frontiers | Frontiers in Sustainable Energy Policy

TYPE Perspective
PUBLISHED 19 December 2023
DOI 10.3389/fsuep.2023.1304673

Check for updates

OPEN ACCESS

EDITED BY
Yukun Shi,
University of Glasgow, United Kingdom

REVIEWED BY
Bi Fan,
Shenzhen University, China

*CORRESPONDENCE
Rebecca M. Entress
✉ Rebecca.entress@ucf.edu

RECEIVED 29 September 2023
ACCEPTED 21 November 2023
PUBLISHED 19 December 2023

CITATION
Entress RM and Stevens KA (2023) Public values failure associated with Hurricane Ian power outages.
Front. Sustain. Energy Policy 2:1304673.
doi: 10.3389/fsuep.2023.1304673

COPYRIGHT
© 2023 Entress and Stevens. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

Public values failure associated with Hurricane Ian power outages

Rebecca M. Entress* and Kelly A. Stevens

School of Public Administration, University of Central Florida, Orlando, FL, United States

Power outages from extreme weather events can diminish community resilience, making it difficult for the areas impacted to bounce back after such events. For socially vulnerable populations, the frequency and duration of power outages can be even more severe. Governments have an obligation to protect public values, or those values that are most fundamental to society, which includes equitable resilience. Using Jørgensen and Bozeman's inventory of public values, this manuscript explores how power outages from extreme weather events create public values failures. More specifically, the manuscript evaluates intraorganizational aspects of public administration during power outages in Florida during Hurricane Ian in 2022. Framing power outages as a public values failure may motivate greater time and effort toward improving equitable access to more resilient power systems.

KEYWORDS

public values, electricity, resilience, extreme weather, power outages

1 Introduction

Power outages are common in the United States, with the average electricity customer experiencing approximately 5 hours of power interruption per year.[1] However, some segments of the population experience greater durations and frequencies of power outages, especially those who are socially vulnerable or susceptible to adverse impacts from extreme weather or natural hazards (Ghanem et al., 2016; Mitsova et al., 2018; Maxim and Grubert, 2022; Nejat et al., 2022; Do et al., 2023). This represents a failure in equitable resilience, including unequal recovery and disproportionate impacts across different socioeconomic populations (Nejat et al., 2022).

In this manuscript, we evaluate equitable resilience as a public values failure in Florida following Hurricane Ian. Hurricane Ian made landfall on Florida's southwest coast on September 28th, 2022 as a Category 4 hurricane with winds of 130 knots (Bucci et al., 2023). While the storm steadily weakened as it crossed the Florida peninsula, hurricane conditions spread across Central Florida extending tropical storm force winds (>35 knots) across most of Florida. With it, catastrophic storm surges (10–15 feet) along the southwest Florida coast and flooding rain across Central Florida (10–20 inches of rain) led to impressive power outages across the state. More than 2.7 million customers in Florida lost power (*Hurricane Ian Update #21 - Final*, 2022), or about 30% of all Florida residential customers (Annual Electric Power Industry Report Form EIA-861, 2021). The map in Figure 1 shows the period of peak power outages, which was 1 day after landfall, following the path of Hurricane Ian with the heaviest winds and rainfall.

This manuscript examines power outages during Hurricane Ian and explores how these outages created a public values failure. Public values are those values that

1 According to U.S. Energy Information Administration Statistics covered in the November 6, 2020 Today in Energy, available at: https://www.jstor.org/stable/resrep22984.

are most essential to society, and when not upheld, a public values failure occurs (Bozeman, 2002; Feeney and Bozeman, 2007; Bryson et al., 2014). Public values protect the rights of individuals and include aspects such as equal treatment, equity, fairness, and ethical consciousness (Jørgensen and Bozeman, 2007). When public values failures occur, social justice and equitable resilience suffer. Applying public values to power outage events highlights human and equity dimensions of understanding power system resilience, which are key considerations as the energy grid continues to transform (Carley, 2022).

The manuscript first explores the existing literature on public values and electricity resilience, then explores how electricity outages during Hurricane Ian created a public values failure. It does so by examining relevant portions of intraorganizational aspects of public administration from Jørgensen and Bozeman's (2007) inventory of public values. Through exploring the impact of electricity resilience, on public values, we aim for policymakers and public administrators to enhance electricity grid resilience for future extreme weather events.

