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The Solar Good: Energy Ethics in Poor Markets

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ABSTRACT

What are the ethical commitments of people who design, build, and sell solar photovoltaic technologies to those living in energy poverty across sub Saharan Africa and South Asia. Over the past decade dramatic falls in the cost of solar photovoltaics has seen our increased capacity to convert sunlight into electricity married to projects of governance, social or moral reform and expressions of care for distant others. Tracing these projects across the floor of an international trade fair in Dubai and a social enterprise in India, this article shows that the pursuit of the solar good hinges on the knowable ground that is capitalism today.

DOING GOOD BY DOING WELL

In June 2008 Bill Gates resigned as CEO of Microsoft to focus his attention on the work of the Gates Foundation. The Foundation had become a vehicle for Gate's philanthropic work and was pioneering the application of business and marketing strategies to the provision of food, water, sanitation and nutrition in contexts of chronic global poverty and humanitarian emergencies. To coincide with his resignation Gates wrote an article for Time Magazine, part of a series titled 'Doing Well by Doing Good' (Gates 2008). In the article Gates argued that our moral concerns with global poverty would be better focused by channelling them into the creation of new markets for manufactured goods.

'We see inequity as a business problem,' Gates wrote. 'It's not just about doing more corporate philanthropy or asking companies to be more virtuous [...] It's about giving them a real incentive to apply their expertise in new ways while serving the people who have been left out [...] It's about harnessing 'self-interest' to 'an ethic of care for others'.

The challenge, Gates argued, is finding 'markets all over the world that businesses have missed, studying the needs of the poorest two billion people in the world, and selling them goods and services that meet their unmet needs.' 'There are critics,' he wrote. 'There are sceptics. There are those that doubt such markets can be found, or that they have not yet been discovered.' But, he wrote, 'I disagree.'

'[Critics] assume that businesses have already studied every possible market for their products. It's like that old joke about the economist walking down the street with his friend. The economist steps over a

\$10 bill that is lying on the ground. His friend asks him why he didn't pick it up. It can't possibly be there, the economist replies, because if it was somebody else would have picked it up already. All those people who decry the potential for doing business with the global poor, they think that all the \$10 bills have already been picked up.' (Gates 2008, p26).

Such arguments circulate globally. Just as concepts that extend our critiques of corporate or financial capitalism have come to act as beacons of hope for scholars, as well as social and environmental activists (e.g. Graeber 2013; Kirsch 2018) arguments that present markets for new goods and services as engines of improvement have also come to act as sources of hope 'within' capitalism (e.g. Miyazaki 2006). Over the past decade Bill Gates and others, like the management guru C.K. Prahalad (Cross and Street 2009, Elyachar 2012), have done much to assert the promise that for-profit businesses can 'do good by doing well', establishing the terrain of humanitarian intervention and chronic global poverty as legitimate arenas for entrepreneurship and corporate activity. By presenting an explicit ideological defence of what has been called 'compassionate capitalism' (Benioff and Southwick 2004) and 'philanthro-capitalism' (Bishop and Green 2008) or what we might also call 'humanitarian capitalism' such ideas create new problems and questions for anthropology (e.g. Schwittay 2011; Collier et al 2018).

One arena in which attempts to 'do good by doing well' have flourished sits at the intersection of global poverty and solar energy. Efforts to provide a minimum, sustainable level of electrically powered lighting, refrigeration and charging to the estimated 1.2 billion people who live without access to reliable mains electricity intersect with the interests of solar manufacturers and distributors, as they seek to accelerate the growth of markets for off grid solar power. Between 2010 and 2018 global sales of 'off grid' solar technologies that generate power for energy services in the absence of any connection to a mains electricity grid reached 130 million units, with the total sales value generated by the off grid solar sector reported to have exceeded \$3.9 billion (World Bank/Dalberg 2018). For many management and business executives in off grid solar companies selling solar power to people living in chronic energy poverty presents itself as an ethical-economic utopia: the opportunity to express care for others and the environment at the same time as fulfilling a fiduciary duty of care to investors and shareholders.

How are such ethical commitments articulated in the everyday life and work of solar markets? What are the ‘ordinary ethics’ (Lambek 2010) of the off grid solar industry? If ethical projects always include values or commitments that compete with or support each other (Laidlaw 2002, 2013; Robbins 2013), then what kinds of overlapping or competing ethical projects underpin the growth of the global solar industry? How do solar executives and entrepreneurs people make the pursuit of market goods – freedom, profit, growth, expansion, property – articulate with an ethics of care to people and planet?

As Mette High and Jessica Smith write, in the introduction to this volume, the everyday ethics of people employed in energy industries - whether fossil fuel, nuclear or renewable - are frequently marked by ‘plurality and complexity’, ‘idiosyncrasy if not inconsistency’. The ethnographic challenge, they propose, is to take seriously how these people make sense of the world rather than move immediately to a position of critique or advocacy. This paper sets out to attempt such a task in the context of the global off grid solar industry, a uniquely rich site from which to examine ethical commitments to people and the environment.

Solar energy has been morally encoded with a spirit of social and ecological entrepreneurialism since the invention of the modern photovoltaic cell in 1953. As I explore in the first section of this paper, the ethical commitments of the solar industry have always had a humanitarian impulse or an orientation towards distant others, underpinned by rhetorics of collectivity and sustainability as well as commercial promise. But energy, as Cymene Howe writes (this volume), is not just ‘power, materialised’ it is always ‘ethics, charged’. Since the mid 20th century the ecological and market commitments - or ‘ecologics’ (Howe 2014; Howe and Boyer 2016) - of solar energy across Sub Saharan Africa and South Asia have been firmly tied to the logics and imaginaries of ‘development’ (Escobar 2011, Ferguson 1990, Li 2007). For the past half-century the deployment of decentralised solar energy technologies in countries from Mali to India have brought solar power into alignment with programmes of ‘improvement’ in health and wellbeing, education, livelihoods and productivity (Cross 2013, 2018).

<insert image 1, w/caption: Solar Panels Charging a Portable Lamp in Goudoubou Refugee Camp Burkina Faso, 2017, Image Credit: Adolphe Yentim/Jamie Cross>

Yet attempts to engineer transitions to a low carbon economy also come with costs (Mulvaney and Newell 2013). As Cymene Howe (this volume) outlines, whilst the dramatic expansion of renewable energy infrastructures worldwide is ethically laudable and necessary they also necessitate a tipping of ‘value scales’; with the deleterious effects of wind or solar on communities, the environment and non-human lives balanced against humanity’s ‘greater good’. Nowhere is this more apparent than in the worldwide solar industry.

Our ability to convert sunlight into electricity depends upon the same extractive industries, globalised production networks and electronic waste flows that have characterised the industrial exploitation of resources, land and labour in the Anthropocene, or what we might better call the Capitalocene (Haraway 2015; Moore 2015). The exponential growth in the installed global capacity of solar over the past decade and the dramatic fall in the cost of solar modules is often framed by clean energy champions as a ubiquitous good (e.g. Sivaram 2018). Yet the accelerated growth of global demand for solar energy is producing new economic inequities, ecological harms, and forms of precarity.

