Representation of energy justice in sustainability planning:
A case study of the District of Columbia, USA

by

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ABSTRACT

The energy transition and its associated sustainability initiatives can mitigate climate change and help meet increasing energy demands. However, energy transitions also can lead to disproportionate, negative effects on underrepresented groups of people. The District of Columbia (hereafter D.C.) has served as a microcosm of the United States' race, class, and identity issues. We employed a text data mining method and compare the count of individual keywords that embody energy justice among sustainability planning categories present in two sustainability plans for the District of Columbia: Sustainable DC (SDC) 1.0, published in 2013 and Sustainable DC 2.0, published in 2019. We also compared energy justice keyword prevalence between plans. We detected disparities in the abundance of individual energy justice keywords; notably, that the terms "justice" and "injustice" each only appeared once in SDC 1.0 and zero times in SDC 2.0. Energy was the most common energy justice keywords in the sustainability plans. SDC 1.0 and SDC 2.0 largely did not differ in energy justice keyword prevalence, indicating a lack of adaptation for promotion of energy justice through time. Energy justice is an important component of sustainability planning; lack of careful inclusion of energy justice in sustainability plans may lead to a delayed just transition.

INTRODUCTION

Recent reports from climate scientists have raised the alarm about the urgent need for a transition away from fossil fuels to renewable energy production (1). The energy transition and its associated sustainability initiatives can mitigate climate change and help meet increasing energy demand (2, 3). However, energy transitions also can lead to disproportionate, negative effects on underrepresented groups of people (4, 5, 6). Currently, a fifth of the world's population has no access to electricity, and of those who do have electricity, millions can't afford to pay for it (7). For example, between 2008 and 2013, 10.1% of EU households reported that they could not keep their home adequately warm (8). In Greece, the energy-poverty rate is greater than 90% among households under the poverty threshold (9). Although economic development has reduced overall poverty in Vietnam, the cost of energy has increased over time, making energy production especially difficult for rural communities (10). A New York City case study investigating the Clean Heat Program found that 53% percent of existing residual fuel buildings are in Uptown where poverty is high (11). Additionally, although New York City has made efforts to green East Harlem, western Queens, and some locations in Brooklyn, few low-income individuals get to experience these green spaces as they are often priced out and must relocate (12). Although Freiburg (Germany) is internationally recognized for its energy-efficient districts, participatory planning, and public transport, the city has gotten less diverse, and fossil fuel reliance in neighboring communities has increased (5, 13). The transition from fossil fuels to sustainable, renewable energy can alleviate or exacerbate these issues.

The concept of a just transition - a fair and equitable process for moving towards a post-carbon society (14) - can offer a roadmap to instill justice in the energy transition. Under a just transition, environmental justice and, by extension, energy justice can be considered in sustainability planning to ensure that everyone has access to energy regardless of ethnicity, income, gender, and race (14). For example, a just transition can be represented by a reduction of households at risk of energy poverty in places like Kansas City, where a recent study suggests that high-risk block groups are poorer, have less educational attainment, and have a greater percentage of Black and Hispanic households (2).

Energy justice has emerged as a specific theoretical framework for understanding the effect of the energy transition on people (15, 16). Our understanding of energy justice is based on Jenkins et al.'s (2022) conceptual review of the energy justice literature. Based on their comprehensive analysis, energy justice fell into three different forms of justice. Distributional justice evaluates where injustices emerge; recognition justice evaluates which affected sections of society are under-represented; and procedural justice evaluates existing processes for their remediation (15). According to Carley & Konisky (2020), "energy justice is a modern branch of environmental justice" (17) and thereby is specifically suited to address energy disparity issues.

Energy injustices are prominent today. In terms of energy delivery and infrastructure, richer communities tend to have higher efficiency and are better equipped for natural disasters, as exemplified in Rhode Island and New Orleans (18, 19). Nationally, only 53% of self-identified Blacks have existing rooftop photovoltaic installations, whereas at least 75% of Whites, Asians, and Hispanics have existing rooftop photovoltaic installations (20). According to the U.S. Department of Energy, low-income households spend 13.9% of their annual income on energy expenses versus 3% for higher-income households (21). Internationally, energy injustice exists in the Nordic electric-mobility movement; electric vehicles are only accessible to the rich (22).

Energy equity and energy justice encompass energy production, consumption, distribution, and procedure (23). In the United States, the per capita emissions are highest in Caucasian neighborhoods, meaning they consume the most energy relative to other neighborhoods (24). According to the same study, African-American households tended to be less energy efficient than Caucasian households (24). An example of procedural justice is scheduling community meetings and comment periods multiple times to be accessible to everyone and ensuring that transportation infrastructure accommodates all who want to participate in the community energy planning process (25, 26). In Wayne County, Michigan, Reames et al. (2018) found significant disparities in the availability and cost of LED bulbs between high and low-poverty sectors in the county (27). An example of distributive justice would be equal access to LED bulbs in Wayne County, Michigan. Due to a difference in response times during Hurricane Irma in the Caribbean, power generating facilitation decreased by varying degrees (28). Although the hurricane was devastating for everyone involved, the amount of pain was distributed disproportionately as 19.7% of dwellings in Saint Martin were destroyed or damaged compared to the dwellings in Saint Barthelemy, in which only 2.5% of residents were destroyed or damaged (28). This resulted in an imbalance in energy usage following Hurricane Irma. An example of recognition-based justice refers to uplifting and supporting all stakeholders as legitimate to account for current and potential disparities. Through these local and national examples of energy injustice, scientists have justified the need for energy justice under a just transition.

The District of Columbia (hereafter D.C.) has served as a microcosm of the United States' race, class, and identity issues (29, 30, 31, 32, 33). As such, it can serve as a case study to understand how cities are planning for sustainability, including energy and environmental inequities, globally. Commonly known as the heart of the United States, D.C. is administratively broken up into eight wards, each with about 80,000 residents (34). Divided by race, the population is 45.5% white and 45.8% black, with American Indians, Asians, and Pacific Islanders making up the remaining 10% (35). Given the city's demographic makeup, the city of D.C. is particularly at risk of being severely impacted by climate change. More than half of the population identifies as non-white, and minorities are statistically more at risk of being affected by climate change due to disparities in income and access to resources (36). According to the NOAA Sea Level Rise and Coastal Flooding Impacts tool, coastal America should expect significant changes in geography and local demography (37). The consequences of intensified weather events and flooding will fall on the marginalized first and then quickly impact all residents living throughout DC. If the local government, businesses, and community organizations do not work together to address local disparities, we may see a continuation of the historical injustice (38). For example, in D.C., BIPOC communities experienced food insecurity at a higher rate than their white counterparts (39).

Our objective was to employ a text data mining method and compare the count of individual keywords that embody energy justice among sustainability planning categories present in both

SDC 1.0 and SDC 2.0 and between SDC 1.0 and SDC 2.0 themselves as a proxy for adaptive change through time. We hypothesized that energy justice keywords would be less frequent among economy and resource allocation categories and more frequent among environment and community categories. We also hypothesized that the abundance of energy justice keywords would increase from SDC 1.0 to SDC 2.0.

