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Practicing urban resilience to electricity service disruption in Accra, Ghana

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ABSTRACT

Electricity is essential for the functioning of contemporary cities. However, despite its overarching criticality, residents of Southern cities like Accra are challenged by splintered access and limited reliability of electricity services. To maintain access, and creatively maneuver blackout situations, residents in Southern cities employ many alternative socio-technical configurations and adaptive strategies. Using the lenses of urban resilience, vulnerability, and social practice theory, we explore the everyday energy practices of residents and businesses in different settlements across Accra, particularly in response to electricity service disruptions. Here, we interrogate electricity as an enabler of practices as well as the consequences of electricity disruption, and the technologies and adaptive strategies employed to maintain those practices. Our goal is to assess the potential for ensuring urban resilience in the face of electricity blackouts through adaptive energy access and user practices. Empirically, we employ primary data gathered from expert interviews with utility providers and local government officials, neighborhood visits, observations, interviews with urban residents and businesses, and document analyses. By examining the everyday energy practices of urban residents, we argue that we can better understand urban/critical infrastructure resilience and the alternative pathways to it. We further contend that the relationship between resilience and practices is predicated on—and necessitated by—systemic socio-economic and socio-spatial inequalities. We therefore advocate for a stronger engagement with electricity user perspectives and everyday energy practices in mainstream resilience and vulnerability discourses related to critical infrastructure disruption.

1. Introduction

Electricity systems, like other energy and critical infrastructure systems, enable the functioning of cities, and particularly everyday practices [1,2]. Electricity infrastructure enables multiple social practices from heating water and cooking to powering household appliances and workplace equipment to facilitating the functionality of buildings, mobility, and manufacturing, and other critical infrastructures. For this reason, Shove and Walker [3] contend that energy needs to be conceptualized as an *ingredient* of the social practices which make up societies—whether energy flows are maintained, absent, or disrupted. Disruptions to electricity flows, therefore, (can) also disrupt practices. However, while academic interest in energy practices is growing, the dialogue between notions of energy practices and debates on urban resilience and vulnerability is limited, with current research mainly focused on Global North contexts [4,5].

Exploring the relationship between practices and resilience in the Global South is important because electricity disruptions there are more frequent and even normalized. While disruptions interfere with everyday practices, examining electricity disruptions through practice theory can provide a valuable lens to understand and open new conceptualizations of urban resilience. The reality of such disruptions has raised concerns about the vulnerability of both technical systems and urban societies across the globe [6]. In cities of the Global South, experience suggests that networked infrastructures service only parts of the city, with many residents situated in areas beyond the reach of these systems [7]. Even in urban spaces where networks exist, electricity systems have limited capacity to provide a reliable and uninterrupted supply. In such spaces, the universal application of electricity across a wide spectrum of everyday practices, as in Global North contexts, is contentious. The limited access to and availability of networked infrastructure services also suggests that the practices of urban dwellers are adapted to such realities. However, how and to what extent remain empirically underexplored.

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Frequent disruptions to centralized electricity networks—and thus the cities they serve—have resulted in their perceived vulnerability [8], with many Southern cities portrayed as synonymous with failure, breakdown, interruption, and inadequacy [9]. However, research also suggests that residents in Southern cities improvise in the absence of networked services and in their disruption [10,11]. Yet, a gap remains in understanding how adaptive strategies—in the context of heterogeneous energy infrastructures and persistent disruption—make cities and residents resilient by enabling the continuity of everyday practices. While knowledge of heterogeneous infrastructures in Southern cities has advanced [12–14], a limited understanding remains of how practices to cope with service disruptions shape and are shaped by heterogeneous infrastructures. Here, the material technologies co-opted, the knowledge deployed, the specific practices maintained, and the flexible ordering of daily activities point to underexplored adaptive capacities. Ultimately, there is a gap in understanding of both the conceptual and practical interconnections between urban resilience and practice theory, and we question the extent to which various adaptive practices employed by urban residents contribute to urban resilience.

In this paper, we examine the diverse adaptive practices of Accra's residents in response to electricity service disruptions, through the lens of everyday practices and the potential to build resilience against such disruptions through practices. The disrupted nature of Accra's electricity network [8], together with its splintered urban landscape which dates back to its colonial past, make an interesting case for understanding the differentiated vulnerabilities and adaptive responses to power interruptions. We ask three questions: (1) To what extent are urban dwellers' energy practices sensitive to electricity disruptions? (2) How do different social groups respond to Accra's unreliable electricity network through adaptive practices? (3) How do people's adaptive practices to electricity disruption vary across different socio-spatial contexts within the city?

The paper has six sections. The following section engages with existing literature on urban and infrastructure resilience and social practice theory to understand existing approaches and how practice theory could inform urban resilience (Section 2). Section 3 outlines our methodology while Section 4 discusses the dynamics of electricity provision in Accra and the role urban dwellers play in *normalizing* electricity disruptions by maintaining or altering urban functions and energy services through various adaptive practices, and whether and how this increases resilience. Section 5 discusses the findings and contributions of this article. Finally in Section 6, we argue that new perspectives on urban and infrastructural resilience can result from a better understanding of the adaptive practices surrounding intermittent energy provision particularly in the Global South. We also argue for increased attention to socio-economic and socio-spatial inequalities in resilience debates.

2. Practicing urban and infrastructural resilience

As the number of social practices that require electricity are considerable, everyday life and work without electricity are unimaginable to many [4]. This section reviews relevant literature on social practice theory and urban and critical infrastructure resilience and outlines specific gaps in the research and the possibilities to better understand urban resilience through social practice theory.

2.1. Understanding practice theory

While there is a long-standing history of practice theory research in the social sciences, its mobilization in energy research is more recent [3]. Practice theory highlights the intricate connections between the material and social constituents of daily life which are embedded in routine activities like cooking, cleaning, cooling spaces, entertaining, and working [4]. Everyday practices, therefore, are at the heart of interactions between infrastructure and society.

Reckwitz [15]: 249 considers 'practices' to be routinized types of behavior which consist of several interconnected elements, including (bodily and mental) activities, (material) 'things' and their uses, knowledge, know-how, states of emotion, and motivation. Practice theory has been mobilized to draw attention to ordinary people's tasks, activities, and experiences in everyday life, which are often taken for granted [5] and not conventionally considered objects of research. However, increasing attention and importance within energy research is being placed on the everyday practices sustained by energy. For some, practice theory provides an analytical lens to better understand the nature and value of energy provision and access through the way energy is deployed and used, and the 'services' it provides to people [16–19]. Silvast [18] argues that the material reality of the power grid alone is insufficient to explain electricity use and access in everyday life; rather, the focus should be placed on energy practices. Likewise, Shove and Walker [3] argue for an understanding of energy-society relations based on the interaction between practices, material arrangements, and social orders surrounding energy.

