moving energy initiative

clean energy for refugees

Research Paper

The Costs of Fuelling Humanitarian Aid

Owen Grafham and Glada Lahn

December 2018

Contents

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;
- **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).

Preface

The Moving Energy Initiative (MEI) is an international consortium seeking to sustainably increase access to energy for displaced people and to improve how energy is dealt with in humanitarian situations. It was formally inaugurated in 2015 as a partnership between Energy 4 Impact, Practical Action, the UN Refugee Agency (UNHCR), the Norwegian Refugee Council and Chatham House. Funding for this publication, and for the wider activities of the MEI, has come from the UK Department for International Development (DFID).

When the MEI published the report *Heat, Light and Power for Refugees* in 2015, the consortium felt it had addressed a fundamental gap in analysis about energy needs in humanitarian settings. This was the first publication that attempted to establish the amount of energy used by forcibly displaced people around the world and the amount that they paid for it. Since then, much has been achieved. The consortium is actively enabling market-based energy provision, and improving energy access in refugee camps in Burkina Faso and Kenya, as well as in areas affected by large-scale migration in northern Jordan. This work – and the 'learning by doing' that is fundamental to this process – remains the central piece of the MEI.

However, a fundamental area of concern – energy use by humanitarian agencies themselves – was not analysed extensively in the original MEI research. Our initial publication had intended to cover the energy use of refugees and the agencies that served them, but the data on the latter were too patchy to generate meaningful projections. This publication addresses that shortcoming by focusing on survey data from our three focus countries. While a global estimate is still out of reach until data collection and standardization improve, we hope that this study advances understanding not only of the problem of diesel dependency but also of the potential solutions. The aim of this paper is to help humanitarian agencies understand their use of, and spending on, energy – and to recommend how they can improve current practice. This publication is also accompanied by a practical 'toolkit' that outlines steps that they can take. Other research resources and publications in this series are available online at www.movingenergy.earth.

Summary

- Energy is essential to humanitarian action. Most refugee and internal displacement camps are in remote locations, so humanitarian agencies consume large amounts of fuel on the long-distance transport of staff, equipment, and goods such as food and water. Operations tend to rely on on-site electricity generation to power reception centres, clinics, schools, food storage, water pumping and street lighting. Peacekeeping operations face a similar situation.
- The global case load for humanitarian agencies has continued to rise throughout the last decade, but no major agency has a comprehensive strategy for addressing its energy use. Nor, despite the UN's stated commitment to carbon neutrality by 2020, is there a concerted effort to move away from fossil fuel.
- Our survey of 21 organizations operating in the humanitarian sector in Burkina Faso, Kenya and Jordan (complemented by interviews with key staff involved in setting energy policy) finds the following problems:
  - Agencies are paying too much for the energy they consume. Agencies are overwhelmingly dependent on oil fuel for electricity generation, even though renewable energy solutions are reducing costs for those deploying them in similar conditions. Well-below-optimum standards of efficiency in buildings, generator use and fleet management are also the norm.
  - Agencies typically have few incentives to do things better. The way that fuel is distributed between agencies contracted to the UN Refugee Agency (UNHCR) in camps means that there is rarely motivation to conserve fuel, while few organizations we spoke with had any performance indicators for energy or fuel use.
  - Energy spending and use lacks transparency. Few agencies collect and report on energy use. Where numbers are available, they are usually partial and unverified. Energy costs are rarely transparent in budgets; and donors do not know how much is being spent.
- In the absence of more reliable data from a greater number of agencies, any estimates of energy costs associated with complex humanitarian situations – or of the potential to effect savings – will be highly flawed. Nevertheless, drawing on our limited research and that of others in the sector, we estimate that around 5 per cent of humanitarian agencies' expenditure goes on diesel, petrol and associated costs such as fixing generators. That would mean that the sector spent some $1.2 billion on polluting fuel in 2017.
- As the examples of best practice in this paper demonstrate, doing things differently could create large savings for individual agencies. Based on the current best-practice examples that we have observed, we estimate that the sector could save at least 10 per cent of fuel costs on ground transport, 37 per cent through behaviour change and more efficient technologies, and 60 per cent on generation – all using currently available, affordable and proven practice and technology changes. At current prices, this could mean operational savings of over $517 million a year for the humanitarian sector, roughly equal to 5 per cent of UNHCR's funding gap for 2017.

- The potential benefits are not just financial. Adopting energy strategies that promote sustainable energy in countries of operation can help humanitarian agencies to build positive relations with host-country governments and societies. This has been the case in Jordan, where first-of-their-kind solar plants for two major refugee camps are making annual savings of $7.5 million for UNHCR, have relieved pressures on the national electricity grid and will remain a legacy asset for local communities.
- There are significant opportunities to save money and improve operational effectiveness through addressing energy practices and technology. Our research finds that:
  - In Kenya, annual spending on diesel and petrol for the seven agencies surveyed was $6.7 million in 2017. The cost reflected the remote location of the camps and agencies' overwhelming reliance on diesel for electricity generation. Replacing gensets with solar systems makes sense because of the costs of diesel, the likelihood of protracted camp situations, and the opportunities that off-grid solar would offer for extending electricity access to refugees and local populations in Garissa and Turkana counties.
  - In Jordan, solar power (introduced since our survey was completed) now powers the majority of camp facilities and many households. However, the use of grid electricity by humanitarian agencies' large head offices in Amman remains high and expensive. Improving the energy efficiency of buildings is a priority for savings.
  - In Burkina Faso's Goudoubo camp, NGO offices are desperately short of power – they have no computers or air-conditioning. Investment in renewable forms of energy for this and other camp services such as street lighting and water pumping would enable better service provision, and could drive increased rural energy access among host populations across this area of the Sahel.
- In all three countries, transport-fuel savings and air-quality improvements through fleet sharing and fuel-management practices would make sense. For example, a fleet-sharing pilot scheme led by UNICEF in five countries demonstrated that the vehicle fleets of agencies were 10–15 per cent too big, and that the initial investment could be recouped through the scheme within one year.
- Opportunities to do things differently are routinely missed because decision-makers lack the requisite data on energy use, costs and alternatives. We make several recommendations for how humanitarian agencies, donors and host governments can open up to innovation in energy use and seize its benefits.
- As part of their commitment to 'do no harm', humanitarian agencies should commit to reducing their emissions footprint in host countries, and set targets for phasing out the use of diesel for electricity generation. They can begin by following a '3M' strategy:
  - **Measuring** – collecting energy and emissions data.
  - **Monitoring** – reporting on these data and identifying 'low-hanging fruit' where improvements would pay back an initial investment in a short period.
  - **Motivating** – introducing emissions reduction targets as key performance indicators and encouraging entrepreneurial activities by country teams. This could include encouraging the development of partnerships that would allow country teams to contract for renewable energy services, or that would facilitate cooperation with other agencies on fleet management and logistics efficiency.