METHODS

The District of Columbia released plans in 2013 and 2019 to address the need for sustainable interventions throughout the district to achieve carbon net neutrality. We sourced two sustainability plans for the District of Columbia, USA, from the Sustainable DC website (40). Each plan is organized by priority challenges, including governance, jobs and the economy, health and wellness, equity and diversity, climate and the environment, and potential solutions, with themes including the built environment, energy, food, nature, transportation, waste, and water. In SDC 2.0, the authors include a subsection dedicated to equity. We condensed these priority challenges and potential solution themes into seven categories for analysis; these categories include: 1) governance; 2) community (i.e., equity, education, and health); 3) infrastructure (i.e., built environment and transportation); 4) environment (i.e., climate and nature); 5) economy; 6) resource allocation (i.e., energy and waste); and 7) food and water. Community refers to sustainability and environmental education at all levels, the continuous improvement of community-level health, and the ability to partake in a healthy lifestyle. Infrastructure refers to building communities that are resilient to climate change and population pressure. It also refers to the reduction of emissions from buildings and cars while subsidizing retrofits and encouraging the use of public transit. Environment refers to the long-term weather patterns and natural spaces that D.C. residents are exposed to, this category combines nature and climate. Resource allocation refers to processes relating to energy production, distribution, procedure, and correspondence. Food and water refer to food security and water security.

We generated PDFs of each section of SDC 1.0 and SDC 2.0 that corresponded with the categories and conducted a text data mining procedure (content analysis) with Voyant Tools (41). We selected a series of keywords representing energy justice based on current definitions by the U.S. EPA (42, 43) and foundational peer-reviewed literature (39, 44). These keywords included the following: 1) access, 2) disproportionate, 3) equity, 4) energy, 5) injustice, 6) impact, 7) justice, 8) opportunity, 9) power, 10) residents, 11) risk, and 12) sustainable. Within Voyant tools, if one searches for a word with an asterisk at the end, all of the word permutations will appear in the search. For example, Voyant searched for the prevalence of impact, impacts, impacted, and impactful for the energy justice keyword “impact”.

We developed Poisson generalized linear models (GLMs) to determine the effect of sustainability plans (i.e., SDC 1.0 and SDC 2.0) and sustainability planning categories on the count of energy justice keywords. We used the count of each energy justice keyword as the dependent variable and sustainability plan and category as independent variables. For all models, we assumed overdispersion when the residual deviance divided by the residual degrees of freedom was >1.0. We ran quasi-poisson GLMs when we detected overdispersion. We performed likelihood-ratio tests on all GLMs to identify significant effects of sustainability plan and sustainability planning categories. For each categorical treatment (i.e., sustainability plan, sustainability planning category) in all models, we performed post hoc Tukey's pairwise comparisons of means using general linear hypothesis testing with a Holm adjustment (glht function; single-step method) in the R package "multcomp" (45). We set α =0.05. We conducted all analyses in R version 4.2.1 (46, 47).

RESULTS

We detected disparities in the abundance of individual energy justice keywords (Fig. 1, Fig. 2, SI Table 1). We documented the keywords "justice" and "injustice" once each in SDC 1.0 and did not record either of these keywords in SDC 2.0; the keyword "disproportionate" appeared once in SDC 1.0 and was not included in SDC 2.0 (Fig 1, Fig. 2). In contrast, we recorded the keywords "energy", "residents", "sustainable", "access", and "opportunity" 418, 332, 243, 177, and 123 times, respectively, across both sustainability plans (Fig 1, Fig. 2).

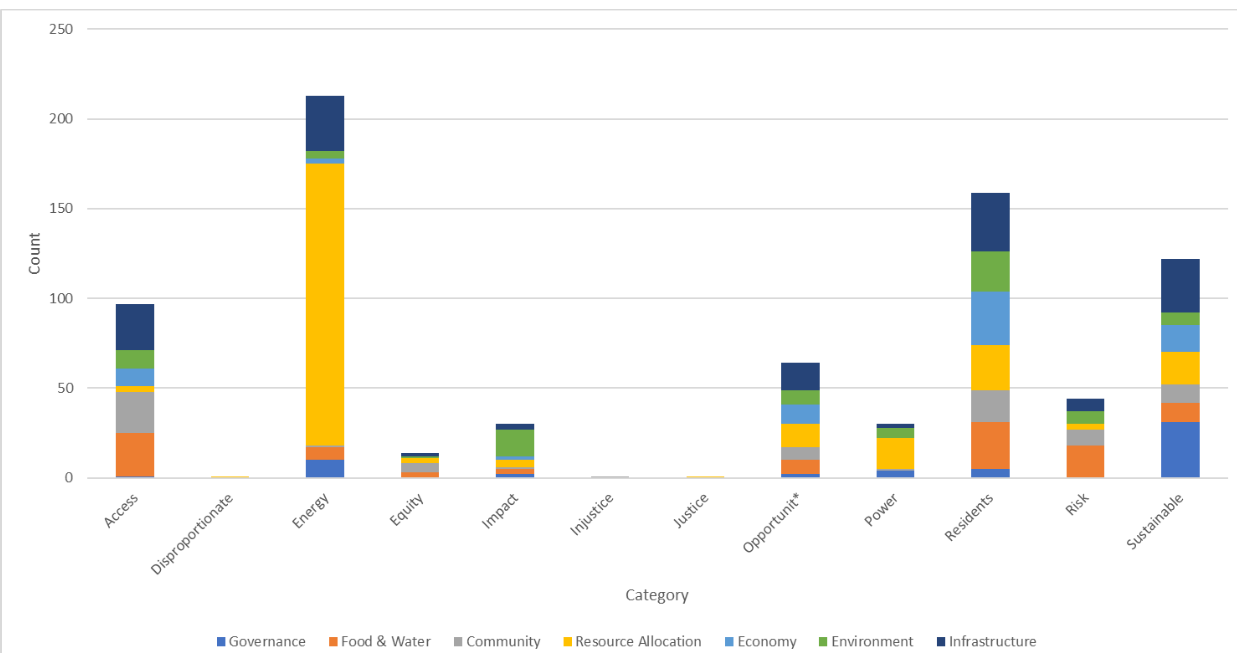


Figure 1: Count of energy justice keywords in Sustainable D.C 1.0. Colors indicate a proportional representation of keywords per category.