To understand energy dynamics through practice theory, Shove and Walker [3]: 47 argue that "energy is used not for its own sake but as part of, and in the course of, accomplishing social practices" [3]. Such practices occur at home, at work, in governments, and in moving from one place to another [20] and, thus, have a crucial spatial component. Warde [21]:145 similarly argues that energy "consumption occurs within and for the sake of practices." Electricity is thus seen as a prerequisite of many daily practices [5], making it possible to study both electricity and infrastructure as mediators of practices [3].

Although critical infrastructure research and studies on service provision in many Southern cities discuss the everyday lived experiences and interactions between people and critical infrastructure, much of this research focuses on embedded inequalities. In addition, studies focus on: (1) the politics of critical service provision [8,22]; (2) the socio-material assemblages which create access to critical services, and the alternate arrangements of service provision [11,12,23]; and (3) how these reinforce or annihilate rights of citizenship [24,25]. Despite this widespread engagement with infrastructural practices in Southern cities, there remains a gap in understanding how everyday practices are shaped and altered through infrastructural disruptions and their potential to increase resilience.

In examining the relationship between electricity and everyday practices in Accra, we focus on electricity as an *ingredient* [3] of practices whose presence or absence has important implications for understanding urban resilience. Specifically, practice theory offers a lens to study the everyday relations of urban residents with energy use and how resilience is configured through the organization and altering of daily practices. Therefore, to better understand resilience through the everyday practices of urban residents, we use the case of electricity disruptions in Accra and the adaptive practices employed in response to these disruptions.

2.2. Understanding resilience through practice theory

Resilience and vulnerability are evolving notions with widespread application in various fields. Recently, policy frameworks have forwarded different meanings of resilience concerning critical infrastructure protection (e.g., [26,27]). Both researchers and policymakers are typically concerned with how critical infrastructure systems, such as electricity systems, respond to and recover from disruptive events. Policy frameworks, therefore, often focus on critical infrastructure protection at the national scale [28,29] to protect cities and prevent energy users from experiencing infrastructure service disruptions. In the event of a disruption, a resilient system is expected to *'rapidly recover'* and return to the state of providing services again.

Within crisis and disaster risk management, the United Nations Office for Disaster Risk Reduction (UNDRR) defines resilience as, "the ability of a system, community or society exposed to hazards to resist,

absorb, accommodate and recover from the effects of a hazard in a timely and efficient manner, including through the preservation of its essential basic structures and functions" [30]: 24. Moreover, Amirzadeh et al. [31] and Campanella [32] point to the importance and agency of communities and urban societies in building urban resilience. To understand resilience and vulnerability, Adger [33] and Gallopín [34] highlight three basic criteria: (1) the exposure to threat/shocks/stress, (2) the level of sensitivity/susceptibility to them, and (3) adaptive capacities. Where exposure is the nature and degree to which a system experiences a shock/stress, sensitivity is the degree to which a system is affected by a disturbance. Adaptive capacity refers to the ability to evolve and respond to stress and to change and expand the range of coping capacity [33]. Alexander et al. [35] and Hegger et al. [36] further outline three main categories of adaptive capacities for assessing resilience including: (1) capacities to resist, (2) capacities to absorb and recover, and (3) capacities to transform and adapt. Here, the study of practices offers an interesting avenue to uncover and assess the adaptive capacities of urban dwellers in contexts where other aspects of resilience are low. For example, Abi Ghanem et al. [4] argue that energy practices are a key means through which residents respond to shocks and supply disruptions. Therefore, practice theory could serve as a means to better understand whether, when coping with power interruptions, user agency increases resilience. This also requires an understanding of 'user vulnerabilities' [37]: 10 i.e., how and what practices are affected by electricity disruptions as well as the variegated criticality of electricity use for various urban groups in everyday life. Crucial questions are thus: how are practices disrupted and how do urban residents respond to disruptive events by altering and reorganizing those practices into distinct strategies [4,38]?

Practice theory provides an avenue to theorize resilience through spatially-differentiated functions of everyday practices among multiple stakeholders and urban groups [4,38]. Such analysis would require an understanding of the uneven spatialities of daily routines and adaptive practices which enable the absorption of and recovery from *'shocks'* like electricity disruptions as well as the adaptive capacities inherent in people's practices to positively adjust through socio-technical systems. Trentmann [39] also highlights the *'alternative orders'* which emanate from infrastructure disruptions, pointing to the flexibility of habits and routines in accommodating disruptions as constituents of daily life. Hasselqvist et al. [40] propose a framework for household energy resilience to include backup energy sources (e.g., diesel generators), energy efficiency (in appliance use), flexibility (in organizing daily activities), and energy sufficiency (i.e., equitably meeting basic energy needs). While backup systems and flexibility are particularly essential to maintaining everyday practices and urban functions, such a framework is intended to embed household resilience within mainstream energy systems resilience. Furthermore, prior experiences of disruptions may result in better preparedness for future interruptions and the development of coping strategies that allow people to maintain essential daily practices [4,41]. Recent studies highlight how "embodied preparedness competence" of households emanates from: (1) previous disruption experience, (2) local geographical knowledge (and culture) and (3) social networks. Each aspect significantly influences a household's level of resilience to disruptions with differences between households [42]. This places the maintenance of daily routines, functions, and practices central to the notion of urban resilience, and creates a sense of normalcy amid disruptions. It, however, remains unclear whether resilience capacities developed in response to specific shocks and disruptions can evolve into lasting forms of adaptive capacities.

In Southern cities, where critical infrastructure disruption is more frequent, and in many cases *'normalized'* [10], there is still little understanding of how everyday practices shape urban and infrastructure resilience and how these routine practices are shaped and altered. Research on the provision of and access to infrastructure services in Southern cities provides examples of the agency and resourcefulness of urban residents [43,44]. Munro [45] for instance illustrates the role urban residents play as energy 'bricoleurs' and calls for a rethinking of electricity geographies in the Global South beyond the "infrastructure of electricity, towards an understanding of how people interact with a dynamic range of energy infrastructures." Multiple researchers also point to the hybrid and heterogeneous arrangements of utility access through urban residents' initiatives and the implications for regulatory and governance mechanisms [12,14,46].

Despite widespread documentation of the agency and resourcefulness of Southern cities residents in response to infrastructure disruption, there is little systematic engagement in debates on urban resilience in relation to spatially situated energy practices. Recent debates have forwarded notions of 'energy resilience' including Wang et al. [47], who identify three primary social factors, namely consumer behavior, the adoption of new technologies (like energy efficient home appliances), and public participation (as a critical link between social factors and governance mechanisms). To this end, the results of studies on energy practices could go a long way to support the drive for resilience in electricity systems. Ultimately, we argue that understanding resilience at the neighborhood level through the everyday practices of individuals, households, businesses, and ultimately communities, could lead to a better understanding of both urban and infrastructural resilience.

