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Rethinking the off-grid city

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ABSTRACT

There has been a resurgence in interest in the off-grid city in the Global South, and on how it functions as a collection of places, lived spaces, and dynamic infrastructural configurations. As scholars and practitioners working in the South African off-grid urban context, we identify four areas for further elaboration in off-grid urban research: 1.) redefining academic and practical understandings of the “grid”, ultimately moving to rethink its meaning in the city; 2.) the need to decolonize and decenter the relationship between global and technocratic urban development “standards”, practices and discourses, and the granular off-grid context; 3.) the imperative of critically engaging with narratives of inadequacy and imperfection as often applied to off-grid, informal urban spaces; 4.) the priority of moving towards a needs-based approach to off-grid development, focusing on urban knowledge co-production with local communities to ensure their needs and interests are met.

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Introduction

There is increasing interest, in urban studies and related disciplines, in understanding the off-grid city and its configurations. For example, Munro’s (2020) recent article in this journal, adopts a Global South focus, and has usefully argued for a decentering of urban research so as to consider off-grid spaces not in light of a “failure” to connect to the modernist, formal and centralized grid, but as functioning places, even if marred by imperfections and inadequacies in service provision. These sentiments are echoed by other scholars such as Kovacic et al. (2021) and Azunre et al. (2021) who argue that off-grid spaces are not imperfections but rather localized sites for developing and promoting sustainability. Engaged in working in the off-grid urban context in South Africa, we offer key points for further elaboration within an urban research agenda on the off-grid city.

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First, we argue that the conceptualization of what counts as the formal “grid” needs to be expanded. In today’s urban scholarship, the “grid” is often taken to mean a single technical infrastructure of service delivery: for example, the energy or water grid. We push for a reconceptualization of the “grid” to include the visible and physically tangible grid (such as energy), the invisible grid (data and digital infrastructures, which tend to be overlooked in contexts of informality), and social grids (including people as infrastructure, social media networks, and the like) and their longstanding presence in cities of the Global South. While urban scholars identify the heterogeneity of urban infrastructures in the informal city (Koepke et al., 2021; Lawhon et al., 2018), there is room to expand and broaden this conceptualization to include all types of urban infrastructures cutting across physical, social, and digital in relation to advancements associated with visions of the future city (Watson, 2015). At the same time, it is key to address service delivery narratives so that the government-grid nexus is enlarged to encapsulate off-grid service provision, where it is constituted by one or more physical, social and other forms at any one time.

Second, we respond to Munro’s (2020) critique of technocratic and abstract approaches to energy service delivery. This critique is based on the call for understandings of the Southern city to be grounded in rich qualitative approaches encompassing a range of formal and informal practices and involving the agency of the poor. Though this argument has clear importance, we argue for a non-binary, more nuanced view of the relationship between off-grid city and global and international development targets and discourses (from the Sustainable Development Goals (SDGs) to the Paris Climate Agreement, to the New Urban Agenda and beyond) (Caprotti et al., 2017). There is a need to understand and value globalized standards and how they relate to a diverse and varied set of urban contexts and not simply write them off as metrics imposed “from above”. At the same time, there is a clear need for a decolonialisation of urban scientific knowledge production to take into consideration the “distinctive” ways in which urban life is expressed in different cities (Robinson, 2005, p. 6). This, we contend, should not just take into account, but actively involve local off-grid urban communities in producing metrics and needs assessments. In other words, the “bricoleurs” referred to by Munro (2020), or people who realize their livelihoods through the creative use of materials, or (as we later explain) through “citizenship-in-action” activities (Lemanski, 2019), do not simply reconstitute energy (and other) networks differently to the formal grid, but have to be considered as knowledge producers in a broader, comparative urban context of which they are a constituent part.

Third, we argue that even though imperfection may be seen as a defining feature of off-grid spaces or indeed the Global South city, it is important that urban geographers engage more critically with narratives of imperfection and inadequacy. Such narratives, while rooted in a useful attempt to be sensitive to the local urban context in its granularity and complexity, may unwittingly underpin or gloss over long-standing politics and deeply rooted narratives that see off-grid urban spaces such as informal settlements as unchanging, suboptimal, and more importantly unchangeable realities. Indeed, these narratives often identify the informal city as a set of spaces with “herculean problems” and rife with poverty, disease and environmental contamination (Roy, 2011, p. 223). As Brand and Dávila (2011) showed in their work on Medellín’s aerial cable cars, highly visible infrastructural interventions can sometimes have the effect of simply

normalizing informality seen “from above” in the city. Similarly, scholars such as Caldeira (2020) describe how fear and uncertainty concerning informal spaces are circulated, influencing city planning and urban development. With the intention of being politically progressive, narratives that simply stop at the description of imperfection and inadequacy may in fact be, at their very core, deeply regressive and work against the needs of local communities. The recognition of a need for change and urban improvement does not necessarily need to align with normative modernist-inspired notions of what the city could or should look like.

