Uneasy Entanglements

Solar Energy Development in Zanzibar

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Abstract

This article considers the entanglements revealed by the recent and rapid influx of solar technology on the archipelago of Zanzibar. Following a technical failure that left the islands without electricity for three months in 2009-10, the Zanzibari government has pursued several avenues to increase energy autonomy, including solar power. However, the future of energy independence promised by solar development is complicated by a legacy of political conflict and new relationships of dependence and inequality. Drawing on interviews with domestic energy users, government officials, state engineers and NGO activists, and situated within the unique post-revolutionary context of Zanzibar, this article explores how solar innovations and investments contribute to the reimagining of social, economic and political entanglements while simultaneously reproducing persistent discourses of hierarchy, inclusion and exclusion.

Keywords: development, electricity, entanglement, inequality, solar, Zanzibar

The semi-autonomous archipelago of Zanzibar has experienced an intense period of energy development over the last ten years. Following an infrastructural crisis in 2009 that left the islands without power for a difficult three months, domestic policy makers, international donors and foreign corporations alike have poured resources into attempts to strengthen Zanzibari energy security. For Zanzibari government officials, these efforts have focused on harnessing the archipelago's 'indigenous resources: While these initiatives include accessing prospective offshore oil and gas reserves, there have been notable investigations and investments into alternative energy development, particularly solar electricity, leading Zanzibar's Energy Department to propose an ambitious target of 30 per cent renewable energy consumption by 2030.

In Zanzibar, these energy projects and projections – both the extraction of offshore fossil fuels and the conversion of energy from the sun – are framed within a broader technical, economic and political logic of capture (Doughty 2019)

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stemming from the complex relationship between the archipelago and the Tanzanian mainland. Zanzibar's dependence on Tanzania for electricity is one of many uneasy relations of reciprocity and exploitation binding the archipelago to the mainland – relations that are physical, political, historical and ideological. Solar electricity has a singular appeal because it offers the potential to reshape the thorny relationships of dependence through promises of autonomous and localized energy production. Similarly, at the level of household energy users, decentralized solar systems offer alternatives to reliance on a government that many still associate with traumatic historical events and ongoing political discord. Solar energy represents a form of freedom within this web of troublesome engagements of capture, yet efforts to loosen existing bonds come with their own complications.

Building on this collection's theoretical framework, I conceptualize capture as a series of ongoing entanglements created, perpetuated or revealed by alternative energy development in Zanzibar. Anthropologists have found the concept of 'entanglement' useful in describing complex assemblages of humans and non-human animals and things (Kirksey 2010; Nading 2014; Ogden 2011), and situating this concept within an analytic of capture further challenges linear thinking and disrupts assumptions of binary relationships. Encounters of capture are uneven but not unilateral, and the ensuing entanglements can be mutually constituting, creating the very objects of entanglement through complex and changing relationships. Entanglement 'marks shifts created through unequal power dynamics without erasing the agency possible within them' (Dennison 2017: 685), illuminating the evolving relations of coercion, collaboration and contestation created through contexts of capture.

Indeed, exploring capture through 'entanglement' requires thinking across space and time, as entanglement is 'at once a material, temporal, and spatial condition' (Nading 2014: 11). Using this broad scope and scale and drawing on interviews and ethnographic work conducted with policy makers, utilities managers, non-governmental organizations and Zanzibari residents, this article considers how the conversations, policies and practices around solar energy development in Zanzibar are both configured by and reconfiguring the historic and contemporary entanglements between Zanzibar and mainland Tanzania while simultaneously creating new dependencies and re-inscribing hierarchical constructions of identity and inclusion. For Zanzibari administrators and civilians alike, perceptions of the benefits and costs of alternative energy development are produced not only by resource availability but also by historical acts of political violence, persistent ideologies of distinction, and ongoing conditions of profound inequality.

Anthropology of energy and infrastructure

Anthropologists have long recognized that a focus on energy illuminates aspects of broader disciplinary importance (Nader 2010 White 1943), and the recent resurgence of anthropological scholarship in this area has contributed important perspectives to the studies of both energy and the related matter of infrastructure. Dominic Boyer coined the term 'energopower' (2014) to describe the meaningful

intersections of energy and power, and anthropologists have added their ethnographic and regional expertise to exploring how different forms of energy and resource production, distribution and consumption create cultural and political structures and inspire diverse ideological interpretations and access strategies (Richardson and Weszkalnys 2014; Smith and High 2017; Strauss et al. 2013). While fossil fuel extraction still garners the majority of ethnographic work on energy (Adunbi 2015; Appel et al. 2015; Behrends et al. 2011; Mitchell 2011; Watts 2005), scholars have also looked at how renewable energy sources such as wind (Howe 2014; Howe and Boyer 2016; Krauss 2010) and solar (Cross 2013; Jacobson 2007) may offer alternative possibilities for meeting energy needs while also deploying new or reconfigured structures of authority and cooperation.