2 Literature review

Governments are responsible for ensuring that public values, or those values that are most fundamental to society, are upheld (Bozeman, 2002; Feeney and Bozeman, 2007; Bryson et al., 2014). Public values include actions by private organizations in addition to government actions (Bryson et al., 2014). This is important since electricity resilience spans beyond government organizations and involves the private sector. Public values can change over time (Fukumoto and Bozeman, 2019), and this manuscript ascribes to the view that electricity resilience is a public value that emerged over time.

Public values failures occur when public values are not upheld (Fukumoto and Bozeman, 2019). Public administration literature identified a variety of public value failures including climate science policy (Meyer, 2011), science policy (Bozeman and Sarewitz, 2005), flu vaccine shortages (Feeney and Bozeman, 2007), and corruption of public officials (Bozeman et al., 2018), among others. In such cases, inequity problems can arise (Fukumoto and Bozeman, 2019). Because socially vulnerable populations often are the most impacted and marginalized during extreme weather events, public values failures are especially problematic for marginalized populations (Laska and Morrow, 2006; Kleinosky et al., 2007). Thus, public values failures can create social justice issues.

2.1 Electricity reliability during extreme weather events

In the United States, power systems that provide electricity to customers involve intraorganizational governance (Lenhart et al., 2016). Policies directed at grid resilience to prevent power outages stem from every level of government and across multiple layers of infrastructure (Lo Prete and Blumsack, 2023). The North American Electric Reliability Corporation (NERC) and the Federal Regulatory Energy Commission (FERC) have regulatory authority over interstate transmission and set reliability standards for regional grid operators (Murphy, 2022). Additionally, the federal government provides varying degrees of infrastructure funding to harden the grid through executive initiatives (e.g., President Biden's Investing in America initiative in 2023) and legislation (e.g., the Inflation Reduction Act of 2022). State public utility commissions set interstate rules that dictate how generators connect to the grid which can also affect grid resilience. Last, utilities conduct transmission planning, design customer-sided demand response programs, implement weatherization programs, and are first-responders during grid outages (Murphy, 2022; Lo Prete and Blumsack, 2023). Thus, system-level reforms are needed to address the highly-complex nature of electricity resilience. Since Florida is a regulated state, nearly all customers in Florida have bundled service, meaning the electricity generation and delivery (i.e., transmission) are included in the electricity services provided by the electric utility, and either side can be a cause for power outages.

Extreme weather events are the most common cause of electric power outages, with an estimated impact of $44 billion a year worldwide (LaCommare et al., 2018). According to the U.S. Department of Energy, high winds and flooding associated with hurricanes have been the most common cause of widespread power outages in Florida in at least the last 20 years [Electric Disturbance Events (DOE-417), 2023].

Research found that the type of distribution system (e.g., overhead vs. underground wires), proximity to community assets such as hospitals, number of customers, type of electricity provider, and investments on the power grid all factor into the grid resilience (Mitsova et al., 2018). Persons of lower socioeconomic status are less likely to live in areas with high resilience investments and are therefore more likely to experience power outages (Liévanos and Horne, 2017; Mukherjee et al., 2018; Hutchinson et al., 2022). Across the country, low-income populations consistently experience more frequent and longer duration power outages (Liévanos and Horne, 2017; Coleman et al., 2023; Do et al., 2023; Macmillan et al., 2023). Previous research found that rural areas in Florida are particularly prone to slower restoration times (Mitsova et al., 2018).

Power outages can have deadly consequences, especially for medically vulnerable populations who may lose access to air conditioning, home heating, and depend on electricity. Typically, communication networks and internet are restricted during a power outage, which can compound challenges for getting necessary aid. For example, power outages during Hurricane Irma in 2017 led to increased mortality of nursing home residents in Florida (Skarha et al., 2021), including 9 deaths due to overheating in one Florida nursing home that lost power (Spencer, 2023).