- We found that field staff often recognize the waste of resources and want to address the issue, but do not feel empowered to make change. Creating channels of communication for receiving ideas from field-office staff on how to improve energy sustainability, and working with them to integrate a culture of efficiency, would be an important step.
- To back such initiatives, donors can take a number of steps. These will often require a multi-year financing approach – in line with Core Responsibility 5 of the UN-managed Agenda for Humanity. Donors can:
  a) Require humanitarian agencies to provide a breakdown of energy cost projections in budgets, backed up with assumptions about consumption and costs. This should also be clearly demarcated in reporting on actual expenditure.
  b) Ask what agencies are doing to reduce their fuel costs and emissions in-country.
  c) Offer support for the scaling up of pilot schemes that have already proven their feasibility (such as the fleet-sharing model or solarization of a whole refugee camp) but that require dedicated efforts and technical capacity to enable future self-financing.
  d) Provide guarantees to enable performance contracts with the private sector. Or contribute to a multi-country fund that would work to de-risk large, transformative energy-related investments.
- To help agencies maximize benefits for local economies and minimize local environmental damage, governments of host countries should:
  a) Ask humanitarian agencies what steps they are taking to reduce their vehicle impact and greenhouse gas emissions.
  b) Include sustainable energy as a priority area in response and resilience plans. This will encourage donors to invest in energy projects that will leave a positive and sustainable legacy in the country, as is the case in Jordan.
  c) In cases of prolonged displacement/humanitarian presence, consider facilitating infrastructure investments that will reduce energy and water demand in camps and harness local market expertise.
  d) Consider partnerships with humanitarian agencies operating in remote locations to improve energy access for rural areas.
- The multi-stakeholder Global Plan of Action for Sustainable Energy Solutions for Situations of Displacement, which launched in July 2018, offers a potential forum through which humanitarian agencies, governments, financiers and technical experts can learn from others in the field and form collaborations to increase their energy effectiveness.

1. Introduction

Ongoing and new crises left an estimated 201 million people in 134 countries in need of international humanitarian assistance in 2017.[1] Such assistance – involving the in-country presence of international humanitarian agencies supporting large groups of vulnerable people escaping war, famine or disaster – has significant implications for local economies and the environment. The agencies must transport staff and resources (including truckloads of food, water and fuel) to provide for the needs of crisis-affected populations and those supporting them. This results in increased air and road travel, and thus fuel consumption. Agencies also need the means to power services such as temporary shelters, clinics, schools, offices and sanitation facilities. Until recently, however, little attention has been paid to the ways in which power is provided to aid operations, or to the financial and environmental impact of the energy use associated with their activities.

Many within the humanitarian sector acknowledge that there is a problem with current practice, and that the potential exists to save money and lighten the energy footprint of humanitarian agencies in their countries of operation.[2] The Global Plan of Action for Sustainable Energy Solutions for Situations of Displacement (GPA) was launched in July 2018. It is supported by the UN Refugee Agency (UNHCR), the International Organization for Migration (IOM), the World Food Programme (WFP) and many others.[3] The GPA aims not only to overhaul systems to enable reliable access to clean energy for displaced people, but also to encourage efficiency and sustainability in the sector's energy use. It calls for reform of a system where current practice is 'inefficient, polluting, unsafe, expensive and inadequate for displaced people, harmful to the surrounding environment, and costly for implementers'.[4]

This paper aims to raise the level of understanding around energy use and spending in the humanitarian sector, using examples from humanitarian agencies in Burkina Faso, Jordan and Kenya as case studies. It identifies the principle obstacles to operational and/or institutional changes, and lays out measures that agencies can undertake (bearing in mind differences in size and resources) to manage energy better and benefit from it. The analysis pays particular attention to crises that involve the displacement of people, given the frequent need in such cases for humanitarian agencies to power off-grid facilities and send staff to remote locations.[5]

With the sharp rise in displacement crises, and in the numbers of people affected by them, in the past decade, humanitarian organizations are under increasing pressure to lower the cost of their operations and to support longer-term community cohesion and development. Managing energy better presents opportunities to save money that can be redirected towards other urgent priorities, while also improving organizations' reputations and relations with

---

[1] Urquhart, A. and Tuchel, L. (2018), *Global Humanitarian Assistance Report 2018*, Development Initiatives, http://devinit.org/wp-content/uploads/2018/06/GHA-Report-2018.pdf (accessed 10 Jun. 2018). This includes peacekeeping operations.

[2] See Lahn, G. and Grafham, O. (2015), *Heat, Light and Power for Refugees: Saving Lives, Reducing Costs*, Chatham House Report, 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; United Nations Institute for Training and Research (UNITAR) (2018), *The Global Plan of Action for Sustainable Energy Solutions for Situations of Displacement*, http://onlinelearning.unitar.org/global-plan-of-action/ (accessed 14 Jul. 2018).

[3] UNITAR (2018), *The Global Plan of Action for Sustainable Energy Solutions for Situations of Displacement*.

[4] Ibid., p. 7.

[5] These countries cannot be deemed to be wholly representative of the wider crisis-affected population, but many of the logistical issues around delivering aid there are similar, especially with regard to overcoming the 'last-mile' distribution challenges. Although this paper therefore focuses on agencies working with the forcibly displaced, the research is also appropriate for consideration by the wider humanitarian community.

refugee-hosting countries. Working together, agencies, funders, host governments, and businesses with expertise in sustainable energy can change several things to enable more resilient and cost-effective solutions. They are not starting from zero; there is a growing body of resources on which to draw – including the case studies in this paper – when instigating new practices.

Squeezed budgets

The number of people displaced around the world is estimated to have exceeded 87.3 million in 2017: 18.8 million as a result of natural disasters, and 68.5 million as a result of conflict. The latter usually entails prolonged displacement, and thus increased energy costs, as emergency measures – such as the use of diesel generator sets, and the provision of goods shipped in from outside the host country – are often in place for long periods. The number of those fleeing conflict is at an unprecedented high, having risen by 3 million between 2016 and 2017, and is 60 per cent higher than it was 10 years ago.