The solar industry is a silicon based microelectronic industry. The falling prices of solar modules have seen smaller margins for solar manufacturers, leading to pinch points across global supply chains. Sustained demand for solar power, for example, will depend on continued access to and exploitation of rare earths and mineral resources – including the silver, copper, bauxite, lithium, silicon which are used to produce photovoltaic modules, rechargeable batteries, and electronic circuitry – at sites across Latin America, Central and Southern Africa, South and South-East Asia (Revette 2017; Bazilian 2018). The continued manufacturing and assembly of mono-crystalline and polycrystalline solar modules, electronic components, and batteries in off grid solar technologies will hinge on efficiencies in the labour process at sites of offshore subcontracting in China and Malaysia, akin to those at any other sites of global electronic production (e.g. Ngai 2005). Finally, when solar systems break, fail or reach the end of their working lives they produce new flows of discarded electronic components and materials, as well as new questions about what to do with e-waste (Lepawsky 2018; Cross and Murray 2018). Like other microelectronic industries, the solar industry frequently conceals the conditions under which its solar goods are produced through forms of obfuscation, misdirection or greenwashing, ‘the glare from solar blinding us to better alternatives’ (Zehner 2012). Rather than presenting an untroubled

solution to our global energy challenges, the growth of the solar industry is also the ‘rebirth’ of extractive and exploitative energy economies (Argenti and Knight 2015).

Seen in this light any attempt to do good *and* do well by harnessing the power of the sun to generate electricity in contexts of global poverty involves compromises or trade-offs. In the shadow of such photovoltaic realism the prospect that there might be something uniquely ethical about solar power is just another ‘corporate oxymoron’ (Benson and Kirsch 2010). But does this analysis do justice to the moral commitments of people running or employed by solar companies?

As Mette High writes of the oil industry (see, this volume) such analysis of the solar industry risks leaving human actors noticeable by their absence; rendered invisible by the moral authority of critique. We are left with little understanding of what it is that moves solar entrepreneurs to action, how people make sense of or articulate their ethical commitments in everyday working life, or how people balance costs and benefits in pursuit of a greater, common good.

My contribution to this special issue attempts to readdress the imbalance by drawing from ethnographic research carried out since 2010 across the off grid solar value chain. This has included fieldwork with designers and manufacturers of off grid solar systems in corporate offices to fieldwork with distributors and users of solar equipment in unelectrified parts of India, Kenya, Tanzania and Burkina Faso (Cross 2016a; 2016b; Cross 2018, Cross et al 2018). If executives in the off grid solar industry engage with social anthropologists it is usually with the aim of better understanding market conditions or the behaviour of poor consumers. They want to know why people adopt solar power or what the social impact of their technologies is in particular places. This paper reverses the ethnographic gaze. Moving from an international trade fair for the off grid solar industry in Dubai to a small solar start-up in Hyderabad, India, I turn the focus away from consumers to the people whose business is selling solar technology to the poor.

Corporate managers and executives in the off grid solar industry are deeply committed to the idea that making consumer markets for solar goods is ethical. In the solar industry making markets is a way of ‘being ecological’ (Morton 2018), of caring for distant others (Bornstein and Redfield 2011), and of creating corporate value (Foster 2007). I propose, building on the

work of Joel Robbins (2012, 2013) and Frederic Jameson (2005), that we take these commitments seriously.

In his call for an anthropology of the good, Joel Robbins encouraged anthropologists to ‘explore the ways in which people organize their personal and collective lives in order to foster what they think of as good, and to study what it is like to live at least some of the time in light of such a project’ (Robbins 2013:457). We must not, Robbins argues, dismiss people’s investments in realizing the good as mere utopianism, or set out to smother their hopes with wet blanket realism (ibid.:458), but rather give these idealizing aspects of their lives a place in our accounts. It is in this vein that I approach the solar industry.

All ethical and utopian visions need a knowable ground. In the off grid solar industry, I propose, the pursuit of social and environmental goods, perhaps even the very possibility of being good) hinges on the knowable ground that is constituted by relationships and systems of market exchange.

This argument takes the ‘anthropology of energy in the global south’ beyond the study of infrastructures of electricity and electrification (e.g. Gupta 2015) to the study of moral economy and exchange. Furthering anthropological knowledge is not the only endpoint, however. As solar energy becomes a more significant part of our energy systems, a deeper understanding of practical ethics in global solar industries is an important first step for critically engaging with solar corporations, solar supply chains and solar goods.

I begin by tracing the contours of ethical action in the brief, modern history of photovoltaics. As I show, the search for new markets defined how the solar industry came to care.

HOW THE SOLAR INDUSTRY CAME TO CARE

The specific content and contours of care in today’s off grid solar industry are shaped by a history of ideas about the relationship between electricity and humanity. The increased significance of electricity in mid 18th century programmes of social or moral reform (which saw the first experimental use of electrical machines to heal diseased bodies) was accompanied by a new ‘electrical humanitarianism’, that presented electricity as the basis for sustaining human life (Delbourgo 2006). At the beginning of the 20th century these ideas

were an inextricable feature of modernist projects of electrification, from the United States and the Soviet Union to India (e.g. Nye 1990; Buck-Morss 2002; Coleman 2017). In the 1950s the invention of a technology that could convert sunlight into a clean, renewable source of electrical power tied electricity and the notion of humanity together in new ways.

On April 25th, 1954, the US research and development company Bell Laboratories publicly announced that three of its scientists – Daryl Chapin, Gerald Pearson and Calvin Fuller – had invented a silicon photovoltaic cell capable of converting enough of the sun’s energy into power to run everyday electronic equipment. The New York Times heralded the invention on its front page, echoing Bell Laboratories claims for its new technology, that the solar cell ‘may mark the beginning of a new era, leading eventually to the realization of one of mankind’s most cherished dreams – the harnessing of the almost limitless power of the sun for the uses of civilization’. These sentiments, with their emphasis on harnessing the power of the sun to the benefit of all, were to become a mainstay of self-representation and corporate story-telling in the solar industry.

<insert image 2, w/caption: Photovoltaic realism: 1950s advertisement for the bell solar battery superimposed on street side electronics traders in rural India in 2012, Image Credit: Jamie Cross/Jenny Littlejohn>

In the 1950s there was little question that the price of electricity generated by silicon photovoltaic cells might immediately be competitive with the cost of grid-connected electricity generated by coal power plants or big dams. Instead, as US based scientists and engineers struggled to find viable applications for the silicon-based solar cell they embraced a post-war idea of ‘development’. In the developing or ‘disconnected world’ they saw not just an unmet need for modern forms of energy but also vast potential markets for their technology. Seeking out these opportunities saw an ecological-utopian vision fused to the commercial interests of the nascent solar industry.