3 Case study: public values failure to maintain electricity resilience during Hurricane Ian

This conceptual paper applies four intraorganizational aspects of public administration (robustness, stability, risk readiness,

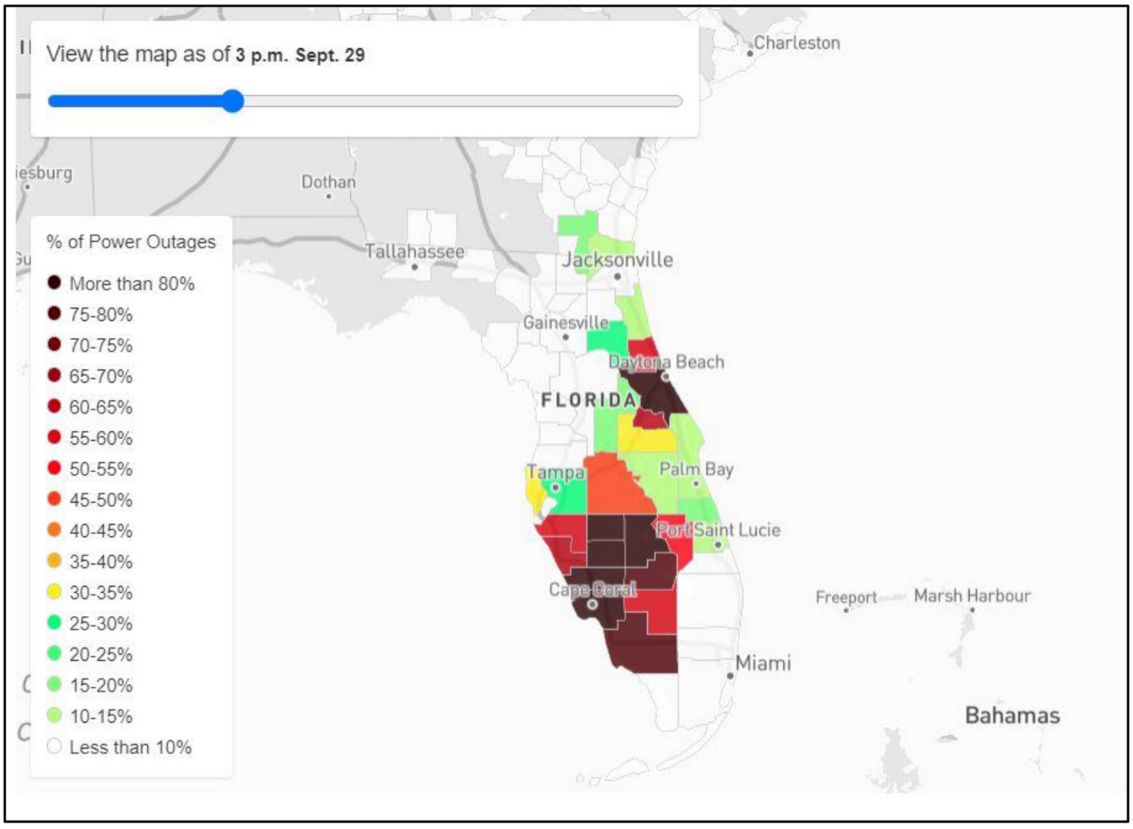

FIGURE 1
Power outages due to Hurricane Ian one day after landfall (September 29, 2022) on the Southwest Florida coast. Map and data provided through Mapbox, OpenStreetMap, and Improve this map. Mapbox is accessible at https://www.mapbox.com/about/maps/, OpenStreetMap at https://www.openstreetmap.org/about/, and Improve this map at https://www.mapbox.com/contribute.

and timeliness) to explore how inconsistent access to reliable energy created a public values failure during Hurricane Ian in Florida. Jørgensen and Bozeman (2007) created an inventory of 72 public values, representing the values most important for governments to uphold. This article explores how these public values criteria representing the intraorganizational aspects of public administration were not upheld during power outages from Hurricane Ian, which is summarized in Table 1. Specifically, we examine each of the public values criteria and use examples from gray literature to explore how power outages from extreme weather events creates a public values failure. We focus on intraorganizational aspects of public administration because power system governance is typically an intraorganizational responsibility. Although there are 14 public values related to intraorganizational aspects of public administration (Jørgensen and Bozeman, 2007), we selected those most closely related to failures seen during power outages from Hurricane Ian. To conclude, we explore how this contributes to literature on power outages in public administration theory and why public administrators have an obligation to ensure electricity is resilient when faced with extreme weather events.

3.1 Robustness and stability

Stability relates to the continuity and predictability of organizations. Robustness as a public value is defined as adaptive, yet stable, and immune to outside disturbances or influences. For this case study, we combine robustness and stability as public values and apply to the *reliability* of the electricity grid, a service residents and businesses need to operate daily. Grid reliability is a commonly used term in studies and operations of the electricity grid defined by the three R's of power system reliability: resource adequacy, operational reliability, and resilience (Geocaris, 2022). Regarding power outages with Hurricane Ian and other extreme weather events, we are typically considering *grid resilience*. Grid resilience refers to the ability of the grid to "bounce back" or as the U.S. Federal Energy Regulatory Commission defines it, "withstand and reduce the magnitude and/or duration of disruptive events, which includes the capability to anticipate, absorb, adapt to, and/or rapidly recover from such an event" [42 USC § 17384a(j)].