Using practice theory as a heuristic device, therefore, we examine specific everyday practices (e.g., cooking, lighting, communicating, cooling spaces, office, and industrial work). We focus particularly on the 'sensitivity' and 'susceptibility' [33] of such practices, i.e., how and to what extent such practices are disrupted or adapted. Subsequently, we identify the adaptive practices employed by residents, which either maintains access to electricity (e.g., through technologies like backup generators, batteries), or maintains specific everyday practices and urban functions (e.g., using alternative energy sources, flexibly scheduling daily routines). Such enquiries reveal how urban residents resist and absorb electricity disruptions [35,36]. Considering that electricity disruptions in Accra are somewhat normalized, we also interrogate how adaptive capacities become embedded over time, transforming how residents enact everyday practices and inform their energy-use decisions. By investigating electricity disruptions in multiple neighborhoods, we also compare the exposure of diverse user groups to disruptions and the spatial dimensions of adaption in Accra.

3. Methodology – towards an intra-urban comparative study of Accra

We take a comparative intra-urban approach to understand urban residents' adaptive practices in response to differentiated electricity provision and the uneven distribution of power disruptions in Accra. The splintered urban development patterns in Accra and differentiated electricity access and exposure to blackouts make this an interesting case. McFarlane et al. [48] call for such intra-urban approaches to develop a deeper engagement with the multiple realities within cities. To understand the differentiated impacts of electricity disruptions, we compare the exposure and sensitivity of different neighborhoods to blackouts. Through the lens of practice theory, we also compare the adaptive practices in these different neighborhoods with the goal of better understanding the resilience of divergent urban neighborhoods and functions in response to frequent electricity disruption.

We took a qualitative approach by gathering data from six neighborhoods (see Fig. 1) within Accra through field (neighborhood) visits, observations, and interviews with urban residents and business managers in 2018, 2019 and 2022. There were five respondents in Kwashieman (low-income), five and six respondents in Lartebiokorshie and Achimota respectively (middle-income) and one respondent in Airport-Residential-Area (high-income). There were also five and three respondents from North-Industrial-Area and Victoriaborg/Ministries respectively. Additionally, twenty semi-structured expert interviews were conducted with local authorities and utility providers. Further interviews were conducted with other experts including facilities

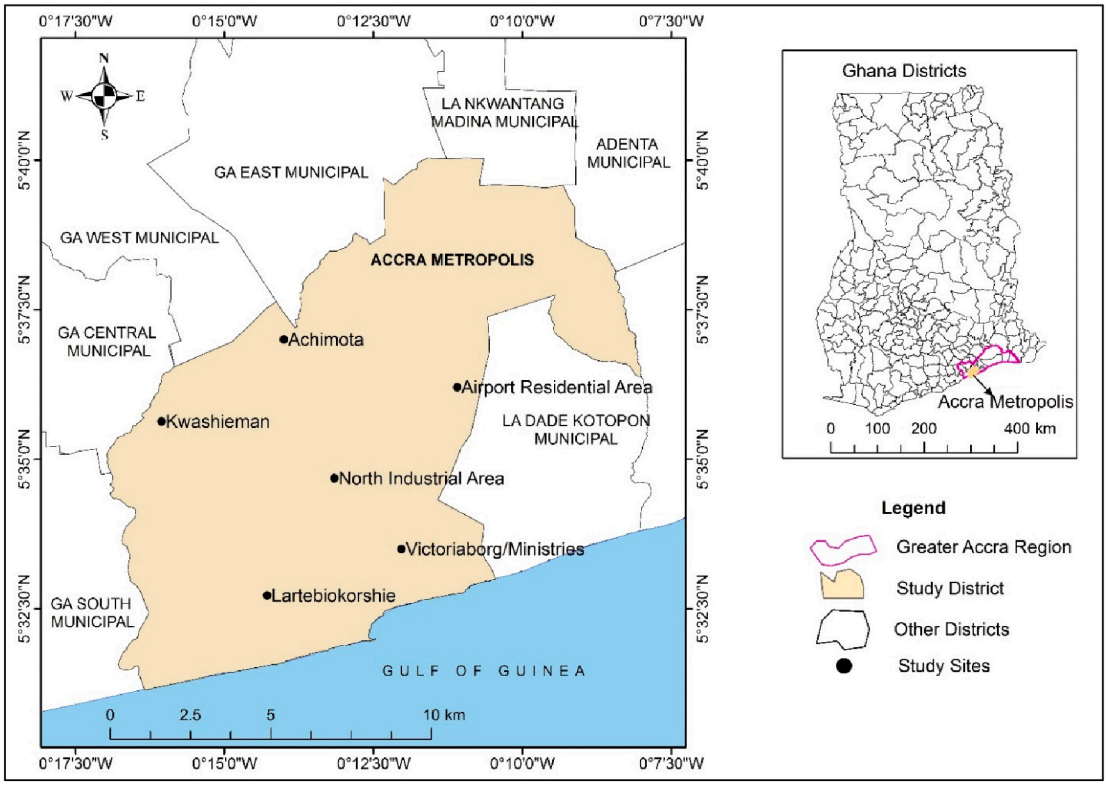

Fig. 1. Map of Accra showing the selected neighborhoods (Source:Author).

managers and real estate developers. We also drew upon published information and media reports, particularly the *Dumsor* report of 2015 and Statistical Data from the Ghana Statistical Service (GSS). Neighborhood selection was based on the concentration of specific urban functions such as residential (low-, middle- and high-income groups), industrial, and business/administrative. Resident interviews focused on what they used electricity for, their energy needs, and blackout coping strategies. Interviews were conducted during power outages for maintenance work on distribution networks, which allowed for additional insights to be gathered through first-hand observations of ongoing urban processes and adaptation practices. Interviews in residential neighborhoods included some non-residential practices as well. Interviews, conducted in both English and Twi, were transcribed, translated, and analyzed.

4. Electricity provision and energy practices in Accra

The following section describes electricity provision in Accra, outlines the socio-technical configurations of electricity within selected neighborhoods, and links those configurations to the adaptive practices across neighborhoods. We examine how: (a) the uneven provision (i.e., reliability) of networked electricity services (and access to socio-technical alternatives) leads to uneven resilience capacities through people's practices; and (b) how the underlying urban functions and socio-technical configurations across Accra relate to or change the nature of energy practices.

4.1. Accra's disrupted electricity network

Like other countries in the Global South, Ghana's national government pursues universal electricity access. The country's centralized electricity network has had considerable improvements in extending connectivity to electricity networks in Ghana, rising from 24% in 1990 [49] to 85.33% in 2020 [50]. With 96.7% in 2019, the Greater Accra region had the highest grid connectivity rate (as a measure of settlement/community access), while household connectivity was 94.9% in 2019 [51]. As of 2017, 96.5% of households within the city of Accra had access to the grid [52]. Despite these improvements, residents are continuously challenged in the access to, availability and reliability of electricity services. This is attributed mainly to the mismatch between electricity supply and the rapidly increasing demand which leads to supply shortages and recurring disruptions [53,54].