Bell Laboratories sold the first license for the commercial manufacture of silicon solar modules to a US based company, National Fabricated Products. National Fabricated Products was exploring the potential for solar power outside of Europe and America, driven not just by the idea of providing cheap power in parts of the world where power was not readily

available but also by the untapped commercial value of new markets in Africa and Asia (Perlin 1999). In the mid 1950s, however, the costs of mass-producing solar modules remained high, and National Fabricated Products was unable to realize its ambitions. It was not until the early 1970s, when Exxon's Solar Power Corporation pioneered the mass production of silicon wafers, and the cost of photovoltaic solar cells dropped enough for them to have viable applications outside the military or the space industry.

The first field trials of a modern, solar powered technology designed for sub-Saharan Africa did not take place until 1977, when a French missionary, Bernard Verspieren, installed a water pump in the drought ridden Sahel. 'Solar power is the answer', Verspieren told people in the village of Nabasso, Mali, 'It will be your salvation. You've seen it, touched it, listened to it – not in a laboratory but in your own backyard' (ibid, 111).

In the 1980s the French and US governments funded further trials of solar power across west Africa, financing efforts to deploy their own solar photovoltaic kits to power irrigation systems, community electricity supply and communications (e.g. Akrich 1987). In the global south as in the global north, photovoltaic technologies allowed policy makers and planners to imagine a decentralised solar future, with solar energy producing electricity for communities and households at the point of consumption.

During the 1980s and 1990s these efforts often coincided with structural adjustment policies that rendered the building or expansion of large-scale electricity infrastructures economically unviable. Across the global south, state energy utilities were restructured or privatised. Meanwhile, post-industrial, green visions of future energy infrastructures turned large-scale grids into ecological problems and championed decentralised or micro level energy infrastructures. In the mid 1990s, amidst growing recognition that access to energy was critical for many development indicators, attempts to increase access to energy in contexts of international development shifted away from the extension of large-scale public infrastructure for electricity towards support for small-scale renewable energy technologies that generate electricity off the grid. Against this backdrop, international financial institutions led by the World Bank and the International Monetary Fund began to fund projects and programmes aimed at creating consumer markets for renewable energy technologies (Jacobson, 2007; Miller, 2009).

South Asia emerged as a testing ground for policies and business models that aimed at creating new consumer markets for off grid solar systems. In the 1990s the World Bank supported solar entrepreneurs in India, Indonesia, and Sri Lanka, setting up small businesses that would allow people to ‘sell solar like coca cola’, in the expectation that they would have a demonstration effect, revealing a market to future businesses and larger competitors. By the end of the 1990s, these trends in international development assistance coincided with a transformation of the global solar photovoltaic industry. New developments in the production and manufacturing of photovoltaic materials and the diversification of Taiwanese and Japanese micro-electronic companies into the sector, saw a dramatic fall in the cost and a dramatic rise in the efficiency of solar cells or modules. As a small-scale technology that could provide decentralised electrical services to individual households or even single appliances, the photovoltaic solar cell proved enormously compatible with neoliberal policies that emphasised the role of the market in the delivery of energy services to people living off the grid (Jacobson, 2007: 145–146).

Since the 1950s the catalogue of photovoltaic appliances designed to do good in places with no or limited access to electricity has expanded exponentially. Alongside solar powered water pumps you can now find solar powered desalination systems and purification kits; solar powered medical packs, diagnostic devices and vaccine refrigerators; solar powered chargers, mobile phones, and routers. Out of all this burgeoning solar array, it is the simple, solar lantern that has become the most ubiquitous application for solar energy off the grid in the global south. Like the clean charcoal described by Walsh or the wind infrastructure project described by Howe in their contributions to this volume, the solar lantern has been designed with an expansive, even all encompassing, capacity to care. This small scale solar technology has reworked the connections between electricity and human life, tying solar power to new biopolitical projects of governance and reform in the global south (Boyer 2011; Gupta 2015). Solar powered lanterns designed in the US, manufactured in China, and distributed in rural India or post-earthquake Haiti, for example, are celebrated for simultaneously delivering cheap and clean energy, safeguarding health, reducing carbon emissions, improving educational outcomes and fostering economic productivity. Across Sub Saharan Africa and South Asia these small solar things fuse ecological, social and economic imperatives, mandates of sustainability, mantras of growth and gain.

Like other kinds of small-scale devices designed and built for people living in conditions of global poverty (Cross 2013; Collier et al 2018), solar powered lanterns emerged as a response to the perceived failures of states to care for or safeguard the health of their populations. In places where large scale infrastructures for the delivery of energy do not reach or have collapsed they are designed to provide a minimalist (Redfield 2012), level of care. Access to a solar lantern - a small portable solar lighting device comprised of a solar photovoltaic cell, batteries, and LEDs (light emitting diodes), often with mobile phone charging capabilities - has become the most basic measure of life with electricity. Under the auspices of the UN's Sustainable Development Goals policy makers have revised measurements and indices of poverty to accommodate the view that modern, efficient forms of electricity are essential for human wellbeing (Cross 2018). Electric illumination, equivalent to that provided by a solar powered lantern, is now an internationally agreed minimum level of access to 'modern energy services' (Cross 2018). Such definitions have made small, portable solar powered devices a vital part of emergency responses to humanitarian crisis; mandating governments, international agencies, and solar companies to make them available to people as part of post-disaster relief efforts as well as people living in chronic global poverty.

As a result, brand name solar lighting devices manufactured by multinational corporations and social enterprises are now a ubiquitous part of humanitarian responses to natural disasters, forced displacement, disease epidemics and chronic poverty. In 2015, for example, the US agency Mercy Corp distributed 10,000 solar lanterns to families affected by the earthquake, adding solar lanterns to its critical basic non-food relief item kits. Mercy Corp determined that the Nepal earthquake was exactly the kind of crisis in which the short-term free distribution of energy technologies was needed and appropriate. Using the experiences from the Nepal earthquake response they set out to creating guidance for other programme teams responding to acute emergencies, lessons learned, and to make a case for including energy access as part of a standard emergency response within the wider humanitarian community, and to establish minimum standards for lighting assistance. The title of a report documenting the lessons of their intervention and their position on the relationship between energy, safety, health and well-being in emergencies, summarised their position succinctly, 'With light there is more life'. This work demanded that they find a balance between the gift of humanitarian assistance and the logic of the market. As the report stated:

In emergency response contexts, we must strike a balance between maintaining the core humanitarian principles and taking measures to not undermine the long term stability of clean energy markets by flooding healthy markets with free or heavily subsidised goods. This requires taking a nuanced approach to defining our humanitarian context, assessing market availability of goods and services, and choosing appropriate response mechanisms (e.g. results based financing agreements with local banks, government, or private sector, direct cash transfers to households, vouchers through local vendors, distributions of food or non-food items etc.)

The design and distribution of solar powered lanterns for the ‘un-electrified poor’ has seen technical support, start-up capital, equity investment, and grants flow into social enterprises from social investment funds and international development organisations. Between 2016 and 2018 off grid solar companies operating in South Asia and Sub Saharan Africa raised \$US 500 million in investment to sell products ranging from small solar powered lanterns and mobile charging devices to solar home systems capable of powering televisions and fans (World Bank/Dalberg 2018).