In addition, anthropologists have noted the need for ethnographic attention focused specifically on the transformations wrought by the global expansion of electricity and electrical grids (Anusas and Ingold 2015; Gupta 2015; Winther 2008; Winther and Wilhite 2015). Located within broader literature on infrastructure, what Larkin defines as 'networks that facilitate the flow of goods, people, or ideas' (Larkin 2013: 328), this scholarship takes materiality seriously – the roads, the pipes, the wires – while recognizing that infrastructural networks such as electrical grids create and demand not only technical connections but also social and political connections (Anand 2011; Larkin 2013). Infrastructure such as electrical grids links citizens and the state and may also forge new connections (or rifts) between family members, neighbours and communities. People's daily lives are shaped by infrastructure, and also by 'its absence or partial presence' (Gupta 2015: 563). Electrical grids are meaningful not only for what they connect, but for what they bypass or neglect, and electricity is meaningful to those who have it and to those who do not (Cross 2017).

The connections created, enabled or restructured through electricity – between things, between places, and especially between people – are particularly significant to the scholarship of Africa, which has emphasized the relational nature of personhood, the idea that a person is constituted through relationships with others (Comaroff and Comaroff 2001; Fortes 1987). Connections defined by relationships of dependence in particular have rich and nuanced meanings in African anthropology, as anthropologists have suggested that these constitutive relationships often take hierarchical forms of patronage and clientelism, that 'relations of dependency are the foundation of politics and people alike' (Ferguson 2013: 223). In Zanzibar, a semi-autonomous archipelago of islands within the East African nation of Tanzania, certain relationships of dependency are particularly conspicuous, but they are also uncomfortable and often contested. Indeed, Zanzibar presents an interesting context for applying an analytic of capture and entanglement in relation to electrification and alternative energy because of the complex and multifaceted ways it is bound to Tanzania: through the physical connections of submarine power cables; the political and economic connections of a controversial Union government; and the unsettling ideological connections of oppositional identity construction.

The current pursuit of alternative energy development in Zanzibar exposes the persistence of these existing entanglements while creating a host of new ones.

The following sections explore these entanglements from multiple scales and with special attention to temporality (cf Doughty 2019). I consider the calculus being made at the level of Zanzibari energy policy and investment in renewable energy, investment focused on decreasing dependence on mainland Tanzania by strengthening the stability and capacity of the expanding electrical grid. I also consider how the expansion of the state electrical grid and the simultaneous proliferation of decentralized solar systems are perceived, measured, engaged with and sometimes resisted by Zanzibari citizens. All of these discussions and decisions, whether by energy policy makers or household users, are influenced by Zanzibar's complex history with Tanzania and how that history has shaped a problematically racialized conception of identity and citizenship.

Precarious connections

In May 2008, the Zanzibar archipelago lost power when a surge destroyed the submarine cable conveying electricity produced on the Tanzanian mainland to the largest Zanzibari island, Unguja. Short-term power outages were not unusual in both Tanzania and Zanzibar, but the rupture of the underwater cable was a major event, resulting in a four-week blackout for the archipelago while engineers awaited replacement parts for the Norwegian-designed utility station. Eventually, the cable was repaired, but the fix was only temporary. In December 2009, the cable was again damaged, and Zanzibar lost power once more. This time, the electricity outage lasted for three difficult months. While many outlying areas of the archipelago were not connected to the electrical grid and therefore were relatively unaffected by the blackout, the lack of power was experienced acutely in Zanzibar City, an urban centre of approximately 250,000 people. The electric pumps supplying water to homes, schools, offices and hospitals stopped functioning, and widespread water shortages led to soaring prices for bottled water. Few residents could afford diesel generators or the fuel to run them, so most did without power. As cell phones and computers died, communication became challenging, and urban residents became increasingly isolated. The vital tourism industry was crippled, and even hospitals were forced to turn off non-essential services (Dean 2008).

In addition to the hardship brought on residents, this crisis dramatically highlighted the vulnerability of Zanzibar's electrical system and the ongoing resource dependence of the archipelago on mainland Tanzania and foreign manufacturers. Without centralized energy production on the archipelago, Zanzibar's electrical grid relied on the hydropower produced in Tanzania. The distribution cable stretching under the sea from the mainland to Unguja was at least ten years older than its twenty-five-year projected working life and had been poorly maintained. The parts to repair it had to come from the manufacturer in Norway, one reason for the length of the blackout.