An electric grid with poor resilience is neither robust nor stable and represents a public values failure. Regarding Hurricane Ian in Florida, over 2.7 million customers in Florida lost power, which is

TABLE 1 Intraorganizational aspects of public administration relevant to power outages during extreme weather events.

Public values criteria	Definition related to power outage	Application to power outages from Hurricane Ian
Robustness and stability	Suitable combination of stability and adaptability, about being immune to outside influences, and about the ability to flow with the tide when necessary. Stability relates to continuity, legality, and social cohesion.	A significant portion of Florida customers lost power during Hurricane Ian, interrupting power service delivery across a wide swath of the state.
Risk- readiness	Readiness to prepare for, respond to, and adapt to energy outages during extreme weather events.	Although utility companies made efforts to be risk ready, those were insufficient and the utility companies were not risk ready, leaving residents without electricity following Hurricane Ian.
Timeliness	The speed with which energy access issues are addressed and communicated to the public during extreme weather events.	Some communities did not have energy access for months following Hurricane Ian, leaving residents without a timely resolution to the extreme weather event.

about 25% of all Florida electricity customers, meaning the grid was not resilient (Annual Electric Power Industry Report Form EIA-861, 2021). In this section, the focus is on the volume of the interruptions rather than duration, which is discussed further in *timeliness* below. As seen in Figure 1, some counties hardest hit by Hurricane Ian had over 80% of customers without power, which can make finding emergency services and aid more challenging. As a result of the storm, some portions of the grid required rebuilding rather than restoration (Taylor, 2022), a significant and expensive undertaking by the impacted utilities. Florida Power & Light (FPL), the largest electric utility in Florida later stated that they would seek over $1.1 billion in electricity restoration costs from its residential customers following Ian (Hurtibise, 2022). Electricity surcharges to cover restoration efforts can have a disproportionate impact on lower income customers who may struggle with energy insecurity and not be able to pay their energy bills to meet basic needs (Carley and Konisky, 2020). The damage caused by Hurricane Ian to the grid that led to increased costs to citizens for restoration represents a failure in grid resilience and therefore public values.

3.2 Risk readiness

Risk readiness refers to the concept of being ready for risks when they occur (Bennetts and Charles, 2016). When emergencies and crises occur, being ready for risks can reduce suffering and harm (Donahue et al., 2014). When organizations are not prepared for emergencies and crises, people and communities are at risk. For example, during Hurricane Katrina organizations and communities were not properly prepared for the risks of the storm, and as a result search and rescue operations were problematic, organizations did not work together, and many individuals in the community died (Waugh and Steib, 2006; Gray and Hebert, 2007). This manuscript focuses on risk readiness from an energy access perspective and thus, we define risk readiness as readiness to prepare for, respond to, and adapt to electricity outages during extreme weather events.

During Hurricane Ian, electricity companies anticipated power outages and prepared for the storm by recruiting employees and supplies from other states prior to the storm (News Service of Florida, 2022). While these efforts are laudable, other methods of risk readiness were not sufficiently implemented prior to Hurricane Ian. Electricity providers did not properly invest in maintenance, which could have reduced electricity outages after the storm (Taylor, 2022). While electricity companies and elected officials in Florida recognize the importance of "storm hardening," or investing in projects to make the energy grid more reliable (such as investing in concrete poles for powerlines), storm hardening efforts were not sufficiently implemented prior to Hurricane Ian (Lee and Swartz, 2022). As a result, approximately 2.7 million people lost power, including approximately 90% of residents in Lee and Charlotte Counties, two of the hardest hit areas (Treisman, 2022). Further planning and risk readiness by utility companies could have better prepared the area to mitigate the damage and extent of power outages following Hurricane Ian. However, the limited risk readiness that left residents without power for extended periods represents a public values failure.