How are we to apprehend the good in these solar goods?

In many respects the social lives of solar goods in the global south reproduce familiar stories of technological or commodity fetishism. Coming to the solar industry afresh, cynics might be forgiven for the suspicion that ‘there is nothing new under the sun’. But, as Joel Robbins’ reminds us, there are other ways to think about ‘the good’ in ‘the solar good’.

What would an anthropology of the good look like when it encounters the work of ecologically minded humanitarian capitalists? What might an anthropology of the good mean when it encounters a green, humanitarian ethic attached to the commodity form? And what might it mean to pursue an anthropology of the good in this double sense, by focusing both on the attempts by people to fashion and pursue the good in their practices of care for others as well as the ways that these ideals are inscribed or materialized in a mass-produced commodity?

In the following sections I explore these questions in two different locations. First, on the floor of a global trade fair for the off grid solar industry held in Dubai, United Arab Emirates. Second on the floor of an off grid solar sales company in Hyderabad, India. These two field

settings offer insight into the ways that people located within the solar industry express their ethical commitments and work to establish the commensurability of ‘doing good’ and ‘doing well’.

PERPETUAL SUNLIGHT

In November 2015 I travelled to Dubai, to attend an international trade conference organised by the Global Off Grid Lighting Association (GOGLA), an organisation established to promote the interests of solar lighting companies in Sub Saharan Africa and South Asia. The growth of the off grid solar lighting business in sub-Saharan Africa and South Asia has been reflected in the association’s increased membership and prominence. The first meeting was held in a Senegal hotel in 2008. ‘At that time if we sold 1000 units that was a big deal,’ the co-founder of D.Light, a leading off grid solar company told delegates. ‘Back then there were just a few of us. Nobody really.’ Seven years and four annual meetings later his company boasted sales of 6 million units, and the annual trade event occupied a suite of gigantic conference rooms across the Dubai World Trade Centre. The change in the off grid solar industry’s profile was signalled not just by the venue but the delegate list, which included the chief executives of global oil companies and government ministers. As D.Light’s co-founder put it in his opening address, ‘Now, policy makers are using our language.’

The trade fair took place in a vast hall at the end of a gigantic plaza - packed with pizza parlours, sandwich and coffee joints. Entering the solar industry event meant leaving the plaza - with its shopping malls, t-shirts and jeans - and entering a world that brought together global finance and solar humanitarianism. By contrast with the plaza beyond, the global off grid lighting event was a sober affair, the challenges of global energy poverty both serious and contained, kept within the confines of its pre-booked hall, out of sight.

The venue was carefully choreographed to facilitate business. Unobtrusively placed white leather sofas allowed participants to conduct out of session discussions, sharing corporate gossip, product launches, and investment success stories, or to broker potential partnerships. People worked on laptops, tablets or phones or threw themselves into performances of entrepreneurialism, with ostentatious and self-conscious finger clicking eureka moments. The event was dominated by young, white, English speaking men: 35-year old executives, the founders of off grid solar companies; the directors of single family trust funds; the industry

analysts and the financiers; many with MBAs or graduate degrees in international development. Collectively, they worked the crowds, establishing themselves as leaders of this, the golden age of solar photovoltaics.

Some noticed my University of Edinburgh name badge and introduced themselves. Two men remembered their days as students in Edinburgh, where they had taken introductory classes in social anthropology before becoming lawyers or financial brokers, joining or starting firms working in the carbon offset market with trading offices in Nairobi or companies with links to mining companies in Mozambique and Tanzania. Like others, they were looking to get a foothold in Sub Saharan Africa's emerging off grid solar industry, seeing out contacts and links.

If these delegates imagined market exchange as a natural, universal, trans-historical and trans-cultural relationship they did not assume that markets themselves were a given. Instead many delegates appeared to share the view - familiar to economic anthropologists and sociologists - that markets must be made (e.g. Foster 2007; Callon 2007; Callon et al 2002; Callon et al 2007; Mackenzie 2007). To this end the conference was resolutely focused on the practicality and materiality of market making. Across panels and roundtable sessions the conference delegates reflected on the role of government regulation, business models, product standards, consumer warranties, market research data, and mobile phones as 'market devices' (Callon 2007); that is as material technologies which, in their operation and use, had a role in making and expanding markets for off grid solar technology in the global south.

Even the most basic or entry level solar powered lamp - like distributed as a humanitarian response to crisis or sold as a replacement for kerosene fuelled lighting - had a part to play; inviting consumers into the solar industry's consumer economy. As one industry analyst put it to me, 'eradicating kerosene is just the first step. Solar energy - decentralized power - allows people to leapfrog the grid and as you get an ecosystem of products available the market can really unlock.' As another industry analyst explained, 'If you want to face the harsh economies of competition you've got to go multi-appliance. There is lots of opportunity to capitalize on the sun.'

The conference formally opened with a short film that showcased the solar industry's solar values and impact. produced by the World Bank's International Finance Corporation.

The film was produced by the World Bank's International Finance Corporation and told the story of two young girls: 'Anisha from India' and 'Adina from Nigeria'. Watching it on the big screen I was struck by a parallel with the oil industry. Big oil companies often open annual meetings or trade events with films that highlight their investments in renewable energy or corporate social responsibility – films that display their commitments to social values - before turning to focus on their investments in and returns from fossil fuel (e.g. Appel et al 2015). For a moment I was taken aback to see a similar film at a solar industry conference, where I assumed all delegates were familiar with the 'social story' of solar. But over the next few days, I came to see that it was incumbent upon solar industry executives to showcase their social and moral commitments before getting down to business. By reiterating the industry's ethical commitments and re-inscribing these in its most iconic technology the film established the parameters to the event, offering a unifying theme and a common message to the participants. 'From these films,' one of the speakers told the gathering, 'we get a glimpse of what it is like to have solar powered light...education...health...the ability to lead productive lives...jobs...it is about much more than light.'

The symbolism of these solar stories reworks the associations between electricity and human life, like those discussed in the previous section. Solar powered lighting systems are presented as a palliative for people living in chronic energy poverty: a technological fix that will offer relief from darkness and improvements in the quality of life. Moving around the conference floor I rubbed up against what Bhri Gupta Singh (2015) has called the 'confident solar assumptions of modernising scientific educators'. 'People,' he has written, 'who like to pronounce on the significance of the candle, or the flame or the lamp in the darkness, and whose words express a kind of Victorian physics or pedagogic morality that are 'etched into modernity'. Over four days in Dubai I listened to solar entrepreneurs hold forth on the inevitable upward movement of the global poor from 'less' to 'more' sophisticated technologies. These transitions from fuel wood, dung, and crop waste to solar power, they argued, in speeches and power-point presentations would drive incremental gains in household income, wellbeing and 'social development'. Across genres of corporate writing about solar energy – from the press releases put out by companies and social enterprises to the good news stories written by technology, business and environmental journalists – the same tropes, assumptions and utopian aspirations appear. Here, solar energy constitutes an unblemished form of the good. Similar sentiments can be heard around other interventions in

low carbon energy and development, like the green charcoal projects in Madagascar described by Walsh (this volume).