The cable was eventually repaired, and power was restored to the archipelago, but significant concerns about Zanzibar's energy security remained. As part of a Millennium Challenge Corporation (MCC) compact with the United States, a new

higher-capacity cable was installed in 2012. This 100-megawatt cable, as well as an additional 25-megawatt cable run from Tanga in mainland Tanzania to the northern archipelago island of Pemba, did take some of the burden off the outdated and fragile older cable (whose capacity was 45 megawatts). However, the question of future energy security and sustainability remains critical to Zanzibaris.

Uneven connection

Zanzibar's current electrical difficulties eclipse the fact that electricity came to Zanzibar relatively early. In the 1880s, a time when Zanzibar functioned as the capital of the Omani Sultanate, a ceremonial palace of Sultan Bargash bin Said was wired with electricity, reportedly becoming the first electrified building in sub-Saharan Africa. The *Beit al-Ajaib*, the House of Wonders, was so named because of its impressive architecture but especially because of its electric lights and elevator. Anthropologists have described how electrification is complicit in the exercise of power (Anusas and Ingold 2015; Boyer 2014, 2015; Gupta 2015; Howe and Boyer 2016; Mitchell 2011), and beginning with this first marvel, electricity signified political authority in Zanzibar, the authority of the Sultan, and later, his waning power and the emerging authority of the British colonial administration. The British expanded electrification beyond the Sultan's palace and into Stone Town, the wealthier area of the primary urban centre of Zanzibar Town populated largely by European, Asian and Arab administrators and business owners.

Tanja Winther (2008) describes how the distribution and spread of electricity in colonial Zanzibar reproduced a system of social classification and a perception of social order based on economically and racially distinguished geographic zones (see also Fair 2001; Myers 1993). The urban core, with its wealthy European, Arab or Asian residents, and European-owned factories were prioritized over those citizens residing in Ng'ambo (the 'other side'), the part of town occupied largely by indigenous Zanzibari and African residents (Myers 1993).[1]

Following the Zanzibar revolution of 1964, described in more detail below, the first Zanzibar president, Abeid Karume, had different political priorities. He expanded electrification as part of a sustained campaign of modernization and rural development. Among other post-revolution developments was the establishment of ZECO, the Zanzibar Electricity Corporation, as a government parastatal charged with distributing electricity in the archipelago. Zanzibar's second president, Aboud Jumbe, oversaw other milestones in electrification, including the construction of the original electrical cable connecting Zanzibar to power generated on mainland Tanzania in 1979–80.

Although the current cables from the mainland to Unguja and Pemba have temporarily resolved the archipelago's energy crisis, the issues of electrification remain complicated and politically weighty on Zanzibar. Relying on Tanzania for electricity is symbolically fraught, as I will discuss later, but it is also practically problematic. First, Tanzania is itself struggling to produce enough power to meet residents' demands. The country is largely reliant on hydro-electric power, and

ongoing droughts – exacerbated and projected to increase due to climate change – have led to sporadic electricity throughout the country.

Second, the cost of this electricity burdens the already indebted Zanzibari government. According to a representative from ZECO, Zanzibar pays approximately TZS 6 billion ($2.6 million) to TANESCO (the Tanzania Electric Supply Company) each month for electricity from the mainland (interview, July 2019). The utility struggles to makes this payment, and in 2017, after Zanzibar fell millions of dollars behind, Tanzanian President John Magufuli ordered the archipelago disconnected from the grid, a forced power cut, a severe penalty that was averted only by commitments to a payment plan (Kidanka 2017).

Finally, even if the additional capacity was reliable and affordable, it is not sufficient to meet Zanzibar's projected needs. Energy Department officials explained to me in 2019 that the archipelago on average uses around 50–60 megawatts per day, with up to a 78-megawatt peak usage during times such as Eid celebrations. Given ongoing development throughout Zanzibar, it is projected that the cable capacity will be exhausted by 2022–23. Using the new Hyatt hotel on the waterfront in downtown Stone Town as an example, one project manager pointed out that this one hotel alone uses 1–2 megawatts of power every day.

From Sultanate to Union

The issues of reliability, affordability and capacity are important concerns for Zanzibaris worried about energy security and autonomy, but there are also powerful political, ideological and symbolic issues at play. The discussions of energy autonomy and security occur within a wider context of historic and contemporary tensions and entanglements between Zanzibar and Tanzania (Glassman 2011; Shivji 2008).