An additional aspect of risk readiness is the ability to communicate risk with the public. There is limited electric grid reliability data in the United States that is publicly accessible and localized (Dunn et al., 2019). Power companies typically provide real-time data on power outages that are aggregated and may lack spatial resolution, however, historical data is more challenging to acquire. As a result, some limited weather-outage models could communicate the probability of a power outage to the local public at a neighborhood scale. Further, previous research found that power outage frequency and duration vary at the neighborhood scale, and socially vulnerable populations are more likely to experience more, longer duration power outages (Ghanem et al., 2016; Mitsova et al., 2018; Maxim and Grubert, 2022; Nejat et al., 2022). At least one news article reported that low-income Americans were likely to face the most difficulty with surviving and recovering from Hurricane Ian based largely on anecdotal evidence (Sainato, 2022). As a result, better risk communications in advance of a storm regarding likelihood of power outages could help improve equitable outcomes post-disaster.

3.3 Timeliness

Timeliness relates to the concept of providing information or services quickly, so that services and information are relevant to current activities (Shanshan, 2014). This is important during emergencies and crises as scenarios and situations are constantly changing. Without timely

information and actions, response operations can fail and leave people to suffer harm during emergencies and crises (Comfort, 2007). In terms of energy access during extreme weather events, we define timeliness as the speed with which energy access issues are addressed and communicated to the public.

During Hurricane Ian, Florida experienced significant electricity outages. Following the storm, many areas of the state had their electricity restored quickly, however southwest Florida where the storm made landfall took much longer (Associated Press, 2022). Approximately 1 week after the storm, 91% of homes in coastal southwest Florida were still without power, while most others had their power restored (Associated Press, 2022; Bayles, 2022). Smaller utility companies in southwest Florida with less infrastructure compared to larger utilities may be partially responsible for the slow response to power outages from Hurricane Ian (Bayles, 2022). One community in Lee County did not have electricity 9 months after the storm, showing that even with the planning that occurred, electricity companies were not sufficiently ready for the risks of Hurricane Ian (Wirtz, 2023). According to data collected from PowerOutage.us (2023) and Stevens and Belligoni (2023) the typical electricity customer in Florida loses power for 14 h per year. This indicates that the restoration time following Ian was extensively longer than can be typically expected for most customers. These slow responses represent a public values failure, as timeliness of electricity restoration was not sufficiently upheld during Hurricane Ian.

4 Discussion and conclusion

This manuscript explored how electricity outages during Hurricane Ian, a catastrophic category 4 hurricane in Florida, created a public values failure. Specifically, we examined how several intraorganizational aspects of public administration: robustness and stability, risk readiness, and timeliness were not upheld during Hurricane Ian. To enhance social justice during future extreme weather events, public values can be upheld by enhancing electricity reliability. Policy makers and public administrators can use this information to advocate for investments in electricity reliability, prioritize policies, and technology that is resilient during extreme weather events, and encourage utility companies to work closely with communities to quickly restore any outages following disruptions. To address the public values failure caused by extreme weather events on grid resilience, more funding and attention is needed to replace and reform the aging transmission infrastructure in the U.S. (Murphy, 2022). Greater emphasis on demand-side solutions such as energy efficiency and customer-side curtailment could lower peak demand during extreme weather events (Lo Prete and Blumsack, 2023). Additionally, policies to promote onsite renewable generation plus energy storage to form resilient microgrids could improve more equitable resilience (Nejat et al., 2022).

While Hurricane Ian represented a public values failure through the lens applied here, some experts concluded that the extent of the power outages could have been much worse given the extreme weather conditions faced by an extended area of Florida (Taylor, 2022). Taylor (2022) reports that experts from FPL stated that of all Category 4 and 5 strength storms to make landfall in the United States, Hurricane Ian had the fastest restoration time for customers in the direct path of the storm. According to a report by the U.S. Department of Energy (Hurricane Ian Update #21 - Final, 2022) more than 44,000 workers from 33 states and the District of Columbia were able to support power restoration efforts in Florida—a huge intergovernmental response success. However, the public value failure that existed in Florida during Hurricane Ian underscores the important obligation that public officials and utility companies have to ensure that electricity resilience is upheld during extreme weather events. Access to better grid resilience across all populations can improve equitable resilience during extreme weather.