Challenges related to income and affordability are major determinants of household energy access and use practices [55,56]. While 39.5% of residents not connected to the grid attributed this to high or expensive tariffs, 28.6% cited high initial connection costs [52]. Only 1.6% of residents not connected to the grid cited network proximity as a barrier [52]. Generally, up to 35% of urban households across the country, likely, lack grid connection because of high monthly electricity bills [52]. A recent study of three informal settlements in Accra revealed that up to 75% of residents illegally accessed electricity due to an inability to present requisite documentation and high connection fees [57]. Essentially, many people in Accra do not have regular access to electricity, not because of lacking network connectivity, but because of affordability. Hence, even for most of the urban poor who become connected, the burden of high electricity bills limits the extent of electricity use. This is despite existing government subsidies and life-line tariffs of 33GHp/kWh (~$0.044) and a monthly service charge of 213GHp/kWh (~$0.274) for consumption between 0-50kWh [50].

Central to the concerns of network inaccessibility and service disruption is urban inequality [54,58]. Contemporary research in Accra highlights how power interruptions resulting from supply rationing (e.g., load-shedding) disproportionately affect poorer neighborhoods and are both economically and politically motivated [54,58]. While many residents are connected to the grid, electricity may seldom be accessible (in sufficient quality) because of their frequent exposure to power interruptions.

Such findings and contestations open critical questions and opportunities to explore how resilience materializes through people's practices

concerning the uneven nature of electricity disruptions within this splintered urban space. This includes the uneven sensitivities of urban residents concerning different urban functions and practices. However, in an interview with an official responsible for the '100 Resilient Cities' project in Accra, it was revealed that only 5% of survey respondents considered power interruptions to be problematic (Interview 13, 2019). This suggests that urban dwellers accept and absorb to a certain extent such spatially explicit disruptions. In the following sections, we examine how urban residents respond, absorb and recover from power interruptions in different socio-spatial configurations within the city.

4.2. Socio-technical configurations of electricity provision in Accra

This section discusses electricity provision dynamics in the case study neighborhoods. We aim to show how the nature of 'responses,' in terms of strategies and adaptive practices to disruptions, differs based on the underlying socio-technical configurations, spatial conditions, and urban functions.

4.2.1. Victoriaborg: central business district

Victoriaborg (popularly called "Ministries"), a former colonial European residential neighborhood, is Accra's central business district. Having transformed over time, the area is now the administrative hub of the national government with many state ministries and departments as well as service industries. Victoriaborg is formally planned with integrated networked infrastructure, consolidated urban development, and moderate building density with mixed building types from low- to high-rise buildings. This area experiences ongoing gentrification, with high-rise infill developments replacing older, low-rise developments. According to an official of the Electricity Company of Ghana (ECG), the electricity network is ubiquitous in this area. Service provision is stable with few disruptions (Interview 7, 2019). This is because Victoriaborg is considered a priority location: government business cannot be interrupted. One respondent stated that power outages only occur when there is a major fault (Interview 11, 2019).

For this reason, the grid in this area is also networked with underground cable systems, considered more stable than overhead networks (Interview 10, 2019). A study of power interruptions by Aidoo and Briggs [54], confirms Victoriaborg's low exposure to power interruptions compared to Lartebiokorshi and Kwashieman. This was again confirmed during a load-shedding exercise in 2015, where Victoriaborg experienced the fewest outages: only one 10-hour power outage occurred in a two-week period [60].

Here, work practices take place in office spaces and typically involve running computers, printers, the internet, air conditioning, and projectors among others. Sensitivity to electricity disruptions is high in this context because electricity is required to operate these devices. As a result, backup generators are a common feature here. One respondent stated:

> "Outages don't happen often during working hours. In rare cases when it happens, we suspend work. My agency doesn't have a generator, but my ministry has it. Other ministries have generators for outages due to major faults."
>
> (Interview 11, 2019)

As the quote indicates, when necessary and possible, critical tasks are moved to the head office building next door, which uses a backup generator until grid electricity is restored.

According to another respondent:

> "Many offices will certainly need standby generators to continue to deliver services to clients when such [outages] happens."
>
> (Interview 21, 2019)

Typically, therefore, offices with generators do not need to alter work practices and can instead continue without interruption. In rarer cases, work comes to a standstill until power is restored in offices without a generator, which typically takes two hours according to respondents in this area (Interview 11, 2019).

4.2.2. North-Industrial-Area: industrial neighborhood—manufacturing

North-Industrial-Area is a planned industrial enclave predominantly comprised of manufacturing and processing establishments and their administrative offices and integrated with networked infrastructure. Urban development here is consolidated but moderately dense. According to ECG officials and other interviewees, the electricity network is ubiquitous and service provision is stable with very few disruptions (Interview 7, 2019; Interview 19, 2019). One respondent explained that power interruptions occurred twice a month on average and lasted less than two hours each time (Interview 18, 2019). However, we found that because power was previously unstable because of network overloads, some industries invested in additional network components to improve electricity access.

> "This area is alright. Not many outages. We have been here since 2011. It was worse back then. […] We used to share a transformer with Polyplast. But now, we have our own transformer, which has made the situation better."
>
> (Interview 19, 2019)

By securing access to higher quality service with the new transformer while reducing the load on the other transformers and increasing the network's overall capacity, these businesses have helped stabilize the network for other industries in the area.

Many heavy-duty machines are used in the manufacturing process and administrative work practices are mediated with electronic equipment, daily practices, including rubber and plastics processing, oxygen manufacturing, and online retailing. As such, factories are very sensitive to disruptions, both in the availability and quality of supply. One factory manager explained:

> "[…] when the light goes off, it creates waste, and our costs go up. Normally, we have like 2%, but with the lights off, it's double [...] and it affects the machines—fuses blow, circuits trip, plugs spoil. When design starts, it gets destroyed because the computer just goes off […]. Sometimes on holidays or even during overtime, the workers come but they cannot work […]. They just sit and you have to pay them. Even if you use a generator, you still have to pay all of them."
>
> (Interview 16, 2019)

Another factory manager stated:

> "This big machine [pointing to the equipment in the middle of the room], that's the main machine. It takes in air from outside and takes the oxygen from it. If the power goes off for twenty-four hours, when the electricity comes back, it has to cool for four hours before production can start. If it trips […] even one second and the machine goes off, you need 10 minutes."
>
> (Interview 19, 2019)

Such quotes highlight the high level of sensitivity industrial businesses have to power interruptions and how electricity—a specific form of energy—is critical to their operations.