The Sultan of Oman moved the capital of his Sultanate to Zanzibar Town in 1840, and Oman ruled Zanzibar until Britain declared a formal protectorate in 1890. Britain left the Sultanate as an administrative unit, and the Sultan of Oman was the ostensible ruler of the archipelago until Zanzibari independence in 1963. However, Britain maintained ultimate authority over the administration and enacted policies, including energy policies, benefitting British interests and ideologies. The British support of Omani rule exacerbated growing tensions in Zanzibar between residents who were identified as Arab (of Omani origin, but also Indian or Comorian origin) and residents identified as African, many of whom had migrated from the mainland. When Britain introduced constitutional reforms to allow for local representation in the legislature, political organization evolved along these problematically simplistic ethnic identities. Arab residents largely organized into the Zanzibar Nationalist Party (ZNP) while mainland Africans united with some indigenous Zanzibaris to form the Afro-Shirazi Union (later the Afro-Shirazi Party, or ASP). Residents of the island of Pemba, along with some support from the other islands in the archipelago, formed the Zanzibar and Pemba People's Party (ZPPP). The first independence elections on the island in 1960 ended in a contested tie, but

in the 1963 elections, a ZNP and ZPPP alliance barely prevailed (Lofchie 1965). In December of that year, independence was formally transferred, giving the minority coalition control of the archipelago.

However, the rule of ZNP-ZPPP was short. In January 1964, members of the ASP overthrew the coalition government in a violent revolution. The months following the revolution were marred by violence and retributive killing as tensions on the islands became even more politicized along ethnic lines. Political dissidents and residents identified as Arab were killed; houses and businesses were destroyed; most surviving Arab and Asian residents fled to refuge overseas. Within months, the new Zanzibari government unified with mainland Tanganyika to form the nation of Tanzania (Clayton 1981; Hunter 2010; Lofchie 1965).

The revolution (*mapinduzi*, literally 'turning upside down') and its aftermath are part of the collective memory of all Zanzibaris, whether they lived through the events or not, and there have continued to be persistent protests – some violent – about the nature of the Union and Zanzibar's relative strength within it (Killian 2008). These differences are still often characterized through ideas of identity and heritage, which play out in dramatic and divisive political theatre.

Scholars of the Swahili people of the East African coast have emphasized that Swahili identity construction is complex and politically contested (Mazrui and Shariff 1994; Spear 2000), and Zanzibari identity is no exception. So, while in political and politicized contexts ethnic identity in Zanzibar is still frequently constructed along essentialist lines of Arab (including Comorian and Indian) and African, evoking the echoes of the revolution, everyday Zanzibari identity involves a more complex perception of both differentiated ancestral origins (*makabila*) and shared attributes of 'Zanzibari-ness' (Larsen 2004). The attributes associated with an idealized Zanzibari identity – a shared Muslim faith, ideals of hospitality, attention to particular rules of etiquette and public behaviour – are often invoked to differentiate Zanzibaris from others, particularly mainland Tanzanians. This practice is so pervasive that I was usually told by Zanzibari friends following any reports of crime or violence on the archipelago that these acts were invariably committed by mainlanders or foreigners, not Zanzibaris. Such oppositional perceptions of identity become entangled with the political realities of the Union government. Elections on Zanzibar remain contentious, with residents politically divided between those who support the ruling political party associated with the mainland government (Chama cha Mapinduzi, CCM) and those who support opposition parties (until recently predominately the Civic United Front, CUF, but now Alliance for Change and Transparency, ACT-Wazalendo) who tend to advocate for more Zanzibari autonomy within the terms of the Union government. Kjersti Larsen (2004) describes the emergence of a new identity label following the 2000 elections, 'Zanzi-bara' (*bara* is the Swahili word for the mainland), referring to those residents of Zanzibar whose loyalties were primarily to the mainland government.

Concerns about energy dependence on Tanzania are part of these larger discussions about Zanzibari identity and uneasiness about Zanzibari representation within the nation-state. Energy independence becomes symbolic of broader

questions of identity, political sovereignty and economic autonomy. Indeed, it is difficult to imagine a more graphic symbol of dependency than the electrical cable that connects Zanzibar to the mainland like a monstrous umbilical cord. It is true that local energy production is practically appealing, but the allure of that goal is also the extent to which it could loosen the ties that bind Zanzibar – physically and politically – to the mainland.

Alternative energy speculation

For all of these reasons, technical and ideological, and to avoid the consequences of dependency and limited capacity starkly revealed by the 2009 blackout, Zanzibar has embarked on an ambitious programme of alternative energy exploration, and there are plenty of willing partners – foreign governments, non-governmental organizations and corporations. Most prominently, starting in 2012, the European Union pledged three million euros towards exploratory wind and solar projects. While the wind tests are ongoing, the positive assessment of solar potential on the archipelago has created momentum and support for solar development among Zanzibari policy makers. The Energy Department has proposed the ambitious target of 30 per cent renewable energy consumption in the archipelago's energy portfolio by the year 2030. There is interest from both the European Union and the World Bank in helping to reach this goal, and there are currently two solar mini-grid projects funded by the Norwegian government being installed on small islands that are not connected to the national grid.