Future research can explore public values failures related to energy reliability during other extreme weather events, such as wildfires, floods, and severe thunderstorms. More investigation is needed to explore the impact that power outages have on the ability of socially vulnerable communities to be resilient. Future research can also include quantitative methodologies for evaluating public values failures for energy reliability, which would help researchers and practitioners better understand public values failures, as well as advance the field of public administration. Finally, future research can examine how other aspects of public values, which are more closely related to social justice, such as equal treatment, equity, fairness, and ethical consciousness, are impacted by electricity outages. As more research on the impact of Hurricane Ian is conducted, researchers should evaluate using other aspects of public values which are more difficult to examine, evaluate, and measure. Having more publicly accessible historical power outage data can help better understand public values failures related to grid resilience. As climate change continues to stress the electric grid and test its resilience, more open and transparent recognition of the importance of resilient electricity is needed.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

RE: Conceptualization, Project administration, Writing – original draft, Writing – review & editing. KS: Conceptualization, Funding acquisition, Writing – original draft, Writing – review & editing.

Funding

The author(s) declare financial support was received for the research, authorship, and/or publication of this article. This material is based upon work supported by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy

(EERE) under the Solar Energy Technologies Office Award No. DE-EE0010418.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

Annual Electric Power Industry Report Form EIA-861 (2021). Available online at: https://www.eia.gov/electricity/data/eia861/

Associated Press (2022). *In Ian's wake, Florida residents brave a slow wait for power'*. Available online at: https://www.tampabay.com/hurricane/2022/10/04/ians-wake-florida-residents-brave-slow-wait-power/ (accessed September 25, 2023).

Bayles, T. (2022). DeSantis: Nonprofit electric provider leaving too many in the dark after Hurricane Ian, WGCU PBS and NPR for Southwest Florida. Available online at: https://news.wgcu.org/news/2022-10-02/desantis-nonprofit-electric-provider-leaving-too-many-in-the-dark-after-hurricane-ian (accessed September 25, 2023).

Bennetts, C., Charles, M. B. K. (2016). Between protection and pragmatism: passenger transport security and public value trade-offs. *Int. J. Public Admin.* 39, 26–39. doi: 10.1080/01900692.2015.1028638

Bozeman, B. (2002). Public-value failure: when efficient markets may not do. *Public Admin. Rev.* 62, 145–161. doi: 10.1111/0033-3352.00165

Bozeman, B., Molina, A.L., and Kaufmann, W. (2018). Angling for sharks, not pilot fish: deep corruption, venal corruption, and public values failure. *Perspect. Public Manag. Gover.* 1, 5–27. doi: 10.1093/ppmgov/gvx002

Bozeman, B., and Sarewitz, D. (2005). Public values and public failure in US science policy. *Sci. Public Policy* 32, 119–136. doi: 10.3152/147154305781779588

Bryson, J.M., Crosby, B.C., and Bloomberg, L. (2014). Public value governance: moving beyond traditional public administration and the new public management. *Public Admin. Rev.* 74, 445–456. doi: 10.1111/puar.12238

Bucci, L., Alaka, L., Hagen, A., Delgado, S., and Beven, J. (2023). *Hurricane Ian. National Hurricane Center Tropical Cyclone Report AL092022.* National Hurricane Center. Available online at: https://www.nhc.noaa.gov/data/tcr/AL092022_Ian.pdf (accessed September 20, 2023).

Carley, S. (2022). Specialty grand challenge: energy transitions, human dimensions, and society. *Front. Sustain. Energy Policy* 1, 1063207. doi: 10.3389/fsuep.2022.1063207

Carley, S., and Konisky, D.M. (2020). The justice and equity implications of the clean energy transition. *Nat. Energy* 5, 569–577. doi: 10.1038/s41560-020-0641-6

Coleman, N., Esmalian, A., Lee, C. C., Gonzales, E., Koirala, P., and Mostafavi, A. (2023). Energy inequality in climate hazards: empirical evidence of social and spatial disparities in managed and hazard-induced power outages. *Sustain. Cities Soc.* 92, 104491. doi: 10.1016/j.scs.2023.104491

Comfort, L. K. (2007). Crisis management in hindsight: cognition, communication, coordination, and control. *Public Admin. Rev.* 67, 189–197. doi: 10.1111/j.1540-6210.2007.00827.x

Do, V., McBrien, H., Flores, N. M., Northrop, A. J., Schlegelmilch, J., Kiang, M. V., et al. (2023). Spatiotemporal distribution of power outages with climate events and social vulnerability in the USA. *Nat. Commun.* 14, 2470. doi: 10.1038/s41467-023-38084-6

Donahue, A., Eckel, C., and Wilson, R. (2014). Ready or not? How citizens and public officials perceive risk and preparedness - Amy K. Donahue, Catherine C. Eckel, Rick K. Wilson. 44, 3S–115S. doi: 10.1177/0275074013506517