While grid electricity is the primary energy source, backup generators were also observed in this area. However, not all businesses had backup generators because the electricity supply was relatively stable, and the occasional interruptions were bearable (Interview 18, 2019). Due to the cost of running generators, several industries operated them manually (i.e., the generator is not automated and needs to be switched on and off by personnel) and sparingly. Walking through the factory, one manager stated:

> "We have these two machines […] And the generator, it can power all machines, but the fuel is expensive. So we use just one machine for now."
>
> (Interview 16, 2019)

As a result, only 'absolutely critical' operations and industrial practices are typically maintained during an outage; less-essential tasks are suspended until grid electricity is restored. Work activities are also sometimes rescheduled to accommodate power outages. One manager of an online retail company, without a backup generator, stated:

> "[…] our business involves internet and electricity. So, it really affects us. So, most of our operations are put on hold when the power cuts. But we sort packages for delivery and dispatch. That one is offline so it doesn't matter if electricity is off."
>
> (Interview 18, 2019)

Therefore, flexibility enhances adaptive capacity and ensures that critical functions are maintained. Furthermore, the adaptive practices of individual industries contribute to a more stable electricity supply within the neighborhood.

4.2.3. High-income residential neighborhoods

Airport-Residential-Area is a high-income mixed-use neighborhood and is inhabited mainly by wealthy Ghanaians and foreigners. It is also home to high-end corporate businesses, international development organizations (e.g., the German development agency or GIZ), embassies, state administrations, and high-end residential apartments and hotels. The area is formally planned with universal networked infrastructures. Urban development is consolidated with high building density and mixed building types (low- to high-rise buildings). There is ongoing gentrification in this area where many formerly low-rise residential buildings are converted to high-rise office complexes and high-end residential apartments.

A local government official reported that networked electricity here is ubiquitous and electricity provision is stable with few disruptions (Interview 5, 2019). One respondent provided a nuanced picture:

> "The residents around Roman Ridge have quite a stable power supply, but the residents around Nyaho Clinic have persistent problems mainly because there's been a total increase in power demand. So the residents have procured transformers to ensure stable supply. […] Well, they buy it and ECG [electricity distribution company] takes over with the installation. But they will still pay for the services […], so the people do not have interruptions."
>
> (Interview 2, 2022)

At the time of the interviews, power interruptions had occurred only three times over a 10-month period and lasted less than 2 hours each time (Interview 5, 2019). This is unsurprising, considering that similarly wealthy neighborhoods like Cantonments and Ridge were supplied with stable electricity 92% and 98% of the time over the two-week period captured in the *Dumsor* report [60], pegging the quality of electricity supply to that of Victoriaborg (Ministries). However, the sensitivity to power interruptions here is relatively high since most business practices here are office-based and cannot function without electricity, similar to those at Victoriaborg (Ministries).

At home, wealthier residents were found to use more electrical appliances in their daily activities compared to poorer residents. Recent studies in Tema, for example, indicate a direct link between electricity use and income, whereby an increase in income leads to an increase in the number of electrical appliances owned and an almost 2 kWh rise in electricity consumption [61]. A facilities manager of a high-end apartment building highlighted this point by stating:

> "Here, they 100% depend on electricity, so when the light goes off, it really inconveniences them because they will need water (i.e., electricity for powering the water pumps to give them pressure), to cook (because only electric stoves are allowed), using the washroom requires power. The way the place is designed, you cannot easily get fresh air. So mostly they depend on ACs and all that. Because of the kind of people that we are dealing with (i.e., mostly expats and elites) […] because with here, if it goes off or if you delay for even like three minutes, they (tenants) come at you (i.e., complain and demand for power) […]. with their foodstuffs and everything in the fridge […] and with the heat also, some can't cope. They don't use gas, everything is electricity. Everything that they do, their day-to-day in the apartment needs electricity"
>
> (Interview 1, 2022)

Despite the low exposure to power interruptions, many residents and businesses have installed backup generators. During the field visits these were often visible on the premises. As the facilities manager puts it:

> "We have a standby generator which comes on automatically […] within a minute or two, then the standby generator comes on for them to have lights […] If it fails, we inform them […] But, if after three–six hours it does not come on, we inform them and then we just have to find an alternative, maybe rent a generator that can give them power. But it only happened once that we had to rent a generator"
>
> (Interview 1, 2022)

In an interview with a local government official, he stated:

> "Many of the people in this area are rich. Rich people always have their backup generator except for the government part (civil servants' enclave). Companies also have generators."
>
> (Interview 5, 2019)

Another respondent added

> "The people who do not have strong generators, to support their appliances, they take some off (disconnecting some appliances e.g., fridge or air conditioner)."
>
> (Interview 2, 2022)

As evident from the responses above, everyday practices generally remain the same when exposure to interruptions is low. Simultaneously, using backup generators in place of grid electricity is perceived as the ultimate adaptive capacity. Once a business or household could afford a generator, all other practices could remain and function as usual. Backup generators therefore sustain everyday practices as electricity would and restores urban functions and practices without the need to alter them.

4.2.4. Middle-income residential neighborhoods

Energy use and adaptive practices in times of electricity blackouts are more nuanced in middle-income neighborhoods like Achimota and Lartebiokorshie. Predominantly residential, both neighborhoods have commercial retail businesses and services along the major streets. Both neighborhoods are planned with integrated infrastructure networks. Urban development here is consolidated with high building density and low to moderately-high-rise building types.

Networked electricity supply is ubiquitous in both neighborhoods. However, while respondents in Lartebiokorshie complained of erratic power supply, Achimota reported a stable energy supply. According to the *Dumsor* report of 2015, electricity was available in Lartebiokorshie only 46.8% of the time, contrary to Victoriaborg and other rich neighborhoods [60]. Back-up generators here are less prevalent than Victoriaborg and Airport-Residential-Area. Few residents have installed but rarely use them, while others have portable generators for times when electricity use is critical during a power interruption (Resident 11, 2019). As this respondent added:

> "Just waiting for the power to return. I have a generator but am not using it right now. I feel it's a lot of work pulling it out of storage and

setting it up, going to buy fuel for it, and switching it on because the power could be back on any minute. I only use it when the outage is certain to persist for a longer period and I have some work to do. Many residents here go to work during the day and even at night, only a few people use generators in their homes in this area. So, we are just waiting for the power to return"

(Resident 11, 2019)

In middle-income residential neighborhoods, specific office-based businesses had installed their own generators. In one commercial building in Achimota, which housed a variety of businesses, while none of the retail shops in the building had a generator, other businesses within the same building, including a foreign exchange bureau and two banks, had generators and were using them. One resident in the area stated:

"Almost all the fuel stations, banks, and some financial institutions use generators"

(Resident 11, 2019)

In both neighborhoods, generators were often visible on the premises and used during an interruption (at the time of interviews). However, small businesses that equally needed electricity to function but could not procure a generator were disadvantaged. One example is a copy shop in Lartebiokorshie where printing, photocopying, and scanning services were forced to stop. In an interview with the owner, she stated:

"We had no knowledge of this outage. It's been off since morning. It is my own business. We can't do anything. We just have to wait. We have no generator and there is nothing we can do"

(Resident 15, 2019)

In terms of cooking and food preservation practices, an Achimota resident reported that his fridge remains cold and preserves food for up to twelve hours without power (Resident 11, 2019). However, this depends on how frequently it is opened, how long it stays open, and the room temperature. Family members are mindful of opening the refrigerator too frequently and avoid keeping it open for long durations. Residents at Lartebiokorshie stated:

"As for cooking, we can cook. Because we use gas and sometimes charcoal. But we can't use the blender[…] we just use 'ayua'(an earthenware bowl for blending ingredients) or we chop them"

(Resident 16, 2019)

We use gas and charcoal. But mostly charcoal. If the power outage lasts long, we warm the food (i.e., food stored in the fridge) so that it doesn't spoil and we cook raw food. Otherwise it will spoil and we have to throw it away […]. We don't have a generator so we just wait. We have a rechargeable lamp.