Fourth, and building on the above point, we claim that urban scholars focusing on off-grid urban contexts should push for a refocusing of research agendas away from provision of physical infrastructures towards needs-based services. While a service provision focus is generally associated with governmental, grid-reliant discourses, a “needs” focus provides an entry point to include local communities in producing knowledges about what is required and important in a specific off-grid urban setting. Meeting needs through self-help and/or through private sector interventions (including where these interventions are coupled with state support) can enable new avenues of citizenship, where residents of the informal city can articulate their rights in the city through urban infrastructure services (Alvarado, 2020; Lemanski, 2020). Following a needs-based approach also includes a willingness to recognize the articulation of agency at multiple scales (Caprotti et al., 2020), and the involvement of actors at the community level as well as at sectoral (private sector, such as utilities and financing firms) and governmental (from municipal to state level departments) and non-governmental levels (such as advocacy, environmental justice, or informal settlement community representative groups). This may be uncomfortable to both policymakers and scholars, but it is sorely needed in efforts to meet international development targets and discourses and supporting meaningful change. Furthermore, these initiatives constitute an essential avenue through which subaltern groups’ needs are met in the city, where they take action to (re)negotiate their rights to live a decent life.

Redefining the grid

Our first point relates to the need to reconsider how the notion of the “grid” is deployed. There exists a continued tendency to define “the grid” as a single and binary technical infrastructure defined by delivery of a specific service (such as energy) and identifiable via its materiality and visibility. While urban geographers have analysed the political nature of grid infrastructures (Lemanski, 2020; Luque-Ayala & Silver, 2016; Silver, 2014), attention must also be given to the interrelationships between grid and off-grid infrastructures and the multiplicity of these infrastructures (Munro, 2020). In the case of off-grid energy in urban areas in the Global South, for example, the off-grid may comprise “illegal” as well as no connections to the formal grid; “illegal” but unusable connections; the use of “clean” energy infrastructures such as solar home systems and liquefied petroleum gas (LPG); the often concomitant use of less “clean”, unsafe and unhealthy forms of energy such as paraffin, charcoal, and candles; and various other forms of energy delivery technologies such as batteries and portable diesel generators (Koepke et al., 2021; Kovacic et al., 2021). In turn, many of these largely informal infrastructures are based on off-grid networks (for example, around the provision, transport, sale and

resale of paraffin) that constitute, we claim, informal grids of their own. Thus, there is a need to continue deepening engagement with the grid by focusing on its heterogeneous, often messy, sometimes non-functioning or disrupted, and almost always unequal nature.

Our conceptualization of the off-grid city is rooted in postcolonial urban studies, which call for the decolonization of knowledge on the city (Roy, 2016). Under this paradigm, mainstream notions of urbanization are identified to be largely associated with Global North perspectives and practices around infrastructure, which tend to frame the development of the Southern city through a “grid” perspective. Building on this paradigm, we set out ways to re-center knowledge by engaging with messy, glitchy, non-functioning, and disrupted nature of the off-grid city to appreciate the many diverse and dynamic ways cities and their inhabitants partake and are involved in the “conflicted arenas” of social and economic life (Robinson, 2005, p. 1; see also Harrison, 2006). In many cases, de-centering knowledge requires a shift in conceptual and methodological approaches to engage with the everyday materialities of urban infrastructures (McFarlane, 2011, p. 382). Considering the diversity of the off-grid city plays an essential role in breaking down notions of uniformity, or totality (Caldeira, 2020) and modernity (Robinson, 2005), which are deeply embedded in mainstream ideas of state-led infrastructure management and associated forms of control.

When broadening the notion of the “grid”, it is also key to take into account the tendency to equate some formal “grids” with specific technologies, and off-grid infrastructural provision with others often perceived as less desirable (Shoniwa & Thebe, 2020). A case in point is the energy grid, where the formal grid tends to be perceived as universal, covering a significant geographical area, and signifies fossil fuel-based energy provision and a high individual level of energy consumption, while off-grid provision tends to mean decentralized and “clean” energy (such as solar home systems, or solar microgrids). This, in turn, leads to the need to (re)consider what the grid means in the context of informality and off-grid spaces in the Global South, where desirability and use is variable (Makonese et al., 2018), thus signaling the need to take into account the multiple interactions and operationalisations of the formal and/or informal grid in these spaces (Munro, 2020).

A recognition of this interrelationship between formal and informal also enables analysis of the politicization and construction of socio-political imaginaries and narratives around these juxtaposed infrastructures (Cross, 2019; Haque et al., 2021; Samarakoon et al., 2021). A case in point is the continued production of narratives around “clean” solar power-based “solutions” for informal settlements: from solar lamps, to solar home systems and microgrids. These technologies are often presented through techno-utopian discourses (Samarakoon et al., 2021). Moving past such discourses enables a consideration of the realities of the production of the off-grid (see Cross, 2019), and of informal settlement communities’ perception of these technologies as “second-rate” and “lesser than the formal grid” (Haque et al., 2021).