In spite of the enthusiasm and hope around these initiatives, so far the promise of alternative energy remains largely unfulfilled. This is perhaps illustrated most dramatically by the ubiquitous solar street lights lining major roads in Zanzibar City. For most residents, these lights are the main evidence of ongoing alternative energy investment. Some of them were installed by ZTE, a Chinese state-run company, and others were purchased with a grant from the World Bank. When I visited Zanzibar in 2015, the majority of these street lamps were non-functioning, leaving long gaps of dark street punctuated by the dim pools of light. At the time, many residents and Zanzibar officials blamed the failure of these lights on the quality of the products themselves, specifically those associated with the Chinese project, and speculated that European and Chinese corporations had sold or offloaded their defective and obsolete merchandise in Africa. There were several other problems with these street lighting projects. The parts were not manufactured locally, so replacement and repair parts were difficult and expensive to get. Perhaps most significantly, these solar instalment projects put the technology in place but did not train local people to maintain or repair them. When the panels broke or the software failed, the lights remained off.

To my surprise, when I returned to Zanzibar in 2019, nearly every single street light was working, illuminating the urban roads with bright and steady light. I marvelled at the change, optimistic about what this dramatic improvement meant for the potential for solar development on the archipelago. However, I soon learned

that the improvement had relatively little to do with updated solar technology, enhanced maintenance or a corporate ethical awakening about the quality of global trade goods. Rather, the lights had been connected to the central electrical grid; like most of the city, they were running off the hydropower generated on mainland Tanzania. The solar panels so prominently affixed on the top of the poles were now there only for backup.

If the reality has not yet met the promise, it is clear that the motivation for alternative energy investment is strong at the level of the government energy ministries and institutions. These motivations are in part economic, but they are consistently explained with discourses of dependence and security. As one utilities manager told me, 'Here we depend on the mainland. If there is a breakdown on the mainland, the island has no power. We are dependent. But solar is different; it is for our islands. We are only dependent on what we need to maintain the system…'. He continued, 'For Zanzibar, it is time to start. Solar is a kind of energy security for our country' (interview, July 2019).

Because local energy production is so often framed within ideals of independence and sovereignty, there is a concern that in the quest to reduce energy dependency on mainland Tanzania, Zanzibar runs the risk of redirecting dependency towards foreign states and corporations. The 'autonomy' promised by localized energy production often obscures the new entanglements of unequal trade relationships and technological neo-colonialism. And in fact, many of the initial investment offers received by officials in the Energy Department suggested terms of trade that would make Zanzibar reliant on the foreign energy providers. Under these offers, Zanzibar would purchase solar panels (with grants from various donors or loans taken to fund EPCs – energy procurement and construction contracts), and then continue to pay the seller or contractor for costly replacement parts and repairs in order to keep the panels functioning. In an interview in 2016, an Energy Department spokesperson was particularly critical of how foreign providers of technology have approached their commitments to Zanzibar. Knowing that the EU and USAID are providing grants to the government for solar development, companies consistently approach the government to bid for solar contracts ('every day!' he said). But, he critiqued, 'They will sell us technology, but we need POWER, not technology'.

In the past year, responsive to the objections about the ongoing costs and maintenance requirements of such technology, the Zanzibari government has approved the pursuit of contracts for IPPs, independent power producers. Private companies from China, the United States, Japan, Germany, the United Kingdom and India are all participating in a competitive bidding process to construct their own solar (and possibly wind in the future) operations and sell power directly to the electricity utility (interview, 2019). However, to be competitive, the contracts must offer this energy at a price that is at or below the cost of energy purchased from the mainland, currently around 8 cents/kilowatt hour.

In spite of the persistent economic challenges, this recent regulatory shift has facilitated ever increasing attention to the alternative energy sector at both governmental and non-governmental levels. This includes addressing the issues

of sovereignty raised by the lack of labour capacity related to solar technology. There are a handful of NGOs providing training to local technicians for installing and repairing solar panels, and renewable energy programmes are also emerging in state-sponsored technical colleges, notably Karume Institute of Science and Technology. As evidenced by the 30 per cent renewable goal in the newest draft energy policy, alternative energy production has captured the imagination of policy makers.

However, alternative energy development and distribution is meaningful at scales other than that of the Zanzibari and Union governments. At the local level, for Zanzibari citizens, alternative energy also offers the potential for social transformation, for improved quality of life. At this level, too, such developments are framed by complex entanglements, raise contradictory possibilities of connection or disaggregation, and are marked by ongoing relationships of inequality.