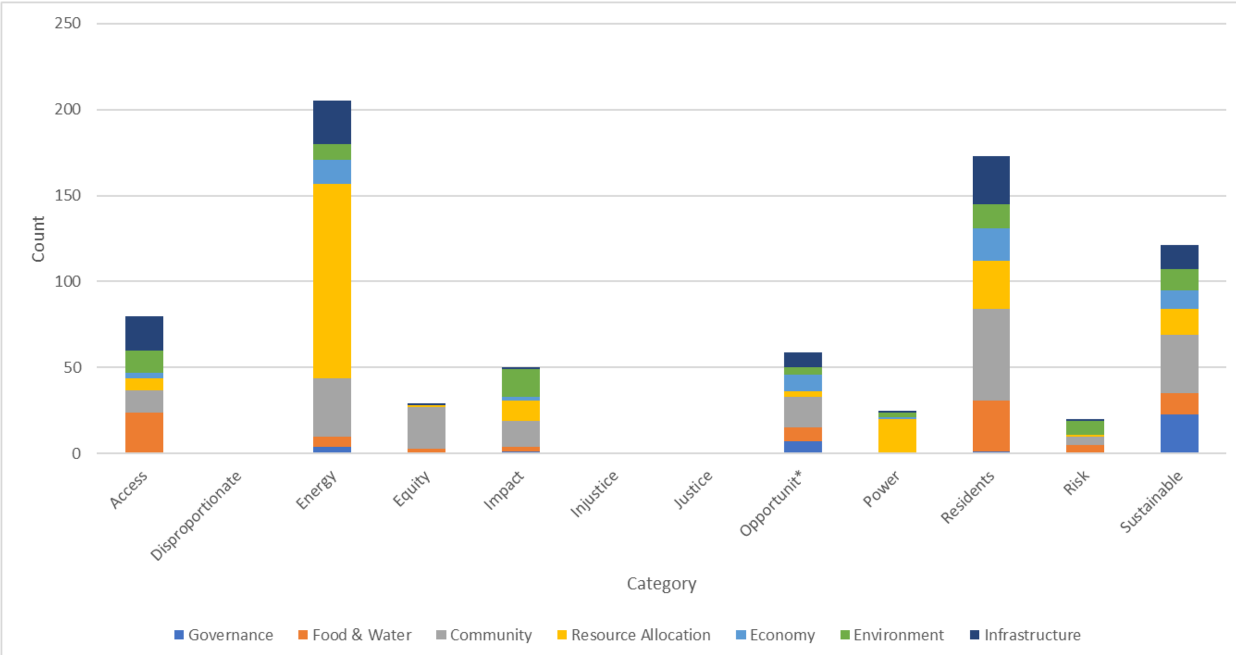


Figure 2: Count of energy justice keywords in Sustainable D.C 2.0. Colors indicate a proportional representation of keywords per category.

We determined that only the keywords "risk" differed between SDC 1.0 and SDC 2.0 (Table 1). The keyword "risk" was more abundant in SDC 1.0 than in SDC 2.0. We detected significant effects of sustainability planning category on the keywords "access," "power,", "imapct", "residents" "energy", and "risk" (Table 1, Fig. 3). We documented greater counts of the keyword "access" in the community, environment, food and water, and infrastructure categories than the governance category (Fig. 3). We documented greater counts of the keyword "energy" in the resource allocation category relative to the other categories (Fig.3). We documented greater counts of the keyword "power" in the resource allocation category relative to the other categories (Fig. 3). We documented greater counts of the keyword "impact" in the environment category relative to the other categories (Fig. 3). We documented greater counts of the keyword "residents" in all categories in relation to governance. Pairwise comparisons of categories later revealed no significant differences among categories.

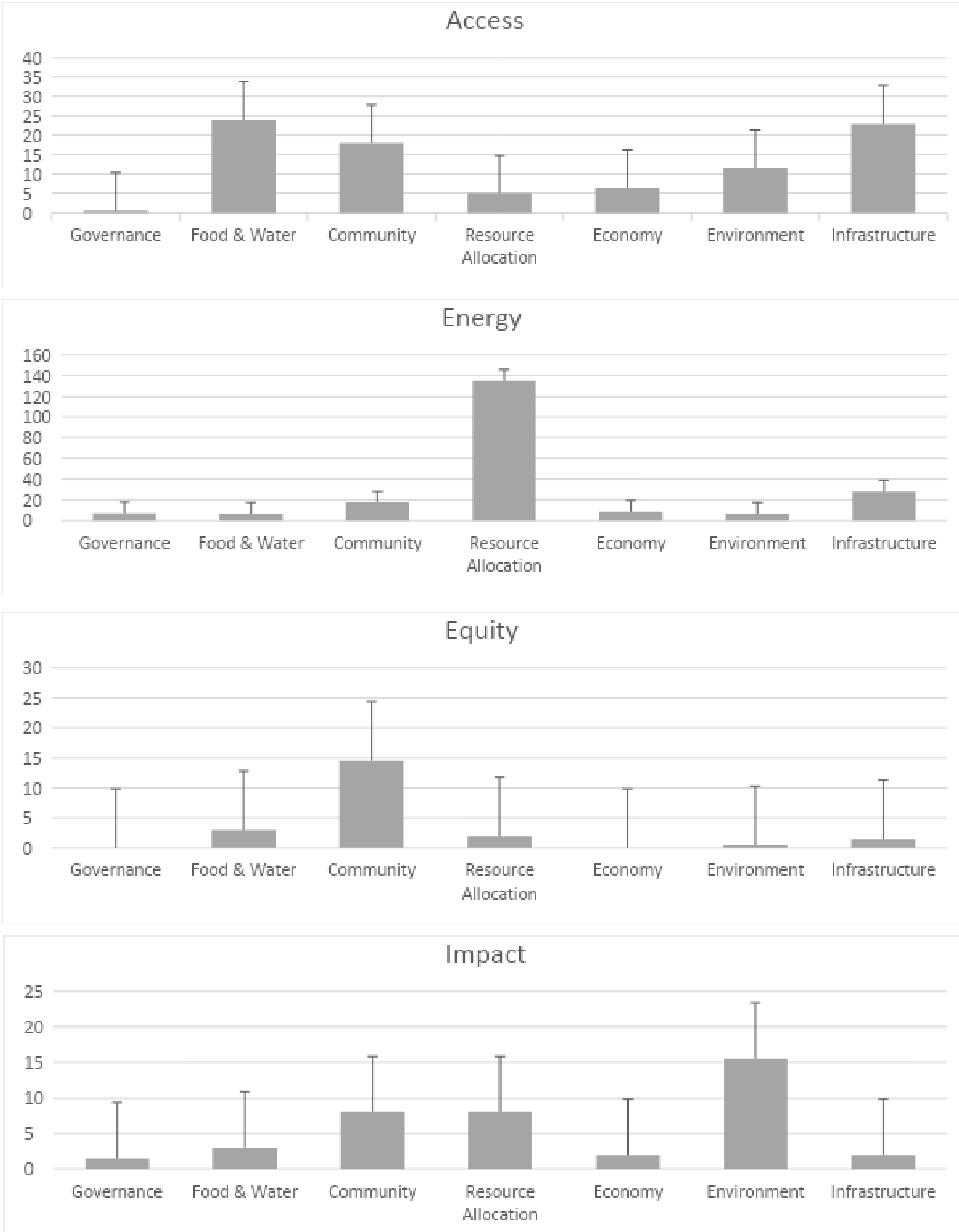
We documented significant differences among categories for access, power, risk, and energy. Category effects on "access" significantly differed for the following pairings: food & water - governance, infrastructure - governance, economy - food & water, infrastructure - economy for $p<0.01$ and community - governance, economy - community for $p<0.05$ (Fig. 3, SI Table 1). "Access" was highly prevalent in food & water, community, and infrastructure and rarely found in governance. Resource allocation, economy, and environment contained a moderate number of mentions of "access."

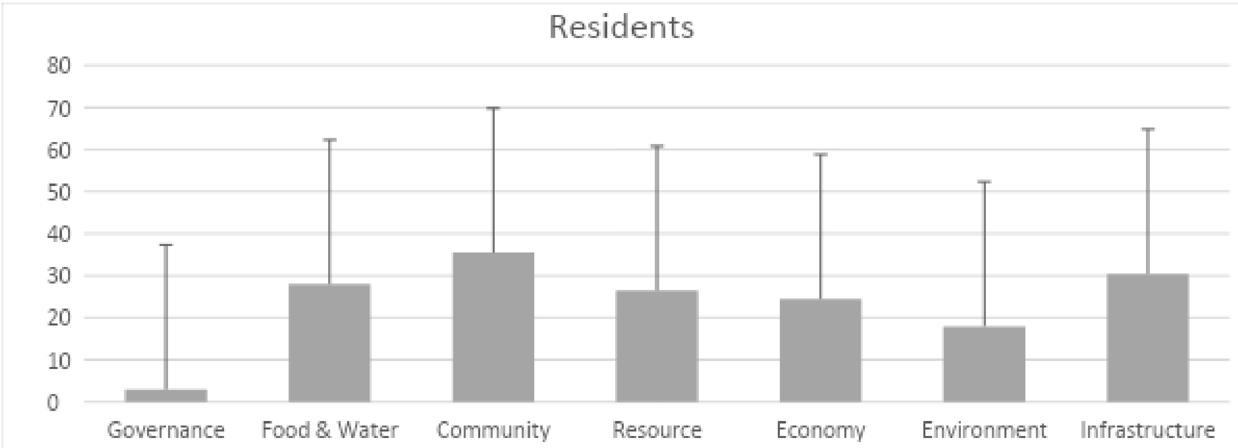
Table 1: Effects of sustainability plan and category on the count of energy justice keywords.