Based on this, the “grid” can usefully be reconceptualised in line with a decentering of urban knowledge, so that a redefined grid includes the visible and physically tangible grid (such as the energy grid), the invisible grid (data and digital infrastructures), and social grids (such as those around social media networks). There is, for example, little research into how increasingly important but largely invisible digital data infrastructures (Onyango, 2019) can be integrated into an understanding of off-grid spaces. These

infrastructures often provide coverage in urban areas that are sometimes “off-grid” in other ways (through having no formal energy or sanitation grid connections, for example). Multiple digital data providers may be active in off-grid spaces, most often in qualitatively different ways (therefore requiring residents to switch between different providers, sometimes multiple times a day, depending on location). Furthermore, digital infrastructures carry more than data packets and media content, they are also key to multiple dimensions of wellbeing, such as jobs and other opportunities for income, health, and enabling social networks (often inter-city and cross-border). This emphasis, then, also helps to broaden the understanding of what a grid *does*, moving past simple point-to-point delivery of a particular service for consumption, and to include more dynamic societal processes that involve social data and mechanisms such as the seeking and exchange of information (on jobs, health, politics, culture, and a host of other issues). This redefinition of the “grid”, then, offers a way to make visible the overlapping, inter-connecting, and mutually reinforcing nature of different infrastructures across energy, digital, and social, and show their importance for understanding off-grid spaces.

Decolonizing and decentering urban “standards”

The off-grid city often seems to sit uncomfortably with formal urban areas, if not in practice then in terms of its integration into international, national and municipal policy discourses and interventions. There has been a proliferation of international development initiatives and targets, such as the UN’s Sustainable Development Goals (SDGs) and the New Urban Agenda, as well as other projects such as the Paris Climate Agreement, which have clear repercussions on cities in the Global South (Barnett & Parnell, 2016). As Angelo and Wachsmuth (2020) point out, this is part and parcel of a broader movement towards identifying the urban as a site where challenges (from climate change to informality and sprawl) can be addressed. These global policy narratives often claim to be working to address challenges faced by the least wealthy urban dwellers. These initiatives can at times be seen as technocratic, top-down, and largely quantitative, drawing on measurement- and evidence-based approaches for demonstrating progress toward achieving their aims. They can also be interpreted as mobilizing the concept of the urban, identifying cities as key sites contributing to the achievement of globalized sets of targets and Key Performance Indicators (KPIs), while simultaneously adopting the language of people, inclusivity and of the right to the city (Martinez et al., 2021). In this context, critiques of the imposition of global standards and agendas on cities globally, and on the poorest urban areas in particular, have usefully focused on the need to view urban processes not simply through a statistical lens, but as deeply qualitative (Munro, 2020; Munro & Schiffer, 2019). This is because there is a pressing “need to situate urban understandings in rich contexts, rather than using abstract statistical snapshots” (Munro, 2020, p. 429). Recognizing this goes some way towards humanizing and deepening policy, practice and research engagement with the off-grid city.

At the same time, we caution against the pitfall of writing off (or seeming to write off) standards, KPIs, and metrics as parachuted “from above” and therefore as illegitimate ways of engaging with the off-grid city. We recognize that all attempts to reshape and engage with the city are “not neutral but deeply political interventions” (Castán Broto

& Robin, 2021, p. 2; see also Fukuda-Parr & McNeill, 2019), that can generate and deepen inequalities. At the same time, there is clearly a role, in strategies, policies, and research on urban development, for standards and metrics due to their often inherently positive and potentially progressive focus on a range of urban issues: from safety to education, equality, and the like (Fox & Macleod, 2021). Sensitively defined standards, in particular, can help the off-grid to attract more investment and governmental resource. These standards and metrics need to include the off-grid, which brings into question existing definitions and approaches. Urban research should (and mostly does) recognize this, to avoid potentially falling into a facile and retrogressive critique that sees all standards, metrics and agendas elaborated “elsewhere” as necessarily negative and exploitative. Rather, what we propose is critical engagement with the *processes* and *actor networks* (and their financiers) of urban knowledge production and its outcomes.

In this intervention, we argue for a widening of engagement with urban knowledge-production processes so as to include actors, stakeholders, and communities from off-grid urban areas themselves. This would contribute to a decolonization of scientific knowledge production so that urban scholarship not only takes into account, but actively involves off-grid urban communities in producing and actively negotiating metrics, KPIs and needs assessments: the “bricoleurs” referred to by Munro (2020) do not simply reconstitute energy networks differently to the formal grid, but need to be considered as knowledge producers in a broader, comparative urban context often characterized by uncertainty (Thieme, 2018). While modernist notions of the grid are often associated with an idealization of scientific and technological knowledge as all-powerful, it has been shown how these narratives often lead to authoritarian views of the state as the only worthwhile agential actor, and a resulting hollowing-out of civil society (Scott, 2008). A way past a binary, technocratic and top-down approach to thinking about, and engaging with, off-grid urban areas is to involve local communities in processes of co-production to understand their everyday aspects (Truelove, 2021; Truelove & Cornea, 2021) and how off-grid areas are in fact “in the making” (Amankwaa & Gough, 2021). Patel et al. (2015) and Frantzeskaki and Rok (2018) emphasize the imperatives for scholars and others, such as practitioners, to co-produce urban knowledge for “deep” transitions required to achieve basic needs, but stress the importance of involving communities themselves, especially in off-grid and/or informal spaces in the city (Siame et al., 2020).