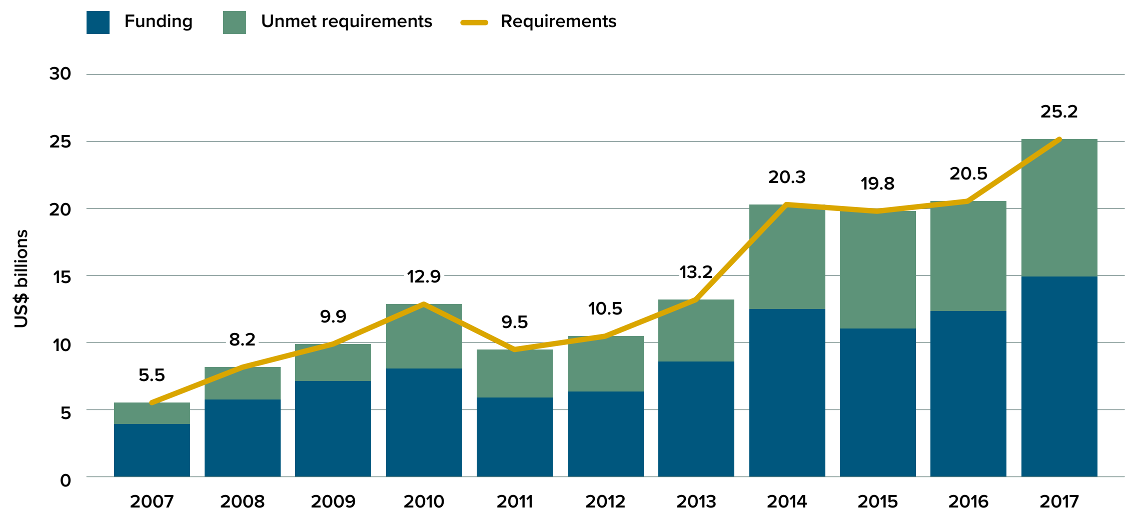
The upsurge in crises has brought in greater funding for humanitarian organizations from foreign aid and private donations,[6] but this has been insufficient to meet the needs of a vast displaced population. Figure 1 shows that the UN's funding requirements for 2017 went unmet by over 40 per cent ($10.3 billion).[7] In 2017 the US negotiated a cut in its contribution to the UN of $285 million for 2018/19 compared with the previous year,[8] and in 2018 the US ended all funding for the United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA).[9]

With the crises in Myanmar, Nigeria, the Democratic Republic of the Congo (DRC) and the Central African Republic worsening at the time of writing, and increasing incidences of extreme weather events coupled with environmental degradation, the need for humanitarian assistance to displaced people shows little sign of abating.[10] The return and resettlement of refugees and internally displaced people (for example, to Syria and Iraq) will also entail large-scale humanitarian efforts. In this context, there is pressure on the UN and humanitarian NGOs to demonstrate value for money and more efficient spending. The Grand Bargain for Humanitarian Action, an agreement between more than 30 of the biggest donors and aid providers, commits to changes in the working practices of donors and aid organizations. The UK's Department for International Development (DFID) says that this will '[p]romote efficiency through smarter forms of financing, reduced management costs, harmonising reporting and increasing the use of cash

[6] This grew from $16.1 billion in 2012 to $27.3 billion in 2017 according to one study. See Urquhart and Tuchel (2018), *Global Humanitarian Assistance Report 2018*.
[7] Ibid.
[8] Entities expected to suffer as a result include the UN Environment Programme (UNEP), the UN Development Programme (UNDP) and the UN Children's Fund (UNICEF). All play a role in the humanitarian field – particularly UNICEF, which leads on water, sanitation and health issues in several major refugee situations, while UNDP has led the response plans to the Syria crisis in which energy has emerged as a priority sector. Goldberg, M. (2018), 'Here's How Trump's Budget Request Would Impact the United Nations', UN Dispatch, 13 February 2018, https://www.undispatch.com/heres-trumps-budget-request-impact-united-nations/ (accessed 25 Jul. 2018).
[9] Lynch, C. (2018), 'U.S. to End All Funding to U.N. Agency That Aids Palestinian Refugees', *Foreign Policy*, 28 August 2018, https://foreignpolicy.com/2018/08/28/middle-east-palestinian-israel-pompeo-trump-kushner-u-s-to-end-all-funding-to-u-n-agency-that-aids-palestinian-refugees/ (accessed 29 Aug. 2018).
[10] According to the UN High Commissioner for Refugees (UNHCR), there were 68.5 million forcibly displaced people worldwide in 2017. UNHCR (2018), *Global Trends: Forced Displacement in 2017*, http://www.unhcr.org/uk/statistics/unhcrstats/5b27be547/unhcr-global-trends-2017.html (accessed 12 Jul. 2018). By another estimate there were an additional 30.6 million new displacements from conflict and disasters in 2017. Internal Displacement Monitoring Centre and Norwegian Refugee Council (2018), *GRID 2018: Global Report on Internal Displacement*, http://www.internal-displacement.org/global-report/grid2018/downloads/2018-GRID.pdf (accessed 12 Jul. 2018).

assistance, leading to up to $1 billion saved by 2020'.[11] Other organizations, including the US Agency for International Development (USAID), have made similar moves,[12] in many cases also becoming members of the International Aid Transparency Initiative.[13] However, the potential savings available specifically from improving the efficiency of energy services have been largely overlooked to date.

Figure 1: Unmet funding requirements, UN coordinated appeals 2007–17



Source: Urquhart and Tuchel (2018), *Global Humanitarian Assistance Report 2018*.

High spending on energy

Humanitarian operations are often concentrated in areas far from big cities and close to country borders. This leads to higher energy costs since it increases the amount of flights needed, miles driven and, in the absence in many cases of connection to the national grid, fuel consumed for electricity.

While energy use and spending in the humanitarian sector are poorly accounted for, it is known that the costs of diesel-powered generation in humanitarian compounds are much higher than national averages in many countries. WFP estimates that the average amount spent on generating electricity in UN compounds is $0.60 per kWh, whereas the average electricity price is $0.20 per kWh in the UK, $0.10 per kWh in the US, and $0.08 per kWh in China and India.[14]

[11] UK Department for International Development (DFID) (2016), *Raising the standard: the Multilateral Development Review 2016*, p. 24, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/573884/Multilateral-Development-Review-Dec2016.pdf. The report adds: 'Organisations must become fully transparent and accountable, so the public can trace aid funding and the results it delivers. DFID will demand that our partners meet international aid transparency standards, if they do not already, and pass the same expectation to their partners.' See p. 28.
[12] See, for example, United States Agency for International Development (USAID) (2015), *Aid Transparency Country Pilot Assessment: Final Report*, May 2015, https://www.usaid.gov/sites/default/files/documents/1870/AidTransparencyCountryPilotAssessment.pdf#page=5 (accessed 10 Jan. 2018).
[13] International Aid Transparency Initiative, https://iatistandard.org/en/ (accessed 10 Jan. 2018).
[14] All this is bad for the planet. WFP estimates that the average carbon intensity of generator-produced electricity in UN compounds is 1,040 g CO_2/kWh, compared to 0.56 g CO_2/kWh in the UK, 0.62 g CO_2/kWh in the US, 0.89 g CO_2/kWh in China and 1.47 g CO_2/kWh in India. WFP (2017), 'Energy Efficiency Survey (EES)' [WFP internal document]; and authors' own analysis.

Box 1: High spending in South Sudan

South Sudan is one of the hardest places in the world for humanitarian organizations to operate in. A lack of infrastructure,[15] low levels of state capacity and the high financial costs of procuring and purchasing basic equipment have combined with failure of governance, the outbreak of civil war, and looming famine and drought to create a 'perfect storm' of challenges for organizations already struggling to fulfil large unmet needs.

