moving energy initiative

clean energy for refugees

Research Paper

Energy and Displacement in Eight Objects: Insights from Sub-Saharan Africa

Jamie Cross, Megan Douglas, Owen Grafham, Glada Lahn, Craig Martin, Charlotte Ray and Arno Verhoeven

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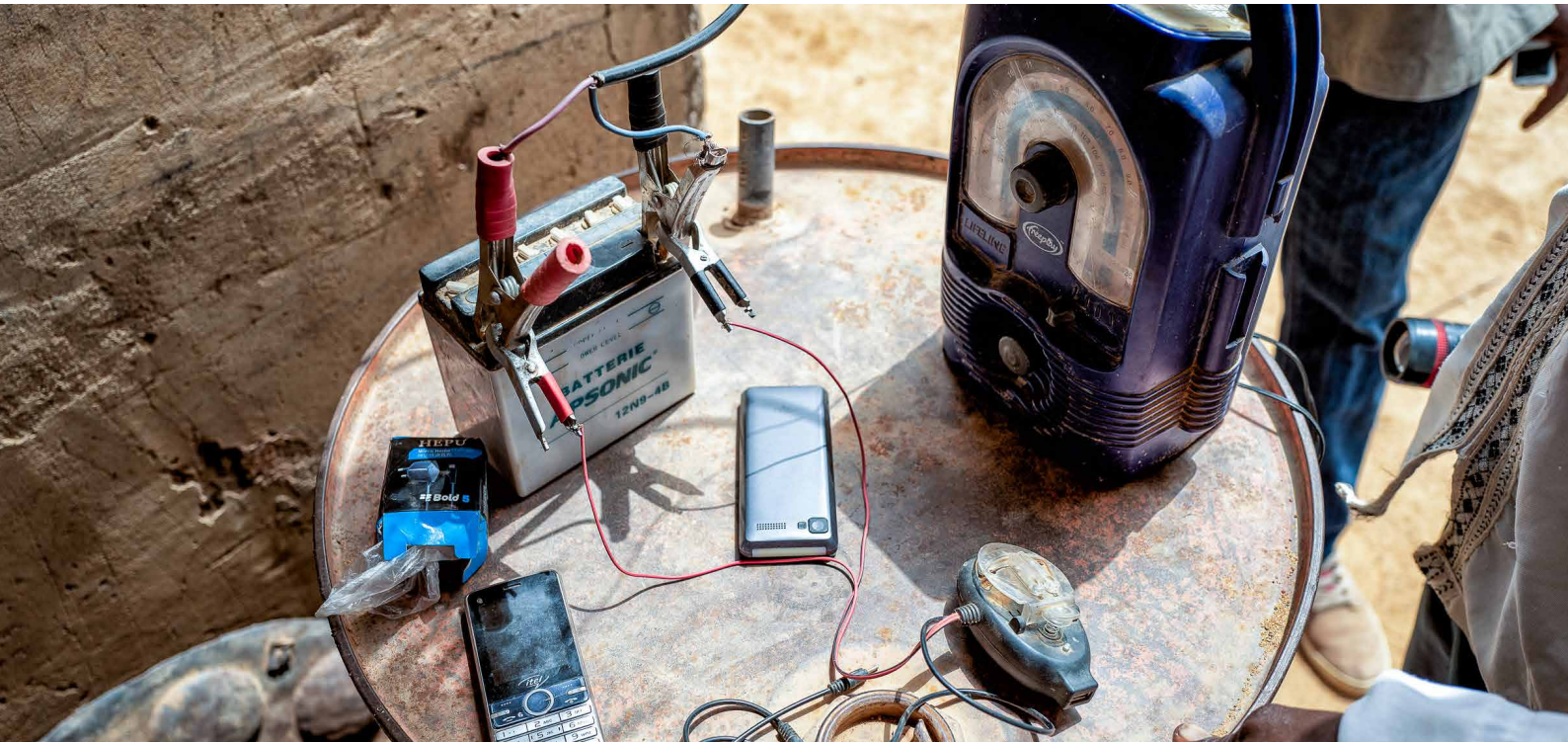

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About the Moving Energy Initiative

The Moving Energy Initiative (MEI) is working to achieve access to clean, affordable and reliable energy among displaced populations by:

- **Working with humanitarian agencies and donors** to change policies and practices based on evidence from practical projects;
- **Working with the private sector** to design and implement innovative market-based solutions;
- **Improving the evidence base** through original research and the demonstration of new approaches tried and tested in camps and host communities; and
- **Cooperating with host governments and national NGOs** to improve energy security among both local and refugee communities.

The MEI is a collaboration between Energy 4 Impact, Chatham House, Practical Action, the Norwegian Refugee Council (NRC) and the Office of the United Nations High Commissioner for Refugees (UNHCR), with funding from the UK Department for International Development (DFID).

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Executive Summary

In recent years, clean energy access for refugees and internally displaced people has emerged as a potential method of improving humanitarian outcomes and enabling self-reliance. While recent research emphasizes the need for more quantitative data to inform energy access interventions, better qualitative understanding would also improve innovation in this area.

This ethnographic study is the first of its kind to analyse energy access and resilience strategies deployed in two refugee camps, Kakuma in Kenya[1] and Goudoubo in Burkina Faso. The stories of residents in these camps demonstrate the importance of considering everyday experiences of displaced people in developing sustainable humanitarian energy interventions.

This paper highlights the need for new methodological approaches to expand the evidence base for humanitarian energy interventions and policies. Future research could usefully inform humanitarian energy projects by examining the technical knowledge and existing practices of refugees in the design of energy technologies, systems and business models. Uptake and sustained use of new systems may be more likely where interventions build on or work in harmony with these factors.

Key observations from Goudoubo and Kakuma

- There is a clear demand for improved energy technologies and services. The lengths to which people in both camps go to procure new technologies and to improve upon available technologies show this.
- Patterns of energy demand are deeply connected to the cultural values that refugee communities attach to specific objects. Some objects (like water-storage vessels and cooking pots) are deemed essential to people's wellbeing and identity. People's preferences for technologies related to cooking and refrigeration are strongly linked to their feelings about taste. Other objects (like batteries and generators) have become important symbols of social and economic status. People's preferences for technologies related to charging batteries are strongly linked to their capacity to deploy these within wider social networks.
- Access to energy involves cash and non-cash exchanges. In both camps, informal markets for the distribution, repair and charging of energy technologies, devices and systems are a vital part of everyday life, bringing together buyers and sellers from refugee and host communities. But in both camps non-market exchanges (bartering or gifting) of fuels, batteries, solar panels and energy-related materials or components were an equally important part of transactions between refugees and host communities, fostering livelihoods, relationships and social cohesion.
- Preferences for energy technologies are strongly linked to the reparability of devices, as well as their affordability and availability. The re-use and repurposing of energy equipment is an important source of personal satisfaction, pride and competence.

[1] Kakuma refugee camp consists of four sub-camps or zones (Kakuma I–IV). In the context of this paper, the term 'Kakuma' also includes the nearby Kalobeyei integrated settlement.

- Camp residents are continually reminded of their exclusion from modern energy services by the proximity of high-voltage transmission lines for regional electricity grids. In both camps, the relative experience of energy poverty is exacerbated by the visible presence of electricity in nearby towns.
- In both camps, energy-related tasks, tools and technologies are gendered. Women drive the food–fuel exchange networks and host community meetings to buy, sell or trade food rations for firewood and charcoal. Meanwhile, men are most closely involved in electrical work, from wiring and battery charging to repair.

Key points of interest for future humanitarian energy interventions

- Taking people's existing knowledge and energy practices into account would, one might expect, already be central to the design of humanitarian interventions. Yet dominant approaches to energy access continue to marginalize questions about what people actually use energy for in daily life. A failure to design projects and technologies for this context may lead to unintended consequences and longer-term challenges. Closer attention to people's existing energy practices and technical knowledge provides opportunities to do better in the design of technologies, systems and business models.
- People's resourcefulness in providing for their energy needs in both camps demonstrates the opposite of a culture of dependency. The repurposing of materials and technologies challenges perceptions that people in contexts of forced displacement are only reliant on forms of 'inbound innovation', via the provision of services and technologies from external and humanitarian agencies. Instead, there is a need to be attentive to the forms of 'circular innovation' – repurposing, adaptation, reconfiguration and customization – that people deploy as they seek to meet their needs.
- Humanitarian energy interventions need to address 'end of life' issues for technology, equipment and materials. The life of equipment under harsh climatic conditions and the possibilities for repurposing should be considered at the outset, as part of design and procurement decisions. The component parts of energy equipment that cannot be re-used and recycled, or that may cause harm to people and the environment, should be a key concern in rethinking energy provision. The dangers of children playing with batteries, of lead and other chemical leakage during attempts to extend battery life, and of disposal are problems that new interventions need to address.
- Labelling conventional fuels and energy practices as 'dirty' or, worse, 'primitive' clouds the understanding of the social and cultural significance that underpin them. Using these labels can widen the gulf between external agencies and displaced people, and it can risk exacerbating inequalities in wealth and gender among refugees.

1. Introduction

There is nothing new about attempts to deploy renewable energy technologies or more efficient cooking equipment in refugee camps. Some of the earliest attempts in East Africa to use solar photovoltaic technology for large rural populations, for example, date to 1982 when solar technologies were used to pump water in refugee camps in Ethiopia and Somalia.[2] However, until recently these had not gone beyond sporadic pilot cases and household access to electricity remains unusual. In the 21st century, several new factors affect deployment considerations, including the rise in the numbers of those living in prolonged displaced situations; pressure from host countries not to use forest resources; Sustainable Development Goal 7, which targets access to affordable, clean energy for all by 2030; and the falling cost of clean energy technologies.[3]

In the past, efforts were often led by governments, NGOs, humanitarian agencies and donors. Today, recommendations for improving the delivery of energy in humanitarian situations are focusing on partnerships with the private sector and the promotion of local markets as the most efficient way to scale up better energy services in refugee camps.

While tangible examples of successful initiatives are few, an argument for the increased role of the market – encouraged by learning from energy access projects in the development field more generally – is shaping rhetoric and research. Risks for refugee camp dwellers remain regarding user uptake and sustainability – i.e. making sure that households use and buy the required equipment and/or fuel at an affordable price, adopt the correct methods of use, and that equipment is maintained.

In this context, there are important lessons to be learned from close attention to people's current material practices around food, fuel, refrigeration, lighting and charging in refugee camps. The appropriate design of future humanitarian energy interventions depends on placing people and practices centre stage.

Material culture in refugee camps

This paper presents alternative ways of engaging with the material culture of displaced people living in two refugee camps – Kakuma in Kenya and Goudoubo in Burkina Faso. It takes seemingly ordinary, mundane, even banal, objects and examines their histories, meaning and active roles in people's social and economic lives. In doing so it offers new insights into the ways that people experience, understand and seek to meet demands for energy services.

The paper is based on qualitative research into energy demand and use in households, enterprises and community institutions, and presents new details about how people living in the two camps cook, light their homes, cool their food and water, and power their devices.

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[2] Brook, P. J. and Smith, S. (eds) (2000), *Energy and development report 2000: energy services for the world's poor*, Washington, DC: World Bank.
[3] Lahn, G. and Grafham, O. (2015), *Heat, Light and Power for Refugees: Saving Lives, Reducing Costs*, Research Paper, London: Royal Institute of International Affairs, https://www.chathamhouse.org/sites/default/files/publications/research/2015-11-17-heat-light-power-refugees-lahn-grafham-final.pdf (accessed 10 Jan. 2019).

The findings suggest that qualitative data should be taken into account to better understand energy demand in the context of humanitarian emergencies and long-term displacement. Qualitative research data can help in understanding processes of technological innovation, the exchange relationships between refugee and host communities, the cultures of care or resilience, and the lasting effects of failed interventions.

Studying material culture means accounting not just for what people have but also for how they experience or engage with material things, technologies, infrastructures and systems in everyday life. It means considering people's lived experiences, their strategies for 'getting by' that make use of the resources at their disposal and the forms of knowledge that allow them to adapt technologies for use.

This introduction establishes the importance of learning from how people live and engage with objects and summarizes key lessons from the research for policymakers and practitioners. It describes how qualitative methods and data can deepen the understanding of energy in humanitarian contexts. It also outlines the methodology used and introduces the stories of eight objects.

The need for qualitative data

Recent studies have extended our understanding of energy in contexts of forced displacement. While they have helped to lay the foundations for current interventions in humanitarian energy, gaps in the evidence base remain.[4] These include the ways that people use, perceive and experience energy technologies; the way we understand non-market or informal exchange relationships through which people access energy goods and services; and the extent of people's working knowledge of materials, tools, technologies and physical systems.

Much recent research on energy in contexts of forced displacement and humanitarian intervention has focused on possessions or desired objects rather than on people's behaviour when using these objects. So, while research studies and more practical toolkits have produced an exhaustive index of the types of 'energy technology' being used in refugee camps, they have provided little detail about how these are used in people's everyday lives.[5] Such studies have revealed that forcibly displaced people frequently carry cooking pots, water carriers, solar panels and battery-powered torches across international borders but little is known about why these items are so highly valued, or how people adapt them for use in new settings. Perhaps this is because, when 'energy' is reduced to a technical or financial problem, humanitarian agencies focus on providing a basic set of material assets. One unintended consequence of this body of work is that energy poverty can sometimes appear as an index of material possessions.

This paper argues for a different approach that can provide a more textured understanding of issues around energy consumption, exchange and technology. Understanding and engaging with energy in terms of social or cultural practices is vital if humanitarian actors are to make appropriate and effective interventions. Such an approach could transform the design of humanitarian energy technologies, the delivery of humanitarian energy programmes, and procurement decisions in humanitarian energy organizations.

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[4] Rosenberg-Jansen, S. (2018), 'Background Paper: Data, Evidence, Monitoring and Reporting on Energy for Displaced People', Rugby: Practical Action.

[5] For an example of the excellent work detailing the types of cookstove being used, see Global Alliance for Clean Cookstoves (2018), 'Clean Cooking Catalog', http://catalog.cleancookstoves.org/.

Gaps in the evidence base around humanitarian energy can be filled using qualitative data methods. As this paper shows, qualitative data can boost understanding of how displaced people live with and without energy services, how existing energy technologies and infrastructures are embedded in daily practices and routines, and how people accommodate themselves to things when they break down or fail. As the paper also shows, qualitative data can help to understand how experiences of energy poverty, energy vulnerability or energy precariousness in refugee camps may be shaped or reinforced by camp infrastructures or previous humanitarian interventions. Qualitative data can provide the humanitarian energy community with vital insight into the social and economic practices that shape people's access to energy services in contexts of forced displacement.

The research findings outlined here are particularly relevant in the context of growing attention to the delivery and provision of energy services for displaced people.

What can we learn from objects?

What can a water cooler, a sheet of metal, a cooking pot, a lump of charcoal, a pair of bellows, and a piece of wire tell us about energy use and its social and economic implications in situations of forced displacement?

Studies of forced displacement in sub-Saharan Africa rarely cover the objects that people carry with them when they move away from conflict, threats of persecution or rapid environmental change. Strapped onto backs, tucked into rucksacks, loaded onto lorries, stored carefully inside temporary homes and shelters, these are the things that people rely upon in contexts defined by uncertainty, precariousness and vulnerability.

These are often things laden with meaning. As journalists have reported, for example, the cooking pots and goatskin water sacks carried by Tuareg people from Mali to Goudoubo refugee camp in Burkina Faso are expressions of cultural heritage and tradition.[6] Such reports directly inform humanitarian interventions. The humanitarian response to the refugee crisis in Burkina Faso has included programmes aimed at 'enhancing' the skills of traditional artisans, with a view to promoting refugee arts, crafts and jewellery products in international markets.[7] This paper goes further by examining how items such as cooking pots and goatskin water bags are actually used? Why are they so significant that people bring them on uncertain or insecure journeys? And what role do they play in the provision of basic energy services for people with limited or no access to mains electricity?