Household and village connection or autonomy

Mzee Hamid was one of the first people I met in the village of Jongowe in 2004. Jongowe is the smaller of two villages on the Zanzibari island of Tumbatu, the third-largest island in the archipelago and a half-day journey by vehicle and boat from Zanzibar Town. I had arrived in the village to learn about celestial navigation, and Mzee Hamid took me out in his small fishing dhow for several nights in a row, teaching me the names of stars and their patterned movements across the sky, demonstrating how to align the mast with both terrestrial and celestial guide marks, and explaining other navigational clues such as the sound of the waves and the feeling of the currents. When I returned to live in Jongowe for my dissertation research, Mzee Hamid was a frequent visitor to the house where I lived, spending many evenings drinking tea and sharing stories in the courtyard with me and my housemates. He is a striking figure, tall and thin, a devout Muslim who stands out among other fishermen by nearly always dressing in a traditional *kanzu* and *kofia*, and he is one of the village elders I regularly consult for perspectives on Jongowe history and customs. In 2012, he built a new house for his second wife near the central mosque. While cement block houses were proliferating on the village outskirts, Mzee Hamid built a traditional house of coral rag and thatch. When I saw him in 2019, he told me he was building another house, and this one would have electricity. For his entire life, he had never had electricity, but this new house would have it, whether from the government grid (*wa serikali*, 'of the government') or through solar panels. 'The time is now', he told me, smiling. 'It is globalization (*utandowazi*).'

Mzee Hamid made clear to me the increasing desirability of electricity in even the most rural areas of the archipelago. The alternative energy investments I have described so far are government attempts to meet this desire. They contribute to centralized forms of energy production and distribution because they are intended to supplement the Zanzibari national electrical grid. That is, they will optimistically improve electrical services for those connected to the electrical grid. As Tanja

Winther's impressive work has shown, household electrification in Zanzibar is transformative in many ways (Winther 2008). However, in practice many Zanzibari households are not attached to the grid. When Jongowe was connected to the national grid in 2010, only those residents who could afford to pay the roughly $200 fee to connect their homes were electrified. Further, after that initial connection fee, residents must pay for monthly usage, either through metered billing or, more common these days, a pre-pay box requiring the purchase of credit vouchers.[2] Thus, to the large number of households financially excluded from the national grid, the state's alternative energy investments mean very little.

In contrast to connection to the government's electrical grid, household-level solar systems offer a different model of decentralized energy production. Unlike on mainland Tanzania and nearby Kenya, where these solar systems are being marketed largely by commercial entities, until recently Zanzibar's domestic solar was being distributed or sold and maintained by local or foreign NGOs. These systems, which range in output and price, offer the potential of energy for those residents not connected to the national grid, particularly when their installation is subsidized by local or international non-profits.

Yet for some Zanzibari residents, the appeal of solar is not only economic or practical but, as at the state level, politically symbolic. Just as Zanzibar as a political entity has chafed under the control of Tanzania, many Zanzibaris believe the existing government does not represent their interests. This is particularly true in opposition strongholds such as Pemba Island. Here, the wind masts of the EU-funded test project were forcibly resisted as residents suspected a governmental land grab. The village of Jongowe is also associated with the political opposition party, and some residents there preferred the solar panels distributed through a US NGO programme to the electricity available through the central grid, in part because of cost, but also because of the way the grid entangled them with the government. This connection is made explicit in the way residents distinguish between these different sources of power generation, using the Swahili terms '*umeme*' (electricity), '*wa serikali*' (of the government) or 'ZECO' (Zanzibar Electrical Corporation, the government utility parastatal) to describe power from the grid, and using the English word 'solar' to describe power generated from the panels. As one elder explained to me following village electrification, 'Solar is better than *umeme*. *Umeme* is not reliable. You have to depend on the government' (interview, 2012).

Reproducing inequality

Dominic Boyer has characterized alternative energy such as solar and wind as potential threats to the state power exercised through the grid, as 'agents of de-growth and grid disintegration' (Boyer 2015), and, indeed, for those residents concerned about the intentions of the government, solar offered an alternative to the centralizing grid which entangled citizens with a state perceived as oppressive. But does decentralized household solar energy production offer a true 'alternative'? Or is it the case that the grasp of carbon-based energy economies and their patterns of

political and economic inequality are not so easily evaded? In northern Tanzania, the for-profit model of household solar development is premised largely on expat investors growing the domestic solar market, creating and then meeting ever-expanding energy demands (McKibben 2017). While there may be different actors, the structures of capitalist extraction are very much intact.