Despite producing a significant amount of oil, South Sudan remains energy-poor. A lack of refining capacity means that the country exports all the oil it produces, and a variety of barriers (finance and security being prominent) hinder the import of other fuels – meaning that fuel has been scarce for the past five years.[16] Some humanitarian agencies have the fuel that powers their operations trucked in from the port of Mombasa (in Kenya) to the South Sudanese capital, Juba – a 2,500-km journey. Much of the supply is controlled by traders and resold on the black market.[17] For two of the main humanitarian organizations operating in South Sudan, the price of diesel delivered to them in Juba is $1.10–1.15 per litre (with transportation fees accounting for around 25 per cent of the cost),[18] driving the energy costs of the two compounds to $33,000–42,200 per month each.[19]

Outside Juba, the costs of operating increase dramatically. For example, for the half of the year when the Sudd swamp is flooded,[20] as well as in many periods of widespread insecurity, fuel must be flown to the refugee camps and 'humanitarian hubs' in the north of the country, a further distance of around 1,000 km. At two of the larger humanitarian hubs, in Malakal and Bentiu, the price of diesel delivered to the sites is $1.7–2.6 per litre (although hub purchases have peaked at over $3 per litre at different times since 2014), meaning that the energy costs of the two hubs are between $73,000 and $80,300 per month each.

Although the South Sudan example is extreme,[21] it is instructive, particularly for countries struggling with similar dynamics such as the Central African Republic, Somalia, the Democratic Republic of the Congo, Mali, Yemen and Nigeria. Costs such as those outlined above not only represent an unnecessarily large expenditure item in the budgets of humanitarian organizations; they also imply an opportunity for using renewable technologies to save money, reduce carbon dioxide emissions and create new energy infrastructure in very poorly electrified countries.

Source: Correspondence with senior UNHCR officials, as well as with private-sector companies' staff and academics working in South Sudan.

---

[15] In 2016 the country had only 200 km of paved roads despite massive efforts at expanding the network in recent years. See World Bank (2016), 'A Triumph Over Long Odds: Building Rural Roads in South Sudan', 9 February 2016, http://www.worldbank.org/en/news/feature/2016/02/09/a-triumph-over-long-odds-building-rural-roads-in-south-sudan (accessed 10 Jan. 2018).
[16] Mozersky, D. and Kammen, D. M. (2018), *South Sudan's Renewable Energy Potential: A Building Block for Peace*, Special Report, United States Institute of Peace, https://www.usip.org/sites/default/files/2018-01/sr418-south-sudans-renewable-energy-potential-a-building-block-for-peace.pdf.
[17] Ibid.
[18] Taking the average price of diesel in Kenya in December 2017 to be $0.88 per litre – based on data from Global Petrol Prices, www.globalpetrolprices.com/Kenya/diesel_prices/ (accessed 14 Dec. 2017) – a price of $1.10–1.15 per litre for fuel imported from Kenya to South Sudan means that the cost of transportation accounts for 20–25 per cent of the final cost. As of 30 July 2018, the average cost of diesel in Kenya had increased to $1.05 per litre. All cost estimates are inclusive of maintenance and depreciation of generators.
[19] Correspondence with senior UNHCR officials, as well as with private-sector companies' staff and academics working in South Sudan.
[20] The Sudd is a vast area of swampland formed by flooding of the White Nile.
[21] For example, WFP has calculated that almost 70 per cent of total emissions are from its South Sudan operation. See http://www.greeningtheblue.org/what-the-un-is-doing/world-food-programme-wfp.

UN peacekeeping missions have been at least partially assessed for their energy use and for potential savings.[22] They spend over $250 million a year on diesel fuel and generators across 17 countries.[23] The Rapid Environment and Climate Technical Assistance Facility (REACT) project of the United Nations Environment Programme (UNEP) identified the potential for cost savings of around 30 per cent from reducing demand, at least 20 per cent from improving the efficiency of generators, and a further 15–20 per cent from the use of renewable energy.[24]

The question is whether energy is being used wastefully, and whether the same or higher demand for energy services can be met with lower costs and lower environmental impact.

High energy costs are not limited to power generation. A 2007 study estimated that transport was the second-biggest overhead cost to the humanitarian system after personnel.[25] Even 10 years ago, it was estimated that the fleet of four-wheel-drive vehicles operated by international humanitarian organizations numbered over 100,000, with running costs nearing $1 billion per year.[26] UNEP estimates this fleet size will triple by 2050.[27]

High costs *per se* do not constitute a problem. The question is whether energy is being used wastefully, and whether the same or higher demand for energy services can be met with lower costs and lower environmental impact. While this paper principally explains the financial and economic rationale for thinking differently about energy, the following subsections outline also the moral and environmental cases for change.

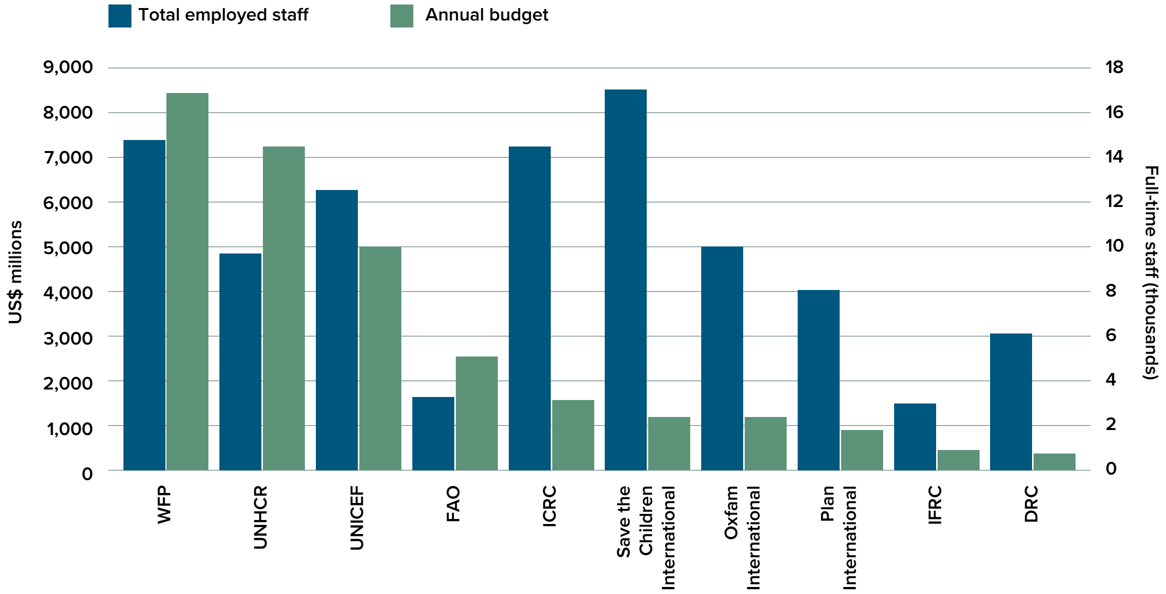
Big organizations, big responsibilities

In 2017, international humanitarian assistance spending reached $27.3 billion, with at least $24 billion going directly to multilateral (mainly UN) agencies and international NGOs.[28] The humanitarian sector has big budgets, large numbers of staff on the ground, and often a strong cultural, social and financial presence in major cities around the world. Humanitarian agencies thus have significant power to influence local economies and environments, especially in low-income countries. For example, humanitarian aid flowing into Jordan in 2015 amounted to $100 per capita, equivalent to 12 per cent of government spending for that year and filling