(Resident 1, 2019)

From these accounts, it is apparent that with equal exposure and sensitivity to power interruptions, poorer urban residents are more vulnerable than affluent residents, particularly where electricity is needed to maintain functionality. However, by detaching certain practices like cooking from electricity, such practices are maintained.

4.2.5. Low-income residential neighborhoods

An estimated 58% of Accra's residents live in low-income residential neighborhoods [62]. Kwashieman is one such neighborhood, with commercial retail and services along its major streets. The neighborhood is comprised of both planned and informal enclaves, an unplanned and historical native settlement, and an extended planned neighborhood area. Urban development here is consolidated with high building density and low-rise buildings. The electricity network is ubiquitous, although there are connectivity challenges in the unplanned parts (Interviews 3 & 7, 2019). Many residents live in multi-family 'compound houses' with shared connections and metering with other tenants. Residents here reported frequent power cuts and low voltage (Interview 3, 2019). From the *Dumsor* report, Kwashieman was supplied power only during 44.8% of the two-week period [60]. Despite the relatively high exposure to power cuts, residents here do not own or install backup generators because backup generators are too expensive, and many of their daily energy practices do not require electricity. Instead, portable generators are rented from commercial vendors when electricity is needed during a blackout (e.g., for special occasions including social events like weddings, naming ceremonies, etc.) (Interview 3, 2019).

The level of sensitivity to power interruptions varies depending on specific practices. For example, several low-income respondents do not use refrigerators to store food (Residents 3 & 12, 2019). Consequently, food storage practices do not need to be altered. Preexisting socio-economic conditions preclude them and limit their electricity use. While they are not affected by 'shocks' of electricity disruptions, access was diminished.

Non-residential energy practices in this neighborhood also presented valuable insights. A dressmaker in Kwashieman stated:

"I use both [referring to her sewing machines]. Normally, I use the electric one. But when the light goes off, I use the manual one. The same with ironing. I have the box iron too. It uses charcoal. Sometimes, I use the time to do cutting so that I can sew later when the light is back on."

(Resident 12, 2019)

This reveals how the frequent disruptions are factored into her work practices. Simultaneously keeping both manual and electric equipment and knowing how to use them enables her to keep working even when electricity flow is interrupted. Also, the flexibility to alternate between electricity-dependent and independent routines increases her adaptive capacity to disruptions. She could not afford a generator to power her electric sewing machine, and, as a result, adapts her practices.

4.3. Adaptive capacities of everyday practices

Having examined the spatially differentiated exposure, sensitivity, and adaptive capacities of urban residents in Accra, we now turn to different everyday practices. Here, we discuss specific cooking, lighting, communicating, and indoor cooling practices and the responses which enable such practices to be maintained during power interruptions. We also discuss waiting as an adaptive strategy.

4.3.1. Cooking

For cooking practices, there is a diverse range of energy sources available, which limits the need for electricity and therefore, the sensitivity to blackouts. Maintaining access to multiple fuels enables urban dwellers to switch from using electricity to other forms of energy. Apart from using electronic appliances (e.g., blenders, microwaves, water heaters, rice cookers), which is generally more common for high-income groups than for low-income groups, none of the respondents interviewed for this study used electricity for cooking except for residents of the apartment building in Airport-Residential-Area. Table 1 below, based on national data sets, gives a broader indication of the dependence of lighting and cooking practices on electricity. In 2017, only 0.6% of households in Accra used electricity for cooking, a decline from 1.0% in 2010. Gas and charcoal are more commonly used for cooking practices. Some low-income residents cite cost as the primary factor in their choice of cooking fuel:

"I use charcoal for cooking. I am yet to begin using gas.[1] To use gas, I must buy a burner and a cylinder so am still saving money for it."

[1] Cooking with electricity is generally considered expensive while gas is deemed a viable and sustainable alternative to electricity and so residents generally pursue a transition from charcoal to gas, and not electricity.

Table 1
Selective household energy use in Accra (Source: [52,63]).

Lighting (%)	Electricity (grid)	Electricity (private generator)	Gas lamp	Solar	Kerosene lamp	Flashlight/ Torch	Candle	Other
	89.1	0.6	0.1	0.1	4.3	3.5	1.9	0.3

Cooking (%)	Electricity	Charcoal	Gas	Firewood	Kerosene	None, no cooking	Other
2017	0.6	39.5	51.2	0.5	0.3	7.6	0.3
2010	1.0	45.6	42.9	1.6	1.2	7.2	0.8

(Resident 12, 2019)

"For about a year now, I cannot buy gas, it's too expensive. Everyone in this compound uses gas but I use charcoal." (Resident 3, 2019).

Many inhabitants own and use traditional cooking equipment as well (e.g., traditional blenders, coal pots and charcoal, often kept in storage for grilling or roasting by high-and middle-income residents who use gas regularly). These enable residents to adapt their practices of 'how' they cook. Instead of heating water with an electric kettle, water is heated with a gas or charcoal stove in a saucepan or pot. Instead of a microwave oven, alternative cooking practices are used. In Kwashieman, one respondent explained:

"I live in a compound house. We are about four people. We all use one prepaid meter […] So, before you start cooking (with a rice cooker), you have to check the prepaid credit. So, that the food doesn't cook halfway and the credit runs out. […] and during the Dumsor time, you must check if you are scheduled for a power cut before using the rice cooker."

(Resident 13, 2019)

Any indication of possible disruption causes a shift away from electricity use. The option to switch cooking practices to different energy sources and devices creates a sense of stability for many respondents. Also, cooking practices, which already do not require electricity, result in reduced sensitivity to power interruptions, where cooking needs to be maintained. At the same time, they provide opportunities for coping with and adapting to power interruptions whenever they occur.

4.3.2. Lighting, communicating, and cooling

Contrary to cooking practices, lighting practices in Accra depend more on electricity. As seen in Table 1, 89% of residents depend on electricity for lighting; this includes all residents engaged in this study and all income groups. Communication, such as with mobile phones, was found to be more flexible in terms of sensitivity due to their batteries. Communication practices are only disrupted when mobile phone batteries run low and grid electricity is simultaneously unavailable for recharging. For indoor air cooling, many low-income earners use fans, while high-income earners and corporate businesses use air conditioners—both of which need electricity to function.