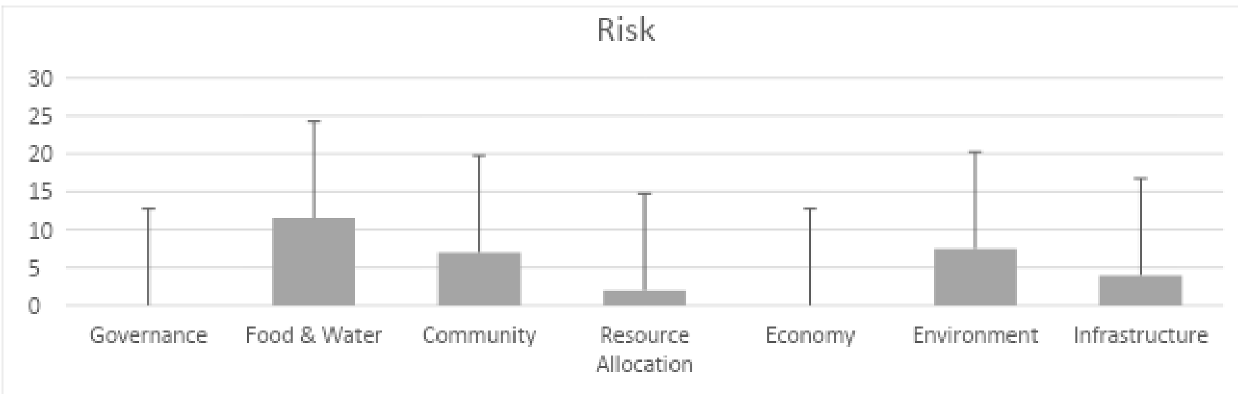
	Plan		Category	
	Scaled dev.	p-value	Scaled dev.	p-value
Access	1.12	0.29	65.24	<0.01
Energy	0.02	0.89	72.21	<0.01
Equity	2.95	0.09	43.25	<0.01
Impact	2.25	0.13	22.67	<0.01
Opportunity	0.07	0.79	4.67	0.59
Residents	0.15	0.70	18.84	<0.05
Risk	9.22	<0.05	60.47	<0.01
Power	0.46	0.50	97.68	<0.01
Sustainable	0.00	0.97	7.85	0.25

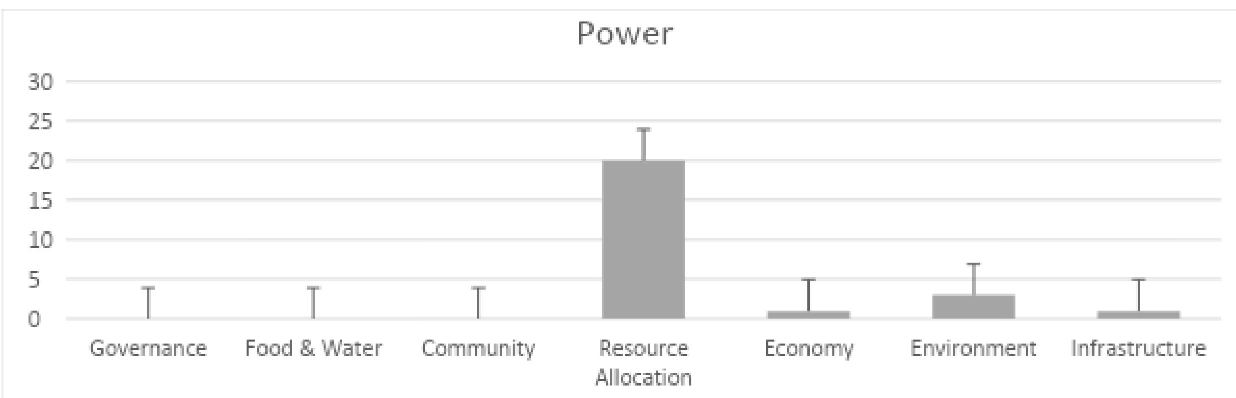
"Power" was significant for the following treatment pairings: resource allocation, infrastructure - Resource allocation for $p<0.01$ and resource allocation - community, economy - Resource allocation, environment - resource allocation for $p<0.05$ (Fig. 3, SI Table 8). "Power" was prevalent mainly in the resource allocation treatment with little dispersion."Risk" was significant for the following treatment pairings: resource allocation - food & water for $p<0.05$ (Fig. 3, SI Table 7). "Risk" was more common in food & water when analyzed against resource allocation. "Energy" was significant for the following treatment pairings: resource allocation - governance, resource allocation - food_water, resource_allocation - community, economy - resource allocation, environment - resource allocation, infrastructure - resource allocation for $p<0.05$ (Fig. 3, SI Table 2). Overall, the resource allocation treatment had the largest count relative to all the other categories by a significant margin. We did not detect differences among categories for equity (SI Table 3), impact (SI Table 4), opportunity (SI Table 5), residents (SI Table 6), and sustainable (SI Table 9).

Figure 3. Mean and upper 95% CI count of energy justice keywords per category pooled among Sustainable DC 1.0 and Sustainable DC 2.0.




Residents
80
70
60
50
40
30
20
10
0
Governance
Food & Water
Community
Resource
Economy
Environment
Infrastructure


Risk
30
25
20
15
10
5
0
Governance
Food & Water
Community
Resource Allocation
Economy
Environment
Infrastructure


Power
30
25
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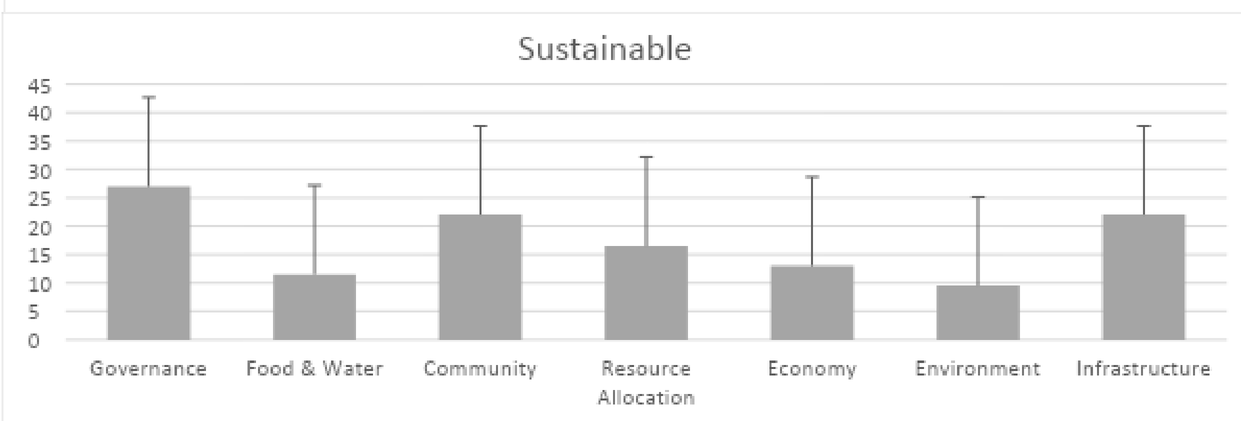
0
Governance
Food & Water
Community
Resource Allocation
Economy
Environment
Infrastructure