The material practices documented in this paper identify energy as an important area of technological innovation in sub-Saharan Africa's humanitarian settlements. The ways in which people repurpose humanitarian goods should be understood as more than simply 'tinkering' and this paper presents such practices as socio-technical innovations,[8] which demonstrate both improvization and resourcefulness.

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[6] Thomas, K. (2016), 'In Limbo: Malian Refugees in Burkina Faso', News Deeply, www.newsdeeply.com/refugees/community/2016/04/20/in-limbo-malian-refugees-in-burkina-faso (accessed 21 Aug. 2019).
[7] UNHCR (2017), 'Weaving for Change – A unique project helps Malian refugee women restore their lives', http://kora.unhcr.org/weaving-for-change/.
[8] In this sense this paper reflects the analysis of Clapperton Mavhunga, the Zimbabwean-born scholar of science and technology. See Mavhunga, C. (2017), 'Introduction: What Do Science, Technology, and Innovation Mean from Africa?', in Mavhunga, C. (Ed.) (2017), *What Do Science, Technology, and Innovation Mean from Africa?*, Cambridge, Mass.: MIT Press, pp. 1–27.

The examples looked at in this paper speak precisely to the point that refugee innovations have extended and supported the resilience of fragile communities. Innovation in these contexts takes organizational, transactional and technological guises. This paper shows how displaced people frequently see limitations in the design and suitability of energy technologies, and that they constantly seek to repair, maintain and repurpose technologies. Rather than straightforwardly reject broken or unsuitable products, people adapt and repurpose them for use.

Understanding such processes of innovation is crucial if appropriate solutions to the energy needs and priorities of displaced people in humanitarian emergencies are to be developed. While the paper does not set out to challenge the critical importance and success of many examples of humanitarian innovation, it highlights the ways in which forms of bottom-up innovation of energy products emerge as a supplement to the top-down approaches of international agencies in partnership with NGOs, commercial and academic organizations.[9] Here 'local' does not mean the opposite of global and is not a shorthand term for 'indigenous' or 'traditional'. Rather it describes knowledge and innovation that is rooted in particular places, practices and relationships. What is meant by 'local' knowledge and innovation in Kakuma and Goudoubo, for example, may be the outcome of exchanges between refugees and their host communities, as well as between refugees and international agencies.

Qualitative methods and ethnographic fieldwork

This study of energy in humanitarian contexts involves a recalibration of focus around material artefacts, drawing on methods from social anthropology and design studies.[10] The network of relationships that connect people, spaces and technologies and energy services like lighting, heating or charging are often too large to research in their entirety. Focusing on specific objects enables following these relationships in a non-linear manner, revealing previously unexpected connections between material things, relationships, spaces and people.

Everyday objects are 'heuristics' or 'entry points' for learning about people's lives.

Everyday objects are 'heuristics' or 'entry points' for learning about people's lives. Wires or water carriers, for example, can be starting points for learning about the experiential and transactional dimensions of energy poverty, and the exchange and exchange-relationships upon which access to basic services depend. This approach focuses attention on the ways that people engage with fuel and electricity in their everyday activities by working with communities to understand how refugees and communities engage with energy technologies and the objects that surround them. Focusing on material objects makes it possible to record the forms of material knowledge that people use and deploy in everyday life, moving beyond an audit of what people have to an understanding of how things are built, maintained and used, what they mean and how they inform people's knowledge of the world.

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[9] Betts, A. and Bloom, L. (2014), 'Humanitarian Innovation: The State of the Art', OCHA Policy and Studies Series, p. 14.

[10] Collier, S. J., Cross, C., Redfield, P. and Street, A. (2017), 'Little Development Devices / Humanitarian Goods', *Limn*, no.9. https://limn.it/articles/precis-little-development-devices-humanitarian-goods/; Cross, J. (2018), 'Solar Basics', *Limn*, no. 9, https://limn.it/articles/solar-basics/; Cross, J., Abram, S., Anusas, M. and Schick, L. (2017), 'Our Lives With Electric Things', Cultural Anthropology https://culanth.org/fieldsights/1277-our-lives-with-electric-things.

Box 1: Methodology

The fieldwork research on which this paper is based took place in Goudoubo and Kakuma during eight trips between March and October 2017 by trained teams of Kenyan and Burkinabe researchers, supported by experienced social scientists, designers and humanitarian energy specialists.

The approach built directly on the MEI's previous studies from Kakuma and Goudoubo.[11] The research team reviewed the survey and focus group data collected in 2016 and 2017 by Practical Action, as part of the MEI, and completed an analysis of the strengths, weaknesses, opportunities and threats in the large quantitative/baseline dataset. The team identified key areas of survey data and focus group discussions where qualitative methodologies could add detail, texture and understanding. It then set out to expand the ethnographic evidence base for decision-making, with a view to informing interventions that aim to improve access to energy for displaced communities.

The findings of this analysis were discussed with key informants in the humanitarian energy sector, including the lead consultants on previous MEI reports and MEI research managers. The research team discussed the approach with scholars involved in practice-led or ethnographic research projects around energy consumption or energy and displacement in the global north.

The analysis of previous research was accompanied by an extensive review of qualitative methods for researching energy practices, habits and behaviour in academic research studies. Key studies in social anthropology, sociology and geography have introduced ethnographic, human-centred, object-oriented, visual, participatory and collaborative methods to the study of energy demand. At the centre of these approaches is the study of energy as a 'social practice', focused on what people use energy for. Dominant approaches to energy demand, scholars argue, marginalize questions about what people use energy to do or achieve.[12] Yet, for most people, fuel and electricity only have value in the context of daily activities or practices: from lighting a space, to cooking food, to sharing information, communicating with friends and relatives, or making a financial transaction. Social science researchers have begun to take a practice-focused approach to energy demand in domestic and urban contexts in Western Europe. But there have been few, if any, attempts to apply this methodological approach to the study of energy in contexts of forced displacement or rural development.

The review and analysis of these previous studies laid the groundwork for a novel methodological approach to the study of energy practices and technologies in refugee camps. The research team compiled a portfolio or toolkit of established techniques and approaches to the study of energy practices and energy demand. The researchers built upon these approaches in an open-ended, iterative manner, during pilot trips and research workshops that aimed to establish contextually appropriate methods to the quality study of energy in refugee camps. Pilot visits to Kakuma and Goudoubo identified specific questions around domains of 'consumption', 'technology' and 'exchange', and also identified the value of focusing on specific objects or things.

[11] Bellanca, R. (2014), *Sustainable Energy Provision Among Displaced Populations: Policy and Practice*, Research Paper, London: Royal Institute of International Affairs, https://www.chathamhouse.org/sites/default/files/field/field_document/20141201EnergyDisplacedPopulationsPolicyPracticeBellanca.pdf; Lahn and Grafham (2015), *Heat, Light and Power for Refugees*; Corbyn, D. and Vianello, M. (2018), 'Prices, Products, and Priorities: Meeting Refugees' Energy Needs in Burkina Faso and Kenya', London: Practical Action/Moving Energy Initiative.
[12] Shove, E., and Walker, G. (2014), 'What is energy for? Social practice and energy demand', *Theory, Culture & Society* 31.5, pp. 41–58.

Subsequent workshops evaluated the methods and developed extended diagrams that distilled these questions and identified further areas for investigation.

Over six months researchers worked closely with camp inhabitants in situ to reconsider the stories that everyday items can tell, the qualities they have and their impact in people's lives.

The research followed people and their possessions across multiple spaces, including:

- Market places and informal spaces of exchange;
- Domestic spaces: inside/outside homes, kitchens and cooking spaces, sleeping spaces, living spaces, storage spaces, and spaces of animal husbandry;
- Distribution centres;
- Community spaces;
- Schools: classrooms, play spaces, kitchen spaces, canteens;
- 'Public' spaces (designated and non-designated);
- Kiosks;
- Workshops; and
- Borders and boundaries.

In each location things were inventoried and their connections to other things, places and people were mapped. In each location researchers paid attention to the 'everyday objects' around them. These things were a starting point for interviews. People were invited to discuss how they came to have them, use them, store them and keep them working. Then they were asked to show how they used, kept and maintained them. The researchers asked the following questions: How are people using these things? What are people doing with these things? How are these things used to make particular places or spaces? Where did these things come from? How did people get them? How are these items connected to other things?

The approach to these interviews sought to build rapport with informants and to use appropriate non-intrusive ways of gathering data. The researchers put conversations and personal relationships with informants first, and structured interactions in a flexible way. The researchers were asked to look for feedback, to be attentive to how their questions were making people feel, to improvise, to take time with people, to listen and to be respectful. Many of the interviews involved multiple follow-ups with the same researchers meeting the same people twice or three times.

By combining recorded transcripts with documented observations the research team compiled stories of use. For this paper the authors chose eight objects with large data sets that offer powerful insights of daily life, and which speak to wider concerns with energy efficiency, host and refugee relations, the experience of displacement, socio-economic status and social mobility, and processes of ad hoc design, innovation, re-purposing, modification, maintenance and repair.

The research data generated privileged biographical information, detailed the materiality of objects, examined how people use objects and methodological details through note-taking or photography/video.

This paper uses the word ‘stories’ to distinguish qualitative data sets from quantitative data sets. Eight stories are compiled from the data bank of field notes, interviews, observations, transcripts and audio/visual material collected by field teams, with names anonymized throughout. Employing story-based accounts acknowledges the importance of how people utilize objects to narrate their everyday social practices. The methods and material presented here offer important lessons for policymakers and practitioners. Qualitative perspectives are vital for managing but also creating innovative approaches to the energy needs of vulnerable people in displaced communities.

2. The Water Cooler

On the edge of the Sahel keeping water cool is an everyday problem. When Goudoubo refugee camp was established in 2012, the supply of a physical infrastructure for the provision of drinking water was one of the first steps in its construction. In 2017, water was supplied across the camp from two diesel generators connecting taps and hand-pumps to ensure a continued supply for the camp's 7,576 inhabitants. But using UNHCR's recommended daily minimum of 15 litres of water per day means addressing not just the supply of clean water but also its refrigeration.[13]

On any given day UNHCR's ubiquitous, standard issue 10-litre plastic water containers can be found in and around Goudoubo. Empty yellow and white containers are lined up at water collection points, waiting to be filled. Full containers can be seen in transit, hauled through the camp by hand or on makeshift wheelbarrows. Meanwhile, just as the inhabitants must travel beyond the camp's boundaries every day to gather firewood, the residents of villages in the vicinity frequently travel into it to access one of the closest, reliable sources of pumped water. Donkey-drawn carts loaded with empty containers pull up at one of the boreholes or taps, stocking up with supplies.

Yet the Tuareg and Fulani people living in and around Goudoubo rarely directly drink the water that comes out of these plastic containers. This is because they think the piped water is too hot to drink. The camp's water distribution system does not keep water at a low enough temperature for it to be pleasant to drink.

> **The use of these technologies for water storage and cooling have much to tell us about people's minimal requirements for living, as well as their energy demands.**

The refugee communities in Goudoubo have several technologies to cool or refrigerate their water, and to turn piped water into water that is acceptable to drink. These range from clay pots and goatskin water bags, to insulated plastic bottles and iceboxes. To date, few if any of these devices, however, have appeared in the audits of energy technologies undertaken in these camps. Yet the use of these technologies for water storage and cooling have much to tell us about people's minimal requirements for living, as well as their energy demands.

The refrigeration trade

On food distribution days, when the camp is at its busiest, people arrive from the towns of Dori and Deou to sell cold drinks out of plastic cool boxes. Many of these vendors are women. Some come with cool boxes filled with plastic bottles of Coke, Sprite and Fanta, and sachets of cold water, alongside other mass-produced goods. Others come with cool boxes filled with locally made produce: bottles of milk, ginger, *bissap* (a hibiscus-based drink) and *degue* (a drink made from yoghurt and millet couscous). In town, some traders refrigerate their wares and produce their own ice in fridge-freezers powered by the local electricity grid or, during blackouts, by diesel

[13] See UNHCR Emergency water standards, https://emergency.unhcr.org/entry/93422/emergency-water-standard.

generators. Other traders, mostly refugees, lack any refrigeration equipment and buy bags of ice in town to cool the goods that they sell in the camp, usually adding a 50 per cent mark-up on the town price.

For Burkinabe traders – people native to northern Burkina Faso – access to the camp often hinges on personal contacts; for example, a brother-in-law who is a local gendarme. Not all of these traders are native to this part of Burkina Faso. Some of them are also refugees, people forcibly displaced by conflict and insecurity in Mali. Some of them lived for a time in the camp, and may still have relatives there. Invariably, refugees who have been able to establish themselves as entrepreneurs in this niche market for refrigerated drinks are those who owned electrical appliances and generating equipment in Mali and brought it with them.

In the morning the cool boxes of these vendors are full. When they return home in the afternoon they expect them to be empty. In the interim, they have to keep them cold and they cover the ice inside with layers of plastic, cardboard and fabric. One of the most prominent cold-drink sellers in Goudoubo was a Tuareg woman from the province of Gao whose family was able to bring a fridge-freezer and a diesel generator by truck when it left Mali. Like other vendors, on distribution day she strategically places herself at key food-distribution points around the camp. Taking their positions, the vendors lay their cool boxes on the ground and sell their wares to people wanting to take relief from the hot weather and the busy camp activities.

The number of cool-drink vendors in Goudoubo is widely thought to have increased, with a regular flow of women from Dori. Some work to establish a loyal clientele in the camp by offering cold water from the bottom of the cool box, ice cubes and credit to their regular customers. As one saleswoman explained: ‘You know if refugees regularly come to buy drinks at your selling place they won’t go and buy things from a new seller. They’ll stay faithful to you.’

The sale of cold drinks has also created income-generating opportunities for the camp’s children, some of whom have inserted themselves into the market as waiters, collecting orders from customers and collecting their payments for a fee (around CFA 250 or $0.46 per day).

Some camp households have acquired cool boxes for domestic use, but without a regular supply of ice to go in them, these lose their utility and people rely on other, more locally made devices – from earthenware pots to insulated plastic bottles and goatskin sacks – to cool water for drinking.

Plastic cooling

The cheapest and most commonly used solution to the challenge of refrigerating water in and around Goudoubo involves the construction of what engineers and designers call ‘evaporative cooling technologies’. These may vary in terms of materials but operate in a similar way. Water is poured over outer layers and slowly heats up and evaporates, keeping inner contents at a lower temperature – much as sweat cools the human body. These technologies can be made entirely from organic materials – such as animal skin and leather – or by combining plastics, cardboard and cloth. They can be used to cool water as well as other fluids, like milk and juice.

Evaporative cooling technologies are not unique to this part of the Sahel or to communities of Malian, Somali, Sudanese or Congolese refugees. Similar devices can be found across sub-Saharan Africa, from Burkina Faso to Kenya, Ethiopia, Tanzania and beyond. Studies show that, when used in areas with hot climatic conditions and low humidity, such low-cost devices can achieve

temperatures of 20–25°C, with potential for the storage of biomedical supplies like insulin.[14] Yet, while evaporative cooling devices are an important part of Africa's indigenous technological heritage, they have thus far been entirely overlooked by humanitarian interventions in energy. Within the context of humanitarian assistance and programmes of energy access for displaced people, such micro-technologies of heat and refrigeration often go unnoticed.

Plastic water containers are used for general storage purposes, and to collect water from taps and standpipes and transport it to homes. People use water directly from the container for bathing, cleaning, washing up and the preparation of cooked food. But, when it comes to drinking it, the water is invariably transferred to another vessel capable of cooling it. One of the most prized water-cooling devices used inside Goudoubo camp is the earthenware pot (sometimes referred to in French as a *canari*). Made from clay mixed with cattle dung, these can be manufactured in and around Goudoubo camp. In homes, they are commonly placed atop a plate on the ground, with the area around it kept damp throughout the day. Such pots are usually household purchases, however, and must be procured from skilled potters.