[22] Such operations have much relevance for humanitarian agencies, given the prevalence of long-distance vehicle use, the dependence on diesel-powered electricity generation, and the potential for recouping the costs of investment (the average duration of a peacekeeping mission is 16 years). This argument is also relevant to military operations, where actors have been far more progressive when it comes to testing the application of renewable energy. For comparisons between the humanitarian and military spheres, see Tatham, P. (2012), 'Some reflections on the breadth and depth of the field of humanitarian logistics and supply chain management', *Journal of Humanitarian Logistics and Supply Chain Management*, Vol. 2 Issue: 2, pp. 108–11, https://doi.org/10.1108/20426741211260714; and Heaslip, G., Sharif, A. M and Althonayan, A. (2012), 'Employing a systems-based perspective to the identification of inter-relationships within humanitarian logistics highlight the possible transfer of skills and logistics from the military sphere to the humanitarian one', *International Journal of Production Economics*, 139(2):377–92.
[23] Morton, A. and Roshni, D. (2017), 'United Nations Electricity Supply Partnership Programme Document Version 2.0 for consultation', United Nations Environment Programme (UNEP), 11 October 2017.
[24] Morton, A. (2017), 'Lessons learned from REACT – possibilities for replication to humanitarian operations', presentation on the Greening of Peacekeeping Operations at the UN Environment Management Group Nexus Dialogue meeting on 'Strengthening partnerships between the environmental and humanitarian sectors in the context of the humanitarian change agenda and the Sustainable Development Goals', Geneva, 19 October 2017.
[25] Disparte, D. (2007), 'The Postman's Parallel', *Car Nation* (2), pp. 22–27.
[26] Ibid.
[27] UNEP (2008), 'Environmental Considerations on fleet management', Fleet Forum Conference, Brindisi, Italy. Cited in Martinez, A. P., Stapleton, O. and Van Wassenhove, L. (2009), *Field Vehicle Fleet Management in Humanitarian Operations: A Case-Based Approach*, Faculty & Research Working Paper, INSEAD Social Innovation Centre, p. 2, https://flora.insead.edu/fichiersti_wp/inseadwp2010/2010-38.pdf.
[28] Urquhart and Tuchel (2018), *Global Humanitarian Assistance Report 2018*. The $24 billion includes government and private funding, including that directed to the International Red Cross and Red Crescent Movement but not that sent to local NGOs or 'public sector' bodies.

a growing gap between foreign debt and the fiscal deficit.[29] Figure 2 lists the top 10 humanitarian agencies by size of annual budget and number of staff.

Figure 2: Top 10 humanitarian agencies by size of annual budget and number of staff, 2015



Sources: Annual reports of the listed organizations. Complete list available on request.

As the size and reach of the humanitarian sector increase, so do its impact and influence on host countries and communities. Its contribution to local pollution and congestion, as well as to the inflation of prices for basic foodstuffs, services and property rents, is the subject of common complaints.[30] As such, there is a need to reassess the sector's responsibility to address the impact of its operations and logistics. The following factors reinforce this:

- The majority of humanitarian work takes place in developing countries that already face environmental degradation and increased exposure to the impacts of climate change.[31]
- The role of environmental degradation coupled with the onset of climate change is now widely recognized as a factor in crises that cause displacement.[32]

[29] Based on several sources, humanitarian aid to Jordan was $956 million in 2015 (with $351 million recorded under 'official aid'), making it the third-largest recipient country for that year. The per capita amount is based on government figures for the total population including refugees. Jordan is, however, an outlier; for example, Iraq received $24 per person in the same year. Lattimer, C. and Swithern, S. (2017), *Global Humanitarian Assistance Report 2017*, Development Initiatives, https://reliefweb.int/sites/reliefweb.int/files/resources/GHA-Report-2017-Full-report.pdf (accessed 14 Feb. 2018). In Sudan, the per capita figure is around $23, based on humanitarian aid to the country in 2015 estimated at $935 million, with government revenues amounting to just under $9 billion and a total population of 41.1 million as of February 2018 according to Development Initiatives (2018), 'Global Picture: Sudan', http://data.devinit.org/country/sudan (accessed 14 Feb. 2018).
[30] In particular, demand from aid organizations has contributed to higher prices for amenities such as hotels, restaurants and taxis; for basic goods such as fuel and clean water; and for business inputs such as skilled labour and office facilities. See Ding, S., Wyett, K. and Werker, E. D. (2012), 'South Sudan: The Birth of an Economy', *Innovations: Technology, Governance, Globalization*, 6:2, http://nrs.harvard.edu/urn-3:HUL.InstRepos:10685819; and Green, A. (2013), 'African oil towns: getting very pricey', *Financial Times*, 21 October 2013, http://blogs.ft.com/beyond-brics/2013/10/21/african-oil-towns-getting-very-pricey/ (accessed 11 Dec. 2017).
[31] No fewer than 85 per cent of refugees are hosted in developing countries. UNHCR (2018), *Global Trends: Forced Displacement in 2017*.
[32] Field, C. B. et al. (eds) (2014), *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Summaries, Frequently Asked Questions, and Cross-Chapter Boxes,* Intergovernmental Panel on Climate Change (IPCC), p. 20, https://www.ipcc.ch/pdf/assessment-report/ar5/wg2/WGIIAR5-IntegrationBrochure_FINAL.pdf.