Sustainable
45
40
35
30
25
20
15
10
5
0
Governance
Food & Water
Community
Resource Allocation
Economy
Environment
Infrastructure

DISCUSSION

Differences among sustainability planning categories energy justice keywords, including “access,” “power,” and “energy”, indicated a lack of focus on energy justice in favor of economics and energy. For “access,” although it was highly prevalent in other treatments per our hypotheses, such as Food & Water, Community, and Infrastructure, it only appears once between the two planning documents. Personal access to one’s government institutions is necessary for a just transition that adequately includes all stakeholders (26, 36, 44). Within these planning documents, access to governing bodies is not discussed and is barely accounted for. For “power,” its lack of inclusion in categorical treatments implies that plans on power disparities relating to food, water, infrastructure, and governance were not considered relative to energy, waste, and environment. Within these planning documents, power is largely discussed regarding resource allocation, which indicates that the plans neglect to discuss power dispartites beyond “concrete” applications to energy generation and production. For “energy,” the resource allocation treatment saw the highest prevalence. This makes sense but fails to account for the intersectionality of energy justice. Suppose residents lack energy; this impacts food and water access and transportation. These planning documents silo energy away from important aspects of energy justice that are vital for a just transition. For “risk,” food and water were the most prevalent concern according to the plan. While this is good for the community's longevity, what about the risks associated with other parts of city life like economic risk and energy generation and distribution risks? These considerations remain unaccounted for in the sustainability plans for DC.

Despite the six-year difference between SDC 1.0 and SDC 2.0, our results indicate that energy justice largely remains underrepresented in sustainability planning for DC. Throughout the development of Sustainable D.C. 1.0 and 2.0, planners spoke with community members in all wards to aid in plan development (48). Unfortunately, neither maintained a community action committee to guide the implementation process (48). For the District of Columbia, our results tell a somewhat green-washed story, with many areas for improvement. Although planners take the time to mention residents and their role in creating a strong community, there is little mention of resolving past problems and achieving justice (Figure 1, Figure 2, Table 1). According to the 2022 SDC 2.0 Update, 96% of plans are in progress (40). Unfortunately, within the energy sections, goals like modernizing energy infrastructure and increasing renewable energy are stuck in the first stage of development (40). The waste section also lags behind, with 8/15 of the interventions stuck in the first stage of implementation (40). DC sustainability plans generally fall in line with the sustainability goals of cities around the world (49). Although statistics on walkability and commute times show improvement between SDC 1.0 and SDC 2.0, we lack comprehensive measures that capture the nuances of sustainability and energy justice.

According to Angelo & Wachsmuth 2014, “methodological cityism” has hampered research into urbanization processes by relying overwhelmingly on analytical and empirical methods (50). We believe SDC 1.0 and 2.0 suffer from this form of “cityism” as progress is shown only through empirical numbers. If planning documentation reflects a culture of empirical superiority at all levels, including governance, how can policymakers expect to implement culturally-nuanced just interventions? One of the stipulations of energy justice is ensuring that energy infrastructure is unbiased against race, gender, place, and ability. According to our word analysis, these documents do not adequately acknowledge energy justice and its implications as plans for a just transition. Residents of the District of Columbia may benefit from messaging that clearly communicates how their government is fighting to comprehensively incorporate energy justice, as the planning documents fail to mention it. As a leader in the Just Sustainability movement, the District of Columbia must do more to set an example of how aggressively cities should undergo a just transition.

A comprehensive analysis of local climate and sustainability plans in U.S. cities found that “relatively few U.S. cities were making social equity goals an important component of their climate and sustainability plans” (49). While numbers have a place in any planning literature, empirical data should not be the only means for tracking change. Brody and Highfield (YEAR) assessed local environmental planning in Florida and found that monitoring a plan catches systematic occurrences of nonconformity and implementation failures early before they become too expensive to deal with (40). Therefore, instead of relying exclusively on numbers, policymakers should rely on multiple forms of energy justice. An example of recognition-based justice in effect is Portland's Climate Action Plan, which faced in-person, and web-based scrutiny since 2009, leading to equity-focused plans (49). As another example, Philadelphia’s Greenworks program has had uneven success regarding its sustainability goals. According to the most recent plan progress update, food access and urban agriculture have shown the most progress, while initiatives concerning stormwater or green energy infrastructure have the slowest implementation while remaining the biggest areas for improvement (49, 51, 52). The conversation surrounding the energy transition has also become incredibly politicized, leading to massive bureaucratic gridlock in the United States and other developed nations (51, 52).

The public can help with this gridlock by actively participating in the planning and intervention processes. Participation can be facilitated by forming a citizen advisory committee (CAC) (53). CACs have a proven history of achieving community engagement. For example, the Boston Climate Action Plan created and proactively facilitated its CAC to maximize its influence as stakeholders (49, 53,54). In the Great Lakes, their Remedial Action Plan process supports stakeholder engagement by making decisions that incorporate public values and knowledge, improving relationships between stakeholders, and building capacity amongst stakeholders to influence local change (55).

A just transition will also require government and NGO support for workforce and economic diversification programs like the US-funded Partnerships for Opportunity and Workforce and Economic Revitalization (POWER) Initiative, which provides support and education for communities that historically relied on fossil fuels for economic development (17). Lack of funding is a major reason why communities have not transitioned to greener technologies and practices; therefore, governments should facilitate career opportunities for retraining and re-education, in addition to retrofits (56). Instead of economically harming fossil fuel-based communities as we transition towards renewable energy sources, a just transition would offer opportunities for retraining and energy career pivots. By weaving justice into sustainability, we can ensure that our plans and interventions do not amplify existing economic, environmental, and social disparities (57, 58).

We attempted to track popular word groupings along with keywords to gain a deeper understanding of how the keyword was being used. Unfortunately, due to the sample size of the planning documents, we could not thoroughly analyze word groupings. Future research could include investigations into specific project times lines within SDC 2.0 and GIS analysis of retrofits within the District of Columbia and in cities worldwide. Understanding today's spatial, social, and financial disparities will help combat future manifestations of disparity as we undergo a just transition.

CONCLUSION

Looking forward, we must move past planning documents and pursue interventions aggressively. Although D.C. has made some strides toward a just transition, such as its status as the first LEED platinum-certified city (40) and improvements in statistics like walkability and tree cover, it fails to make significant strides in economic and infrastructure progress for the communities that desperately need it. More broadly, comprehensive interventions to mitigate climate are discussed but are not currently implemented to the degree required to make an impact in the long term. Before any planning or intervention, local government should establish, empower, and continuously support community action committees representing the entire community.

To address disparities, we must build programs and institutions that acknowledge yesterday's inequalities while preparing for an uncertain future (59, 60). Using interventions that enact distributive justice, procedural justice, and recognition-based justice, we can continue and expedite the work required for a better future. Since we are long past completely stopping climate change, we must refocus our initiatives toward mitigation, long-term consumption reduction, and regenerating nature (61, 62). In our efforts to build a better tomorrow, energy justice is required for success.