The conference's opening film reiterated these ethical credentials and, in doing so, also neutralised any moral ambiguities or critiques about money making in contexts of chronic global poverty. The film screening was followed by a keynote address by the Nobel peace prize winner and microfinance champion Muhammed Yunus.

'How can solar technology flow to where it didn't flow before,' Muhammed Yunus asked the audience in a recorded video statement?

'I invite you, the off the grid movement, to think about doing it as a social business, without making any money out of it,' he said.

His speech received warm applause. Yet far from presenting the assembled entrepreneurs with a moral quandary – 'how to do good without doing well' – Muhammed Yunus' invitation was politely ignored. After his speech many people in the audience muttered about the irony of his words, given how much money he was reputed to have been paid to deliver them. Instead, the words of Bill Gates appeared to provide a stronger inspiration and intellectual scaffold for action. If there was an implicit moral message to the conference, it was that it was acceptable, appropriate and necessary to do good by doing well.

In the plenaries that followed speaker after speaker from international financial institutions, governments, and oil companies gave the gathered solar entrepreneurs a 'green light' to do business. Some made the moral case with facts and figures, detailing the numbers of people living at different tiers of access to modern forms of energy.

A director of the global off grid lighting association, for example, gestured to the industry's grand ambitions. 'Markets for solar energy in the global south are not just confined to people who live off the grid', he told the assembled guests. 'We're not just talking about the 1.2 billion people without no access to electricity. We're also talking about the 1 billion people with only partial access to electricity.'

Others outlined the moral imperative in personal terms, with stories of their own experience of worlds without electricity. A senior executive from the French oil company Total, for example, described his grandfather's life without electric light in the Netherlands during the 1930s. A senior head of marketing for the multinational lighting company Philips described his father life as a 'country boy', growing up without electric power in the mid-western United States. And, a senior representative from the World Bank, a high caste Indian woman, described her childhood in Mumbai. 'The best sound of my childhood was the sound of the fan coming back on after a power cut,' she said. 'When the electricity was off, we had to study by the headlights of our car and we were the rich ones. We could only imagine what life was like for the poor.'

Other speakers made the moral case for market action a response to broken public infrastructures. 'Where infrastructure is failing or insufficient or non-existent, we need to encourage innovative alternatives, rooted in commercial models, rooted in the scalability and viability of the private sector and private sector capital,' the vice-president of the World Bank's International Finance Corporation told the audience.' Grant Schapps, then UK minister for international development, told the gathering that it was 'unimaginable to speak of development without energy.' 'But accelerating sustainable access to energy in the developing world needs competition,' he said. 'That is the future: a race, village to village, as commercial companies compete to supply energy to people'.

On the main stage and in off stage discussions, conference delegates largely cleaved to this ordering narrative in which market actors and solutions were unquestionably successful. Occasionally, however, there was whispered ambivalence at this collective social and technical imaginary from the sidelines.

During one coffee break I was button holed by a smartly dressed, middle aged Indian man, the senior manager for a major global social investment fund. My interlocutor had flown into the conference from Mumbai for just one day.

'I'm here to keep my ear to the ground,' he said. 'My first teacher was Mo Tzu,' referring to the Chinese philosopher who lived in the fourth century BC. 'Just listen, Mo Tzu taught. I'm here to listen.' But he also had questions.

‘Does more light really improve people’s lives,’ he asked me? ‘Come on! You’re the social anthropologist. Does a solar light really bring development? Does it really improve well-being? Does it really make people happy? Can we prove it?’

He paused. ‘That’s what we really need to know. Because that’s how we can attract money?’

Like Bill Gates, the social entrepreneurs or humanitarian capitalists circulating around the solar industry make an ethic of care for distant others a core business proposition. They make market exchange the ‘source and circumference’ of what it means to do good. And they perform themselves as moral actors through a commitment to systems of market driven systems of mass production and consumption.

If the proper and heroic job of the capitalist entrepreneur is to match supply to unmet wants and desires, the proper and heroic job of these social or humanitarian capitalists is to match supply to unmet needs. In the following section I explore how the performance of these market moralities plays out on the floor of a solar distribution company in India.

SELLING IN THE DARK

The rickshaw bounced over a collapsing road in a leafy Hyderabad suburb and dropped me at a nondescript three-story building in a quiet lot. The young rickshaw driver asked me with a smile if I had come to see Mahesh Babu, a Telugu film star who lived in the area, but I was looking for a solar lighting company. The driver looked up at the shoddy facade.

‘Brother, are you sure this is the place?’, he asked.

I was not sure. There were no signs on the gate and the courtyard was deserted. A guard, hanging about in the forecourt, pointed me towards the stairwell. I walked up the stairs behind a fruit salesman, laden with papaya. On the first floor a Brahman woman, *tilak* on her forehead, opened her front door to the fruit salesman. When I asked her, in my politest Telugu, where the solar energy company is, she told me to go away with a flick of her hand.

On the top floor, I rang an unmarked buzzer on an unmarked wooden door and hoped for the best. The door was opened by a beaming young, European man. He ushered me over the

threshold, bouncing across the marble floor in shorts and bare feet, his T-shirt the colour of iridescent sunlight. I had come to the right place. This was the Hyderabad office of a company I will call Radiate Energy, an international social enterprise that was making a name for itself by selling solar lanterns to India's urban poor.

In the 2010s small solar lighting devices become market leaders for a new kind of company in India; one whose core business was the sale of small, durable consumer goods and technological devices to rural and urban consumers under the rubric of development. Selling solar in India involves new kinds of practices, strategies and organizational collaborations. The sale of solar lighting systems has allowed distributors and salespeople to acquire new knowledge about the aspirations of consumers, to test new sales strategies, and to develop new market strategies. As one of the directors of Radiate Energy put it, 'We're good at solar lights. We know how to sell them.'

On the third floor of the suburban apartment an open plan living area had been converted into a makeshift distribution centre. Cardboard boxes, full of solar lanterns ordered direct from the manufacturer, were stacked against doorframes. Bright yellow motivational posters were taped onto white walls. 'Stop being afraid of what could go wrong, think of what could go right,' they read. Or, 'It always seems impossible until it's done - Nelson Mandela'. On a desk lay a stack of corporate brochures, newsletters, a calendar and a profile piece published in a regional newspaper, 'Lighting the Urban Slums'.

Radiate's operations in Hyderabad were set up by two young European men who I will call Guy and Logan. Guy and Logan share much with a generation of global, social entrepreneurs. Aged in their late twenties, with graduate degrees in business and law from internationally recognized universities, they are driven by a desire to do good in the world while navigating through a graduate labour market characterized by its precariousness and a post-neoliberal transformation in the arena of international development. 'We just hit sales of 10,000 solar lanterns in India,' Guy told me.

We could have given away those lights. But we sold them. And if I can sell one, I can sell another. We could sell another 10k here. In the long term, selling solar lights is more sustainable than charity. And our generation are looking for ways that you can do that and make money on the side.