- The UN is committed to climate neutrality in its own operations[33] and has led international agreements to combat climate change and to achieve the Sustainable Development Goals (SDGs).[34]

Easing pressure on host countries is the first objective of the Comprehensive Refugee Response Framework that UNHCR, other UN bodies, governments and NGOs are developing. Developing crisis-response plans that take into consideration host-country concerns about the local pressures on fuel and electricity subsidies, as well as the pressures on transport, is a priority. Although it makes no mention of energy, the UN-managed Agenda for Humanity set out in 2016 has a focus on increasing efficiency and sustainability in the system. It also asks that the sector and its donors 'transcend humanitarian-development divides'.[35] Through its actions the sector can help support or undermine the SDGs in its countries of operation, particularly with relation to sustainable energy access. The most relevant SDGs here are SDG7 ('Ensure access to affordable, reliable, sustainable and modern energy for all'), SDG3 ('Ensure healthy lives and promote well-being for all at all ages'), and SDG 13 ('Take urgent action to combat climate change and its impacts').[36]

'Do no harm'

The principle of 'do no harm', developed in the 1990s and integrated into training for humanitarian workers, has never been more relevant in addressing resource use and environmental impact. With short-term and unpredictable funding cycles, as well as an emergency mindset, humanitarian organizations have found it difficult to embrace the green agenda, with few having a robust policy on this issue. Research on aid relief logistics has shown that processes and protocols aiming to minimize environmental impact – including reducing emissions from energy use – have tended to be seen as an impediment to the sector's primary function of delivering life-saving aid quickly.[37]

Despite this, where humanitarian organizations have taken practical steps to prioritize sustainability in their operations, interventions have generally been justified under the 'do no harm' principle. For example, WFP acknowledges that 'humanitarian actions that save lives today carry a carbon cost for future generations'.[38] It is one of several agencies to have purchased carbon credits to offset the increased emissions arising from reliance on air transport for humanitarian emergencies. The

[33] United Nations (2017), '39 UN Agencies and Entities Achieved Climate Neutrality in 2016', 27 November 2017, https://cop23.unfccc.int/news/39-un-agencies-and-entities-achieved-climate-neutrality-in-2016.

[34] The Environment and Humanitarian Action Network says: 'Change is happening [...] strong entry points for the environment/humanitarian nexus have been defined in the 2030 Agenda for Sustainable Development, the Secretary General's UN reform agenda, and the multi-stakeholder reform agendas as outcomes from the World Humanitarian Summit.' See Environment and Humanitarian Action Network (2018), *Environment and Humanitarian Action in the age of global reform agendas: Background Document to the Nexus Dialogue*, Joint Environment Unit of UNEP and the United Nations Office for the Coordination of Humanitarian Affairs (OCHA), p. 21, http://www.eecentre.org/wp-content/uploads/2017/10/Backgroundconcept.pdf. Further details on the SDGs are available on the Sustainable Development Knowledge Platform (undated), 'Sustainable Development Goals', https://sustainabledevelopment.un.org/?menu=1300.

[35] OCHA (2016), 'About the Agenda for Humanity', https://agendaforhumanity.org/agendaforhumanity?referer=home (accessed 23 Jul. 2018).

[36] United Nations Statistics Division (2018), 'SDG 13: Climate Action', https://unstats.un.org/sdgs/report/2017/goal-13/ (accessed 23 Jul. 2018).

[37] Prior to 2005, there were only a few academic studies on humanitarian logistics, the most famous being Long, D. C. and Wood, D. F. (1995), 'The Logistics of Famine Relief', *Journal of Business Logistics*, 16 (1): 213–29. Since then, it has become a growing topic of research. A good example illustrating the traditional problems of prioritizing sustainability in humanitarian logistics comes from Abrahams, D. (2014), 'The barriers to environmental sustainability in post-disaster settings: a case study of transitional shelter implementation in Haiti', *Disasters*, 38 (1), S25–49. Other examples where the debate on speed versus sustainability is set out include Belz, F. M. and Peattie, K. L. (2009), *Sustainability marketing: a global perspective,* Chichester: Wiley; Kuittinen, M. (2016), *Carbon Footprinting in humanitarian construction. What are the CO_2 emissions and how to mitigate them?* Aalto University publication series doctoral dissertations; Oloruntobe, R. (2014), 'A planning and decision making framework for sustainable humanitarian logistics in disaster response', in Klumpp, M., de Leeuw, S., Regattieri, A. and de Souza, R. (eds) (2014), *Humanitarian Logistics and Sustainability*, Springer Press; Oloruntobe, R. and Gray, R. (2006), 'Humanitarian Aid: an agile supply chain?', *International Journal of Supply Chain Management*, 11 (2): 115–20; and Schaefer, A. and Crane, A. (2005), 'Addressing Sustainability and Consumption', *Journal of Macromarketing*, 25 (1): 76–92.

[38] WFP (2016), 'Climate Neutrality at WFP', https://docs.wfp.org/api/documents/3bb784e1c1ac4321bb9a229ba80e750a/download/ (accessed 16 Apr. 2018). WFP is carbon-neutral by purchasing credits from the UNFCCC Adaptation Fund, one of four agencies chosen to pilot an Emissions Monitoring Scheme (EMS).

Norwegian Refugee Council has stated: 'It is absolutely essential that we understand how sensitive the environment is to impact from our operations, and that we work to reduce that impact.'[39] Such arguments are not new. In 2005 UNHCR published environmental guidelines that highlighted issues around the sustainable consumption of energy within operations, while in 1998 WFP published *WFP and the Environment*. Several other major humanitarian agencies have followed suit since then (see Table 1).[40] Their relevant documents are not well known within the humanitarian community but provide a basis on which to build sustainability initiatives, including in energy. Some organizations are only just beginning to think about these issues. All are on a learning curve.

Table 1: A selection of relevant publications and documents

Agency	Sustainability initiatives
International Committee of the Red Cross (ICRC)	Since 2012 the ICRC has produced an overview of efforts to integrate sustainable development into its practices. This has evolved into a biennial report, the most recent being the 2015–16 edition.[i] Building on this, a Sustainable Development Strategy for 2017–2022 has been outlined in order to develop the institutional uptake of sustainable development in the ICRC's operating practices. This includes a roadmap reflecting awareness that the strategy will be directly relevant to six of the UN SDGs.
International Federation of Red Cross and Red Crescent Societies (IFRC)	The IFRC's Plan of Action on Climate Change for 2013–2016[ii] presents a five-year roadmap for scaling up activities to reduce operational impact on the environment and to 'climate-proof' IFRC programmes and operations. The Red Cross Red Crescent Climate Training Kit is aimed at helping IFRC staff design training programmes or workshops on climate-risk management.[iii]
International Organization for Migration (IOM)	In 2017, IOM launched its institutional Environmental Sustainability Programme with the objective of mainstreaming environmental sustainability principles into IOM's policies, operations and programmes, focusing on three key areas: energy, water and waste management. The long-term goal is to ensure that activities are environmentally sustainable and climate neutral.[iv]
Médecins Sans Frontières (MSF)	MSF's Operational Centre in Brussels (OCB) has articulated an Energy Vision for the organization, published in 2018. The report is the most comprehensive analysis of systematic energy use undertaken in the humanitarian sector thus far. It seeks to understand three key questions: What is the current energy situation in OCB? What is the desired energy situation of OCB? How can OCB reach this envisioned energy situation?[v]
Save the Children	Save the Children's Global Accountability Report 2016/17[vi] outlines progress towards the global strategy agreed in 2015 across all 29 Save the Children member organizations, with the principal aim of improving accountability and transparency (including on key environmental targets).

[39] Norwegian Refugee Council (undated), 'Preserving the environment', https://www.nrc.no/what-we-do/themes-in-the-field/caring-for-the-environment/ (accessed 10 Jan. 2018).
[40] Other international organizations are producing relevant publications that are not included here.