Less celebrated but more ubiquitous and long-lasting is the homemade or upcycled cooler, made by wrapping plastic water containers in layers of insulating fabric. These homemade evaporative devices can be found throughout Goudoubo: on a mat or blanket in the shade of people's homes or on the move, slung beneath a donkey cart or around a shoulder.

Five-litre jerrycans of Indonesian palm oil (fortified with vitamin A and D) distributed to refugees by the World Food Programme are commonly found inside people's homes in Goudoubo, upcycled into bespoke cooling devices.

People requisition a variety of containers to this end. These include the 10-litre plastic water containers that are distributed by humanitarian agencies as well as the five-litre containers that are brought into the camp alongside other mass-produced goods by shopkeepers and traders from Dori. People also repurpose receptacles once used to carry other substances, like cooking oil. For example, five-litre jerrycans of Indonesian palm oil (fortified with vitamin A and D) distributed to refugees by the World Food Programme are commonly found inside people's homes in Goudoubo, upcycled into bespoke cooling devices.

These homemade water coolers are often elaborate and highly personalized. For example, a four-litre water bottle, may be wrapped in two layers of fabric – first felt, then old cloth – before being rolled in tarpaulin and stitched together.

These homemade water coolers are ad hoc innovations, defined by the repurposing of extant objects and available raw materials. People employ several tactical and localized approaches to their immediate material circumstances, responding to the ways in which the centralized distribution of goods and services, like water, is deemed unable to meet their needs by reworking objects and artefacts (including those distributed by NGOs) around other priorities and needs.

[14] On the energy efficiency of water-cooling technologies, see Gill, G., Price, C., English, P. and Eriksson-Lee, J. (2002), 'Traditional clay pots as storage containers for insulin in hot climates', *Tropical doctor*, 32(4), pp. 237–238; Ogle, G. D., Abdullah, M., Mason, D., Januszewski, A. S. and Besançon, S. (2016), 'Insulin storage in hot climates without refrigeration: temperature reduction efficacy of clay pots and other techniques', *Diabetic Medicine*, 33(11), pp. 1544–1553.

A cooler goatskin

The homemade plastic cooler is widely held to be an adequate or functional device. But the most highly regarded evaporative cooling device is the goatskin bag that can be carried over the shoulder. In northern Burkina Faso and southern Mali, goatskin bags – called *Soumaley* in Fulani, *Agadoud* in Tamasheq and *Guerba* in Arabic[15] – used to carry water are prized objects. Goatskin bags are most closely associated with the material culture and traditions of the Tuareg people, and are also valued by the Fulani and Bella peoples. 'When you open it, the water tastes like it has come from a fridge', said a Fulani man from a village neighbouring Goudoubo. 'These things cool water so fast, it can become too cool: like ice!'

In Goudoubo goatskin water vessels can be found strung up on wooden sticks just inside homes or in the shade under carts. They are widely held to be better at keeping water cool than either plastic jerrycans or clay pots. 'The water you drink from one of these is cooler than the water you drink from any pot,' said one Tuareg man in Goudoubo. 'If you have one of these and put it in your home, you'll never drink water from anything else again.'

With the cool water that flows from these devices comes memories of the lives that people once lived. Goatskin water coolers were a common feature of everyday life in Mali for many of the Tuareg and Fulani people now living in Goudoubo; for some they had once been their family's primary means of storing and cooling water. As some people describe it, life before the camp was life lived without plastic jerrycans, and goatskin water containers were one of the few larger, personal items that people carried with them when they fled or left Mali in the early 2010s.

The taste of water from a goatskin bag evokes the sense and feeling of lives left behind. One Tamasheq-speaking Tuareg woman in Goudoubo said:

> I once lived in Gao, at the edge of the waterhole of N'Tillit. The weather was colder than here. There were trees and there was shade. We used these goatskins to quench our thirst and to cool our water. But here in the camp, it's the desert. There are no trees. There is no shade, we have plastic containers and they can store our water but they cannot keep it cool. The water that comes out of the taps here is too hot. So we have to keep using these goatskins to keep our water cool.

In Goudoubo goatskin coolers are important vessels of cultural heritage and tradition. People's investments in these – their interest in making or acquiring them, as well as discussion of their unique properties – is motivated by their connections to the past as much as by their function or utility. In a context in which people live without access to mains electricity, the benefits of these locally made technologies are often weighed explicitly against modern, electrical appliances. One young man explained:

> When water comes from a fridge you can't drink it directly, you can't drink it in one-shot, you have to stop because it's too cold and uncomfortable. If you begin drinking from a *Soumaley*, though, you can keep drinking it. When you drink from a *Soumaley* the water tastes better, cold and pleasant. You will prefer it to a fridge.

The Tuareg and Fulani people from the Gao region in southeastern Mali who are now housed in Goudoubo once used these leather vessels to store milk from cows and goats, as well as curd, porridge and water. Different animal skins have diverse qualities, determining how people used

[15] Smith, A. B. (2005), *African Herders: Emergence of Pastoral Traditions*, Walnut Creek: Altamira Press.

them and for what purpose. Sheepskin, for example, is seen as more flexible than goatskin. People prefer it as a container for porridge, milk and curd, which need to be regularly shaken and skimmed. By contrast, people prefer to use harder, more resistant goatskin for water.

Not everybody romanticizes the goatskin bag in this way. For some, it is a reminder of hardship and a lack of basic infrastructure. For some people, life in the camp makes everyday access to drinking water significantly easier than it was in the homes they left and reduces their appetite for a labour-intensive leather-manufacturing process. For one young Tuareg couple, respectively employed in the camp's school canteen and as the school's watchman, the goatskin bag carried strong association of work and labour. 'We only used the goatskin bag because we didn't have water', the wife explained. 'Now, the tap is just right here, and you can buy pots in the market to keep your water in.' Her husband added: 'People don't need to make goatskin water bags anymore when water is always available, close by, next to the place you live.'

The transformation of goatskin into water vessels involves a gendered division of labour that has been well documented.[16] Men kill the goat, cut the skin from the throat to the chest and hang the carcass, before removing the hooves and skin. Only particular goatskin is good enough to be turned into a water carrier. Even in a refugee camp context the age and sex of a goat remains important. Though they are more difficult to come by, people in Goudoubo prefer mature female animals, whose reproductive life has stretched their skin, providing water carriers with a volume of up to 40 litres.

The transformation of goatskin into water vessels involves a gendered division of labour that has been well documented.

Women treat the skin and tan it, soaking it in water with a mixture of ash and ground seed pods (*bagaruwa* or *gabaruwa* in Hausa and *Gaodey* in Fulani). The skins are soaked for several days before they are dried and sewn together with a leather thread. The legs are tied together so that the skin can be hung in the shade and a small hole is left in the throat that can be pulled open or closed each time it is filled with water.

Depending on the intended contents, different manufacturing techniques and leather treatments are required. Liquids like milk are considered to be 'thin' or 'transparent', allowing any animal residue to be quickly skimmed off before drinking. The goatskins that are used to make water or milk carriers are often not turned inside out. 'Thicker' liquids like curd and porridge are seen as more difficult to filter and demand a cleaner carrier, and skins are turned inside out after being treated.

It takes a minimum of two weeks to make a *Soumaley*. A plastic jerrycan bought in Dori can be used as soon as it is purchased but, despite the time it takes to produce, the goatskin vessels are widely considered to be better technologies and more efficient water coolers. While plastic canisters are widely seen to cool less with age, the animal skins are understood to cool more as they become old. They can last for up to three years but require care and maintenance. Before they can be used a dry and rigid skin must be carefully wetted, to prevent it breaking as it fills with water. If the skin is damaged or pierced it can be repaired. A little cooked rice applied onto

[16] For anthropological descriptions of the gendered division of tanning practices in West Africa, see Hill, P. (1972), *Rural Hausa: a village and a setting*, Cambridge: Cambridge University Press.

the surface of the skin works as an adhesive, and a new square of leather can be stuck on top and stitched in place. One of the risks is the camp water itself. For some refugees in Goudoubo, the pumped water in the camp is so hot that it risks damaging these highly regarded devices.

The leather water cooler is also associated with cleanliness and hygiene. In contrast to water stored in an open, earthenware pot, it is seen to reduce potential risks from waterborne disease by preventing children from touching the water with dirty hands.

In Goudoubo leather water vessels are desirable objects and the people who make them are acutely aware of their value on the market or as objects to exchange. During 2016, for example, one skilled craftswoman made two goatskin water coolers that she bartered for other goods, exchanging one for a hijab and one for a blanket.

Such examples of local leather production are increasingly rare within Goudoubo, however, for many of the camp's inhabitants goats are more valuable alive than dead. Each week, refugees can be found at the nearby cattle market of Seydou, exchanging goats for cash to buy rice, oil and other basic provisions. At a time of scarcity, leather is a relative luxury and the raw materials for a goatskin water cooler are less widely available.

Beyond cooling

As the following chapters show, these simple homemade coolers connect water storage and refrigeration to other kinds of energy object. People transport plastic water carriers filled with water around the camp in wheelbarrows that have been upcycled from old or unused solar cookers (see Chapter 4) and these same wheelbarrows are also used to carry gas canisters into and around the camp (see Chapter 7).

3. The Cooking Pot

Aluminium cooking pots are omnipresent in Goudoubo and Kakuma camps. They can be found perched on rooftops, stacked in narrow doorways and perched atop the wood fires burning in countless households. These pots come in all shapes and sizes; some are an arms-length across and deep, others the size of a small dish. Some are dimpled and indented from heavy use or blackened with soot. Others shine smooth and metallic, brightly juxtaposed against the muted tones of the earthen household floors and walls.

Some of these pots have been purchased in local markets, and some were given to people on their arrival as part of the humanitarian distribution of non-food items.[17] Many were counted among the few possessions people were carrying with them when they first arrived in these camps.

While much attention has been given to the role of so-called 'clean' or improved cooking technologies in the energy sector, the role of established artefacts in people's everyday lives, such as the aluminium cooking pot, is often overlooked.[18] Yet cooking pots are a vital part of people's experience of and engagement with food preparation, storage and distribution, as well as with the ritual of cooking. In contexts of forced displacement, these everyday things can become important symbols of identity and heritage.

Vessels of life

In crises many refugees anticipate possible future energy needs and pack accordingly. In Goudoubo and Kakuma, people described the cooking pot as one of the few belongings that had been carried with them when leaving homes in Mali, Congo, Sudan and Somalia. One of the translators in Goudoubo, Karim, said that, when they left Mali, he, his wife and children brought nothing but 'two bags of clothing, a small mattress, some money and a two-kilogramme cooking pot'. Though heavy and cumbersome, the pot was brought because it was deemed essential for the family's survival on the journey and for sustaining their life upon arrival in Burkina Faso.

Because of the haste with which they left or their mode of transport, some refugees from Mali in Goudoubo were not able to carry their cooking pots with them. One woman recalled how she had arrived in the camp without anything to cook with. Her sister, who had already arrived previously, gave her a standard, ready-made aluminium vessel distributed by UNHCR. But the quality of the pot and the food that came out of it left the woman distressed. At home in Mali, she had run a restaurant. The flat-bottomed UNHCR pots just were not the same as the aluminium vessels with the rounded bottom that she was accustomed to cooking with. She persuaded her brother to return to their home in Mali and track down the large vessels she had used in her restaurant. When he returned, successful, she set up a kitchen in the camp and re-established her business.

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[17] UNHCR (1997), *Commodity Distribution: The handover of commodities to the intended beneficiaries, fairly, according to specified rations, selection criteria and priorities*, http://www.unhcr.org/3c4d44554.pdf; UNHCR (2017), *Burkina Faso: Operational Update September 2017*, http://reporting.unhcr.org/sites/default/files/UNHCR%20Burkina%20Faso%20Operational%20Update%20-%20September%202017.pdf.
[18] Ray, C., Sesan, T., Clifford, M. and Jewitt, S. (2017), 'From Barriers to Enablers: Where next for Improved Cookstoves?' *Boiling Point*, 69, 2–5.

Such stories are testament not just to the distinct qualities of a particular cooking vessel for the taste of food, but also to the feelings of belonging and well-being that everyday material objects can invoke. The research teams encountered similar references to the significance and importance of cooking pots across Goudoubo and Kakuma. People attached particular memories of the places and homes they had left behind to specific types of vessel.[19] It is perhaps not surprising that these everyday things become even more significant in moments of heightened anxiety, stress and tension.

Pots, people and things

During the 20th century, aluminium pots replaced earthenware vessels across sub-Saharan Africa and proliferated as a normal piece of everyday cooking equipment. However, earthenware vessels remain in use. As noted in Chapter 1, in Goudoubo clay pots or *canari* are a preferred technology for cooling water, but the cooking pots most frequently encountered in Goudoubo and Kakuma are made from aluminium.

In or around Kakuma and Goudoubo camps, ready-made or mass-produced aluminium pots can be found for sale on market stalls and in small shops. There are two kinds of commonly used mass-produced aluminium pots. Those with flat bottoms are sometimes referred to using the French word 'casserole' in Burkina Faso and the Swahili word *sufuria* in Kenya, while deep-sided pots with a rounded base are sometimes referred to as 'marmite' in Burkina Faso and *chungu* in Kenya.

> **Like other energy objects, cooking pots have utility or 'value' in their relationship to other things. As a cooking vessel, they become useful in conjunction with other technologies and materials.**

These pots can also be locally manufactured. Aluminium pots are produced in Goudoubo camp itself, where they are highly desired objects. The time-intensive production process involves sand casting, whereby a sand mould is made in earth and molten aluminium is then poured into it. As discussed in Chapters 4 and 5, aluminium can be sourced in the camp from abandoned solar cookers and forged using a pair of locally made bellows.[20] Locally made pots are typically more expensive than ready-made ones and more highly valued. In households that have a locally made pot, women prefer to use this vessel to prepare daily staples, placing it on a three-stone fire rather than on an improved cookstove.

Like other energy objects, cooking pots have utility or 'value' in their relationship to other things. As a cooking vessel, they become useful in conjunction with other technologies and materials. Some form of cookstove is needed for pots to cook food. Fuel, such as firewood or charcoal, is required to fuel the fire. Matches are needed to light the fire. A hand, a piece of cardboard, or a pair of bellows is needed to control the circulation of air. Food and water is needed to fill the pot. A spoon is needed to stir. Lids must cover the content to keep it hot and to make it cook faster. Handles may be attached to transport the heavier pots.

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[19] Nathani-Wane, N. (2014), *Indigenous African Knowledge Production: Food-Processing Practices among Kenyan Rural Women*, University of Toronto Press.
[20] Osborn, E. L. (2009), 'Casting aluminium cooking pots: labour, migration and artisan production in West Africa's informal sector, 1945–2005', *African Identities*, 7(3).

Among these elements, the simple cooking pot is uniquely valued because it can serve multiple uses. The same pot can be used to transport firewood, used as a storage container for ingredients in households and shops, or filled with soapy water and used as a washing tub.

In moments of technological scarcity, the cooking pot can fill other gaps. For example, in the absence of weighing scales, which are not widely available in either camp, the cooking pot can also be used as a unit of measurement. During a trade interaction witnessed between a Congolese woman and Turkana women in Kakuma, a small aluminium pot was used to measure out three portions of sorghum and one of yellow peas that were traded for one plastic basin of charcoal.