A productive approach to decentering and decolonizing urban knowledge production in and about off-grid spaces is also emerging through the use of more nuanced, qualitative methodologies (Cocks et al., 2020). Decentering urban knowledge enables a closer engagement with site-level dynamics, rather than relying on existing notions of off-grid and indeed informality bounded by understandings from the West (Acuto et al., 2019; Marx & Kelling, 2019). Whilst not seeking to replace quantitative methods and their clear potential in forming macro- and micro-level analyses of energy practices, the use of qualitative methods (from interviews to ethnography and in between) adds depth and richness to analysis.

In this light, recent research has focused on using qualitative methodologies including narrative devices such as vignettes (Ebbensgaard, 2020), to bring to light the granularity and human, lived experience around multiple aspects of off-grid informality. Another way of looking at this is Munro’s (2020) use of four vignettes of off-grid residents living

“on”, “off”, “below” or “beyond” the formal grid in Gulu Town, Uganda, is a useful case in point. These studies herald an important rebalancing of research on the off-grid city by introducing a wider analytical lens that goes beyond a top-down, technocentric approach, and which balances multiple socio-technical configurations. In turn, by enabling qualitative accounts to emerge, these more nuanced approaches lend themselves to challenging dominant narratives around the off-grid specifically, and urban informality more generally.

Additionally, and perhaps more importantly, bringing to the fore qualitative approaches to engaging with the off-grid city humanizes such spaces rather than treating them as opaque ones, *on* which, and *from* which, data needs to be collected or “extracted” (Caprotti & Cowley, 2017). While off-grid spaces can be considered as experimental in many ways (Azunre et al., 2021) a qualitative, humanizing dimension enables a sidestepping of potential tendencies to treat off-grid communities as “problems” and/or “issues”, and to take into account the political processes involved in urban change in these spaces (Savini & Bertolini, 2019). We refer to humanization, here, as a process through which transformative change pathways can be envisioned from bottom-up and decentered perspectives that, as Skinner and Watson (2020) have argued in relation to informality in urban Africa, are aware, converse with, and take seriously specific contexts and power relations. It is at this juncture that engaging with the off-grid city can help reposition Global South urbanism more centrally: “Finding a way in which planning can work with informality, supporting survival efforts of the urban poor rather than hindering them through regulation or displacing them with modernist mega-projects, is essential if it is to play a role at all in these new urban conditions” (Watson, 2009, p. 2268).

We argue here that engaging with the granularity of off-grid communities (and with their needs as defined by communities themselves) enables radical change to be conceptualized from a grounded perspective that is rooted in ambitions of change *for* the community. Working on energy access for the urban poor, Castán Broto et al. (2017) have argued that a grounded perspective enables three key questions to be asked around (1) needs; (2) the availability of appropriate data for understanding the contexts in question; and (3) the importance of identifying (mis)matches between needs and government policy. This helps to move past a more static tendency to analyse the off-grid in the light of broader systems of oppression which although real, require addressing at a more structural level and over a longer time period than the sorts of changes that can be thought of as radical at the community level and delivered over a far shorter timeframe with meaningful implications for people’s lives. As de Satgé and Watson (2018) have shown in their study of the development of the N2 Gateway settlement project in Langa township, Cape Town, while conflicts around governance and planning are expressed at municipal and national scales, it is through engagement with the detail of conflicting rationalities around multiple stakeholders within one urban area that transformative trajectories can be identified from the ground up. The opposite has also been shown to be true: in work on the formerly informal Iztapalapa area of Mexico City, Silvonen (2021) examined how, over a 40-year transformative time span, community engagement and once-strong participatory planning practices waned, leading to failures in community participation initiatives. This, in turn, underlines the fact that to “address the frequent failure of urban planning to engage with informal urbanisation, partnerships that are resident-led or that draw on local knowledge should be pursued” (Silvonen, 2021, p. 492).

Off-grid narratives of inadequacy and imperfection

Off-grid spaces are often described as areas of the city that are lacking in several ways, zones that are inadequate, imperfect, unsafe (Angelo & Wachsmuth, 2020; Davis, 2007; Rains & Krishna, 2020). Analysis of these sentiments is well established in subaltern and urban studies scholarship on the Global South, where the “recognizable frame” of the informal city is perceived and perpetuated by both scholarly and policy literature. For example, Roy (2011, p. 231) highlights notions of inadequacy and imperfection, where conditions of informality are described as spaces of “poverty” and “habitus of the dispossessed”. For example, the UN describes informal settlements as being “spatially disengaged from broader urban systems” (UN-HABITAT, 2015, p. 3). Although this may describe infrastructural, service and socio-economic inequalities, it is less accurate when considering the deep interrelationship between “formal” and “informal” urban areas (Marx & Kelling, 2019; Acuto et al., 2019). Informality is also often linked to inadequate hygiene and increased health risks: the World Bank describes the informal settlement context as a “hotbed of viral spread” (Lall, 2020, np.), threatening both their own residents and the broader city. Thus, informality is often understood through recognizable frames of imperfection and inadequacy both in itself and in relation to its supposed disconnection from the wider city, while at the same time being undesirable and a repository of potential ills and dangers that can threaten that self-same (and presumably not so disconnected) city (Kovacic et al., 2021). A corollary of the above narratives, outlined by Roy (2011), Caldeira (2020), and Kovacic et al. (2021), is that it is informal settlement residents themselves that become seen as both embodiments of urban “issues” (inequalities, poverty, negative health and educational outcomes), and as vectors for negatively affecting “formal” urban residents.

