 24 interviews and would be candidates for 'next-level' renewable energy production.

Climate Action Plans, Goals, and Perceptions

Using collected survey data (N=118), when asked "What do you think the current goals of [The Univeristy]'s Climate Action Plan are?" (fig. 3), around 80% (n=94) of respondents felt confident that they were aware of the content of the goals. Within this population, only those that responded, "None of these," (n=10) were factually accurate as the strategic sustainability plan at the time only intended to *reduce* energy, carbon, and emissive impacts and not *achieve net zero* as most confident responses stated (n=83). 14% of responses (n=17) were certain that goals did *exist* but reserved doubts that the goals were achievable or intended to be achieved, and almost 7% (n=8) were completely unaware (and sometimes unable to find) that The University had a climate action plan.

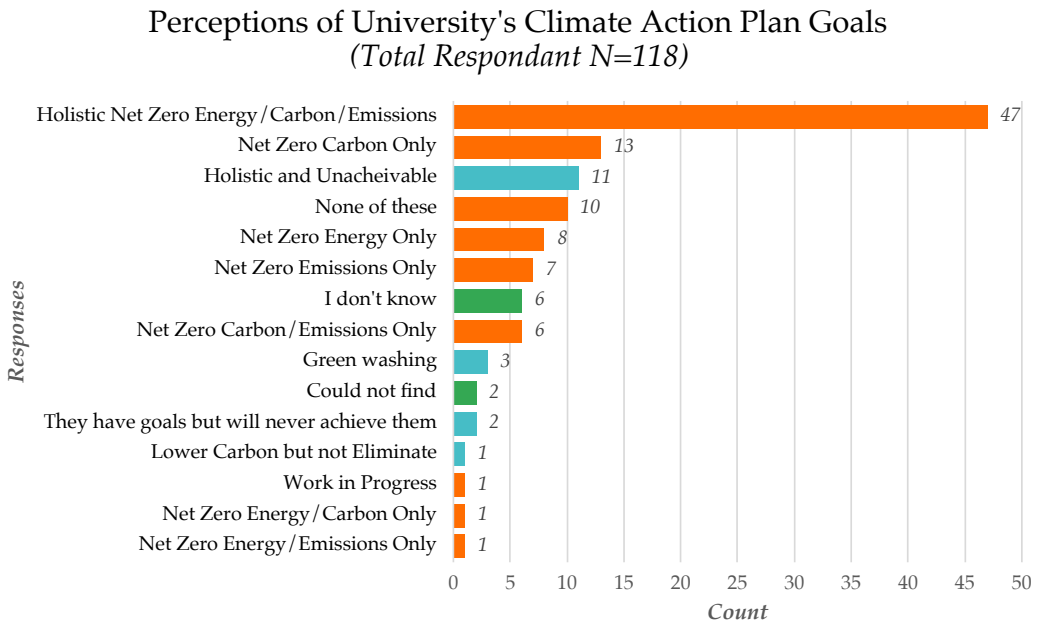

Figure 3: Bar chart showing counts of responses regarding the contents of The University's climate action plan. Sum of n > N due to respondents that exhibited more than one type of response. Responses cleaned for statistical clarity.

When crafting/adjusting/assessing an institution's climate action plan, a lack of feedback may be more a failure in marketing rather than alignment with what stakeholders want to see in place. If stakeholders are led to believe (via marketing efforts and on-campus renewables) that they share

an environmental 'ethos' with the institution (as is the case in this study), the presence and rigor of a climate action plan may feel inherent and thus might not be investigated nor critiqued. Based on the above findings' yield of under 10% of respondents having accurate knowledge about The University's climate action plan, it can be inferred that The University's innovation-forward marketing approach leads environmentally minded stakeholders to assume that goals are much more rigorous than in reality. In addition, when stakeholders do not have the opportunity to assess or help form goals, there is a tendency to doubt feasibility or seek out the goals themselves. **Both of these assumptive and destructive feedback loops may mislead institutions into thinking (based on the lack of feedback) that climate action plans, as written, are valuable and meaningful to stakeholders when it really is absent from their consideration entirely**.

Similarly, based on interview data, participants were not aware of the school's goals explicitly. The common language was that they 'hoped' the school had one, and participants imagined that it was in alignment with other universities and standards like the Paris Agreement. This is supported by the fact that there were essentially no interviewees who had sought out the Sustainability Strategic Plan before the start of this research. I warn that **while institutions might not be hearing criticism** (because of this blind trust)**, institutions should include stakeholders in the development and execution of climate action plans, and these efforts should be widely marketed to all stakeholders in order to increase participation, trust, and accountability.**

Implications

For Groups Organizing Institutional Climate Change

While these findings emerge from a limited population of environmentally minded individuals within a very specific culture and context, other institutions who hope to mitigate their broad impacts on sustainability problems through internal policy and institutionally attached action might still be able to learn from this study.

Firstly, with this study providing no compensation for participation, it can be said that stakeholders who are concerned about a wide variety of environmental problems are ready to talk about their concerns, especially when pertaining to electricity use: a topic that is frequently on the minds of those surveyed and interviewed at The University. However, it is important that institutions stay in good faith standing with their stakeholders; even at The University where participants assumed that innovation-forward marketing led to rigorous climate action goals, there were still plenty of participants who held doubt that plans were able to be implemented or even intended to be implemented. To mitigate the development of these positive and negative assumptions, institutions should include their stakeholders throughout the development and

execution of climate action plans to facilitate critical engagement with institutional climate action.

In terms of climate action goals themselves, the inclusion of stakeholders in the development of plans and goals can help administrators find the right verbiage to use when it comes to phrases like renewable-/clean-/green-energy and 'net-zero carbon'/ 'decarbonization' to better align with stakeholders' mental models of the institution's participation. On the side of energy production, if innovation is a priority for an institution, technologies like concentrated solar power, vertical-axis wind turbines, geothermal, large-scale storage, thermal batteries, hydrogen storage, and nuclear might resonate with stakeholders and align with broader marketing tactics better than traditional solar photovoltaics and horizontal-axis wind turbines.
The balance of feasibility, innovation, and marketability in the realm of institutional climate action is a delicate one, but by including stakeholders in the planning and implementation processes, institutions might see increases in critical action towards shared goals and an overall more harmonious environment between administrators, their stakeholders, the institution, and the environment around them.

For Engineering Education

While it was not the original intent for this research project to contribute to the space of environmental engineering education, these findings might inform how environmentally minded engineering students could be better prepared to take on sustainability problems beyond the impacts of their campus. It seems that these students are eager to voice their concerns and dynamically think about energy systems as inherently place-based and tied to institutional values. As a means to lean into the marketing of decarbonization efforts and including students in the process, administrations might consider formalizing participation in climate action efforts by providing paths for academic distinctions [10], internships [11], [12], and project-based learning [12], [13]. These structures could build on students' inherent interest in topics like energy and provide training to students in skills like stakeholder engagement and identifying opportunities for institutional alignment to foster more impactful, representation-based approaches to climate action [14]. These projects would not only be prime opportunities to market a hands-on approach to teaching engineers about sustainability but also could further on-campus climate action efforts and increase student confidence in implementing sustainability in their careers [15].

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