The story of the cooking pot is also a story about its unique capacity to make and sustain social relationships among people. Nobody in Goudoubo or Kakuma uses a cooking pot to prepare food for themselves alone.[21] The stories of displacement that people in Goudoubo and Kakuma shared included repeated accounts of hospitality. People's accounts of their journey to the camp often included descriptions of households and communities that had invited them to share cooked food or borrow extra pots. Accounts of arrival in the camp often included descriptions of the multiple social and economic exchanges through which people acquired the objects and fuels needed to make their cooking pots useful. The fire itself can also have positive benefits. Soot (more specifically tar) helps seal leaks in thatched roofs. Smoke repels insects. It can keep weevils out of food stored above the hearth. It may have ripening effects on food hung over the fireplace. In this sense, the contents of the pot provide a range of uses, as well as sustaining and nourishing forms of friendship and kinship, and social ties between individuals and families.

The 'shame' of soot

Cooking with wood produces soot that sticks to cooking pots. Across Kakuma and Goudoubo, soot is both seen and unseen, produced in countless wood fires and lifted on the arid wind, settling on surfaces and breathed into lungs. It lays claim to all surfaces in its vicinity, stubbornly sticking and leaving smudges in its wake.

In both camps the collection, transportation and usage of wood fuels is, almost exclusively, undertaken by young girls and women. This gendered division of labour is widely acknowledged by the humanitarian energy community. Less widely acknowledged is the deeply gendered presence of soot in everyday life. Its management consumes hours each day for women within the camps, who toil to scrub it clean from their skin and cooking pots.

Across both camps women report a preference for fuels that do not leave residues. One Malian woman in Goudoubo said 'it is easier to cook with gas, as the pots stay clean and do not blacken. We don't need to spend time to clean the pot.' Likewise, in Kakuma, women describe their preference for using charcoal over firewood, despite it being more expensive, in part because this means less time is needed to clean soot from their pots after cooking.

[21] Although it must also be noted that humanitarian interventions in 'communal cooking' have not had a great deal of success. For example, Bellanca reports on the situation in Haiti where displaced people rejected communal cooking sites on the basis of safety and being unsure what was going into the cooking pot. For more see, Bellanca, R. (2014), *Sustainable Energy Provision Among Displaced Populations: Policy and Practice*.

For many women, soot produces shame. Some people described their dirty pots as a source of embarrassment. One Congolese woman in Kakuma said that she spent hours each day scrubbing the outside of her cooking pots because ‘it is very shameful to have pots that are blackened by soot.’

Soot is not equal. Cooking residues do not stick to all pots in equivalent ways, and the shame of soot is not universal. Within each camp there are significant variations in cooking technologies and fuels. Many women cover their cooking pots with a mixture of ash and mud; after cooking they peel off that mixture, revealing a clean pot. The stain of soot on pots and hands, therefore, is a social signifier – one more material identifier of economic status within the refugee camps.

Many local conceptualizations of energy materials may be too diverse across Goudoubo and Kakuma to be generalized. But in both contexts people’s concern with removing soot from cooking pots are a commentary on the complex social and power relations in which they are embedded. As discussed in the following chapter, the top-down labelling of technologies as ‘clean’ or ‘dirty’ can create or reinforce stigma that are already being felt keenly by refugees.

4. Firewood

Firewood is more than fuel. It is an essential part of cooking cultures – linked to the taste and smell of everything from rice to tea. Demand for firewood is also a vital part of refugee economies, constantly defining and shaping exchanges between displaced and host communities. In Kakuma and Goudoubo refugee camps people find themselves in a changing energy landscape where traditional fuels are recognized by humanitarian actors and refugees alike as 'dirty', yet where firewood also remains a crucial fuel source to meet daily cooking, lighting and heating needs.

Everyday relationships with firewood are not equally shared. Women and girls encounter firewood most frequently, and bear the greatest responsibility for its collection, transportation and use. This takes them outside their domestic worlds and into new exchange networks with other displaced people and host communities. Women's physical labour is a vital part of the energy landscape in Goudoubo and Kakuma, keeping daily life ticking along and connecting people in complex exchange networks. Gender is inextricable from the shaping of everyday energy experiences in both camps. Tasks related to firewood and charcoal are typically gendered activities, with the collection, transportation and usage of firewood nearly exclusively relegated to girls and women within the camp. These tasks are often time-intensive; the collection of firewood, for example, often requires the crossing of great distances inside and outside of the camp. Women also drive the food-fuel exchange networks in Kakuma and Goudoubo, host community meetings to buy, sell or trade food rations for firewood.

In other parts of sub-Saharan Africa, the gendering of tasks around firewood is often normalized by displaced communities and humanitarian practitioners. It is often referred to as an inevitable, even common-sense facet of everyday life.[22] Yet women's experiences cannot be homogenized. Multiple variables, including ethnicity, age and status, shape their energy encounters. Those with higher levels of wealth can minimize time spent in the management of fuels by paying for other camp inhabitants or members of the host community to transport food and fuels from the distribution centre to their household, and this time can be spent doing other tasks, such as engaging in income-generating activities.

This chapter explores the nature of this work, focusing on barter as a non-market economic transaction. Despite attempts to introduce new technologies, firewood remains an important part of people's lives. In contexts defined by poverty, precariousness and vulnerability, what does it mean to brand these things as dirty and primitive?

Bartering food for fuel

The processes surrounding firewood in Kakuma and Goudoubo are marked by symbolic contrasts between refugees, the host community and the state. In Kakuma, the Turkana people who form the host population harvest and deliver wood, while aid workers and the police monitor (some of) the transactions, and the female inhabitants of the camp carry the wood home and are responsible for using it to cook and later for scrubbing their pots of its residue. In Goudoubo, additional firewood is sought outside of the camp boundaries on land that is inhabited by the local Burkinabe host community, and women and girls manage the collection, transportation and utilization of firewood.

The organization of refugee camps as defined by top-down policy and practice is not always reflected on the ground, where refugees structure their own interactions in ways that are shaped by political, social and cultural hierarchies. Despite not being legally permitted to work, for example, the inhabitants of Kakuma and Goudoubo engage in far-reaching and complex informal networks that reconfigure systems of exclusion.

Neither Kakuma nor Goudoubo are connected to centralized electricity grids (although businesses in a subsection of Kakuma were able to connect to a regional grid in 2018). But, rather than see these spaces as defined by the absence of electricity grids, each camp can be viewed as defined by other kinds of grid. These include the humanitarian grid that is organized in top-down systems of control, including systems for the registration and identification of inhabitants as well as restrictions on freedom of movement and employment. Another might be the grid of informal economic interactions that underpin much of everyday life. This grid is defined by the cash and barter transactions that take place between camp inhabitants, as well as between them and members of the host communities, connecting people together in a lattice of exchange relationships.

The attention of some in the humanitarian energy community has recently focused on the possibility of cash transactions within the camps, but many transactions are not cash-based and instead involve barter.

The attention of some in the humanitarian energy community has recently focused on the possibility of cash transactions within the camps, but many transactions are not cash-based and instead involve barter. The exchange of food for fuel is a classic example of barter and, in both camps, is undertaken predominantly by women who must make the unenviable decisions about how to balance scarce household finances in order to best feed their families.

Refugees in Kakuma camp are provided with a firewood collection card that they use every two months to collect wood from a designated distribution centre. Firewood is sourced from members of the Turkana host community, who are licensed to provide firewood. These donations, however, are often inadequate for heating and cooking needs, particularly for smaller families who receive less firewood, as the quantities are determined by the number of people in a family unit. There are numerous complaints concerning the challenge of firewood supply; one exasperated South Sudanese refugee said, ‘we always run out of firewood… This is impossible.’

In 2016, the free distribution of firewood in Goudoubo was partially replaced by the distribution of liquid petroleum gas rations (see Chapter 9). Humanitarian agencies and refugees were keenly aware that the firewood hand-outs of 10 kilogrammes of wood per refugee per month were inadequate for meeting energy needs. In a sign of the increasing scarcity of wood in the region, at one point supplies were being collected more than 100 kilometres away from the camp.[23]

As explored in Chapter 9, although the use of gas does not add to tensions regarding local resources like wood, does not produce smoke or soot like wood fuels, and can reduce cooking time, it does not totally address the challenge of sufficiently meeting household energy needs. There are relatively few examples of functional gas distribution networks serving humanitarian

[23] Corbyn and Vianello (2018), *Prices, Products, Priorities*, p. 20.

settings, and in Goudoubo's case gas is not always available.[24] This means that many women and girls make simultaneous use of multiple energy technologies and fuels, sourcing firewood elsewhere, either through trade networks or from foraging beyond the camp boundaries.

With employment illegal for refugees in Burkina Faso and Kenya, money is in short supply and refugees use food rations to barter for more firewood and charcoal with host communities. In Kakuma, a South Sudanese inhabitant said that she frequently trades three bowls of sorghum for one basin of charcoal. 'It's a good deal', she said. Recent research has shown the high prevalence of a trade in food for fuel within both camps, with one-fifth of refugees surveyed in Goudoubo in 2017 exchanging their food rations for additional fuel among themselves and with members of the host community.[25]

With employment illegal for refugees in Burkina Faso and Kenya, money is in short supply and refugees use food rations to barter for more firewood and charcoal with host communities.

These exchanges between refugees and host-community members happen in public spaces, in domestic spaces, in markets and in places of work and trade. Though they might be described as taking place within the informal economy, these interactions are not without rules and expectations. People often seek out or choose the same exchange partners on a regular basis. Sometimes, establishing the exchange value of commodities demands a process of serious negotiation. This is a demonstration of the market at work in its oldest form.

The language barriers that often exist between refugees and host-community members do not prevent social and economic interactions; sometimes these transactions can occur without words. In one such interchange researchers witnessed between a female refugee, her husband, and a Turkana woman in Kakuma, the refugee couple laid down a plate of rice outside their shelter and the Turkana woman responded by laying down two bundles of firewood beside the plate. The refugee woman chose the larger bundle of the two, and the Turkana woman claimed the plate of rice. Not a word was spoken, yet there was a successful trade interaction despite significant cultural and linguistic differences.

Scarcity and disruption

Firewood is not without its tensions, however. In Kakuma, cash payments to the Turkana people for the harvesting and sale of firewood has emerged as a primary source of income for this local community. The inadequacy of firewood provision by the humanitarian administration for daily energy needs drives many refugees to cross the camp perimeter in search of more of this precious fuel. Given their legal status and the boundaries etched out in sheet metal gates and invisible lines between the camp and Turkana county, this movement also creates tensions with

[24] Although it is worth noting the schemes that have been undertaken in Niger (http://www.unhcr.org/uk/niger-access-to-gas-project.html), Tanzania (https://reliefweb.int/report/united-republic-tanzania/gas-initiative-protecting-refugees-and-improving-lives) and Bangladesh (https://reliefweb.int/sites/reliefweb.int/files/resources/environment-2018-5-9_twopage_eetwg_summary9.pdf) among others.
[25] Corbyn and Vianello (2018), *Prices, Products, Priorities*, p. 20. Unfortunately this is also common in many other humanitarian settings. In Ethiopia's Dollo Ado camps, for example, Haskamp and Haas found that 28 per cent of households had sold food rations to buy cooking fuel in the week prior to being surveyed. Haskamp, S. and Haas, O. J. (2015), 'Baseline Survey Ethiopia Dollo Ado', Integration Environment and Energy for UNHCR, 28 April.

the host community. This can be a risky endeavour for those that make the journey. Instances of gender-based violence towards refugee women and girls who leave the confines of Kakuma in search of firewood occur in confrontations with Turkana community members.[26]

As one Somali woman said, 'I have no option. I need the food, and I need the wood. I do not have the money to buy anything additional. We move in groups when we leave the camp, we will be attacked otherwise.' Stories like these demonstrate the lengths that some refugee women go through to provide their family with fuel for cooking and heating, as well as illustrating a vulnerability of women and girls that is enhanced by their refugee status and driven by their energy needs in the absence of adequate humanitarian provision.

In Goudoubo, too, scarcity of wood threatens to disrupt the relatively peaceful relationship that has existed between refugees and host communities so far.[27] Currently, however, among host-community members this concern appears to be outweighed by the belief that the refugees' presence contributes to a mutually beneficial relationship. One man in a nearby village said, 'I am very happy with the arrival of the refugees. It contributed to developing the village. When the refugees arrived everything changed. Water is now available and we have a market with lots of vendors and activity.'

According to Sustainable Energy for All, the international organization mandated with fostering sustainable affordable energy access, some 4 billion people remain dependent on solid fuels even after decades of experience in the technologies and fuels that could improve their living standards and health outcomes.[28] The stories and relationships formed around firewood suggest that difficulties in changing practice may have specific dynamics in displacement situations. These include the fact that 'traditional cooking fuels' have a cultural and social significance that can be particularly strong in times of crisis and the possibly mutually beneficial relationships that the informal markets for wood create between refugee and host community.

'Clean' vs 'dirty' cookstoves

New cooking fuels are often touted as 'clean' by humanitarian organizations within the camps, in contrast to traditional cooking practices. But what exactly is cleanliness, and how do understandings and experiences of it and energy vary across diverse demographics within a refugee camp, shaped by social structures of religion, ethnicity and gender?

The low adoption rate of 'cleaner' technology in refugee camps cannot be explained only in reference to people's limited resources or generic user preferences; they also need to be understood with reference to specific forms of local knowledge.[29] Varying levels of interest in solar cookers in Goudoubo, for example, reflect specific forms of practical wisdom about material technologies and specific ideas about food and shame. People's preferences are linked to their understanding of the reparability of devices and of storage challenges as well as to the way new technologies make food taste.

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[26] Dobrowolsky, A., et al. (2013), *Women, Migration and Citizenship: Making Local, National and Transnational Connections*, Ashgate.
[27] Corbyn and Vianello (2018), *Prices, Products, Priorities*, p. 20.
[28] World Bank/ESMAP (2018), 'Tracking SDG7: The Energy Progress Report 2018', International Bank for Reconstruction and Development/ The World Bank, https://trackingsdg7.esmap.org/data/files/download-documents/tracking_sdg7-the_energy_progress_report_full_report.pdf (accessed 21 Aug. 2019).
[29] Low adoption rates for new technologies are seen in both camps. For example, despite a range of interventions, 'Ninety-nine per cent of households in Goudoubo and 86 per cent of those in Kakuma I rank as Tier 0 or Tier 1 (out of six tiers) for cooking and lighting access on the Sustainable Energy for All (SE4All) index', Corbyn and Vianello (2018), *Prices, Products, Priorities*, p. 5.

Against this backdrop, attempts to characterize old or established technologies as dirty is problematic. ‘Dirt’ and residues have a power, driving people to action. Across Goudoubo and Kakuma, cleanliness within the household is a task largely relegated to women, with the spotlessness of one’s cooking pots, hands, and clothing a measure by which one is judged socially. The energy landscape in both camps is ever evolving, and the humanitarian push for ‘cleaner’ cookstoves contributes to shifting standards in cleanliness, yet access to this technology remains uneven.

In places, like Goudoubo and Kakuma, where people articulate a consistent desire for cheaper and less residue-producing cooking technologies, there remains a heavy reliance on firewood and charcoal for everyday energy needs as disparities in access to alternative fuels and cooking technologies persist. Labelling technologies as ‘dirty’ or ‘clean’ perpetuates an existing narrative of shame and does not help those who want to switch heating, cooking and lighting methods yet lack the resources to do so. If humanitarian energy programmes and policies are to be appropriate and sensitive to context, they need to develop a greater understanding of the diverse economic, social and cultural factors that slow or prevent the uptake of cleaner energy services.

5. Sheet Metal

From cooking to cladding, and beyond

During one visit to Goudoubo refugee camp the research team came across an unusual structure. The construction had a disarming quality. The highly reflective aluminium sheeting shimmered in the light; the surface displayed a combination of cloudless sky and dusty earth. At first glance, looking at the team's photographs, it is difficult to discern the structure's function. The building appears to merge into the background: it blends in. In part, this is due to the reflective surface of the aluminium, but it is also due to the structure's similarities with others across the camp, many fashioned from a similar range of materials.