Urban scholars have moved some way beyond the reproduction of such narratives. In other words, they have begun challenging “apocalyptic and dystopian narratives” of the informal city (Roy, 2011, p. 223). Munro (2020, p. 444), for example focuses on how the energy bricoleurs of Gulu Town, Uganda, craft “imperfect, yet functioning” lives. This places the focus less on what is missing, or lacking, from off-grid and informal contexts, and more on recognizing the complex and lived realities existing in these spaces, while not underplaying the often harsh and detrimental conditions that these realities encompass. At the same time, we argue that there is a need for caution when using narratives that deal with notions of inadequacy and imperfection, even if from a position of sensitivity towards local informal contexts. This is because such narratives, while aiming to be sensitive and constructive, could reproduce notions of informality and of off-grid spaces as unchanging, and therefore potentially static, where its unplanned and evolutionary aspects serve to define them in their own right (Banks et al., 2020). When urban analysis stops at description, however rich, of imperfections and inadequacy, the risk is that local communities’ needs and aspirations are side-lined in an attempt to valorize these communities’ current struggles and experiences.

A needs-based approach to the off-grid city

The notion that urban research must do more than recognize the granularity and qualitative richness of off-grid informal spaces, enables the analytical lens to be focused away

from basic service provision, or limited provision of physical infrastructures. Rather, a changed focus involves bringing to the forefront the imperative of identifying and pursuing services that are needs-based. As Acuto et al. (2019) point out, the former (basic, physical infrastructural provision) can generally be associated with the sorts of governmental, grid-reliant narratives that are, in turn, based on those technocratic and top-down approaches critiqued above, where the “formal” network is considered as the starting point and endpoint for analysis. The move from a largely supply-based approach to a more nuanced perspective that takes into account the co-production of needs by multiple stakeholders has been recognized in some fields of research, notably within urban energy poverty (Bouzarovski & Petrova, 2015) and infrastructural citizenship (Alvarado, 2020; Lemanski, 2019, 2020), including South African scholars reflecting on infrastructural governance as being associated with negotiation between local and provincial rights in relation to national interventions (Oldfield, 2002). The latter (needs-based) approach carries with it the implicit responsibility of actually engaging (over a meaningful time span that is likely to exceed current short-term horizons made available by policy and research funding timeframes), with local actors and communities in identifying and fleshing out needs, constraints and opportunities that are both locally sensitive and that can be placed in conversation with agendas and initiatives from a multiplicity of scales, including the means through which residents negotiate their rights in relation to urban services (see Alvarado, 2020). This may be an uncomfortable ask for policymakers and scholars: communities and local households may well challenge and/or speak some truths that destabilize often-held views or conclusions about off-grid and/or informal spaces.

Enabling communities to identify their own needs and critically engage with the (often limited and highly constrained) “needs” proposed (and in some cases constructed) by external agencies may, however, lead to urban development processes that are better attuned to tackling the issues in focus. One way to incorporate needs-based into urban development processes is through “citizenship-in-action” activities, where the provision and use of infrastructure services become closely intertwined with citizen identities (Lemanski, 2019, p. 589). Considering and incorporating citizenship building activities breaks down siloed understandings of needs as related solely to infrastructure: for example, the idea that energy poverty needs to be tackled with energy infrastructure and/or other access options, or the hierarchical notion that some services can necessarily be defined as more important than others without involving the communities in question. A nuanced approach may, for example, uncover “needs” as characterized by a “bundle” of infrastructures formerly defined as separate, such as energy and water, or energy and data; while different sectors of the community may prioritize different (but sometimes linked) needs at different times (for example, data or mobile network access over reliable electricity). This brings into question existing notions of infrastructure configurations (Koepeke et al., 2021; Wittmayer et al., 2021), and/or typologies (Rateau & Jaglin, 2020).

Our argument does not imply that physical infrastructure is somehow unimportant. Rather, we push for a more nuanced approach, away from a monolithic focus on built infrastructure, to include a broader palette of infrastructural dimensions. Key to this is the importance of bringing infrastructure (and its absence) to light through processes of visibility. We highlight here Jackson and Robins’ (2018) argument, based on analysis of the politics of sanitation provision in Cape Town, which points to the need to consider

the relationship between decaying or not complete infrastructural grids, and negative political and other outcomes. The threat of the link between infrastructural deficiency and political instabilities can in part be allayed by rendering infrastructure visible, in such a way that it becomes clear how “rights to the city and civil society are both negotiated and denied” (Jackson & Robins, 2018, p. 84). Thus, while urban infrastructure can rightly be seen to potentially replicate modernist, racialised and colonialist projects in the city (Cowen, 2020), rendering it visible – where it exists, and where it does not extend to – can have productive potential.