Sustainable UN and UN Environment Management Group (EMG)	Sustainable United Nations (SUN) came into existence as a result of the UN's commitment to climate neutrality in 2007. It has been working to measure and reduce the environmental footprint of UN facilities and operations. UN entities are attempting to measure and report climate and environmental indicators, to undertake efforts to holistically reduce environmental impacts, and to achieve climate neutrality by 2020. Progress towards this is captured in the Greening the Blue[vii] platform, which presents annual greenhouse gas emissions data reported by all UN agencies.
UN High Commissioner for Refugees (UNHCR)	UNHCR published Environmental Guidelines in 1996 that 'lay a basis for incorporating environmental factors into specific UNHCR guidelines'.[viii] UNHCR began implementing a Green Procurement Policy in 2012, which built upon earlier efforts in the Environmentally Friendlier Procurement Guidelines (1997).[ix] This policy tries to make sure that social and environmental factors are combined with financial considerations when UNHCR is making purchases. In 2015 UNHCR produced the UNHCR, the Environment & Climate Change[x] report, which outlined the challenges that climate change presents for its operations and the measures taken in response.
United Nations Children's Fund (UNICEF)	UNICEF's Strategy on Environmental Sustainability 2016–2017[xi] aims to consolidate work on environmental sustainability across its operating practices. Priorities include improving guidance on environmental sustainability and incorporating environmental sustainability management into the organization.
World Food Programme (WFP)	WFP's approach to environmental sustainability was first laid out in WFP and the Environment in 1998. It was one of the first UN agencies to report greenhouse gas emissions, in 2008, and it has done so annually since then. It also has a greenhouse gas emissions reduction strategy – for reducing energy use in buildings, transport and travel – contributing to its aim of climate neutrality. In 2017, WFP announced a new Environmental Policy, superseding the previous one, that outlined concrete ways in which the organization could raise standards, better capture environmental risks and develop a high-class environmental management system.[xii]
World Vision (UK)	World Vision's environmental policy lays out how the organization seeks to have the least negative impact, where practicable, on the environment, and to reduce its impact. It plans to set targets and monitor and report on environmental performance. The NGO also plans to set up an Emissions Monitoring Scheme.

Notes

[i] Oppliger, A. and Bellevaux, L. (2017), *Biennial Report on Sustainable Development 2015–2016*, International Committee of the Red Cross (ICRC), https://www.icrc.org/en/document/sustainable-development-icrc.

[ii] International Federation of Red Cross and Red Crescent Societies (IFRC) (2013), *IFRC Plan of Action Climate Change 2013–2016*, http://www.climatecentre.org/downloads/files/IFRCGeneva/IFRCPlanOfActionForClimateChange.pdf.

[iii] IFRC (undated), 'Red Cross Red Crescent Climate Training Kit', https://www.climatecentre.org/training (accessed 10 Feb. 2018).

[iv] International Organization for Migration (2017), 'Director General's Report To The 109TH Session Of The Council', https://www.iom.int/speeches-and-talks/director-generals-report-109th-session-council.

[v] Persson, J., Ten Palomares, M. and Huchulak, S. (2018), *OCB Energy Vision: Energy Mapping and Roadmap*, MSF Operational Centre Brussels, February 2018, https://static1.squarespace.com/static/5a8e96a9017db281d70a3ace/t/5a9d63918165f55874920f03c/1520264110859/OCB-Energy-Vision-Report-2018.pdf.

[vi] Save the Children (2017), *Global Accountability Report 2016/17*, https://www.savethechildren.org.au/getmedia/7d84da5b-70ed-4372-9f54-224c1c1c7790/Save-the-Children-Global-Accountability-Report-2016-2017_0.pdf.aspx (accessed 10 Jun. 2018).

[vii] United Nations Environment Management Group (EMG) (2018), 'Greening the Blue: United Nations High Commissioner for Refugees [UNHCR]', http://www.greeningtheblue.org/what-the-un-is-doing/united-nations-high-commissioner-refugees-unhcr (accessed 10 Feb. 2018).

[viii] UNHCR (1996), *UNHCR Environmental Guidelines*, http://www.refworld.org/docid/42a01c9d4.html (accessed 27 Jul. 2018).

[ix] Türk, V., Corliss, S., Riera, J., Lippman, B., Hansen, E., Gebre Egziabher, A., Franck, M., Dekrout, A. and Kuroiwa. Y. (eds) (2015), *UNHCR, the Environment & Climate Change*, UNHCR, http://www.unhcr.org/540854f49.pdf.

[x] Ibid.

[xi] UNICEF (2015), 'UNICEF Strategic Framework on Environmental Sustainability for Children 2016–2017', https://www.unicef.org/environment/files/Framework_on_Environmental_Sustainability_final_as_approved_by_OED_3Dec15.pdf (accessed 3 Mar. 2018).

[xii] WFP (2017), *Environmental Policy*, February 2017, https://docs.wfp.org/api/documents/WFP-0000019504/download/?_ga=2.166836153.609300027.1510314877-869235485.1498481421 (accessed 5 Feb. 2018).

Across the UN system, the emphasis has been on aligning practices with commitment to global climate change mitigation. The Greening the Blue initiative to reduce the UN's environmental footprint has included gathering data on its operations' aggregate greenhouse gas emissions (although not from field facilities) since 2009. In 2007 Secretary-General Ban Ki-moon set the goal for all UN organizations to achieve carbon neutrality by 2020.[41] Data collection on emissions covers the main UN agencies involved in humanitarian relief – including UNHCR, UNICEF, the United Nations Office for the Coordination of Humanitarian Affairs (OCHA), the United Nations Office for Project Services (UNOPS) and WFP – although this has not yet translated into comprehensive emissions-reduction strategies within the sector.

Workers on the ground regularly voice concern about energy and environmental issues, and about the fact that too little concern is paid to operations. This is especially the case in three areas: food logistics; water, sanitation and hygiene (WASH); and Safe Access to Fuel and Energy (SAFE). There is also awareness of the problem at a high level. For example, a 2017 Save the Children report states:

> We recognise that historically, neither monitoring nor reporting environmental impact have been set as organisational priorities, despite an awareness of the importance of reducing our environmental footprint. This had yet to be institutionalized – only six Save the Children member organisations report on environmental impact.[42]

Given the evidence about the costs of existing fossil fuel solutions, there is a significant opportunity within the humanitarian sector to achieve the win-win of reduced energy costs and reduced environmental impact through strategies that improve energy efficiency, or that improve energy supply chains and substitute certain technologies for more contextually appropriate ones. This paper examines the state of play with regard to costs and sustainability.

Methodology

The results presented in the next parts of this paper are based on information received from humanitarian organizations working with refugees in Burkina Faso, Jordan and Kenya. These countries were chosen because of the work of the Moving Energy Initiative (MEI) there and our desire to cover a variety of geographic, economic and demographic situations.