Everyone is talking about social entrepreneurship. It's become sexy. It's become cool.

Radiate Energy had been operating a successful venture in another South Indian city for two years. Guy and Logan had flown into Hyderabad with the aim of opening a new office and creating a new market for solar lanterns amongst the city's urban poor. They knew that their target customers, in line with the company's remit as a social enterprise tackling energy poverty by selling solar light, were informal and irregular settlements. But they arrived with a very limited knowledge of the city's geography or demographics. Neither of them had visited Hyderabad before; neither of them spoke Telugu; and they had few if any local contacts.

The company's business model was simple: recruit a network of young, local people and train them to become sales agents, selling door-to-door in poor urban communities. The move to Hyderabad was the company's first attempt to scale up their business model in India and, when I first visited, they had been there for eight months. Logan explained how they began.

'From the beginning, we knew that just because our strategy had worked in one Indian city, that didn't mean it was going to work here too. We knew that we had to be flexible. We knew we had to adapt locally. We knew that every Indian city was different, that populations are different that the labour markets are different. Basically, we were creating the process from scratch.'

On the day they flew into Hyderabad for the first time they began fixing up meetings with companies, NGOs, and other social enterprises in the city; introducing themselves and the company, and mapping the institutional landscape. Within two weeks they had rented and furnished an apartment, which doubled up as their home and their office space. Over the next fortnight they turned themselves to the challenge of mapping potential markets onto the city's social and economic geography. One of their early moves was to approach Hyderabad's municipal corporation, the urban planning authorities, and ask for access to detailed maps off the city. This proved unsuccessful, an outcome that they blamed on the corruption of Indian officials. Instead, they found a novel, work around solution.

The company does not just sell solar light to the poor. It also packages and sells a social impact experience to a market of students, young professionals and budding entrepreneurs in the UK and Europe, North America and Australia as well as in India. These market

internships offer a social impact experience or intensive training programme that provides a hands-on experience. Within a month of their arrival in Hyderabad, Guy and Logan hosted the first, month-long impact experience programme. Their first intake included ten people that Guy and Logan categorized simply as ‘internationals’ with differential fee rates depending on their country of origin, and six Indians.

This team helped to set up the office, painting walls, varnishing tables and helped establish Radiate’s city strategy. Charged with mapping the city’s solar markets, the first group of interns came up with an alternative strategy. Opening up laptops, they pored over Google’s satellite imagery of Hyderabad, scrolling over the city, identifying potential bottom of the pyramid urban markets based on a typology of roofing material. They were looking for blue tarpaulins, which the organisation’s managers associated with the presence of an un-electrified, informal settlements; what some civil planners and activists in India call ‘slums’ but what this organisation called ‘tents’. ‘Yes! Just on the basis of what a roof looks like we can identify our target bottom of the pyramid solar market’, Guy explained.

Identifying the communities on the ground was, of course, a much more complicated operation. Once a location had been identified from Google’s satellite imagery Radiate Energy sent a team on what they called ‘verification’ trips. These teams comprised both Indian and non-Indian team members. The international composition was deemed particularly important. ‘Having a white face is a simple weapon for entrepreneurs entering communities,’ Logan told me. The two managers wrestled with the implications of this strategy, at one point introducing all Telugu teams, but they eventually made the mobilisation of ‘internationals’ into a key part of their work.

Before heading off into the city by bus or on foot, the team downloaded a set of coordinates from *Google Maps* and uploaded them onto a different smartphone mapping application that could be used offline and without mobile reception. These preliminary visits were intended as ‘baseline surveys’ that would give a broad-brush picture of market demographics and income. Each team had a form to complete, again using their smartphone, which would also enable them to ‘name the community’, give a ‘number of tents’ and details of community ‘access to water and electricity’. As Guy and Logan acknowledged, this was an imperfect and, at times, wholly subjective method. There was a time delay between the acquisition of the satellite imagery and the field trips. Sometimes people discovered that there was no tented

community at all or that blue tarpaulins had been erected over open spaces for public functions, ceremonies or festivals rather than above informal settlements. Meanwhile, the organisation discovered the limits to their data collection capacities. 'If the community is very big, with more than 200 people, then it is very difficult and our database is not very clean. We ask our teams to keep updating the numbers. It's not a precise science.'

With little or no information about these locations from the civic authorities or from the communities themselves the teams assigned their own names. Looking over the map on a laptop in the company's office, the cartography of Hyderabad's squatter settlements they produced read more like a work of psycho-geography than an exercise in participatory mapping. I traced my finger across the new chart of the Telugu capital, tracing the experiences of the map makers: 'The Descent', 'The Valley', 'Pellets', 'Train Junction', 'Smelly Stream', 'Pride Rock', 'Shepard'.

By the end of February 2015, Radiate had mapped and validated 400 communities across Hyderabad. Over eight months this combination of remote mapping exercises and first person visits had allowed the company to build up their own grid of communities or markets across Hyderabad, dividing the city's temporary migrant communities and longer-term squatter settlements on the basis of whether or not they had access to mains electricity and the number of 'tents'. 'Somewhere between 600-800 tents feels like the right market to start with but we might cut the community differently,' Logan said.

When they made it into one of these communities the moment of sale involved a slow set up. In their pre-visit briefings, team members were taught not to introduce themselves as salespeople or even to mention solar lanterns on their first visit. 'A good sales person does not even show the solar light on the first visit,' people were taught. Instead the sales representatives were coached to introduce themselves as 'working for an organisation that wants to help people' and use this to initiate conversations about people's living conditions. These early visits were described as a 'way of getting a feel for the market'. As Guy and Logan put it, during training sessions for new salespeople, knowing when the moment of sale had arrived was a skill acquired through practice and patience. 'For that first sale you have to use your gut feeling. You have to think, is this person going to be a reliable customer?'

On the streets of Hyderabad's squatter settlements, the unique qualities or affordances of the solar lantern allowed it to be sold in particular ways. As one of Radiate's sales team put it:

You can sell a solar light at night, you can sell it in the darkness. At night people can actually see what it does. You can see it immediately. Kerosene lanterns are smoky and dirty. But if you come in with a solar light people can see there is something in it. People can see that solar light fixes the problem immediately. They can see the change in front of their eyes as soon as the light is turned on. You can't see that with any other products. In fact I don't know any other product where you can see the change. Try selling a water filter. You put water in the filter, four hours later it comes out and it looks more or less the same. The water might have been filtered but you can't see it!

In such everyday interactions, as solar entrepreneurs work to create markets for their goods in places of global poverty, the pursuit of 'solar goods' subtly reproduces modes of relational power and differential authority. On the ground the distribution of solar goods involves a moment of encounter between people who occupy radically different positions of wealth and poverty, caste and class. Salespeople and entrepreneurs attempt to overcome this social distance by drawing on registers of caste and class or claims to superior and expert knowledge. On the streets of Hyderabad the everyday work of increasing access to clean, solar energy also re-inscribed racial and caste hierarchies, forms of class inequality and vernacular prejudice (Cross 2018b) into the solar economy.