In making the point that infrastructural provision (or its lack) needs to be considered more from a community- and citizen-informed, needs-based perspective than from a viewpoint solely focused on the materiality and physicality of infrastructural networks themselves, we are again underlining the importance of citizenship-building activities and co-producing urban knowledge and practice with local communities, households, and individual citizens (Croese et al., 2021). Building on the point above, considering the needs of people by involving them in the process forms a basis for understanding how and why infrastructure services are desired and used in off-grid spaces, rather than focusing on approaches centered on narratives, standards and practices constituted by existing notions of “formal” infrastructure. Doing so, and considering not simply projects aimed at formalizing the off-grid, but also the many instances of resistance to, co-optation of, and adaptation to/of the grid, also enables a reframing of what it means to be citizens of the off-grid urban space. It is in this sense that the state, citizens, and infrastructure can be understood as co-producing particular forms of infrastructural citizenship by one or more stakeholders (Lemanski, 2020), while also illuminating the politics of informality (Sharp, 2022) and recognizing the ongoing challenges of engaging with political leaders who may not take community views seriously, may not be easily held accountable, and are incentivised from elsewhere.

Conclusion

In this paper, we have highlighted four key areas for further development in geographical research on the off-grid city. In highlighting the imperatives to develop research engagement with standards, reexamine narratives of off-grid inadequacy and imperfection, adopt needs-based approaches to the off-grid city, and develop a more nuanced (re)definition of the grid, we have suggested ways to both deepen and broaden the focus on an urban reality that has endured and is ever-more present and important, but is consistently overlooked in narratives about the city and its future. We conclude by identifying three key themes that cut across the areas mentioned above, and which are key for future research on the off-grid city. The first cross-cutting theme is that of *co-production*. In the off-grid context, the need for multiple stakeholders, including communities themselves, to debate and define assessments of needs, standards, and priorities, will help to shape the production of urban knowledge and practice in ways that are not attached to Northern notions of infrastructure and development both in specific off-grid spaces, and in policy and other forms of practice. The second theme is *visibility*: related to co-production, visibility is the need to render visible the often intangible, sometimes invisible, almost always shifting and heterogeneous configurations of infrastructure, communities, and knowledge in off-grid spaces. The third theme is *redefinition*: much of what we have written

above is premised on the need to re-engage with, question, and broaden the way(s) in which infrastructure, needs, standards, KPIs, metrics, forms and narratives about the off-grid are currently understood. Flexibility and the ability to redefine what is “grid” and “off-grid” is, therefore, a key feature for ensuring its broad reading both in academic terms and in practice.

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References

- Acuto, M., Dinardi, C., & Marx, C. (2019). Transcending (in)formal urbanism. *Urban Studies*, 56(3), 475–487.
- Alvarado, N. A. (2020). Migrant politics in the urban Global South: The political work of Nicaraguan migrants to acquire urban rights in Costa Rica. *Geopolitics*, Ahead of Print, 1–25.
- Amankwaa, E. F., & Gough, K. V. (2021). Everyday contours and politics of infrastructure: Informal governance of electricity access in urban Ghana. *Urban Studies*, Ahead of Print, 004209802110301.
- Angelo, H., & Wachsmuth, D. (2020). Why does everyone think cities can save the planet? *Urban Studies*, 57(11), 2201–2221.
- Azunre, G. A., Amponsah, O., Takyi, S. A., & Mensah, H. (2021). Informality-sustainable city nexus: The place of informality in advancing sustainable Ghanaian cities. *Sustainable Cities and Society*, 67, 102707.
- Banks, N., Lombard, M., & Mitlin, D. (2020). Urban informality as a site of critical analysis. *The Journal of Development Studies*, 56(2), 223–238.
- Barnett, C., & Parnell, S. (2016). Ideas, implementation and indicators: Epistemologies of the post-2015 urban agenda. *Environment and Urbanization*, 28(1), 87–98.
- Bouzarovski, S., & Petrova, S. (2015, November). A global perspective on domestic energy deprivation: Overcoming the energy poverty–fuel poverty binary. *Energy Research & Social Science*, 10, 31–40.
- Brand, P., & Dávila, J. D. (2011). Mobility innovation at the urban margins. *City*, 15(6), 647–661.
- Caldeira, T. P. R. (2020). *City of walls*. University of California Press.
- Caprotti, F., & Cowley, R. (2017). Interrogating urban experiments. *Urban Geography*, 38(9), 1441–1450.
- Caprotti, F., Cowley, R., Datta, A., Castán Broto, V., Gao, E., Georgeson, L., Herrick, C., Odendaal, N., & Joss, S. (2017). The new urban agenda: Key opportunities and challenges for policy and practice. *Urban Research & Practice*, 10(3), 367–378.