Yet this structure is distinct. Upon closer examination, it becomes clear this is a shelter of some sort. It has a door, hinges and a rudimentary lock. The aluminium sheeting, along with scraps of a standard issue UNHCR tarpaulin and pieces of woven matting, has been used as a form of external cladding. These are affixed to a frame made from discarded metal and wooden uprights. Each material component has its own story. The aluminium sheeting, for example, was once part of solar cookers that were distributed by UNHCR. Its appearance as a designed structure prompts several wider questions. How are displaced people actually using humanitarian energy products? What happens to energy technologies when they become redundant? What economic and material value might these products offer beyond their intended purpose? What forms of practical, working knowledge and resourcefulness are required for displaced communities to repurpose these goods?

This chapter reflects on these questions and their relevance to contexts of displacement across sub-Saharan Africa. Many apparently redundant materials have potentially useful purposes beyond their original function. Following one material – sheet metal – opens up other discarded technologies and practices of repurposing to scrutiny.

The use of aluminium sheet metal from a solar cooker in a shelter reveals several important facets of material, social and economic culture in Goudoubo and Kakuma. First, it points to the ingenuity of displaced communities in recognizing the material and utilitarian value of broken energy products. Second, it points to the emergence of novel, localized practices around repurposed energy technologies or products. Trying to address their daily issues on their own, using broken products for unsuspected purposes, speaks loudly of the large variety and linkages between refugees' unmet needs. Third, it points to the mobility of practical knowledge and skills, such as that required to fashion a shelter.

The blacksmith

The project researchers initially met Yaya, who described himself as one of the most talented blacksmiths in the camp, at an artisan centre established in Goudoubo. The strength of his claim soon became apparent when he invited the team to his home and they observed his skills as a fabricator.

Next to Yaya's standard UNHCR-provided dwelling stood the striking reflective structure described above. A similar structure was built alongside, adjacent to a covered, cooking area constructed from rush branches. Yaya's skill was evident in the construction of the aluminium-clad shelter, which he proudly described as being based on his own design. For some time after his family's arrival in the camp, they kept food in the main dwelling. But on several occasions the food had gone to waste, been eaten by goats or been spoiled by rainwater, leading him to devise alternative storage arrangements. He built the shelter to store their food, alongside tools, gas equipment and firewood.

The blacksmith's shelter was an artefact of the skills and practical knowledge that he had acquired as a young apprentice in Mali. He carried these with him when he left, and in Goudoubo he put them to use meeting new needs and generating a modest income. But the finished shelter was also an artefact of knowledge, relationships and materials that were available in and around the camp itself.

As people seek out materials to improve their lives, they enter into diverse exchange relationships, combining market exchanges with forms of barter and intra-camp bargaining with external exchanges involving members of the host community.

The shelter offers an insight into the socio-economic infrastructure of the camp, as well as the relationships between its inhabitants and other communities in this part of Burkina Faso. As people like Yaya seek out materials to improve their lives, they enter into diverse exchange relationships, combining market exchanges with forms of barter and intra-camp bargaining with external exchanges involving members of the host community.

Goudoubo's artisan centre gives people access to tools and raw materials, including the aluminium from broken or discarded solar cookstoves. Some people have sought out these to make utensils (from ladles to drinking vessels) and bracelets, either for personal use or for sale in the camp and in Dori.

Yaya borrowed a pair of ready-made pliers from the centre and rummaged through its stock of spare parts to build two hammers. These homemade tools also displayed his resourcefulness. The handles are fashioned from discarded wood and attached to a piece of iron, which is used as the head of the hammer.

Yaya's skills extend beyond knowledge of construction and materials. His ingenuity is also evident in his ability to procure materials through social networks. The artisan centre does not give metal sheeting away for free. This can be purchased with cash or bartered for other goods. Yaya acquired the 10 aluminium sheets he used in his shelter for a combination of nearly $9 (CFA 5,000) and, as he said, 'some tea and grilled meat'. The construction of the shelter demanded other materials too. He paid $3.5 (CFA 2,000) for two nail boxes at the artisan's centre, $21 (CFA 12,000) for two wooden columns in Dori, and just over $2.5 (CFA 1,500) on iron to make the lock-holder.

Such examples of material resourcefulness highlight the ways that displaced people remake their worlds by fabricating tools, livelihoods and shelter from what is at hand, whether these are the non-food items that have been distributed by humanitarian agencies or things that have been discarded by family, friends and neighbours.

So what does it mean to understand these acts of material resourcefulness as displays of practical knowledge and ad hoc or localized innovation?[30] And how do their registers of value shift as they find new use?

Scrap materials – changing values

The Blazing Tubes solar cooker is a common sight in Goudoubo. The research team noticed one of these placed next to a tree outside the home of the project's translator, Karim. Although somewhat battered and dented it still appeared to be in working order, and still contained cooking oil in the pot. It is a rather awkward design, ungainly in its stature and somewhat unwieldy to move. However, the Blazing Tubes solar appliance has proved an important energy product for tackling issues around access to adequate cooking facilities in camps such as Goudoubo.[31] It was developed in 2008 by John Grandinetti following prototype testing in Hawaii and has gone through an iterative process through field testing.

The Blazing Tubes solar cooker provided to Karim by UNHCR in October 2016 differs from the original designs but its essential functioning is the same. One of the key design innovations is the use of the glass tube that sits inside a parabolic, trough-shaped reflector (or compound parabolic curve) and is attached to the heat-retaining pot in the cooking box. The heat for cooking is generated by the solar heating of high-heat vegetable oil in the glass tube, which acts as a heat-transfer fluid. It can reach cooking temperatures of 150°C and the oil only needs to be changed once every 18 months.

Behind the development of this particular design lies a clear recognition of the meteorological conditions under which many displaced people live in sub-Saharan Africa, with large amounts of sunshine. This is one of the reasons UNHCR and other agencies have introduced solar cookers such as Blazing Tubes into camps in Burkina Faso. However, while some reports note the positive response to Blazing Tubes, more recent ones point to limited long-term use on the part of displaced people in Goudoubo.[32]

Fundamentally, the reason behind this is a cultural one, related to cooking practices. Karim and his wife, Timi, described how the intense heat that the mineral oil reaches often leads to it smoking, which affects the flavour of the food. This may be a design flaw with the oil being reheated continuously over the 18-month period. Owing to the smell from the oil the solar cooker is more suitable for cooking highly spiced foods such as meat, but much less for staple foods such as rice, which take on the flavour of the oil. Karim described how he came to really recognize the powerful smell from the oil when he used the stove to heat water for a bath – the water itself began to smell like mineral oil. The researchers experienced this when Karim took them outside to smell the oil: lifting the lid of the cooking pot there was a distinct smell, akin to refried food.

A similar story emerged when the research team spoke to people in a household two or three minutes away from Karim's home. A woman here, Coumba, recounted a similar story. She had received her family's solar cookstove three years previously. She spoke about its advantages and

[30] Collier, S. J., Cross, C., Redfield, P. and Street, A. (2017), 'Little Development Devices/Humanitarian Goods', *Limn*, no. 9, https://limn.it/issue/09/; Jencks, C. and Silver, N. (2013), *Adhocism: The Case for Improvisation* [second edition], Cambridge, Mass.: MIT Press.
[31] While the specific focus of this chapter is on Goudoubo, there are examples of solar cookstove initiatives in Kakuma (http://solarcooking.wikia.com/wiki/Kakuma_Refugee_Camp). However, we found little evidence of the repurposing of these stoves in Kenya.
[32] Corbyn and Vianello (2018), *Prices, Products and Priorities*, p. 19.

said she still occasionally used it, but she had decided to use it less frequently due to the need to top up the oil and also because of the smell. The petrol-like smell had become so unpleasant to her children that they refused to eat the food.

Cooking smell might be one of the most widely cited reasons for the Blazing Tubes solar cooker not being widely accepted in Goudoubo, but a UNHCR representative also noted other problems. Although the device is designed for sub-Saharan climates, the cooler season in Burkina Faso from November until February and the rainy season from June to September limit the number of cooking opportunities.

This might lead some to conclude that the solar cooker needs a series of simple design tweaks before it can be successfully deployed. Yet the bigger challenge is that many intended beneficiaries see no particular problem with the cooking system they currently use, and the benefits of their 'traditional' or 'conventional' cooking systems continue to outweigh those of 'cleaner' or 'modern' alternatives. It is no surprise that component materials of cookers are often deemed to be more useful.

> **Parts of stoves have been used as windbreaks for cooking with fire, a door, part of a fence, storage shelving, to deliver animal feed, and the arms of a chair.**

Blazing Tubes solar cookers, particularly the vacuum tube, are also quite fragile and prone to breaking. But they can also become something else when they are broken or redundant: an object of different potential and value. Across Goudoubo the research team identified numerous incidences of creative repurposing. It was aluminium sheet metal from a broken Blazing Tubes cooker that Yaya had acquired as cladding for his shelter. Parts of stoves have been used as windbreaks for cooking with fire, a door, part of a fence, storage shelving, to deliver animal feed, and the arms of a chair.

Timi had come up with her own ingenious use for another broken cooker. The Blazing Tubes solar cooker is manoeuvred through a rudimentary frame that has wheels attached. It is a wheelbarrow of sorts on which the parabolic trough and glass tube sit. Timi put the frame to a different use. As she explained to the researchers, she had been struggling to transport jerrycans of water without a cart or other means of transportation. One day, watching her husband Yaya return from the artisan centre with sheet metal from a broken cooker to build their shelter, she came up with her own solution. For Timi, the broken stove's potential was self-evident.

The research team identified other comparable examples of repurposing and reuse across Goudoubo. Although not as immediately noticeable as the Blazing Tubes cookers, empty tins of fortified vegetable oil provided by USAID could be found around the camp put to a variety of uses. A row of empty four-litre tins half buried in the ground marked out the boundary of a dwelling. Tins were hung up as storage pots from the branches of a tree. But, in terms of pure function, perhaps the most creative repurposing was the use of these tins as the supports for a bed made of reeds and matting. Given the circulation of these tins and the diversity of uses they are put to around the camp, there is something ironic about the message printed on each one: 'Not to be sold or exchanged'.

Such examples offer up a more complex portrait of the relationship between humanitarian energy technologies and their contexts of use than that found in field reports or impact assessments. This complexity is perhaps best exemplified by a comment from one of the UNHCR representatives who accompanied the research team on a visit to Goudoubo's marketplace. This is a space in which local communities and Malian refugees come together to buy and sell goods, and to socialize. A Burkinabe food seller, Safi, was sitting with a group of Malian women under a shelter and offered the researchers two empty armchairs on which to sit. Immediately the researchers recognized that the arms of the chairs were made out of sections of the Blazing Tubes stove. This was a high-skill design assemblage, with the framework of the chair fashioned out of a variety of metal tubing and wooden branches. The seat itself was made from bent twigs, held together with thread. The arms were the most striking due to their sheen but were also part of the solar stoves.

As the researchers sat down on the chairs, the accompanying UNHCR representative turned to the group of refugees and asked, 'who has done this?' Before anybody had a chance to answer, he turned to the researchers and said, 'you see how they spoil our gifts!' Although the comment was not made with malice, it exposed an important question about the economy of the camp and the expectations among officials of appropriate behaviour, gratitude and material respect among those deemed dependent on the humanitarian provision of basic needs.

Yet the examples in this chapter all point to a disjuncture between the intended and actual or eventual use of energy technologies, highlighting the practice of repurposing as a form of creative innovation and value creation.[33]

The examples in this chapter offer an important insight into the economics of humanitarian relief. The purchase by UNHCR of Blazing Tubes solar cookers for distribution has obvious budgetary implications. On the surface, the failure of the cookers to adequately fulfil the needs of the refugee community signals an apparent failure and thus a waste of money. In these terms this is an entirely negative outcome in which the utility of humanitarian goods is destroyed and the economic outlay is wasted.

Yet the repurposing of the Blazing Tubes solar cooker in the camp signalled the operation of a parallel system of value. It involves a shift in value – a transformation in the meaning and utility of these things. What began as an economic object to UNHCR, or a humanitarian technology designed to meet a universal basic need, moved into a new value register defined by users themselves. For some, the repurposing of these solar cookers might seem an indictment of the decision-making by investors and policymakers, with the ingenuity of refugees a small silver lining. But, while the repurposed solar cooker may showcase people's material ingenuity, it is not the sole example of it. The sheet metal is important because it reminds us that people living in Goudoubo are materially ingenious on a daily basis, even if such resourcefulness is frequently ignored by humanitarian interventions.

Resourcefulness as 'local innovation'

Understanding people's adaptive strategies reveals their resourcefulness rather than a culture of dependency. Close attention to the contexts in which people use, adapt and repurpose material technologies provides insight into cultures of production and consumption, and the future provision of humanitarian goods.

[33] Mavhunga (2017), 'Introduction: What Do Science, Technology, and Innovation Mean from Africa?', p. ix.

Like other members of the displaced Malian community in Goudoubo, people like Yaya and Timi took a localized or situated approach to dealing with their immediate problems. Their material resourcefulness emerged out of necessity – from the failures in the humanitarian distribution of goods that adequately fulfil their needs and the failures of these goods themselves. Their repurposing of available materials challenges any perception that people in their position are reliant only on 'inbound innovation',[34] via the provision of services and technologies from external agencies.

Weaknesses in the design of the standard UNHCR shelter led Yaya to develop his own solution to the problem of storage, one dependent on his practical knowledge as a blacksmith as well as on the availability of materials such as the discarded aluminium sheeting from the broken Blazing Tube solar cookers. His understanding of the material properties of aluminium, notably its capacity to reflect sunlight, led him to see it as ideal for storing food. Timi's solution to the challenge of transporting drinking water saw her find new utility and value in the cookers' metal frame. In both cases, practical knowledge coupled with resourcefulness in recognizing the potential application of discarded materials must be understood as a form of innovation in its own right.

Such examples of what are called 'indigenous', 'frugal' or 'bottom-up humanitarian innovation' have not been sufficiently studied in refugee contexts.[35] The qualitative approach here to humanitarian energy demonstrates the importance of better understanding these processes and practices of 'local innovation', but one must also be mindful of the drive to operationalize the resourcefulness of refugee communities.

One humanitarian response to the local forms of resourcefulness and practices of innovation described in this chapter might be to try to 'scale them up', however, this is not always possible. An alternative and equally important response is to recognize and appreciate these forms of innovation in their own right and to acknowledge the ways they alter the original configurations of economic and use value in humanitarian energy technologies. Participatory or co-design approaches to innovation – which invites displaced people to have a stake in the development of humanitarian technologies, products and services – are increasingly credited with producing a deeper understanding of the specific needs of different communities and accelerating scale.[36]

[34] Ibid., p. 8.
[35] Bloom, L. and Betts, A. (2013), 'The Two Worlds of Humanitarian Innovation', Working Paper Series no. 94, Refugee Studies Centres, The University of Oxford.
[36] See, for example, the work of UNHCR's Innovation Service, https://www.unhcr.org/innovation/unhcrs-first-refugee-start-up-weekend/.

6. Bellows

Ceremony

During an early pilot trip to Goudoubo the research team was invited to take tea with Meddur, a Tuareg man living in the camp with his extended family. Taking tea is a common occurrence in the camp and this was an important way of fostering trust and good relations with informants. But as they sat down next to a small decorative stove heated by coal, it become evident that something more than tea was being prepared. Meddur was sitting proudly with a set of bellows, a rather antiquated piece of equipment, and using them to tend the fire.

As explored earlier in this paper, life with a traditional cookstove involves many different objects: from the cooking pot (see Chapter 3) to firewood (see Chapter 4). As researchers mapped the network of objects involved in cooking, they brought additional, supplementary technologies – like the bellows – into focus. The bellows were not standard issue equipment for displaced households. So where did they come from and how were they made?