SOLAR UTOPIAS AND BEYOND

Just as life with climate change is creating new anxieties and compulsions so too it is creating new ethical elisions, horizons and commitments. Across both the locations presented above – an investment forum for the solar industry and the offices of a solar enterprise - we can discern a kind of collective refusal of 'structural pessimism' about climate change. To listen to the chief executives, chief technical officers, sales executives and regional managers of solar companies is to hear the outlines of a politics of hope, founded in the promise of solar energy. 'The solar light is a means of communication,' the founder of one solar lantern company told me.

It is a means of communication through something that actually contributes to the solution. It helps people to imagine that solutions are possible, because they just have it in their hands and because it is very simple...It's communicating, conveying a message, that renewable energy is available and can help right away, that by just pushing a button you can tap into the power of the sun. It makes people feel that they are, albeit on a small scale, actually and effectively cooperating to make change happen. And people really like that.

Such visions of the solar good are both pre-figurative and pastoral. They grant small scale, solar energy technologies a decisive role in materialising a low carbon future. And they suggest the possibility of a pure, unmediated relationship to sunlight. In these visions the technology that converts sunlight into electricity fades into the background, doing invisible work; and the mass production and consumption of solar power takes place without contradictions.

How are we to engage with attempts to do well by doing good at the intersection of climate change and chronic energy poverty? How do people come to see the marketing and distribution of small scale solar technology as, simultaneously, an engine of corporate value, a means of alleviating suffering, and a solution to ecological crisis? As Didier Fassin (2012) might put it, the only way to 'grasp the logics and the assumptions, the ambiguities and the contradictions, the principles of justice and the practices of judgment' that come together in the solar industry is to explore them head on: examining the pursuit of solar goods in relation to capitalist political economy. This paper has outlined the beginnings of such a task, following ethical projects, logics, assumptions, principles and practices that are articulated by entrepreneurs and executives in the off grid solar industry.

Doing so reveals how ecological-economic utopias hinge upon what Frederick Jameson (2005) has called a 'dialectic of identity and difference'. Solar entrepreneurs promise a world that is radically different from this one; but not so radically different as to be unimaginable. Utopian visions of a global solar future present a world that is liberated from 20th century commitments to fossil fuels, a world without kerosene, or energy poverty. But it is a future that remains tethered to the systems of production and exchange, ownership and property, relations of power and exchange that are defining features of contemporary capitalist economy. In this sense, the utopian conditions of possibility are premised upon an identity with the present.

Such commitments are not universally shared, even by solar advocates. Anti-capitalist social and environmental activists who promote bottom up or community based solar development projects, for example, map other pathways to environmental justice and social equity. These pathways are defined by notions of a ‘solar commons’ and of collectively owned and managed resources. Yet such projects are no less utopian. The contours of these alternative solar futures are also rooted in a ‘dialectic of identity and difference’, tethered by actually existing and idealised forms of community, non-hierarchical exchange and horizontal organisation.

As people seek to bring about rapid social and economic transitions to a low carbon or post carbon economy they make pragmatic decisions and choices, evaluating the trade-offs between outcomes. As one of the original reviewers of this article wrote, ‘the need to transition to lower carbon fuels is in fact critical for many different reasons, climate change and human health among them, and being somewhat flip about market efforts doesn’t change that —while it would be nice to see more non-profit effort, I think that we need as many different kinds of efforts toward energy transition as possible.’

Many readers may agree. Yet the question is not whether markets are good or bad but rather what it means for our energy ethics when it is almost impossible to imagine a future without them. For the solar industry actors who are working to provide access to sustainable energy for people who live without electricity, markets provide a total moral scaffold for action: the source and circumference of what it means to do good. Such insight offers grounds for an anthropological understanding of ethics in practice. But the production of anthropological knowledge need not be our only endpoint. Understanding the grounds upon which interlocutors in the solar industry seek to act ethically can also be the starting point for an ethnographically informed ethics of engagement with solar corporations, solar entrepreneurship, solar supply chains and solar goods that seeks to foster a more just solar economy through critical analysis, art, and activism. After all, what hope is there if - for all the stellar talk - the ethical trajectories of solar power in the 21st century fail to escape the orbit of the Capitalocene?

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REFERENCES

- Adams, V., M. Murphy & A. E. Clarke 2009. Anticipation: Technoscience, life, affect, temporality. *Subjectivity* 28:246–265.
- Appel, H., Mason, A. And Watts, M. Eds., 2015. *Subterranean estates: Life worlds of oil and gas*. Cornell University Press.
- Akrich M (1994) The de-description of technical objects. In: Bijmer WE, Law J (eds) *Shaping Technology/Building Society: Studies in Sociotechnical Change*. Cambridge, MA: MIT Press, 205–224.
- Argenti, N. And Knight, D.M., 2015. Sun, wind, and the rebirth of extractive economies: renewable energy investment and metanarratives of crisis in Greece. *Journal of the Royal Anthropological Institute*, 21(4), pp.781-802.
- Bazilian, M.D., 2018. The mineral foundation of the energy transition. *The Extractive Industries and Society*, 5(1), pp.93-97.
- Benioff, M. And K. Southwick. 2004. *Compassionate capitalism: How corporations can make doing good an integral part of doing well*. Franklin Lakes: The Career Press.
- Benson, P. And Kirsch, S., 2010. Corporate Oxymorons. *Dialectical Anthropology*, 34(1), pp.45-48.
- Bishop, M. And M. Green. 2008. *Philanthrocapitalism: How giving can save the world*. New York: Bloomsbury Press.
- Bornstein, E. And Redfield, P. Eds., 2011. *Forces of compassion: humanitarianism between ethics and politics*. School for Advanced Research Press.
- Boyer, D. 2011. Energopolitics and the anthropology of energy. *Anthropology News* 52(5):5-7.
- Buck-Morss, S., 2002. *Dreamworld and catastrophe: The passing of mass utopia in East and West*. Boston: MIT press.