- Caprotti, F., Essex, S., Phillips, J., de Groot, J., & Baker, L. (2020, December). Scales of governance: Translating multiscalar transitional pathways in South Africa's energy landscape. *Energy Research & Social Science*, 70, 101700.
- Castán Broto, V., & Robin, E. (2021). Climate urbanism as critical urban theory. *Urban Geography*, 42(6), 715–720.
- Castán Broto, V., Stevens, L., Ackom, E., Tomei, J., Parikh, P., Bisaga, I., To, L. S., Kirshner, J., & Mulugetta, Y. (2017, October). A research agenda for a people-centred approach to energy access in the urbanizing Global South. *Nature Energy*, 2(10), 776–779.
- Cocks, M., Shackleton, C., Walsh, L., Manyani, A., Duncan, H., & Radebe, D. (2020). Decolonisation of nature in towns and cities of South Africa: Incorporation of biocultural values. In M. Cocks & C. Shackleton (Eds.), *Urban Nature: Enriching Belonging, Wellbeing and Bioculture* (pp. 104–125). Routledge.
- Cowen, D. (2020). Following the infrastructures of empire: Notes on cities, settler colonialism, and method. *Urban Geography*, 41(4), 469–486.
- Croese, S., Dominique, M., & Inês Macamo, R. (2021). Co-producing urban knowledge in Angola and Mozambique: Towards meeting SDG 11. *Npj Urban Sustainability*, 1(8), np.
- Cross, J. (2019). The solar good: Energy ethics in poor markets. *Journal of the Royal Anthropological Institute*, 25(S1), 47–66.
- Davis, M. (2007). *Planet of Slums*. Verso.
- de Satgé, R., & Watson, V. (2018). *Urban planning in the global south: Conflicting rationalities in contested urban space*. Palgrave Macmillan.
- Ebbensgaard, C. L. (2020). Light infrastructures and intimate publics in the vertical city. *Urban Geography*, Ahead of Print, 1–20.
- Fox, S., & Macleod, A. (2021). Localizing the SDGs in cities: Reflections from an action research project in Bristol, UK. *Urban Geography*, Ahead of Print, 1–21.
- Frantzeskaki, N., & Rok, A. (2018). Co-producing urban sustainability transitions knowledge with community, policy and science. *Environmental Innovation and Societal Transitions*, 29, 47–51.
- Fukuda-Parr, S., & McNeill, D. (2019). Knowledge and politics in setting and measuring the SDGs: Introduction to special issue. *Global Policy*, 10(S1), 5–15.
- Haque, A. N., Lemanski, C., & de Groot, J. (2021, April). Why do low-income urban dwellers reject energy technologies? Exploring the socio-cultural acceptance of solar adoption in Mumbai and Cape Town. *Energy Research & Social Science*, 74, 101954.
- Harrison, P. (2006). On the edge of reason: Planning and urban futures in Africa. *Urban Studies*, 43(2), 319–335.
- Jackson, S., & Robins, S. (2018). Making sense of the politics of sanitation in Cape Town. *Social Dynamics*, 44(1), 69–87.
- Koepke, M., Monstadt, J., Pilo, F., & Otsuki, K. (2021). Rethinking energy transitions in southern cities: Urban and infrastructural heterogeneity in Dar Es Salaam. *Energy Research & Social Science*, 74, 101937.
- Kovacic, Z., Musango, J. K., Buyana, K., Ambole, A., Smit, S., Mwau, B., Ogot, M., Lwasa, S., & Brent, A. (2021). Building capacity towards what? Proposing a framework for the analysis of energy transition governance in the context of urban informality in Sub-Saharan Africa. *Local Environment*, 26(3), 364–378.
- Lall, S. (2020, June 18). Yes, cities will survive COVID-19. But they must manage their economic geography. *World Bank Blogs*. <https://blogs.worldbank.org/sustainablecities/yes-cities-will-survive-covid-19-they-must-manage-their-economic-geography>
- Lawhon, M., Nilsson, D., Silver, J., Ernstson, H., & Lwasa, S. (2018). Thinking through heterogeneous infrastructure configurations. *Urban Studies*, 55(4), 720–732.
- Lemanski, C. (2019). Introduction. In C. Lemanski (Ed.), *Citizenship and Infrastructure: Practices and Identities of Citizens and the State* (pp. 1–8). Routledge.
- Lemanski, C. (2020). Infrastructural citizenship: The everyday citizenships of adapting and/or destroying public infrastructure in Cape Town, South Africa. *Transactions of the Institute of British Geographers*, 45(3), 589–605.