Although the upfront cost might not be more expensive than we'd like it to be, we are paying for the lives of billions of future humans that will hopefully inherit a livable, somewhat stable home. At their cores, environmental justice and energy justice are movements in which everyone should be emotionally and financially invested as this isn't just a fight for BIPOC communities, it's a fight for single mothers, it's a fight for rural white communities, it's a fight for the unborn, this is a fight for all of humanity. Therefore, policymakers and local planners must redistribute and reallocate resources immediately to enable a just transition and address disparities. If a transition to sustainability occurs in a vacuum, we will only continue the historical discrimination that has plagued American society since its inception.

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SUPPORTING INFORMATION

1. Category Justifications

Governance

Broadly, governance can be defined as the coalescence between government, corporate, and community institutions and systems meant to coordinate life. Defining governance is somewhat elusive, but for this study, governance refers to local governments' ability to interact with businesses and community organizations and the resulting impacts (3). This definition follows Kjær's conceptualization of governance that sees "a move of power away from the central state upwards, towards supra-national units, and downwards towards decentralized units of governance" (3). For the purposes of this study, governance in public administration and public policy will be the focus of this analysis. According to Rhodes, governance follows four general principles. The first is interdependence between organizations, the second is continuous interaction between network members for resource exchange, the third is game-like interactions that are rooted in trust, and the fourth principle is "a significant degree of autonomy from the state. Networks are not accountable to the state; they are self-organizing"(18). Within Sustainable D.C.1.0 and 2.0, this category specifically refers to the progress of individual interventions and overall plan implementation.

Food & Water

This category combines the food and water sections of Sustainable D.C. 2.0. According to the USDA, food insecurity generally deals with reduced quality, variety, or desirability of diet (19). Water insecurity, on the other hand, generally deals with access to safe and reliable water. According to the United Nations, water security requires the "capacity of a population to safeguard sustainable access to adequate quantities of and acceptable quality water" (20). Nationally, members of the BIPOC community are the most at risk of dealing with food and water insecurity. According to historical National Health Interview Survey data, "food insecurity was most prevalent among blacks and Hispanics, regardless of gender" (5). Historically, access to these resources favored those with the economic privilege to do so (13). Within DC, the COVID-19 pandemic intensified existing disparities in food and water (13). Within Sustainable D.C. 1.0 and 2.0, these categories involve issues dealing with food security, water security, and management. Through this grouping, we hoped to understand the importance of long-term residential health throughout both plans.

Community

This category combines the equity, education, and health sections of Sustainable D.C. 2.0. BIPOC and low-income communities are often barred from participating in community efforts due to a lack of time to attend meetings or resources to contribute to new initiatives (4). These households were suffering before the pandemic, and the children of these households experienced greater hardship, including higher chances for depression or anxiety, lower cognitive performance and academic success, and higher odds of suicidal ideation (7, 10,11).

Resource allocation

This category combines the energy and waste section of Sustainable D.C. 2.0. According to Ostrom, effective local governance is possible if the following conditions are met: commons have clearly defined boundaries, rules fit local circumstances, participatory decision-making is vibrant, the commons are monitored, sanctions for those who abuse the commons are graduated, conflict resolution is easily accessible, the commons has a right to organize, and nestedness (14). Through our analysis and discussion, we will understand the prevalence of these principles concerning resource allocation. Energy equity must be at the forefront of all plans for the future as we're not all starting from the same place. Some individuals are well equipped to deal with the consequences of climate change, while others are ill-equipped to deal with everyday challenges, let alone intensifying weather systems.

Economy

Economy refers to the delicate balance between the needs and desires of business owners and the needs of their employees and the surrounding environment. D.C. is economically stratified by ward (6). The median income of households in wards two and three is more than double that of households in wards seven and eight (6). At the end of 2021, the D.C. council approved redistricting plans to make wards seven and eight more economically viable (17). Unfortunately, local communities will not feel these changes until many years down the line or not at all, as money is funneled out of these developments in protest of the new map lines. Under our current system of capitalism which puts profits above the needs of the people, how can we cultivate a sustainable market that benefits everyone? The economy sections of SDC 1.0 and 2.0 attempt to maintain a status quo of growth while enabling the development of underdeveloped and overlooked areas of the district. Without a dramatic relocation of wealth and funding the district of Columbia will follow historical trends of inequitable growth. We were interested in understanding how the texts directly related money to businesses and residents. As one of the primary pillars of Sustainability, the economy is a motivating force for businesses and individuals not already feeling the negative impacts of climate change (15).

Environment

We grouped these two sections together in an effort to get a snapshot of the documents' views on the environmental side of the climate crisis. According to several studies, nationally, BIPOC communities have longer commute times, breath dirtier air, and have less access to green space when compared to white residents (8, 9, 16).

Infrastructure

This category combines the built environment and transportation categories from Sustainable DC 2.0. Infrastructure refers to building communities that are resilient to climate change and population pressure. It also refers to the reduction of emissions from buildings and cars while subsidizing retrofits and encouraging the use of public transit. Historically, there have been social barriers preventing households from participating in the clean energy transition (2, 1). As prices continue to increase, access to electricity will continue to be stratified by class (12). Energy poverty is only positioned to increase under our current system, so local governments need to act now to ensure that we implement energy-efficient technology and make it accessible to those who can't afford it. At the same time, we acknowledge that residents in developed countries consume too much energy, and it would surely be unsustainable if everyone lived that way in the future.

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2. Category pairwise comparisons for each energy justice keywords

SI Table 1: Tukey's pairwise comparisons of category treatment means for the energy justice keyword "access."

Category comparison	Estimate	Std. Error	z-value	p-value
Food and Water - Governance	3.87	1.22	3.17	0.02
Community - Governance == 0	3.58	1.23	2.92	0.04
Resource_Allocation - Governance == 0	2.30	1.27	1.82	0.50
Economy - Governance == 0	2.57	1.26	2.04	0.35
Environment - Governance == 0	3.14	1.24	2.54	0.12
Infrastructure - Governance == 0	3.83	1.22	3.13	0.02
Community - Food_Water == 0	-0.29	0.27	-1.08	0.92
Resource_Allocation - Food_Water == 0	-1.57	0.42	-3.73	<0.01 **
Economy - Food_Water == 0	-1.31	0.38	-3.46	<0.01 **
Environment - Food_Water == 0	-0.74	0.31	-2.40	0.17
Infrastructure - Food_Water == 0	-0.04	0.25	-0.17	1.00
Resource_Allocation - Community == 0	-1.28	0.43	-2.96	0.04
Economy - Community == 0	-1.02	0.39	-2.60	0.11
Environment - Community == 0	-0.45	0.32	-1.39	0.78
Infrastructure - Community == 0	0.25	0.27	0.91	0.97

Category comparison	Estimate	Std. Error	z-value	p-value
Economy - Resource_Allocation == 0	0.26	0.51	0.52	1.00
Environment - Resource_Allocation == 0	0.83	0.46	1.82	0.50
Infrastructure - Resource_Allocation == 0	1.53	0.42	3.62	<0.01 **
Environment - Economy == 0	0.57	0.42	1.36	0.80
Infrastructure - Economy == 0	1.26	0.38	3.33	0.01
Infrastructure - Environment == 0	0.69	0.31	2.25	0.24