Dunn, L. N., Sohn, M. D., LaCommare, K. H., and Eto, J. H. (2019). Exploratory analysis of high-resolution power interruption data reveals spatial and temporal heterogeneity in electric grid reliability. *Energy Policy* 129, 206–214. doi: 10.1016/j.enpol.2019.01.042

Electric Disturbance Events (DOE-417) (2023). Available online at: https://www.oe.netl.doe.gov/oe417.aspx

Feeney, M., and Bozeman, B. (2007). Public values and public failure: implications of the 2004-2005 flu vaccine case. *Public Integr.* 9, 175–190. doi: 10.2753/PIN1099-9922090204

Fukumoto, E., and Bozeman, B. (2019). Public values theory: what is missing? *Am. Rev. Public Admin.* 49, 635–648. doi: 10.1177/0275074018814244

Geocaris, M. (2022). *Assessing Power System Reliability in a Changing Grid, Environment, NREL.* Available online at: https://www.nrel.gov/news/program/2022/assessing-power-system-reliability-in-a-changing-grid-environment.html (accessed September 25, 2023).

Ghanem, D.A., Mander, S., and Gough, C. (2016). "I think we need to get a better generator": household resilience to disruption to power supply during storm events. *Energy Policy* 92, 171–180. doi: 10.1016/j.enpol.2016.02.003

Gray, B.H., and Hebert, K. (2007). Hospitals in Hurricane Katrina: challenges facing custodial institutions in a disaster. *J. Health Care Poor Under.* 18, 283–298. doi: 10.1353/hpu.2007.0031

Hurricane Ian Update #21 - Final (2022). *Situation Update. U.S. Department of Energy.* Available online at: https://www.energy.gov/sites/default/files/2022-10/TLP-CLEAR_Ian_DOE%20Situation%20Update_21-Final%20%281%29.pdf

Hurtibise, R. (2022). *FPL customers could see monthly bills hiked $4 or more to pay for Hurricane Ian restoration. Orlando Sentinel*, 1 November. Available online at: https://www.orlandosentinel.com/2022/11/01/fpl-customers-could-see-monthly-bills-hiked-4-or-more-to-pay-for-hurricane-ian-restoration/ (accessed September 28, 2023).

Hutchinson, S., Heredia, W.G.B., and Ghatpande, O.A. (2022). "Resilience metrics for building-level electrical distribution systems with energy storage," in *2022 IEEE Conference on Technologies for Sustainability (SusTech)* (IEEE), 71–78. doi: 10.1109/SusTech53338.2022.9794261

Jørgensen, T.B., and Bozeman, B. (2007). Public values: an inventory. *Admin. Soc.* 39, 354–381. doi: 10.1177/0095399707300703

Kleinosky, L.R., Yarnal, B., and Fisher, A. (2007). Vulnerability of hampton roads, virginia to storm-surge flooding and sea-level rise. *Nat. Haz.* 40, 43–70. doi: 10.1007/s11069-006-0004-z

LaCommare, K. H., Eto, J. H., Dunn, L. N., and Sohn, M. D. (2018). Improving the estimated cost of sustained power interruptions to electricity customers. *Energy* 153, 1038–1047. doi: 10.1016/j.energy.2018.04.082

Laska, S., and Morrow, B.H. (2006). Social vulnerabilities and hurricane katrina: an unnatural disaster in new orleans. *Mar. Technol. Soc. J.* 40, 16–26. doi: 10.4031/002533206787353123

Lee, M., and Swartz, K. (2022). *4 things holding back restoration of Florida's electric grid - POLITICO.* Politico, 20 September. Available online at: https://www.politico.com/news/2022/09/30/florida-power-grid-hurricane-00059859 (accessed September 26, 2023).

Lenhart, S., Nelson-Marsh, N., Wilson, E. J., and Solan, D. (2016). Electricity governance and the Western energy imbalance market in the United States: the necessity of interorganizational collaboration. *Energy Res. Soc. Sci.* 19, 94–107. doi: 10.1016/j.erss.2016.05.015

Liévanos, R.S., and Horne, C. (2017). Unequal resilience: the duration of electricity outages. *Energy Policy* 108, 201–211. doi: 10.1016/j.enpol.2017.05.058

Lo Prete, C., and Blumsack, S. (2023). Enhancing the reliability of bulk power systems against the threat of extreme weather: lessons from the 2021 texas electricity crisis. *Econ. Energy Environ. Policy* 12, 2. doi: 10.5547/2160-5890.12.2.clop