Adaptive practices generally include the use of energy-service-specific technologies such as rechargeable lamps for lighting and power banks for charging mobile phones and rechargeable fans (Interview 3, 2019). Some of these devices are used for multiple practices because they provide more than one energy-service. For example, lighting or ventilation technologies often offer possibilities to charge mobile phones. Residents also reported using mobile phones for lighting during blackouts (Resident 13, 2019).

Many residents adapt through practices of 'maintaining charge' of battery powered devices. This means that devices are recharged while grid electricity is available and in anticipation of future power interruptions. However, when power interruptions last longer than a day, residents charged devices at work, for use after returning home (Interview 3, 2019). This speaks to the uneven spatial experiences of blackouts discussed in the previous sections. In Kwashieman, residents sometimes ask friends and relatives to help them charge their devices (Interview 3, 2019). Residents would also get these devices charged at a 'recharge station' [see 64], such as the one located close to the Achimota market, operated by a private individual. In a discussion with him, he stated:

"I have been doing this business for a long time, over ten years now, even before Dumsor time. I charge mobile phones, but I can charge other devices too—laptops, rechargeable lamps, whatever you want to charge. Some people in the market don't have 'light' [electricity] in their shops, so if the phone goes off, they come to charge. Others don't have chargers, so they come here to charge. Sometimes, people come to this area and their phones go off and they just want to charge a little, so they come here"

(Resident 20, 2019)

His response indicates that the practice of charging devices at the recharge station existed even before the exposure to severe power interruptions (see also [64]), necessitated by the in-access to electricity of some shops in the marketplace. Although he relied on networked electricity for his operations, he also had a small generator which he used during power outages, to continue providing this service to the public. Such charging practices enable the maintenance of lighting, communication and indoor air-cooling practices.

4.3.3. Waiting for electricity as an adaptive capacity

Waiting for power to be restored is another strategy that residents practice across different socio-spatial and socio-economic configurations, either as the only resort or as part of several available alternatives. This is sometimes indicative of vulnerability as in the case of the copy shop in Lartebiokorshie which was rendered idle and the day's income was lost (Resident 15, 2019). This was also the case in Kwashieman, where one business lost a day's work to the competition:

"When we have to spray the entire car, we take it to the oven. There are two places, one doesn't have a generator. So, when the light is off, they have to wait. But, the other one has a generator, so they continue working, and we go there"

(Resident 13, 2019)

This example reveals the varying capacities to respond to disruptions. In other cases, waiting for power to be restored is a choice urban residents make, particularly low- and middle-income residents; this is a calculated understanding of the situation and a strict management of personal resources, namely money, time, and energy. This also indicates the high costs of accessing electricity during a blackout. However, an individual's capacity, willingness, and need to bear that cost are constantly re-evaluated (see Resident 11, 2019 above).

Finally, the use of generators has evolved into a distinct form of adaptive practice. As relayed by Resident 11 in Achimota, adaptive capacities in generator use involve both bodily and mental activities of "pulling it out of storage and setting it up" if it's not a fixed, on-site installation. Installing or setting up a generator requires specific equipment know-how. Powering the generator requires additional activities including purchasing and hauling fuel, filling the fuel tank, and then starting it up. Additionally, the generator needs to be connected, whether to a single device or an entire building. Backup generators are either manually or automatically operated; in the latter, a power outage triggers the backup generator to start. According to respondents from

Victoriaborg and Airport-Residential-Area, the use of backup generators requires more complex logistics.

Clear evidence of the spatially differentiated quality of electricity access can be seen that is relative to the splintered urban development patterns between poorer and richer neighborhoods and between residential and non-residential areas. Despite the uneven exposure to blackouts, there are also uneven sensitivities among urban residents based on their specific everyday practices, the requirement of electricity for those practices, and what alternatives may be available beyond electricity. Consequently, adaptive practices vary but are also uneven. This unevenness, occurring across different socio-spatial contexts within the city, correlates with income (resource availability) and the determination of criticality (based on the need for electricity for specific practices). Temporal shifts in practices as a means of adaptation are based on the specific tasks that must be performed at that moment as well as on whether electricity was already an ingredient of those practices while it was available.

Energy practices are therefore predicated on the reliability of electricity supply, coupled with accessibility issues like cost and affordability. Some functions and spaces are prioritized and privileged with a more reliable supply, and, as a result, those functions can continue uninterrupted or at least experience minimal disruption. Individually, specific functions and practices are also maintained through the use of backup generators. Ironically, while those with reliable supply (i.e., high-income areas and businesses) rely more on backup generators, those with a more precarious supply of electricity tend to rely more on behavioral changes and the alteration of practices. The anticipation of (and vulnerability to) electricity disruptions is also higher among lower-income groups, which feeds back into the materiality of the socio-technical configurations, and makes analyzing resilience difficult and complex.

5. Discussion

In this paper, we used practice theory as a lens to understand urban resilience to electricity disruptions among Accra's various urban groups. We shifted the current focus in conventional resilience debates away from the preparedness of key institutions such as governments and utility providers to 'respond' to 'shocks' [26,27] and placed it on electricity users across various urban functions, namely residential and business areas. Although similar studies on household preparedness for electricity disruptions exist, these have mostly been conducted in Global North contexts where disruptions are rather rare. Our focus on Accra therefore brings a Southern perspective to these debates and from a context where disruptions are somewhat normalized. The advantage of this approach is that it moves away from viewing 'users' as passive consumers of networked services, who are susceptible to disruptions, and instead reveals the agency of residents in building resilience through adaptive practices and strategies. This heeds the call of researchers like Oudshoorn & Pinch [65], who consider users as active participants in the development and advancement of technology. It also furthers the vast body of research, which points to users as co-providers of critical services in Southern cities (e.g., [8,12,14]) by revealing how socio-technical assemblages are co-opted by urban residents, in negotiating their own resilience. The study further builds on the work of researchers like Aidoo and Briggs [54] and Nduhuura et al., [66] by highlighting not just the unequal exposure to and impacts of blackouts, but also the differentiated adaptive capacities of urban residents.