Table SI2: Tukey's pairwise comparisons of category treatment means for the energy justice keyword "energy"

Category comparison	Estimate	Std. Error	z-value	p-value
Food_Water - Governance == 0	-0.07	1.11	-0.07	1.00
Community - Governance == 0	0.92	0.92	1.00	0.95
Resource_Allocation - Governance == 0	2.96	0.80	3.72	<0.01 **
Economy - Governance == 0	0.19	1.05	0.19	1.00
Environment - Governance == 0	-0.07	1.12	-0.07	1.00
Infrastructure - Governance == 0	1.39	0.87	1.60	0.65
Community - Food_Water == 0	0.99	0.94	1.05	0.93
Resource_Allocation - Food_Water == 0	3.03	0.82	3.68	<0.01 **
Economy - Food_Water == 0	0.27	1.07	0.25	1.00
Environment - Food_Water == 0	<0.01	1.14	0.00	1.00
Infrastructure - Food_Water == 0	1.46	8.93	1.64	0.63
Resource_Allocation - Community == 0	2.04	0.52	3.92	<0.01 **
Economy - Community == 0	-0.72	0.86	-0.84	0.98
Environment - Community == 0	-0.99	0.94	-1.05	0.9
Infrastructure - Community == 0	0.47	0.63	0.75	0.99

Category comparison	Estimate	Std. Error	z-value	p-value
Economy - Resource_Allocation == 0	-2.77	0.73	-3.81	<0.01 **
Environment - Resource_Allocation == 0	-3.03	0.82	-3.68	<0.01 **
Infrastructure - Resource_Allocation == 0	-1.57	0.43	-3.69	<0.05 *
Environment - Economy == 0	-0.27	1.07	-0.25	1.00
Infrastructure - Economy == 0	1.19	0.80	1.48	0.73
Infrastructure - Environment == 0	1.46	0.89	1.64	0.63

Table SI3: Tukey's pairwise comparisons of category treatment means for the energy justice keyword "equity"

Category comparison	Estimate	Std. Error	z-value	p-value
Food_Water - Governance == 0	20.35	8737.00	<0.01 **	1.00
Community - Governance == 0	21.92	8737.00	<0.01 **	1.00
Resource_Allocation - Governance == 0	19.94	8737.00	<0.01 **	1.00
Economy - Governance == 0	<0.01 **	12360.00	0.00	1.00
Environment - Governance == 0	18.56	8737.00	<0.01 **	1.00
Infrastructure - Governance == 0	19.65	8737.00	<0.01 **	1.00
Community - Food_Water == 0	1.58	0.60	2.61	0.08 .
Resource_Allocation - Food_Water == 0	-0.41	0.87	-0.48	1.00
Economy - Food_Water == 0	-20.35	8737.00	<0.01 **	1.00
Environment - Food_Water == 0	-1.79	1.45	-1.23	0.83
Infrastructure - Food_Water == 0	-0.69	0.95	-0.73	0.99
Resource_Allocation - Community == 0	-1.98	0.72	-2.76	0.06.
Economy - Community == 0	-21.92	8737.00	<0.01 **	1.00
Environment - Community == 0	-3.38	1.37	-2.46	0.12

Category comparison	Estimate	Std. Error	z-value	p-value
Infrastructure - Community == 0	-2.27	0.82	-2.78	0.05 .
Economy - Resource_Allocation == 0	-19.94	8737.00	<0.01 **	1.00
Environment - Resource_Allocation == 0	-1.39	1.51	-0.92	0.95
Infrastructure - Resource_Allocation == 0	-0.29	1.03	-0.28	1.00
Environment - Economy == 0	18.56	8737.00	<0.01 **	1.00
Infrastructure - Economy == 0	19.65	8737.00	<0.01 **	1.00
Infrastructure - Environment == 0	1.10	1.55	0.71	0.99

Table SI4: Tukey's pairwise comparisons of category treatment means for the energy justice keyword "impact"

Category comparison	Estimate	Std. Error	z-value	p-value
Food_Water - Governance == 0	0.69	1.06	0.66	0.99
Community - Governance == 0	1.67	0.94	1.78	0.54
Resource_Allocation - Governance == 0	1.67	0.94	1.78	0.54
Economy - Governance == 0	0.29	1.14	0.25	1.00
Environment - Governance == 0	2.34	0.91	2.58	0.12
Infrastructure - Governance == 0	0.29	1.14	0.25	1.00
Community - Food_Water == 0	0.99	0.72	1.37	0.80
Resource_Allocation - Food_Water == 0	0.98	0.72	1.37	0.80
Economy - Food_Water == 0	0.41	0.97	-0.42	1.00
Environment - Food_Water == 0	1.64	0.67	2.46	0.16
Infrastructure - Food_Water == 0	-0.41	0.97	-0.42	1.00
Resource_Allocation - Community == 0	<0.01 **	0.53	0.00	1.00
Economy - Community == 0	-1.39	0.84	-1.66	0.62
Environment - Community == 0	0.66	0.46	1.44	0.76
Infrastructure - Community == 0	-1.39	0.84	-1.66	0.62
Economy - Resource_Allocation == 0	-1.39	0.84	-1.66	0.62

Category comparison	Estimate	Std. Error	z-value	p-value
Environment - Resource_Allocation == 0	0.66	0.46	1.44	0.76
Infrastructure - Resource_Allocation == 0	-1.39	0.84	-1.66	0.62
Environment - Economy == 0	2.05	0.80	2.57	0.12
Infrastructure - Economy == 0	<0.01 **	1.06	0.00	1.00
Infrastructure - Environment == 0	-2.05	0.80	-2.57	0.12

Table SI5: Tukey's pairwise comparisons of category treatment means for the energy justice keyword "opportunity"

Category comparison	Estimate	Std. Error	z-value	p-value
Food_Water - Governance == 0	0.58	0.69	0.83	0.98
Community - Governance == 0	1.02	0.65	1.58	0.69
Resource_Allocation - Governance == 0	0.58	0.69	0.83	0.98
Economy - Governance == 0	0.85	0.66	1.28	0.86
Environment - Governance == 0	0.29	0.73	0.39	1.00
Infrastructure - Governance == 0	0.99	0.65	1.51	0.73
Community - Food_Water == 0	0.45	0.53	0.84	0.98
Resource_Allocation - Food_Water == 0	0.00	0.59	0.00	1.00
Economy - Food_Water == 0	0.27	0.55	0.49	1.00
Environment - Food_Water == 0	-0.29	0.63	-0.45	1.00
Infrastructure - Food_Water == 0	0.41	0.54	0.76	0.99
Resource_Allocation - Community == 0	-0.45	0.53	-0.84	0.98
Economy - Community == 0	-0.17	0.49	-0.35	1.00
Environment - Community == 0	-0.73	0.58	-1.26	0.87
Infrastructure - Community == 0	-0.04	0.48	-0.09	1.00
Economy - Resource_Allocation == 0	0.27	0.55	0.49	1.00

Category comparison	Estimate	Std. Error	z-value	p-value
Environment - Resource_Allocation == 0	-0.29	0.63	-0.45	1.00
Infrastructure - Resource_Allocation == 0	0.41	0.54	0.76	0.99
Environment - Economy == 0	-0.56	0.60	-0.93	0.97
Infrastructure - Economy == 0	0.13	0.50	0.27	1.00
Infrastructure - Environment == 0	0.69	0.59	1.18	0.90

Table SI6: Tukey’s pairwise comparisons of category treatment means for the energy justice keyword “residents”