- Luque-Ayala, A., & Silver, J. (2016). *Energy, Power and Protest on the Urban Grid: Geographies of the Electric City*. Routledge.
- Makonese, T., Ifegbesan, A., & Rampedi, I. (2018). Household cooking fuel use patterns and determinants across Southern Africa: Evidence from the demographic and health survey data. *Energy & Environment*, 29(1), 29–48.
- Martinez, R., Bunnell, T., & Acuto, M. (2021). Productive tensions? The “city” across geographies of planetary urbanization and the urban age. *Urban Geography*, 42(7), 1011–1022.
- Marx, C., & Kelling, E. (2019). Knowing urban informalities. *Urban Studies*, 56(3), 494–509.
- McFarlane, C. (2011). On context. *City*, 15(3–4), 375–388.
- Munro, P. (2020). On, off, below and beyond the urban electrical grid the energy bricoleurs of Gulu Town. *Urban Geography*, 41(3), 428–447.
- Munro, P., & Schiffer, A. (2019, April 1). Ethnographies of electricity scarcity: Mobile phone charging spaces and the recrafting of energy poverty in Africa. *Energy and Buildings*, 188–189, 175–183.
- Oldfield, S. (2002). Partial formalization and its implications for community governance in an informal settlement. *Urban Forum*, 13(2), 102–115.
- Onyango, C. L. (2019). *Mobile phone adoption and usage: an analysis of social, cultural and economic factors in Gauteng’s informal settlements* [Doctoral thesis]. Johannesburg, University of Johannesburg. <https://ujcontent.uj.ac.za/vital/access/services/Download/uj:34519/SOURCE1>
- Patel, Z., Greyling, S., Parnell, S., & Pirie, G. (2015). Co-producing urban knowledge: Experimenting with alternatives to ‘best practice’ for Cape Town, South Africa. *International Development Planning Review*, 37(2), 187–203.
- Rains, E., & Krishna, A. (2020, August). Precarious gains: Social mobility and volatility in urban slums. *World Development*, 132, 105001.
- Rateau, M., & Jaglin, S. (2020). Co-production of access and hybridisation of configurations: A socio-technical approach to urban electricity in Cotonou and Ibadan. *International Journal of Urban Sustainable Development*. Ahead of Print, 1–16.
- Robinson, J. (2005). *Ordinary cities: Between modernity and development*. Taylor and Francis.
- Roy, A. (2011). Slumdog cities: Rethinking subaltern urbanism. *International Journal of Urban and Regional Research*, 35(2), 223–238.
- Roy, A. (2016). Who’s afraid of postcolonial theory? *International Journal of Urban and Regional Research*, 40(1), 200–209.
- Samarakoon, S., Bartlett, A., & Munro, P. (2021). Somewhat original: Energy ethics in Malawi’s off-grid solar market. *Environmental Sociology*, 7(3), 164–175.
- Savini, F., & Bertolini, L. (2019). Urban experimentation as a politics of niches. *Environment and Planning A: Economy and Space*, 51(4), 831–848.
- Scott, J. C. (2008). *Seeing like a state: How certain schemes to improve the human condition have failed*. Yale University Press.
- Sharp, D. (2022). Haphazard urbanisation: Urban informality, politics and power in Egypt. *Urban Studies*, 59(4), 734–749.
- Shoniwa, T. T., & Thebe, V. (2020). Informal and unserviceable: The state, informal settlement residents, and sanitation management in Western Tshwane City, South Africa. *Urban Forum*, 31, 553–547.
- Siame, G., Chibamba, D., Nyanga, P. H., Mwalukanga, B., Mushili, B. M., Kabaghe, W., Membele, G., Nchito, W. S., Mulambia, P., & Ndhlovu, D. (2020). The formal-informal interface through the lens of urban food systems: The Soweto food market in Lusaka, Zambia. In N. Marrengane & S. Croese (Eds.), *Reframing the Urban Challenge in Africa: Knowledge Co-production from the South* (pp. 18–41). Routledge.
- Silver, J. (2014). Incremental infrastructures: Material improvisation and social collaboration across post-colonial Accra. *Urban Geography*, 35(6), 788–804.
- Silvonon, T. (2021). One step forward, two steps back? Shifting patterns of participation in a former informal settlement in Mexico City. *Environment and Urbanization*, 33(2), 478–495.

- Skinner, C., & Watson, V. (2020). The informal economy in urban Africa: Challenging planning theory and practice. In M. Chen & F. Carré (Eds.), *The Informal Economy Revisited: Examining the Past, Envisioning the Future* (pp. 123–131). Routledge.
- Thieme, T. A. (2018). The hustle economy: Informality, uncertainty and the geographies of getting by. *Progress in Human Geography*, 42(4), 529–548.
- Truelove, Y. (2021). Who is the state? Infrastructural power and everyday water governance in Delhi. *Environment and Planning C: Politics and Space*, 39(2), 282–299.
- Truelove, Y., & Cornea, N. (2021). Rethinking urban environmental and infrastructural governance in the everyday: Perspectives from and of the Global South. *Environment and Planning C: Politics and Space*, 39(2), 231–246.
- UN-HABITAT. (2015). *Habitat III issue papers. 22: Informal settlements*. United Nations. https://unhabitat.org/sites/default/files/download-manager-files/Habitat-III-Issue-Paper-22_Informal-Settlements-2.0%20%282%29.pdf
- Watson, V. (2009). Seeing from the South: Refocusing urban planning on the globe's central urban issues. *Urban Studies*, 46(11), 2259–2275.
- Watson, V. (2015). The allure of “smart city” rhetoric: India and Africa. *Dialogues in Human Geography*, 5(1), 36–39.
- Wittmayer, J. M., Avelino, F., Pel, B., & Campos, I. (2021, February). Contributing to sustainable and just energy systems? The mainstreaming of renewable energy prosumerism within and across institutional logics. *Energy Policy*, 149, 112053.