> **As refugees in Goudoubo described their desire for a more convenient, more efficient and less labour-intensive cooking fuel, like gas, they often complained about the work involved in keeping air circulating through a fire.**

Cooking with biofuels is labour intensive as fires require constant attention. As refugees in Goudoubo described their desire for a more convenient, more efficient and less labour-intensive cooking fuel, like gas, they often complained about the work involved in keeping air circulating through a fire (see Chapter 9). As one Tuareg woman said, 'when you cook with gas you can even go inside your house and take a rest while cooking, you don't even need to blow on it.'

Tools to control the circulation of air and the temperature of a fire, allowing people to extend their 'blow', are a vital part of energy systems. In Goudoubo the bellows play a pivotal role in everyday life, establishing a rhythm and a ritual that gets the fire started and keeps it alive. They offer important insights into processes of creative construction and modification.

Efficiency

During further investigation on return trips to Goudoubo, the research team came across another set of bellows: a double-bag design, with two skins attached to dual windpipes joined through a central block of wood. The use of this larger piece of equipment appears frequently in the historical record across centuries and continents, demonstrating a significant trajectory in practice and knowledge, shared across generations and time.[37]

[37] For example, there are similarities in bellows technology between Goudoubo refugee camp, historical records of blacksmith practices in West Africa, and practices from rural Ireland.

These double-bag bellows were owned by a nineteen-year-old Tuareg blacksmith, Oumar, who learned the trade from his father. He and his father showcased the family's craftsmanship. They used the bellows in a makeshift forge, as a tool to make the coals red-hot. The heat makes metal pliable and allows them to fashion or repair a range of useful tools.

Oumar began by creating his makeshift forge in the sand by carving a small groove where the bellow pipes are laid out, the end coming to meet at a small pit where some cold coals are deposited. He covered the coals with a handful of wood shavings. Finally, he deposited some hot coals from the tea stove over the shavings. Then he began pumping on the bellows with rhythmic oscillation. One hand rose up to fill the left skin with air and the second-hand descended, closing the skin and pushing the air into the coals. Then, like the revolving pistons of a steam engine, his hands moved up and down, one skin feeding the fire while the next took its breath, readying itself for its turn to heat the coals.

Within seconds, the wood shavings were alight, smoke quickly rising, then gone, followed by a burst of flame. The shavings disappeared, the flames too, but the glow grew brighter, as the coals took the heat with each breath of air from the bellows. Within three minutes, the coals at the top of the pile were moved aside with a large machete, revealing a white ember coal fire hot enough to heat steel for shaping. The machete was left in the coals while Oumar readied his improvised anvil: what appeared to be an oversized railroad spike embedded in a piece of timber. As the machete reached its optimum temperature, Oumar's father gestured at him to pause, preventing the bellows from overheating the fire needlessly. Oumar's father now took up his file, grinding the edge of the hot machete, and finishing the edge with his hammer.

Practical knowledge

As the research team asked more detailed questions about the bellows it uncovered details about the blacksmith's life history and specialist knowledge. Oumar's father, Ousmane, had been working as a blacksmith since childhood and had made the bellows himself. A pair of double-bellows, he said, were simply the best way to get a fire hot enough to work metal better than a fan or simply fanning the flames with cardboard.

Ousmane described how he had made the bellows from goatskin, since sheepskin is not strong enough. The goat, he explained, needs to be skinned from the rear. The skin around the throat needs to be preserved as a skilled maker uses the goat's windpipe to connect the sack to a wooden block, which holds the pipes leading to the fire. The skin at the throat, he explained, needs to be strong since any reduction in the pathway through to the tubes results in increased air pressure, causing a faster flow of air through the pipes to the fire, and requiring a strong connection in order to remain intact with repeated use.

Ousmane explained that he had had this particular bellows for more than two years. As he told his story to the researchers, his son sat patiently in the background, waiting for his father's cue to resume his gyrations, and breathe life back into the coals, generating heat to get the iron hot again. Tending the bellows is the first task every blacksmith apprentice learns. Oumar expects his son to begin by the age of four and by the age of 12 to have learnt the craft of hammering metal.

But, as any blacksmith knows, bellows are good for more than forging metal. As Ousmane explains, his bellows are put to other uses in their family. He sometimes lets his wife, Nene, borrow them to get the cooking fire going; particularly when the firewood is wet and difficult to light.

More than air

Historians and social anthropologists working in West Africa offer some insights into the social and cultural significance of the blacksmith, and the nature of the two-bag bellows at work.[38] Such accounts move beyond purely technical and practical dimensions to highlight the spiritual and emotional dimensions of blacksmith practices, and role of the blacksmith in community life.

Getting a fire hot and to be able to forge, strike and mould steel over an anvil in order to shape and temper tools, ornaments, farm implements and often weaponry has been revered across West Africa's Mande ethnic language groups since at least the early 15th century. Mande blacksmiths have been described as a caste – a group that has sought to retain specialist occupational knowledge and bloodlines through marriage within the community. Blacksmiths have also been described as figures of awe and fear, associated with the possession and control of *nyama*, a life force that in many Mande traditions is associated with power, knowledge and creation. The blacksmith's alchemical ability to shape hard metal ores into forms useful for cultivating life and material culture offers a quintessential display of *nyama*. Such ideas present Ousmane and Oumar in a fresh light. The bellows are more than a technology for making fire efficient; they are also a medium through which a practical knowledge of fire is exchanged between master and apprentice, father and son.

> **The blacksmith's alchemical ability to shape hard metal ores into forms useful for cultivating life and material culture offers a quintessential display of *nyama*.**

In the context of forced displacement, such practices are subject to rapid transformation. In Goudoubo, for example, the UNHRC made blowtorches available to metal workers in the artisan centre, in the expectation that this would catalyse activity. The blowtorch is a standard piece of equipment in many metal-working industries – highly efficient, clean and portable – it is an ideal tool for heating metal quickly and easily. But what the blowtorch gains in ease of use it loses as a vehicle for the transmission of practical mastery, craft traditions and culture. Rather than simply providing him with the tools to forge a livelihood in the camp, the blowtorch presented Ousmane with a new challenge: how to pass on and showcase his skilled knowledge with dignity.

Fire practices

Firewood and charcoal remain the fuel of choice for most humanitarian agencies and their distribution remains the norm in many humanitarian settlements. As the humanitarian energy community pays closer attention to the impact of burning biomass on air quality, however, these fuels are increasingly presented as a 'dirty', 'primitive' and 'inferior' to alternatives like liquid petroleum gas or solar. Framing biomass as dirty may be a necessary means of securing resources and new initiatives aimed at enhancing the provision of energy services in complex humanitarian environments.[39] But this is also a narrow frame that erases the understanding of what makes fuel dirty.

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[38] McNaughton, P. (1993), *The Mande blacksmiths: Knowledge, power and art in West Africa*, Bloomington: Indiana University Press.
[39] Law, J. (2002), *Complexities: social studies of knowledge practices*, Durham: York University Press.

'Dirtiness' is not an intrinsic quality of biomass; it is also an effect of materials, practices and systems. Dirtiness is an effect of burning poor-quality materials, like wet wood. Dirtiness is an effect of inefficient combustion, with poor air circulation in and around a fire heightening pollution. Dirtiness is also an effect of failure in infrastructures of fuel distribution. When dry wood or 'clean' alternatives like gas are unavailable, people seek out and make do with the fuels they can find (see Chapter 9).

Such an analysis does not imply the need to be content with fuels that have negative impacts.[40] Rather, it suggests that the range of possible interventions around humanitarian energy can be widened by examining what people do when they seek to improve the efficiency of fire.

In this chapter the focus was adjusted to better account for and learn from the social and cultural context. A deceptively simple technology like the bellows reveals the heterogeneity of practices that take place around a fire. Bellows are an artefact of cottage industry as well as a tool of ritual and ceremony. They are important vehicles for the inter-generational transmission of artisanal skill. They are also vital technologies for the controlled circulation of air in a fire and thus temperature control and efficiency.

As this chapter suggests, humanitarian energy practitioners have much to gain from approaching material cultures around fire as a source of knowledge, practice and innovation rather than as impediments to change.[41]

[40] Goffman, E. (1974), *Frame analysis: an essay on the organization of experience*, New York: Harper & Row.
[41] Khandelwal, M. and Lain, K. (2018), 'The Humble Cookstove', in The Limn 9, https://limn.it/the-humble-cookstove/ (accessed 21 Aug. 2019).

7. Wires

Despite the refugee camp being filled with nearly 180,000 people, and growing fast due to the ongoing unrest in South Sudan, a birds-eye view of Kakuma at night would show the sprawling area plunged into relative darkness, save for small punctuations of light. On the ground, UNHCR and its partner agencies have access to an array of diesel generators that provide electricity. Providing fuel to power these generators is big business. In 2017, they were trucked into the camp and distributed by the NGO Action Africa Help International, which was contracted by UNHCR to look after the logistics of fuel transportation as well as to service vehicles and generators.

Unofficially, many households and shops secure access to diesel-generated electricity.

Unofficially, many households and shops also secure access to diesel-generated electricity. In the oldest area of the camp, known as Kakuma 1, for example, the market place is woven together by thick tangles of hundreds of cables and wires, live and disconnected, that hang in and between small storefronts. In some places, strips of plastic bags hold bundles of wires together. Similar wires hang haphazardly throughout the camp, connecting households.

These seemingly chaotic wires and cables are evidence of a complex and territorial system of energy ownership. They facilitate trade, providing electricity to power the light bulbs and fans that hang in the market shops, and welcoming clients to escape the dimness and heat as shopkeepers try to set themselves apart from the competition. Examining the cables and wires reveals a highly organized and complex supply network, managed by informal energy contractors and subcontractors operating within kinship and ethnic-community clusters.

Control, ownership and access

In Kenya and Burkina Faso, the World Bank estimates that over 40 per cent of those who live close to the national electricity grid do not have access to the power it provides.[42] This holds true for the displaced people living in Kakuma and Goudoubo, where the proximity of high-voltage transmission lines offers a visible, daily reminder of their disconnection and exclusion from energy services.

On a clear day, the pylons of the national grid are visible from Goudoubo. Northern Burkina Faso's electricity grid passes just short of the camp. Similarly, though Kenya Power claims to be in the process of powering Kakuma's marketplaces, as evidenced by rows of pylons and cables laying on the ground waiting for installation, it is not known when this grid will be functioning. Although the infrastructure for the Kenya Power grid is present, the connections are not. Residents of Kakuma town, near the camp, had as of February 2018 received power from a Rural Electrification Agency-constructed, Kenya Power-operated diesel mini-grid, which is reducing local energy bills, although indications suggested the supply would be extremely limited.[43]

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[42] Chuhan-Pole, P. et al. (2017), 'Africa's Pulse', World Bank Group, April, Vol. 15.

[43] The average peak load is just 140 kWp, so there is room (and likely a business case) for adding connections and building demand. See Patel, L. (2018), 'Assessing Potential for Off Grid Power Interventions in Turkana County with a Focus on the Communities around Kakuma and Kalobeyei', Smart Communities Coalition – MAKE Change Pilot, https://www.energy4impact.org/file/2087/download?token=BsWZzcRf (accessed 12 Jan. 2019).

Grid-like experiences of electricity are available to some residents of Kakuma, however, courtesy of a small number of micro-grid operators, who run diesel generators to provide power.[44] These micro-grids map closely onto the camp's social organization, which is largely along the lines of national and ethnic identity. Kakuma's Sudanese, Congolese, Somali and Ethiopian communities often live in spatially segregated areas, with further divisions by kinship, clan and language group. The networks of cables that connect generators to consumers map tightly onto these social networks; for example, the Somali mini-grid supplier largely serves members of the camp's Somali diaspora. Localized tangles of wires indicate further layers of connectedness, with a single electricity connection shared between families and households. Such shared electricity connections are a common phenomenon in Kakuma, with people 'tapping' power lines and extending diesel micro-grids still further across kinship networks.

For many consumers, the promise of a future connection to the national power grid offers some relief from the activities of these operators, and electricity from Kenya Power is likely to be cheaper than that provided by any mini-grid operator. Little surprise, then, that the coming of grid connectivity represents a challenge to the micro-grid operators.

The cables owned by a micro-grid operator, a Somali man we will call Abdullahi, carry electricity to 150 storefronts and 75 households throughout the area. He is very well-known throughout Kakuma; though energy provision is territorial and often contentious, there is an informal association of these energy operators, of whom Abdullahi claims to be the spokesperson.

Abdullahi is the only private micro-grid operator in Kakuma 1, and with the help of his father, he operates six generators that he bought at a UNHCR auction. Energy providers like him have control over price, who is connected and for how long. One micro-grid operator, speaking paternally about his technology, explains that its frequent power cuts are because 'a generator is like a human body, sometimes it needs to rest'. But these decisions can be shaped by many different imperatives, over which the grid operator asserts total control. Abdullahi tells us that he chooses to shut down power between 12:30 p.m. and 3:00 p.m. in the Somali marketplace because of the heat.

Micro-grid operators are often highly territorial, with each supplying a specific area of the camp and protecting their market with vigour. They constitute informal energy oligopolies: they can fix prices, they operate outside of the purview of the humanitarian apparatus, and they can occasionally call upon the police to protect their interests. As Abdullahai said, 'if another guy connects anyone on my side I will call the police on them… they will close him down'.

By acting simultaneously as friends, patrons, bosses and beneficiaries, micro-grid operators like Abdullahi become energy brokers, mediating access to basic energy services. Abdullahi, for example, sold electricity to the Ethiopian market and had ties to local government officials, who (he claimed) had promised him an additional generator so that he might expand his business to the host population. Whether such individuals are able or willing to harness their social networks and their knowledge of the market to help bridge gaps in the delivery of basic energy services across Kakuma, however, is a different matter.

[44] There are an estimated 30 'jua-kali'– informal diesel mini-grid operators – across Kakuma according to Patel, L. (2018), 'Assessing Potential for Off Grid Power Interventions in Turkana County with a Focus on the Communities around Kakuma and Kalobeyei', https://www.energy4impact.org/file/2087/download?token=BsWZzcRf (accessed 12 Jan. 2019).

In search of a quick fix

Wires are not just a feature of connections to diesel generators; they are also a vital part of the operation of small-scale electrical devices from solar lanterns to mobile phones. These devices have become a regular feature of the standard non-food items that are distributed to refugees on arrival at a camp but they would be redundant without the wires that allow them to be charged.[45]

Electrical wires, cables and connectors have become an increasingly important part of the material culture of camps. As small solar-powered lighting devices, for example, have become more widely distributed, the copper threads (coated in plastic and capped with a small micro-electronic connector) that connect lamps to photovoltaic panels have become an essential part of the humanitarian energy infrastructure. Without these, people cannot connect electrical appliances to sources of power. Similarly, as mobile phones have become important for purposes beyond telecommunications – integrated into camp payment and identification systems, for example – their wires and cabling are becoming increasingly relevant features of the energy infrastructure.

The single most common request for electric repairs in Goudoubo and Kakuma involves broken wires or electrical connectors. The demand for these repairs has created economic opportunities for refugees and non-refugees. When Abdullahi's generators or electrical wires break down, he hires a Kenyan man from Kitale, a city that is almost 10 hours away by bus, who visits the camp every two to three months. Abdi explained that he did not trust anybody locally. 'They get paid per repair,' he said, 'so they'll never fix something completely. They'll just want to create more work for themselves.'

However, this negative attitude towards technical skill levels and ingenuity in the camp is not borne out in interviews. Take Iken, a Tuareg man in his thirties who has set up a repair shop in Goudoubo's main market centre. In Mali he repaired radios and mobile phones. In the camp – without the benefits of any of the organized training and skill development programmes run by humanitarian agencies and NGOs – he extended his knowledge and range to include solar lamps and solar panels. 'Before coming here, in Mali, I was already repairing radios and mobile phones. I taught myself', he explained. 'Here in the camp I taught myself how to repair solar lamps too. It is easy to learn how to do it when you have some knowledge in repairing radio and mobile phones'.