- Callon, M. 2007. An essay on the growing contribution of economic markets to the proliferation of the social. *Theory, Culture & Society* 24:139-163.
- Callon, M. And K. Caliskan n.d. Economization: New directions in the social studies of the market.
- Callon, M., C. Meadel and V. Rabeharisoa 2002. The economy of qualities. *Economy and Society* 31:194-217.
- Callon, M., Y. Millo and F. Muniesa 2007. An introduction to market devices. *The Sociological Review* 55:1-12.
- Coleman, L., 2017. *A Moral Technology: Electrification as Political Ritual in New Delhi*. Cornell University Press.
- Collier, S., Cross, J., Redfield, P. And Street, A. 2018 Little Development Devices/Humanitarian Goods. *Limn #9*
- Cross, J. And A. Street 2009. Anthropology at the bottom of the pyramid. *Anthropology Today* 25:4-9.
- Cross, J. 2013. The 100th object: Solar lighting technology and humanitarian goods. *Journal of Material Culture* 18:367–387.
- Cross, J. 2014. *Dream Zones: Anticipating Capitalism and Development in India*. London: Pluto Press.
- Cross, J. 2016a. Current. *South Asia: Journal of South Asian Studies*, 40:2, 291-293,
- Cross, J., 2016b. Off the grid: Infrastructure and energy beyond the mains. *Infrastructures and Social Complexity: A Companion*, pp.186-196. London: Routledge
- Cross, J. 2018. Solar Basics. In Collier, S., Cross, J., Redfield., And Street, A. 2018 Little Development Devices/Humanitarian Goods. *Limn #9*
- Cross, J. 2018b. Selling with Prejudice: Youth, Caste and Social Entrepreneurship at the Bottom of the Pyramid in India. *Ethnos*.
- Cross, J., Douglas, M., Martin, C., Ray., Verhoeven, A. 2018. *Energy and Forced Displacement in Eight Objects: Stories from Sub Saharan Africa*. London: Chatham House
- Delbourgo, J., 2006. *A most amazing scene of wonders: Electricity and enlightenment in early America*. Harvard University Press.
- Dolan, C. And Rajak, D., 2011. Introduction: Ethnographies of corporate ethicizing. *Focaal*, 2011(60), p.3.
- Donovan, K.P., 2015. Infrastructuring Aid: Materializing humanitarianism in northern Kenya. *Environment and Planning D: Society and Space*, 33(4):732-748.

- Escobar, A., 2011. *Encountering development: The making and unmaking of the Third World*. Princeton University Press.
- Elyachar, J. 2012. Next practices: Knowledge, infrastructure, and public goods at the bottom of the pyramid. *Public Culture* 24:109–130.
- Fassin, D. 2009. Another politics of life is possible. *Theory, Culture & Society* 26:44–60.
- Fassin, D. 2011. *Humanitarian reason: A moral history of the present*. Berkeley: University of California Press.
- Ferguson, J., 1990. *The anti-politics machine: 'development', depoliticization and bureaucratic power in Lesotho*. CUP Archive.
- Foster, R.J., 2007. The work of the new economy: Consumers, brands, and value creation. *Cultural Anthropology*, 22(4), pp.707-731.
- Gates, B 2008, “How to fix capitalism”, *Time*, August 11, pp.26-31.
- Graeber, D., 2013. The democracy project: A history. *A crisis, A movement*.
- Gupta, A. 2015. An anthropology of electricity from the global South. *Cultural Anthropology* 30:555–568.
- Haraway, D., 2015. Anthropocene, capitalocene, plantationocene, chthulucene: Making kin. *Environmental Humanities*, 6(1), pp.159-165.
- High, M. And J. Smith. 2018. Energy and Ethics? The Ethical Constitution of Energy Dilemmas. *Journal of the Royal Anthropological Institute* [XX:XX, this volume]
- High, M. 2018. Projects of devotion: Energy exploration and moral ambition in the cosmoeconomy of oil in the Western United States. *Journal of the Royal Anthropological Institute* [XX:XX, this volume]
- Howe, C., 2014. Anthropocenic ecoauthority: the winds of Oaxaca. *Anthropological Quarterly*, 87(2), pp.381-404.
- Howe, C. And Boyer, D., 2016. Aeolian extractivism and community wind in southern Mexico. *Public Culture*, 28(2 (79)), pp.215-235.
- Howe, C. 2018. Greater Goods: ethics, energy, and other-than-human speech. *Journal of the Royal Anthropological Institute* [XX:XX, this volume]
- Jacobson, A., 2007. Connective power: solar electrification and social change in Kenya. *World Development*, 35(1), pp.144-162.
- Jameson, F. 2005. *Archaeologies of the future: The desire called utopia and other science fictions*. London: Verso.

- Kirsch, S., 2018. *Engaged Anthropology: Politics Beyond the Text*. Univ of California Press.
- Laidlaw, J., 2002. For an anthropology of ethics and freedom. *Journal of the Royal Anthropological Institute*, 8(2), pp.311-332.
- Laidlaw, J., 2013. *The subject of virtue: An anthropology of ethics and freedom*. Cambridge University Press.
- Latour, B. 2005. *Reassembling the Social: An Introduction to Actor-Network-Theory*. Oxford: Oxford University Press.
- Lepawsky, J., 2018. *Reassembling Rubbish: Worlding Electronic Waste*. MIT Press.
- Li, T.M., 2007. *The will to improve: Governmentality, development, and the practice of politics*. Duke University Press.
- Mackenzie, D. A. 2007. An engine, not a camera: How financial models shape markets. 112:1555–1557. Boston: MIT Press
- Miyazaki, H., 2006. Economy of dreams: Hope in global capitalism and its critiques. *Cultural Anthropology*, 21(2), pp.147-172.
- Moore, J.W., 2015. *Capitalism in the Web of Life: Ecology and the Accumulation of Capital*. Verso Books.
- Morton, T., 2018. *Being Ecological*. Penguin UK.
- Newell, P. And Mulvaney, D., 2013. The political economy of the ‘just transition’. *The Geographical Journal*, 179(2), pp.132-140.
- Ngai, P., 2005. *Made in China: Women factory workers in a global workplace*. Duke University Press.
- Nye, D.E., 1990. *Electrifying America: Social meanings of a new technology, 1880-1940* (p. 185). Cambridge, MA: Mit Press.
- Perlin, J., 1999. *From space to earth: the story of solar electricity*. London: Earthscan.
- Redfield, P. 2012. Bioexpectations : Life technologies as humanitarian goods. *Public Culture* 24:157–184.
- Revette, A.C., 2017. This time it’s different: lithium extraction, cultural politics and development in Bolivia. *Third World Quarterly*, 38(1), pp.149-168.
- Robbins, J., 2012. On becoming ethical subjects: freedom, constraint, and the anthropology of morality. *Anthropology of this Century*, 5.
- Robbins, J., 2013. Beyond the suffering subject: toward an anthropology of the good. *Journal of the Royal Anthropological Institute*, 19(3), pp.447-462.
- Schwittay, A. 2011. The marketization of poverty. *Current Anthropology* 52:S71–S82.

- Singh, B., 2015. *Poverty and the quest for life: Spiritual and material striving in rural India*. Chicago: University of Chicago Press.
- Sivaram, V., 2018. *Taming the Sun: Innovations to Harness Solar Energy and Power the Planet*. MIT Press.
- Smith, J. And High, M.M., 2017. Exploring the anthropology of energy: Ethnography, energy and ethics. *Energy Research & Social Science*, 30, pp.1-6.
- Szeman, I. 2014. Conclusion: On energopolitics. *Anthropological Quarterly* 87:453–464.
- Walsh, A. 2018. The ordinary ethics of charcoal in Northern Madagascar. *Journal of the Royal Anthropological Institute* [XX:XX, this volume]
- World Bank/Dalberg. 2018. *The 2018 Off-Grid Solar Market Trends Report*. Available at:
https://sun-connect-news.org/fileadmin/DATEIEN/Dateien/New/2018_Off_Grid_Solar_Market_Trends_Report_Full.pdf.
- Zehner, O., 2012. *Green illusions: the dirty secrets of clean energy and the future of environmentalism*. University of Nebraska Press.