This for-profit model has recently achieved a tentative foothold in Zanzibar as well, with a handful of solar shops operating across Unguja and the small, plastic solar equipment on prominent display in market kiosks. Even among the solar projects spearheaded by non-profits and NGOs, the organizations providing solar panels to rural villages often have conditions tied to their distribution. For example, an NGO providing solar panels to Jongowe required residents build fuel-efficient stoves in exchange for solar panels (Dean 2012). Situating this exchange squarely within a carbon economy, the NGO asked residents to build four stoves for each panel, a carbon credit calculation based on the costs of the solar panels and the NGO's valuation of the anticipated carbon reduction each fuel-efficient stove would make over its lifetime. For every four stoves built, one solar panel was provided, requiring some complex negotiating among villagers. Further, because the material to build the stoves was not located on the island, only those who could themselves travel to collect the material or pay someone else to do so were able to build the stoves. This meant that female-headed households and the elderly were unlikely to get solar panels through this programme. In subsequent solar programmes, and even with the assistance of NGOs or cooperative organizations, only some residents have been able to afford the solar panels or the expensive replacement batteries.

Thus, while local, decentralized solar systems may reconfigure the field of power by offering some people the potential for energy autonomy or the hope for independence from government oversight, at the same time these systems are reflecting and reproducing existing inequality. In interviews I conducted in 2019, residents using solar panels expressed conflicting views on whether solar energy mitigated or perpetuated conditions of economic and social inequality. Unlike conversations I had in previous years, when solar was generally seen as a desirable commodity, in 2019 I heard solar energy described as a stigmatized technology of the poor. My friend Mussa, a government employee with an environmental advocacy background, explained, 'People here think solar is for poor people, even the government. They think solar is a temporary situation; the grid is a permanent solution' (interview, June 2019). And some interviews with users of household solar systems supported this perception, with users describing their solar panels as inferior options to be used only until they could have 'real' electricity. The panels were understood in terms of waiting, of 'not yet' (*bado*), of anticipation, and in the logics of capture, of exile. They purchased or used solar panels until it was possible for them to connect to the electrical grid, either when the grid reached them or when they could afford it. Solar was a stop-gap, a source of power that provided them with some interim comforts, but it also marked their poverty and their exclusion (Cross 2017) from an energy system that they perceived was providing not just access to electrical power but access to the kind of modern life power enabled.

In the outskirts of Zanzibar City in particular, the connections between electrification, political power and the forms of racialized identity associated with colonial energy policy and post-revolutionary politics are still visible. A large percentage of homes without connection to the electrical grid are occupied by migrants, either from mainland Tanzania or from Pemba Island, people considered ethnically 'other'. Thus, historically informed practices of ethnic identity construction and differentiation are continuing to find contemporary expression in the patterns of inclusion and exclusion traced by the electrical grid.

I found the perspective that solar energy marked poverty or exclusion striking, but it was not universal. In contrast, for others, solar power actually gave them a sense of inclusion, enmeshed them in the web of those who had power, and connected them to a community of modernity and prosperity. I met with Yusuf at the construction site where he was working as a mason. He lives in a peri-urban district of Zanzibar City, where many homes are connected to the electrical grid and many are not. His family home has solar power, and he found the panels both useful and meaningful. He explained that with solar, he can feel the same as people who are connected to the grid because he also has lights. 'Sometimes you are poor (*mnyonge*), but you can feel like you are not poor because you have power.'

Still others argued that decentralized solar was superior to the electrical grid. They noted that solar provided a more stable and consistent current, that it was cheaper and that it was safer, especially for children. Though framed as issues of safety or reliability, many of the concerns were still rooted in the ongoing distrust of the government and distaste for government entanglements. Solar was more reliable because it depended only on the equipment, not the state-managed electrical infrastructure. Similarly, it was more affordable because the costs were clear; with the electrical meters, there was not transparency about what you were paying for. As one man explained, 'ZECO sometimes goes off, and we don't know why. Solar doesn't break as often. It is an emergency if that happens, and you can find a *fundi* (handyman) to fix it … The way you buy it (electricity), they can cut your power or deduct more without your knowledge. Solar doesn't have bills. If there is sun, then it works' (interview, July 2019).

New entanglements

These competing views that residents expressed about solar energy – as a marker of poverty, as a representation of inclusion, as a technology of transparency and autonomy – suggest that while alternative energy infrastructure such as solar may not represent a complete disruption of the conditions of global or local inequality, these systems do create different entanglements and build different relationships from the centralizing electrical grid. Rather than concerns about the thinning or absence of the African state in the wake of neoliberal reforms (Ferguson 2006; Piot 2010), in Zanzibar discussions of electricity reflect concerns about state expansion and intrusion, even surveillance, and the electrical 'tentacles' (Winther and Wilhite 2015) that entwine citizens with a potentially negligent or even malicious actor.

Household-level solar systems create different connections. They belong to the category of decentralized humanitarian technologies (Cross 2013; Redfield 2016), whose services are targeted to the individual or household rather than the community, restructuring relationships of responsibility and obligation. Jason Cons (2018) suggests these technologies may foreshadow a dystopic future of climate crisis, where atomized families are responsible for their own survival and resilience with the help of these humanitarian tools. Taken to this extreme, autonomy represents not freedom from an oppressive and coercive state or from unequal economic and political attachments, but bleak hopelessness and pessimism about perpetual and permanent state and institutional failure.