Macmillan, M., Wilson, K., Baik, S., Carvallo, J. P., Dubey, A., and Holland, C. A. (2023). Shedding light on the economic costs of long-duration power outages: a review of resilience assessment methods and strategies. *Energy Res. Soc. Sci.* 99, 103055. doi: 10.1016/j.erss.2023.103055

Maxim, A., and Grubert, E. (2022). Anticipating climate-related changes to residential energy burden in the United States: advance planning for equity and resilience. *Environ. Justice* 15, 139–148. doi: 10.1089/env.2021.0056

Meyer, R. (2011). The public values failures of climate science in the US. *Minerva* 49, 47–70. doi: 10.1007/s11024-011-9164-4

Mitsova, D., Esnard, A. M., Sapat, A., and Lai, B. S. (2018). Socioeconomic vulnerability and electric power restoration timelines in Florida: the case of Hurricane Irma. *Nat. Hazards* 94, 689–709. doi: 10.1007/s11069-018-3413-x

Mukherjee, S., Nateghi, R., and Hastak, M. (2018). A multi-hazard approach to assess severe weather-induced major power outage risks in the U.S. *Reliab. Eng. Syst. Safety* 175, 283–305. doi: 10.1016/j.ress.2018.03.015

Murphy, S. (2022). Modernizing the U.S. electric grid: A proposal to update transmission infrastructure for the future of electricity. *Environ. Progr. Sustain. Energy* 41, e13798. doi: 10.1002/ep.13798

Nejat, A., Solitare, L., Pettitt, E., and Mohsenian-Rad, H. (2022). Equitable community resilience: the case of winter storm Uri in Texas. *Int. J. Disaster Risk Reduct.* 77, 103070. doi: 10.1016/j.ijdrr.2022.103070

News Service of Florida (2022). *Florida utility companies preparing for Hurricane Ian power outages.* 27 September. Available online at: https://www.fox35orlando.com/news/florida-utility-companies-preparing-for-hurricane-ian-power-outages (accessed September 26, 2023).

PowerOutage.us (2023). Available online at: https://poweroutage.us/

Sainato, M. (2022). 'Our community is wiped out': low-income Americans likely to be hit hardest by Hurricane Ian. *The Guardian*. Available online at: https://www.theguardian.com/us-news/2022/oct/01/hurricane-ian-inequality-recovery-damage-florida (accessed November 29, 2023).

Shanshan, S. (2014). Assessment of e-government service quality under user satisfaction orientation: the establishment of e-govqual model. *Asian J. Bus. Manage.* 6, 111–117. doi: 10.19026/ajbm.6.5335

Skarha, J., Gordon, L., Sakib, N., June, J., Jester, D. J., Peterson, L. J., et al. (2021). Association of power outage with mortality and hospitalizations among florida nursing home residents after Hurricane Irma. *JAMA Health Forum* 2, e213900. doi: 10.1001/jamahealthforum.2021.3900

Spencer, T. (2023). *Hurricane deaths at nursing home: accident or manslaughter? AP News.* Available online at: https://apnews.com/article/disaster-planning-and-response-hurricanes-typhoons-florida-health-nursing-homes-06000d4222cec785bca7f3e9e3068eef (accessed September 28, 2023).

Stevens, K., and Belligoni, S. (2023). Policymaking in the dark: the impact of power outage information asymmetry on local government resilience efforts. *Available at SSRN 4554714*. doi: 10.2139/ssrn.4554714

Taylor, A. (2022). *Most Floridians got power back quickly after Ian. But for some the wait has just begun.* Washington Post, 14 October. Available online at: https://www.washingtonpost.com/nation/2022/10/14/hurricane-ian-power-outages/ (accessed September 25, 2023).

Treisman, R. (2022). *How to prepare for and stay safe during a power outage.* NPR, 29 September. Available online at: https://www.npr.org/2022/09/29/1125945890/hurricane-ian-power-outage-safety-portable-generators (accessed September 26, 2023).

Waugh, W., and Steib, G. (2006). Collaboration and leadership for effective emergency management. *Public Admin. Rev.* 66, 131–140. doi: 10.1111/j.1540-6210.2006.00673.x

Wirtz, T. (2023). *Community without power more than 9 months Ian*. Available online at: https://winknews.com/2023/07/11/community-remains-without-power-more-than-9-months-ian/ (accessed September 25, 2023).