Iken supplies himself with spare parts, although his ability to do so is conditional upon the travel permit granted by the camp administration. Once every few months he applies for a travel permit from the Commission Nationale Pour les Réfugiés, a national government body, which requires everybody formally registered in the camp to obtain a permit in order to travel beyond a 30-kilometre radius. He then travels to Dori from where he takes a bus to Ouagadougou where he scours the markets of Sankaré Yaré or Zabré Darga, buying old and broken mobile phones that he can use for spare parts and batteries. He also stocks up on mobile cases, new batteries, phone speakers and headphones.

One of the most common problems are broken wires. Sometimes Iken is asked to make modifications, replacing or extending the original wire with a more multifunctional cable that can charge mobile phones. In such cases he uses a mobile-phone charger, with a plug on one

[45] The Sphere Handbook, for example, recommends that solar chargers be included in a package of 'household items' for people on the move. Sphere (2018), *The Sphere Handbook: Humanitarian Charter and Minimum Standards in Humanitarian Response*, Geneva: Sphere Association, p. 99.

end and multiple connectors on the other end. He cuts the plug away and ties the loose wire to a wire coming directly from the solar panel. With this modification, people use the solar panel to charge both their solar lamp and multiple types of mobile phone.

This repair economy operates entirely without the use of electricity. In Goudoubo market, repairs on micro-electronic components and printed circuit boards are carried out with screwdrivers and a homemade soldering iron. Iken has built bespoke soldering irons out of metal and wood, which he heats with a small charcoal stove before welding electronic components on the printed circuit or motherboard. Such livelihoods are precarious. In early 2017, for example, a fire in the market place destroyed all this equipment, alongside a stock of tools, spare parts and broken devices that Iken was repairing.

When people turn to these providers of micro-electronic repairs it is often because they have reached the limits of what they can accomplish without them. Many people attempt everyday fixes themselves, learning through trial and error, turning to friends and neighbours and passing on their acquired knowledge and skills to their children.

One of the translators in Goudoubo, Karim, had four solar-powered lamps in his home: a small one given to his family by the IKEA Foundation, one given to his daughter at school, one given to his wife, and a large model that he exchanged with another refugee for a tarpaulin. The latter, a highly prized possession, had been rendered useless by his children, but Karim found a work-around. ‘When I got the solar lamp,’ he said, ‘there were connectors at the end of the wire. My children cut them, though, so now, when I want to connect the lamp to the battery, I strip the end of the wire and I wind the wire around the battery terminals.’

Karim taught his eight-year-old and six-year-old daughters the fix. ‘I told them both, as you can see there are two wires, the red one and the yellow one. With the red one, you connect it to the red terminal of the battery and then you connect the yellow wire to the blue terminal before switching on the lamp. Now, even if their mother is absent they can do it themselves’. For Karim, applying this kind of technical know-how was simply an extension of his previous knowledge and skills. ‘I used to be a driver and have a driving licence,’ he said, ‘I used to have contacts with mechanics and electricians in a garage, and I learned a basic competence with electrical equipment from them’.

Refuge on a wire

Wires and cables are often a prominent and visible part of ‘camp life’. Any visitors to Goudoubo and Kakuma may quickly become aware of the array of wires that are in use around people’s homes, either as electrical connectors or repurposed as lines to keep clothes off the ground or to dry wet laundry. Yet the value and significance of these objects rarely if ever appears in published studies of energy in refugee camps. Following wires around a camp reveals everyday economic exchanges through which people secure access to goods and energy services, and the power of informal brokers who have emerged to fill energy gaps, as well as a culture of repair and maintenance. The way that people interact with wires reveals their relationship to energy systems and technology as a source of memory and identity, as well as an opportunity for skill and innovation.

8. Batteries

Electrochemical essentials

Batteries are an everyday household staple in northern Kenya and northern Burkina Faso. These electrochemical essentials are as common as fruit or vegetables in the basket of consumer goods that partly defines people's lives at the bottom of the economic pyramid. Batteries can be found for sale alongside charcoal, earphones, cotton thread and costume jewellery, as well as soaps, deodorant, tea, sweets and cooking utensils.

Estimates from surveys conducted by the MEI suggests that households in Goudoubo and Kakuma refugee camps can spend a substantial proportion of their meagre wages on simple alkaline batteries for torches.[46] But what happens to these batteries after people have bought them? And what about the larger lead-acid batteries used to power devices and systems in a household? How are batteries used? How do batteries circulate around a camp in non-market exchanges between households and individuals? And what happens to old batteries as they enter electronic waste streams or are disposed of?

Despite the ubiquitous presence of batteries in people's everyday lives they remain literally 'black boxed'. They are physically sealed, coated in layers of plastic and metal that prevent people from interacting with the chemicals inside. They are also frequently concealed, hidden inside devices or technologies, in ways that sometimes make them difficult or impossible to remove and replace. As a result, even as batteries have become a commonplace and taken-for-granted part of refugee economies, they have also been largely invisible and forgotten.

This chapter puts batteries centre stage in the humanitarian energy landscape. It follows them across contexts of exchange as people purchase, barter and share them. The focus is on batteries in spaces of use – as people charge, discharge and recharge them in order to power mobile phones, lights, radios and televisions – and at the end of life – as batteries enter recycling and upcycling. Batteries can shed considerable light on the forms of economic inequality between refugees and on economies of repair and maintenance.

Battery consumption

A variety of battery types and brands can be found in circulation and use across Goudoubo and Kakuma. Most commonplace are the primary, single-use or disposable, batteries that can no longer generate power once they are discharged. In both camps brand-name AA-sized dry-cell alkaline or zinc carbon batteries are used to power portable torches and radios.

Equally widely used but more expensive are secondary batteries that can be recharged with a diesel generator or a solar panel. These include the lead-acid or gel batteries that are found in vehicles (cars, trucks, motorbikes), solar home systems and some models of portable solar lighting, as well as the lithium ion or lithium ferro phosphate batteries used in mobile phones

[46] Corbyn and Vianello (2018), *Prices, Products, and Priorities*.

and in some models of portable solar-powered lighting and charging kit. The ubiquity of these batteries in both camps is testament to their significance across sub-Saharan Africa. Trade in batteries is a crucial part of local economies, connecting host communities to refugees.

The electronic and electrical equipment stalls around Dori, a key transport route into Goudoubo, for example, are stocked with batteries, alongside DVDs and CDs, solar panels and solar lamps, radios, amplifiers, wires, earphones, mobile-phone chargers, fans and voltage regulators. Meanwhile, in one market place in Kakuma shops sell small disposable dry-cell batteries alongside kettles, water bottles and flasks, hand-powered meat grinders, blenders, extension cables, pots and pans, pestle and mortars (hand-powered), spaghetti, flour and oil.

In one shop, a shopkeeper showed where he kept wholesale packets of AA-sized batteries, below the shelves of battery-powered torches. The batteries were stocked next to the 10 kg, 20 kg and 40 kg bags of maize, stacked waist-high. 'The bigger the bag of maize, the bigger the family', he explained. His comment had a double meaning. Since bigger bags of maize are not just purchased by bigger families but also by richer families. Here the quality of people's diet reflected disparities in social and economic status. Simply put, wealthier refugees can afford to eat more.

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Just like diet, access to electrochemical energy in Goudoubo and Kakuma demonstrates differences in wealth and status among residents.[47] Wealthier families are able to invest in bigger batteries. In both camps, access to energy storage is a prominent means through which people demonstrate household wealth and status. Higher-status households in Goudoubo, (those of block chiefs, refugee elders or refugee representatives), for example, proudly present the large lead-acid batteries that they bought for household use, charged via solar panels. For many the battery was one of few items brought with them when they fled Mali to Burkina Faso. These households are likely to have electrical goods that would run off the battery (e.g. TV, radios etc.) but also own larger-voltage solar panels they most likely purchased.

Similarly in Kakuma, disparities in disposable income between families are most obvious in differential access to electrical power. As shown in Chapter 7, the electrical transmission lines and cables that crisscross Kakuma show differential patterns of access to diesel-powered micro-grids. These systems allow relatively wealthy refugees to run televisions, radios, fridge freezers and electric lights. Off-grid systems offer a similar marker of socio-economic difference, with the wealthiest families able to afford bigger systems and, sometimes, multiple lead-acid batteries.

In Kakuma disparities in the relative wealth of refugees are often related to personal histories of displacement as well as to local employment opportunities. Refugee families that settled in the camp in the 1990s, for example, are more likely to have members now living in North America, from whom they may receive remittances. Meanwhile, refugees employed by a humanitarian agency or NGO are eligible to be paid a fixed stipend, offering some guarantee of a regular income.

[47] For wider discussions on inequality between refugees, see Omata, N. (2017), *The Myth of Self-reliance: Economic Lives Inside a Liberian Refugee Camp* (Vol. 36), Berghahn Books.

The presence of an off-grid solar home system that provides electricity to a household is one of the most highly visible reminders of such differentials in income. But the unequal distribution of energy systems and the differences in energy consumption are also reflected in the varying ability of refugees to enter the informal economy as micro-entrepreneurs. One of the most popular income-generating opportunities available to people in Kakuma is provided by the operation of a simple charging station for batteries and battery-powered devices.

The electric tap

In Goudoubo and Kakuma enterprising refugees have established solar-powered mobile charging stations. One or two solar panels charge a lead-acid battery, which is then used to charge batteries inside mobile phones. Charging stations are often analysed in terms of income generation and celebrated as creating opportunities for micro-enterprise within camp economies. In this sense, they can appear as a novel introduction to the energy landscape. But another way to understand the place of these charging stations or charging businesses in the landscape is to emphasize their continuity with other kinds of infrastructures, institutions and sites of exchange.

In many respects, for example, the place of the battery-charging station in the daily routines and flows of camp life mirrors the place of the water pipe or tap. As seen in Chapter 2, the daily collection of water is a social and gendered activity. Women and children gather at taps each day to collect water and transport it to the point of consumption. At home, demand for water of a particular temperature has given rise to considerable innovation in water-storage technologies.

Similarly, each day people gather at or around sites of charging to replenish portable batteries. Battery charging is an equally gendered activity, one more associated with the work of men rather than of women. Batteries are carried to the charging station inside the electrical devices they power (like phones) and sometimes carried on their own, independent of any electrical equipment. They are then transported to other sites.

Water from a tap has volume and mass, and these qualities shape the forms of labour and the kind of technologies that are required for its transportation and storage. A standard issue 10-litre water carrier is light when empty but heavy when full. The water carrier can be adapted for use, covered and coated in ways that keep water cool. Unlike water, electricity has neither volume nor mass and a battery has a fixed size and shape regardless of how fully it is charged. This size and shape determines how batteries can be moved and used.

Just as people adapt vessels for transporting and storing water, people also adapt batteries for use. For example, some connect multiple batteries in series to power more energy-demanding appliances. Others swap batteries between appliances, using mobile phone batteries in solar-powered lamps, for example. In appliances that require multiple batteries people combine cells of different ages and brands, trying to find ways of maximizing a charge. People introduce novel ideas about storage, sometimes keeping batteries in special places in an effort to retain or extend their charge. They seek out novel ways of connecting their appliances to batteries, when wires have come loose. Each of these examples presents opportunities for examining people's situated ideas about electrical energy and for examining local systems of innovation.

Today, the infrastructure for refilling water carriers is deemed essential to the daily operation of Kakuma and Goudoubo. The installation of taps and pipes is often a humanitarian priority. By contrast the infrastructure for recharging batteries remains largely private, creating new opportunities not only for micro-enterprise but also for individual gain. Privately operated solar-powered charging stations are a common feature of both camps. Each operator's combination of panel and battery offers a telling indication of socio-economic status. Wealthier operators have the capacity to invest in larger panels and multiple batteries. Poorer operators have smaller, simpler systems, sometimes constructed from second-hand components.

In Kakuma 1, the research team visited Hubert, a refugee from the Democratic Republic of Congo, who used to be employed by one of the camp's humanitarian agencies. When he left this post he combined his savings with remittances from a brother who remained in the DRC to purchase a solar home system and install it on the roof of his home. He used the system to power a domestic lighting system and sold the surplus stored in a lead-acid battery through a charging business run out of his home. As Hubert said, 'I can charge anything for 10 bob (KES 10 or approximately $0.1). Some people come with their solar lights, some with their mobile phones, some with their lead batteries, I can charge anything'.

By contrast, in Goudoubo those able to operate comparable charging services are more likely to be members of the local, Burkinabe community. A market space just outside the camp has emerged as an important space for mobile charging service providers. Take Karim, a middle-aged man from the village of Yalgo, which is 50 km away. Every three days he travels to this market space where he operates a small stall charging mobile phones and selling rope used to harness livestock. He travels to the camp carrying a stock of rope and 50-watt solar panels that he erects behind the stall. The panels are connected to a lead-acid motorbike battery that he acquired second-hand; a system that cost him CFA 50,000 ($94) in Dori. The battery is connected, via an AC/DC invertor to a series of electrical sockets mounted on a plywood panel. Karim's customers can plug their mobile phones and batteries directly into the socket. His business is so popular that he has devised his own system of organization, carefully taping and labelling each battery on the panel to avoid confusion between customers. He will fully charge a mobile phone for CFA 100 ($0.18) each, the equivalent of a cup of rice.

The battery fix

Battery-powered technologies, systems and devices are increasingly vital to the provision of basic services in contexts of humanitarianism and forced displacement. But batteries are also the weak spot in these systems. For example, they are the most common source of failure in small-scale, solar-powered lighting systems.[48]

Everybody who has ever used a battery-powered device over time is a witness to changes in its charge cycling and lifespan, and the ubiquity of batteries as a technology in Goudoubo and Kakuma is reflected by the ubiquity of stories about their failure. Across both camps people describe acquiring battery-powered lighting and mobile devices that, they are told, will hold a charge for up to six hours, only to discover after repeated use that this quickly drops to two hours between charges.

[48] Cross, J. and Murray, D. (2018), *The Afterlives of Solar Power: Waste and Repair Off the Grid in Kenya*, Energy Research and Social Science.

As people seek to recoup their expenditure on batteries, both camps have seen the expansion of second-hand markets in batteries from used lithium ion batteries to lead-acid batteries repurposed from old motorbikes and trucks. The circulation of second-hand batteries connects refugees to host communities and humanitarian practitioners. In Goudoubo, for example, people living adjacent to the camp reported securing second-hand batteries directly from a refugee employed as a driver within the camp. There are no mechanisms to guarantee the quality of these second-hand batteries and their efficacy can vary greatly.

Demand for batteries has also seen the growth of secondary markets around repair and reuse. The proliferation of electrical repair services includes informal and ad hoc repair work as well as formalized services established by people who have attended training programmes run by humanitarian agencies.

In 2017, an NGO in Goudoubo was contracted to provide a basic micro-electronic training course for six young male refugees. The aim was to teach them how to repair solar-powered lamps, on the basis that this might become some kind of income-generating activity for them. The trainees were given a multi-meter, a device that measures electronic voltage, current and resistance as well as a screwdriver set. At the end the trainers announced the men were all now electricians. But behind the scenes the trainers had a dim view of what they could fix. ‘Most of these kinds of lamps cannot be repaired,’ one NGO respondent said. ‘When the batteries are broken you cannot do anything. Some of the motherboard components, electric circuits and electronic controllers are too complicated. How can you even weld there? I’m an engineer and I couldn’t fix this – how can the people we are training. And then it comes to the battery. How can you repair a phone battery? The only solution is to change it for another.’

The proliferation of electrical repair services includes informal and ad hoc repair work as well as formalized services established by people who have attended training programmes run by humanitarian agencies.

Most replacement mobile phone batteries entered Goudoubo via Dori, which in 2017 was flush with dedicated microelectronic traders. Many of the traders made regular trips to Ouagadougou by public transport. Markets like Sankaré Yaré or Zabré Darga in Ouagadougou are full of stalls with old or broken mobile phones that provide traders with a variety of second-hand parts, including batteries.