Category comparison	Estimate	Std. Error	z-value	p-value
Food_Water - Governance == 0	2.23	0.87	2.57	0.12
Community - Governance == 0	2.47	0.86	2.88	0.06 .
Resource_Allocation - Governance == 0	2.18	0.87	2.50	0.15
Economy - Governance == 0	2.10	0.87	2.40	0.18
Environment - Governance == 0	1.80	0.89	2.01	0.39
Infrastructure - Governance == 0	2.32	0.86	2.68	0.09
Community - Food_Water == 0	0.24	0.36	0.66	0.99
Resource_Allocation - Food_Water == 0	-0.05	0.39	-0.14	1.00
Economy - Food_Water == 0	-0.13	0.40	-0.34	1.00
Environment - Food_Water == 0	-0.44	0.43	-1.02	0.94
Infrastructure - Food_Water == 0	0.09	0.37	0.23	1.00
Resource_Allocation - Community == 0	-0.29	0.37	-0.80	0.99
Economy - Community == 0	-0.37	0.38	-0.99	0.95
Environment - Community == 0	-0.68	0.41	-1.6	0.64
Infrastructure - Community == 0	-0.15	0.35	-0.43	1.00
Economy - Resource_Allocation == 0	-0.08	0.40	-0.20	1.00

Category comparison	Estimate	Std. Error	z-value	p-value
Environment - Resource_Allocation == 0	-0.39	0.44	-0.89	0.97
Infrastructure - Resource_Allocation == 0	0.14	0.38	0.37	1.00
Environment - Economy == 0	-0.31	0.44	-0.70	0.99
Infrastructure - Economy == 0	0.22	0.39	0.57	1.00
Infrastructure - Environment == 0	0.53	0.43	1.24	0.87

Table SI7: Tukey’s pairwise comparisons of category treatment means for the energy justice keyword “risk”

Category comparison	Estimate	Std. Error	z-value	p-value
Food_Water - Governance == 0	22.68	10650.00	<0.01 **	1.00
Community - Governance == 0	22.19	10650.00	<0.01 **	1.00
Resource_Allocation - Governance == 0	20.93	10650.00	<0.01 **	1.00
Economy - Governance == 0	<0.01 **	10650.00	<0.01 **	1.00
Environment - Governance == 0	22.25	10650.00	<0.01 **	1.00
Infrastructure - Governance == 0	21.63	10650.00	<0.01 **	1.00
Community - Food_Water == 0	-0.50	0.34	-1.47	0.70
Resource_Allocation - Food_Water == 0	-1.75	0.54	-3.23	0.01 *
Economy - Food_Water == 0	-22.68	10650.00	<0.01 **	1.00
Environment - Food_Water == 0	-0.43	0.33	-1.29	0.81
Infrastructure - Food_Water == 0	-1.06	0.41	-2.57	0.09
Resource_Allocation - Community == 0	-1.25	0.57	-2.21	0.22
Economy - Community == 0	-22.19	10650.00	<0.01 **	1.00
Environment - Community == 0	0.07	0.37	0.19	1.00
Infrastructure - Community == 0	-0.56	0.44	-1.26	0.82
Economy - Resource_Allocation == 0	-20.93	10650.00	<0.01 **	1.00

Category comparison	Estimate	Std. Error	z-value	p-value
Environment - Resource_Allocation == 0	1.32	0.56	2.35	0.16
Infrastructure - Resource_Allocation == 0	0.69	0.61	1.13	0.90
Environment - Economy == 0	22.25	10650.00	<0.01 **	1.00
Infrastructure - Economy == 0	21.63	10650.00	<0.01 **	1.00
Infrastructure - Environment == 0	-0.63	0.44	-1.4	0.72

Table SI8: Tukey's pairwise comparisons of category treatment means for the energy justice keyword "power"

Category comparison	Estimate	Std. Error	z-value	p-value
Food_Water - Governance == 0	-18.99	4039.00	<0.01 **	1.00
Community - Governance == 0	-1.39	1.12	-1.24	0.84
Resource_Allocation - Governance == 0	2.23	0.53	4.23	< 0.001 ***
Economy - Governance == 0	-1.39	1.12	-1.24	0.84
Environment - Governance == 0	0.811	0.60	1.35	0.77
Infrastructure - Governance == 0	-0.29	0.76	-0.38	1.00
Community - Food_Water == 0	17.61	4039.00	<0.01 **	1.00
Resource_Allocation - Food_Water == 0	21.22	4039.00	<0.01 **	1.00
Economy - Food_Water == 0	17.61	4039.00	<0.01 **	1.00
Environment - Food_Water == 0	19.80	4039.00	<0.01 **	1.00
Infrastructure - Food_Water == 0	18.71	4039.00	<0.01 **	1.00
Resource_Allocation - Community == 0	3.61	1.01	3.56	<0.01 **
Economy - Community == 0	<0.01 **	1.41	0.00	1.00
Environment - Community == 0	2.20	1.05	2.08	0.29
Infrastructure - Community == 0	1.10	1.16	0.95	0.95

Category comparison	Estimate	Std. Error	z-value	p-value
Economy - Resource_Allocation == 0	-3.61	1.01	-3.56	<0.01 **
Environment - Resource_Allocation == 0	-1.41	0.37	-3.80	<0.01 **
Infrastructure - Resource_Allocation == 0	-2.51	0.60	-4.19	< 0.001 ***
Environment - Economy == 0	2.20	1.05	2.08	0.29
Infrastructure - Economy == 0	1.10	1.16	0.95	0.95
Infrastructure - Environment == 0	-1.10	0.67	-1.65	0.57

Table SI9: Tukey's pairwise comparisons of category treatment means for the energy justice keyword "sustainable"

Category comparison	Estimate	Std. Error	z-value	p-value
Food_Water - Governance == 0	-0.85	0.48	-1.78	0..56
Community - Governance == 0	-0.21	0.40	-0.52	1.00
Resource_Allocation - Governance == 0	-0.50	0.43	-1.16	0.91
Economy - Governance == 0	-0.73	0.46	-1.59	0.69
Environment - Governance == 0	-1.05	0.52	-2.03	0.39
Infrastructure - Governance == 0	-0.21	0.39	-0.52	1.00
Community - Food_Water == 0	0.65	0.50	1.31	0.85
Resource_Allocation - Food_Water == 0	0.36	0.52	0.69	0.99
Economy - Food_Water == 0	0.12	0.55	0.22	1.00
Environment - Food_Water == 0	-0.19	0.60	-0.32	1.00
Infrastructure - Food_Water == 0	0.65	0.45	1.31	0.85
Resource_Allocation - Community == 0	-0.29	0.44	-0.65	1.00
Economy - Community == 0	-0.53	0.48	-1.10	0.93
Environment - Community == 0	-0.84	0.53	-1.59	0.69
Infrastructure - Community == 0	<0.01 **	0.41	0.00	1.00

Category comparison	Estimate	Std. Error	z-value	p-value
Economy - Resource_Allocation == 0	-0.24	0.51	-0.47	1.00
Environment - Resource_Allocation == 0	-0.55	0.56	-0.99	0.95
Infrastructure - Resource_Allocation == 0	0.29	0.44	0.65	1.00
Environment - Economy == 0	-0.31	0.58	-0.54	1.00
Infrastructure - Economy == 0	0.53	0.48	1.10	0.93
Infrastructure - Environment == 0	0.84	0.53	1.59	0.69