Our findings corroborate those of Silver [8]: poorer residents are unable to access costly technologies like backup generators and therefore resort to alternative ways of maintaining everyday practices. This generally reinforces disparities between the poor and social elites across different settlements and urban functions. Moreover, it can also be argued that 'premium spaces' are systemically protected from infrastructural disruptions. At the same time, although the inability to acquire costly technologies can be perceived as vulnerable, there are considerable capacities embedded in the alternative strategies of poorer residents, which reveals more nuance in disruption response. Analyzing people's practices shows that resilience is negotiated based on three factors. First, the urgency of particular practices (whether business or domestic), encourages people to find alternative ways to accomplish such practices (e.g., the dressmaker in Kwashieman). Secondly, the criticality of electricity for some tasks (such as the industrial plants at North-Industrial-Area), makes such practices more sensitive to electricity disruptions and so encourages a specific kind of adaptive capacity (e.g., alternative sources/continuation of electricity, especially backup generators). This shows that electricity is a specific form of energy with defined utilities which cannot always be easily substituted. Without a generator, as the copy shop at Lartebiokorshie shows, work is halted until power is restored, which shows the vulnerability of many business activities. Third, income (resource availability) plays a significant role in determining how a person or business builds adaptive capacity. The inability of poorer residents to afford electrical appliances or limiting their electricity consumption to avoid costly electricity tariffs means that most routine practices do not depend on electricity use (e.g., Residents 3 and 12, 2019). As such, they can maintain such practices with or without electricity. Despite the high dependence of wealthy residents on electricity in enacting everyday practices, their ability to afford backup generators also means that daily routines are maintained. Resilience practices are, therefore, highly selective and shaped by temporal understandings and determinants of criticality and sensitivity of individual persons, institutions, and practices. At the same time, the 'heterogeneity' and unevenness of such responses highlight how deeply uneven socio-spatial conditions—alongside exposure and susceptibility to disruptions—play a crucial role in how energy practices are affected and their potential to build resilience.

Adaptive practices arise from a disposition of preparedness, both materially and economically. Preparedness for power interruptions, as evidenced in Accra, challenges dominant conceptions which focus on higher-level planning and early warning systems [5]. While researchers have argued that households are better prepared for possible future disruptions after experiencing a significant disruptive event [4], our study reveals that living through more frequent critical service disruptions leads to two outcomes. First, residents are prepared to maintain essential practices and urban functions in times of disruption (e.g., Interview 16, 2019). Second, decision-making surrounding energy and electricity use and daily practices are organized in ways that are independent from the power networks to prevent future disruptions. As with cooking, for instance, the detachment from electricity as the primary cooking fuel by most households (see. Table 1) means that cooking is not disrupted by blackouts and hence, does not require building additional capacities. Besides such long-term disconnection from electricity, there are also temporary detachments based on reigning circumstances like the case of the Kwashieman resident. Therefore, previous power interruptions, reach beyond the manifestation of embedded systemic vulnerabilities, to reveal the critical parts of everyday practices that need to be maintained during blackouts and the possibilities for resilience. When adaptive practices are performed as frequently as they are in Accra, they become embedded in social cultures and the fabric of a place.

While the adaptive practices of urban residents create a semblance of resilience in Accra, there is a need to critically reflect on these forms of resilience. The overarching focus in mainstream resilience debates on dimensions of exposure, susceptibility, and adaptability, for example, fails to critically reflect on the embedded inequalities. Practices reveal the limited focus in resilience debates on the precarity and inequalities surrounding service provision in geographies like Accra. Through a practice lens, this paper reveals how responsibility for ensuring resilience is also shifted to urban populations. Therefore, there is a need to pay critical attention not just to the goal of maintaining urban functions, but also to the (long-term) implications of such practices. It thus presents critical insights into how adaptive capacities can be both positive and

problematic simultaneously. More intra-urban comparisons are thus needed to better understand the inequalities in dealing with critical infrastructure disruption within cities to pave the way for more realistic approaches to urban resilience.

6. Conclusion

In this paper, we argue that, by examining the energy practices of urban residents, we can better understand urban and critical infrastructure resilience and the alternative pathways to it. By engaging with people's adaptive practices, we reveal the dialectic nature of how individualized efforts to increase resilience to critical infrastructure disruptions highlight underlying inequalities in energy access. Thus, adaptive practices are a double-edged sword. We showed how variegated practices of adaptation are both useful and practical avenues for urban resilience, but also how such practices of resilience can be challenging and problematic. Additionally, the cultural embodiment of energy practices reveals how resilience and vulnerability are contextually sensitive because of the different ways of accomplishing everyday tasks and the practices which make up everyday life.

Through an intra-urban comparative approach, this study reveals the spatialized and differentiated levels of exposure, sensitivity, and adaptation to blackouts. In so doing, we further highlight the nuances of different socio-spatial configurations and varied socio-economic conditions in the city and the individualized strive for urban resilience. We contend that resilience is predicated on—and necessitated by—systemic socio-economic and socio-spatial inequalities. These continuously deprive poorer urban residents access to critical electricity services while creating conditions that reinforce these inequalities and the disruptive tendencies of the network. When economic elites continue to enjoy premium networked services and have the capacity to produce their own electricity during disruptions, there is little incentive to build more resilient systems that alleviate inequalities and create a more just society.

Beyond reiterating the highly unequal geographies of electricity in Accra, our study highlights the specificity of electricity. The focus on practices highlights the differentiated criticality of electricity as an *ingredient* of specific everyday practices. For example, lighting and printing are more dependent on electricity than cooking. Relatedly, some practices (like cooking) can be more easily adapted to other forms of energy as opposed to printing and photocopying or industrial manufacturing and many crafting practices.

In addition to the critical insights revealed for both practice theory and resilience research, this study also contributes valuable insights for other research areas such as sustainability transitions and urban and energy (electricity) governance. The continued reliance on unsustainable forms of energy like charcoal and firewood by the poor and the resort to diesel generators by the rich, in response to the repeated disruptions of networked electricity services, poses fundamental challenges to more sustainable energy transitions, thereby calling for a more critical assessment of how resilience materializes (see also [40]). Similar to Hasselqvist et al. [40], we caution that common resilience practices might have detrimental environmental consequences. These consequences, and the inequalities revealed, call for more critical perspectives on the governance of urban and infrastructure resilience. They also raise questions on the responsibility for, and the accountability of, more sustainable and just resilience responses.

Declaration of competing interest

The Authors declare that there is no conflict of interest.

Data availability

The authors are unable or have chosen not to specify which data has been used.

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Appendix A

Cited interviews

1. Interview 3, 2019: Local government official
2. Interview 5, 2019: Local government official
3. Interview 7, 2019: Official, Electricity Company of Ghana
4. Interview 10, 2019: Official, Electricity Company of Ghana
5. Interview 11, 2019: Official, Land Use and Spatial Planning Authority
6. Interview 13, 2019: Official, Accra Metropolitan Assembly
7. Interview 16, 2019: Manager, plastic processing company
8. Interview 18, 2019: Manager, Online retail company
9. Interview 19, 2019: Manager, oxygen manufacturing company
10. Interview 21, 2019: Official, Architects and Engineering Services Ltd.
11. Interview 1, 2022: Facilities Manager, Airport Residential Area
12. Interview 2, 2022: Official, Ghana Real Estate Developers Association -GREDA
13. Resident 1, 2019: Lartebiokorshie
14. Resident 3, 2019: Kwashieman
15. Resident 5, Airport Residential Area
16. Resident 11, 2019: Achimota
17. Resident 12, 2019: Kwashieman
18. Resident 13, 2019: Kwashieman
19. Resident 15, 2019: Lartebiokorshie
20. Resident 16, 2019: Lartebiokorshie
21. Resident 20, 2019: Achimota

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