While lithium ion batteries are near impossible to repair, lead-acid batteries, particularly larger models like those extracted from cars and motorcycles, can be more easily reconditioned by adding distilled water or through a reconditioning processes using disulphates. Re-conditioning acid batteries takes some degree of specialist skill and creates new kinds of electrochemical risk.

Electrochemical risk

As a source of power in mobile phones and decentralized energy lighting systems, batteries are associated with increased access to energy services from artificial lighting to information and communication networks. But they can also be sources of potential hazard. Lead, for example,

is a heavy toxic metal and is lethal for humans. Journalists reporting from the camps of Rohingya refugees in Bangladesh, for example, describe children opening up and playing with dry-cell batteries in the absence of other toys or entertainment.[49]

While the humanitarian energy community often presents off-grid energy storage as a solution to challenges of energy access in refugee camps,[50] accelerating global demand for batteries also risks exacerbating some worrying patterns of environmental pollution at sites of mining and waste disposal.[51] For example, the widespread practice of repurposing lead-acid batteries in Kakuma and Goudoubo raises important questions about disposal. What happens to the battery acid in old or abandoned equipment, in the old car batteries or solar batteries that circulate around refugee camps? What happens to the lead that leaches into the groundwater or contaminates food or hands? Can the relatively bounded nature of refugee camps be utilized to set up recycling systems? There is currently little attention to these questions. They proved beyond the scope of the research of this paper but they signal important directions for future enquiry. These broaden concern with the humanitarian provision of basic energy services in sub-Saharan Africa and beyond to questions about the human and environmental cost of energy technologies, systems and solutions.

[49] McGrath, M. and Korn, M. (2017), 'Razors, syringes and batteries: The toys that Rohingya children play with', ABC News, http://abcnews.go.com/International/photographer-captures-life-inside-refugee-camp-rohingya-children/story?id=51587804 (accessed 21 Aug. 2019).
[50] Franceschi, J. et al. (2014), 'Off-grid Solar PV Power for Humanitarian Action: From Emergency Communications to Refugee Camp Micro-grids', Procedia Engineering, 78, pp. 229–235.
[51] Scheele, F. (2016), 'Cobalt blues: Environmental pollution and human rights violations in Katanga's copper and cobalt mines', Stichting Onderzoek Multinationale Ondernemingen (SOMO), https://www.somo.nl/cobalt-blues/ (accessed 21 Aug. 2019).

9. Gas

Distribution

There is a cage at one edge of Goudoubo refugee camp that is made of red metal. One day when the research team passed by, they found children climbing on it, like a piece of playground equipment. Across the top of the cage a banner said 'ORYX GAZ'. This is the camp's liquefied petroleum gas (LPG) distribution facility. On this occasion it contained nothing but a few empty canisters. A cluster of people, mostly women, stood around, waiting for refuelled cylinders, but nobody had any clear idea when or if they would arrive.

Gas is the fuel of choice in Goudoubo. For the women standing around the distribution cage, the benefits are obvious. Gas is cleaner than wood and does not produce smoke. It is safe; users do not need to roam at the far reaches of the camp scavenging for it like they do for firewood. And it is efficient, reducing the time they spend cooking and tending fires, or allowing them to simultaneously perform multiple tasks. In 2016, UNHCR trialled the distribution of LPG in Goudoubo as an alternative to firewood for domestic use. This chapter reflects on how the inhabitants of the camp viewed the initiative.

For women, the benefits are obvious. Gas is cleaner than wood and does not produce smoke. It is safe; users do not need to roam at the far reaches of the camp scavenging for it like they do for firewood. And it is efficient, reducing the time they spend cooking and tending fires, or allowing them to simultaneously perform multiple tasks.

Following gas is difficult. It has an odour but it is invisible. People cannot touch, handle or interact with it directly. Instead, they interact with it via the cylinder: a crucial technology for the storage, transportation and combustion of gas. This chapter follows the cylinders, using these to unpick the distribution networks associated with gas, and reflecting on the futures of energy technologies in contexts of humanitarianism and forced displacement.

The LPG pilot in Goudoubo was run by Hilfe zur Selbsthilfe (HELP), one of 14 non-governmental organizations working in partnership with UNHCR to deliver basic health services, nutrition, education, shelter, energy, water and sanitation to refugees in the camp. By September 2017, single-unit 6 kg Oryx gas cylinders had been distributed to 961 households, or just under one-third of the camp.

Before launching its distribution operation HELP conducted a survey. This identified trial users who would receive a gas stove, a 6 kg refillable gas cylinder and formal training. Some of the camp's residents, mostly those who came from Mali, had used gas before but for many this would be a new experience. The survey also allowed HELP to calculate likely patterns of gas demand in an average household and to estimate the number of days that it would take until a bottle of

gas runs out. The aim was to avoid refugees waiting a long time before having their cylinders refilled. HELP estimated that a gas cylinder would last approximately 17 days for a family of six to seven people.

Based on this estimation, HELP negotiated a contract for collection, refuelling and distribution with a Burkinabe supplier in Dori. But while the organization focused its preliminary research on the point of consumption and on end-users, it appears to have under-examined the motivations and interests of other actors in the supply chain.

Refills

Yaya and Timi (see Chapter 5) were among the camp's pilot LPG users. Like others, they adapted the canister for use with materials scavenged from across the camp. Yaya built a windbreak for it out of sheet metal repurposed from an abandoned solar cooker, fixing this around the canister.

For most trial users, it took about one week to use up the gas in their 6 kg canister. But, for people learning to use a new technology, the rate at which gas was used up was not just about cooking. Stories circulate in the camp of friends and neighbours who had 'lost the gas' in their canisters because they did not fully tighten the valve on the top of the bottle.

Once empty the gas canisters do little except take up space waiting to be refilled. They are much harder to re-purpose than solar cookers. Though the gas has value, the canister is the bottleneck. Empty canisters had to be returned to the distribution centre, where they could be eventually retrieved by the gas company and taken away to be refilled. UNHCR expected this process to be regular and timely but, soon after the pilot began, participants began reporting severe delays before the canisters were refilled.

Without refilled gas canisters, people had to revert to the use of old technologies, cooking on open fires using firewood or charcoal. Every time Yaya and Timi's gas canisters emptied, for example, they experienced a lag before they were refilled. During each waiting period, Timi would go out beyond the camp in search of firewood and return to cook on their stove.

Running on empty

The original contract between HELP and the local supplier had been intended to ensure that refugees could recharge each bottle of gas without delay and that the collection, refuelling and distribution of canisters could proceed as efficiently as possible. 'There need to be 100 filled bottles stored in the camp's gas distribution facility to ensure some continuity in gas supply and avoid any delivery break,' the local HELP representative said.

In practice there were problems. 'The main problem is that the local supplier in Dori has financial difficulties and cannot pre-purchase new gas bottles from Oryx in Ouagadougou,' the representative explained. 'When the supplier comes to collect empty canisters he doesn't replace them immediately with refilled ones. Instead, he takes the empty bottles back to Ouagadougou and has them refilled there. That means we have to have at least 50 empty canisters in the camp before we can call the supplier to collect them. Otherwise he refuses to come because it's not profitable for him.' On occasion, the supplier refused to come and collect even 50 canisters.

On one occasion HELP's representative collected somewhere between 400 and 450, more than half the total in the camp, before the local supplier agreed to collect and transport them to Ouagadougou for refuelling.

Bottlenecks

To some critical observers in the humanitarian energy sector, the failure of the gas distribution system in Goudoubo was a failure of planning. The project was not based on a proper assessment of the distribution logistics or an evaluation of the incentives that might motivate different actors. Those spoken to for this paper describe this failure in terms of a mismatch between values and expectations, which created friction in trade and bottlenecks in the flow of goods.

Following the canister makes these differences strikingly apparent. For camp residents a canister has value when it is full. When given the option, displaced people in Goudoubo clearly articulate their preference for gas over other forms of fuel for cooking. A full canister allows for new rhythms of daily life. It disrupts gendered patterns of work and domestic labour around the collection of firewood (see Chapter 4), promises to transform a culture of shame around soot (see Chapter 3), and creates new opportunities for creative innovation (see Chapter 5). An empty canister interrupts this new dynamic, returning people to established relationships and practices.

Not all actors in the network share the same values, however. The gas suppliers have an inverse relationship to the canister; a canister has most value for them when it is empty and needs to be refilled. This value connects the local distributor in Dori, who can only secure new full canisters by depositing empty ones or by paying a deposit, to Oryx, the gas supply company in Ouagadougou, which seeks to guarantee the continued return and re-use of its canisters. In this supply chain the local distributor is a crucial intermediary, the link between Oryx and the camp. The distributor's business hinges on the movement of canisters between Goudoubo and Ouagadougou, and it seeks to recoup the cost of transportation and secure a profit by minimizing the number of journeys.

HELP was left to manage the fragile balance between fuel utility, consumption and delivery. It struggled to enforce contracts with suppliers and to manage the time lag between an empty and a full canister.

Energy access and market futures

Against the backdrop of increased interest in market-based approaches to the delivery of humanitarian energy services, this chapter provides a timely reminder that markets do not always work as expected. In this example, the interests of market actors – like the local distributors of gas canisters – were ultimately at odds with the interests of the intended beneficiaries – the refugees. For a time, attempts to deliver gas to displaced people in Goudoubo met people's expectations. When people took delivery of a full canister of gas, the relationships between consumers, intermediaries and suppliers worked. When empty canisters of gas remained uncollected in the camp these relationships broke down.

There is no guarantee that the introduction of newer, cleaner energy technologies, like LPG or solar panels, into the lives of displaced people will mark a permanent break or shift in their lived experience of fuel or electricity. On the contrary, as UNHCR's experiment with gas in Goudoubo shows, sustained and continued access to modern energy technologies is dependent

on logistics, infrastructure and crucial ‘last-mile’ distributors whose role is often unacknowledged and unreported. Understanding and engaging with these wider systems is crucial to the success of humanitarian energy interventions.

The capacity of organizations to ensure the continued supply of technologies in places like Goudoubo will ultimately owe as much to their understanding of the motivations and interests of intermediaries in the supply chain as it would to their knowledge of the needs and aspirations of end-users.

10. Future Interventions and Research

This paper sheds light on some of the ways in which refugees in Kenya and Burkina Faso are engaging with energy products and technologies. The research observed how people secure or try to secure energy services for the things they need and want such as cool drinking water, cooked food, electrical power, light and adequate shelter. It also notes the value that they attach to certain energy-related objects as well as the social and economic relations that surround these. The study also reflects upon some experience with past energy projects orchestrated by humanitarian agencies.

Studying these eight objects through an ethnographic lens brings to light several issues and opportunities worthy of consideration in planning humanitarian energy interventions, bearing in mind of course that no two camp cultures will be the same. While is it not possible to translate these observations into concrete recommendations for how humanitarian energy interventions should be planned or implemented, they point to a number of considerations and areas for approaches and further research that could enhance design for acceptance and sustainability of energy access projects.

One important consideration would be whether to focus on providing externally designed 'ready-made' solutions tailored to the assessed needs, or on ones that are co-designed, or to provide beneficiaries the tools for innovation, renovation and upcycling.

The personal satisfaction gained through craft and repurposing of materials was particularly evident among the Malian refugees in Goudoubo. The existence of a workshop where people could use their engineering and other crafting tools, for example, to weld would appear to be a valuable addition to enable energy resilience and self-reliance. In both Kakuma and Goudoubo, people's preferences for energy equipment were strongly linked to their understanding of the reparability of devices, as well as their affordability and availability.

On the other hand, both communities could benefit greatly from camp-wide access to electricity and cleaner methods of cooking. The evidence gathered in Kakuma, for example, suggests that camp-wide connection to electricity may reduce inequality by reducing the gap between those who can afford to buy expensive electricity provided by private suppliers and those who cannot. Yet such an endeavour would affect vested interests. Understanding existing monopolies in power provision, how much people in different areas interact with providers and how livelihoods are dependent on, for example, fixing wires may assist with designing camp-wide electrification and mechanisms for managing and/or paying for use.

The difficulties of replacing biomass for cooking are well-known. While people often desire gas, it is still firewood and charcoal that form the basis of many vital activities that connect them with their roots and past as well as with local communities. UNHCR's trial with gas in Goudoubo and the problems in maintaining reliable supply shows that sustained access to modern energy technologies is dependent on logistics, infrastructure and crucial 'last-mile' distributors. Without timely access to exchange canisters or refills, people lost trust in the system and reverted to old methods.

The examples in this paper point to the importance of assessing the level of skill, innovation and enterprise already existing in settlements as well as that of understanding how external markets will be able to serve the camp needs of any new programme over time. Many of the activities and repurposing described here illustrate impressive forms of a circular economy centred on energy. More attention is needed for the kinds of equipment being brought into a camp. Parts of energy equipment that cannot be recycled and may cause harm to people and the environment should be a key concern in rethinking energy provision. For example, the dangers of children playing with batteries, of lead and other chemical leakage during attempts to extend battery life, and of disposal are current problems that new interventions need to address. The life cycle of equipment under harsh climatic conditions and the possibilities for its repurposing should be considered at the outset.

Another issue is the way in which interventions will affect status and social relations in a community. Energy equipment and access is a marker of status in both camps and approaches to humanitarian energy should be aware of how new systems and technologies could impact the organic development of communities as well as existing inequalities. For example, the labelling of traditional fuels and technologies (such as firewood-burning open cookstoves) as ‘dirty’ and ‘primitive’ could reinforce gender and income inequalities in the camp. Likewise, a programme that relies on sales of equipment or services such as lighting or solar home systems only affordable to the higher-income households may create more visible inequalities. This is not to say the programmes should not go ahead but these aspects should be investigated.

This paper points to the need to expand the evidence base for humanitarian energy interventions and policies with new methodological approaches. Further questions include:

- Can this qualitative approach be made widely available in a way that is usable by agencies?
- Could an ethnographic study be used directly to assist with the design of a camp-wide sustainable energy plan? Could its effectiveness be quantified?
- How can the results be practically used?

Future research could usefully inform humanitarian energy projects by examining people’s technical knowledge and existing practices in the design of energy technologies, systems and business models. Uptake and sustained use of new systems may be more likely to happen where interventions build on or work in harmony with these.

About the Authors

Jamie Cross is a senior lecturer in social anthropology at the University of Edinburgh.

Megan Douglas is a PhD candidate in international development at the University of Edinburgh.

Owen Grafham is department manager, Energy, Environment and Resources at Chatham House, the Royal Institute of International Affairs.

Glada Lahn is a senior research fellow, Energy, Environment and Resources at Chatham House, the Royal Institute of International Affairs.

Craig Martin is a reader in design at the University of Edinburgh.

Charlotte Ray is a research associate at the University of Loughborough.

Arno Verhoeven is a lecturer in design at the University of Edinburgh.

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Further information about the Displaced Energy project and country specific reports are available at the links below:

- Displaced Energy: http://www.displacedenergy.com/about-the-project
- Overview: https://policy.practicalaction.org/resources/publications/item/the-lived-experience-of-energy-and-forced-displacement
- Kenya Report: https://policy.practicalaction.org/resources/publications/item/the-lived-experience-of-energy-and-forced-displacement-kakuma-refugee-camp-kenya
- Burkina Faso Report: https://policy.practicalaction.org/resources/publications/item/the-lived-experience-of-energy-and-forced-displacement-goudoubo-refugee-camp-burkina-faso

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Cover image: Portable battery connected to a solar PV and used to recharge mobile phones and power a radio in Goudoubo Refugee camp (Burkina Faso).

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The Royal Institute of International Affairs
Chatham House
10 St James's Square, London SW1Y 4LE
T +44 (0)20 7957 5700 F +44 (0)20 7957 5710
contact@chathamhouse.org www.chathamhouse.org

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