However, insights from Zanzibar suggest that there are ways of producing and understanding power that are not limited to choices between global extractive capital, oppressive political hegemony, or lonely but self-sufficient households. Certainly, there is pessimism about the capacity of both the Tanzanian and the Zanzibari governments reflected in the development of alternative energy in Zanzibar. Yet the entanglements described here point to the multiplicity of choices and the web of possible connections created by electrification and alternative energy development options. Zanzibar's historic conflicts and vulnerable infrastructure make local, renewable energy production from solar and wind appealing, but every expert and policy maker I spoke with agreed that without substantial offshore oil and gas resources and domestic processing facilities, the archipelago will never be completely energy autonomous. Alternative energy production will supplement Zanzibari power but not erase the reliance on mainland Tanzania, creating a hybrid system of neither complete dependence nor complete autonomy. At the same time, Zanzibar's new foreign investment policies and especially the growth of alternative energy programmes in the archipelago's technical colleges provide meaningful challenges to the economic and technical dominance of foreign investors and technology.

At the household level, in rural Zanzibar, individuals with electricity in their homes, solar or otherwise, describe that resource as a communal good, necessitating reciprocity and obligation among neighbours (Dean 2012). The residents in Jongowe repeatedly told me that they shared electricity. Neighbourhood children gathered in the evenings in the lighted homes to do homework, neighbours charged phones and radios at each other's homes and gathered to watch the few televisions in the village, and fishermen returning late from the sea stored their catch in others' refrigerators until the morning markets opened. The energy was connective in tangible and intangible ways. At least to a point, community bonds and relationships appeared to be developed and strengthened, even though both solar and grid electricity flowed to specific houses. The isolating model of household self-sufficiency is perhaps being resisted and reinterpreted through the norms of communal practice and collective identity.

Conclusion

Every context of capture is marked by ongoing entanglements, and it is these complex ontological relationships, these evolving consequences of capture, that this article has explored. 'Entanglement' highlights the competing forces at play in alternative energy development in Zanzibar and the material, political, economic and historical relations in which the archipelago is enmeshed through its energy pursuits.

Materially, Zanzibar and Tanzania are linked by a complex network of physical infrastructure generating and distributing electricity, quite literally binding the archipelago to the mainland through a web of wires and submarine cables. This tenuous and contested infrastructure is a tangible source of ongoing economic tension between the archipelago and the mainland, and it is a vivid symbol of continued relations of dependency.

Zanzibar is also entangled in emergent economic engagements with foreign investors shaped by nascent energy policies focused on harnessing 'indigenous' resources. These new relationships offer the potential for freedom from energy dependency on mainland Tanzania but also present their own entanglements, including the prospects of new dependencies and obligations to foreign governments and corporations.

These complex material and economic conditions are understood within the entanglements of historical racialized violence and persistent tensions about identity and belonging on the archipelago. Energy development in Zanzibar has accentuated the connections between politicized processes of identity construction and contemporary conditions of inequality.

Finally, there are the entanglements created by the relationships of responsibility and reciprocity structuring daily life in Zanzibar. Centralized and decentralized forms of energy production promote different forms of sociality, drawing distinctions between common good and household self-sufficiency, but bonds of communal obligations may also restructure and regulate unequal energy access.

Tracing these entanglements illuminates the myriad choices and web of possibilities existing in this energy frontier. It foregrounds relationships of mutuality and co-creation, but, as Elizabeth Roberts suggests in her work in Mexico City (2017), it can also draw our attention to resistance to or rejection of entanglement. For the entangled, endless relations of reciprocity or exploitation can be exhausting; it is boundaries and the stability they signify that bring hope and peace. Thus, amid these troubled entanglements, visions of autonomy and self-sufficiency are particularly valued by the Zanzibari government and households alike.

The issues that alternative energy development raises are fraught with many ghosts in Zanzibar, and interpreted in historical, political and even racial ways. Yet, although they are particularly visible and resonant in Zanzibar, these are forces that are likely at work in every energy project, which is why this case study is both exceptional and representative. Alternative energy such as solar offers the optimistic potential for improvements in quality of life and environmental sustainability, dreams of independence, and maybe possibilities for community building and solidarity – but also new entanglements, old hierarchies, yet unknown challenges.

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Notes

1. Ng'ambo was not electrified until the late 1940s and 1950s (Winther 2008).
2. Currently most household units in Zanzibar have been or are in the process of being replaced by the pre-paid systems, in part because the meters proved vulnerable to tampering.

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