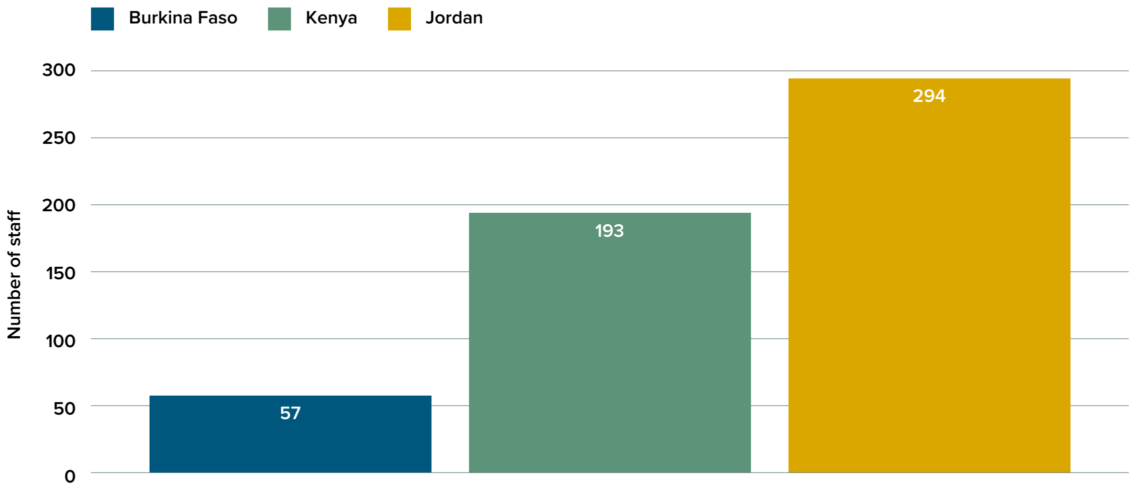
Although the selection of countries is small, together they paint a reasonably representative picture of how agencies are using energy in varied contexts: from the large-scale (Kenya and Jordan) to the small-scale (Burkina Faso), from the primarily camp-based (Burkina Faso and Kenya) to the primarily urban (Jordan), from the grid electricity-dependent (Jordan) to the overwhelmingly off-grid (Burkina Faso and Kenya). While a 'guesstimate' is made about the global costs of diesel based on an estimate of percentage spend, further research is needed in other countries in order to reach better estimations of the humanitarian sector's total energy use and costs.

The research for this paper began with an in-depth examination of the secondary literature on this subject. Drawing on local networks of partners in Burkina Faso, Jordan and Kenya, we identified organizations considered likely to provide answers to a written questionnaire distributed in English and French (see Appendix B for the English version). The organizations

[41] UNEP (2007), 'Sustainable United Nations: Helping the UN system become sustainable', Sustainable United Nations, http://www.greeningtheblue.org/sites/default/files/SUN4pager31.03.11_0.pdf (accessed 16 Nov. 2017).
[42] Save the Children (2017), *Global Accountability Report 2016/17*.

ranged from some of the largest to some of the smallest operating in each country. Figure 3 shows the average number of staff per organization for the humanitarian agencies sampled in each country.

Figure 3: Average number of staff in surveyed organizations, by country, 2015–16



Source: Data collected during survey and interviews with humanitarian organizations. Further information available from the authors.

Between January and June 2017, 21 completed questionnaires were returned (seven from each country). Most organizations returned data relating to energy use in 2015–16 (although the precise period covered was not consistent between respondents). It should be noted that not all respondents were able to answer all of the questions. The information obtained in the questionnaires was supplemented by 10 additional semi-structured interviews with persons and teams responsible for sustainability or environmental management in the head offices of humanitarian organizations. Some of these interviews were at organizations that had been sent a questionnaire. All data collected from the survey have been anonymized. Without the assurance of anonymity, the number of respondents would have been lower and the quality of the data less robust.

Box 2: The challenges of data collection on energy use

Few humanitarian agencies capture comprehensive data about their energy use. Consequently, only a small percentage can actually say how much fuel they use and how much it costs them. The same is true for electricity use. Most initial respondents to the survey were understandably able to provide only a partial or cursory picture of their energy use, but in follow-up correspondence even most of those responsible for logistics or finance were unable to answer questions comprehensively. The difficulty of 'finding the right person' or knowing where to access data is indicative of the challenge in changing energy practices.

Even when better data were available, there was no common standard for measuring energy use. Agencies measure the use of fuel over different periods and according to different methodologies. For the purposes of clarity, and ease of comparison, this paper attempts to standardize the figures included.

An additional problem is that humanitarian agencies' data on energy use are often aggregated, with unclear division of costs. For example, transportation fees (mainly for agency drivers) are at times added to the costs of fuel and at others accounted for separately. In other instances, the total costs cited in the survey actually reflect payments to a company or partner for diesel supply, with no disaggregation of the supplier's fee. Few organizations could provide comprehensive information about the ongoing costs of maintenance for diesel generators or the installation costs associated with these. Wherever possible, the authors have attempted to clarify the division of costs in the data presented.

Some aspects of data collection fell beyond the scope of this research. The paper considers just one aspect of the sector's environmental footprint – energy – from the perspective of saving costs and reducing environmental harm. While energy is a key area for emissions reductions and potential cost savings, it should be considered as part of a wider sustainability agenda that is needed in humanitarian organizations. Equally necessary are policies and practices that tackle solid waste, water management, food sustainability, forest degradation and procurement in order to reduce overall environmental footprint.

Some issues were omitted from the survey for the sake of simplicity and to encourage completion. These included technical analysis of the performance of diesel generators, supply chains and aviation, all of which are important parts of the energy and emissions picture in humanitarian operations and require further assessment. For example, WFP operates a Humanitarian Air Service (UNHAS) that enables more than 8,000 aid workers from over 230 organizations to access 69 hard-to-reach destinations monthly.[43] Across the UN, 40 per cent of greenhouse gas emissions are from flights.

Finally, the primary data in this paper are based on the information provided by individuals within humanitarian agencies without verification. Further studies are required to monitor accuracy. However, reference is made to independent audits that have been carried out – for example, as part of the UN's Environment Management Group (EMG) Peer Review Process – and that provide a partial basis for comparison.

The rest of the paper is structured as follows. Chapter 2 sets out the findings from the primary research on energy use, alongside some contextual analysis of the differences apparent between the three sets of country data. Chapter 3 outlines the challenges facing humanitarian agencies in reforming their energy practices. Chapter 4 suggests opportunities for, and potential approaches to, overcoming challenges in the system, based on several case studies that show what is possible. A concluding Chapter 5 offers recommendations for humanitarian agencies, donors and host-country governments on improving energy-use practices.

[43] Phiri, T. and Ungerank, C. (2016), 'UNHAS: Helping Aid Workers Access People In Need', WFP, 15 January 2016, https://panorama.wfp.org/unhas-helping-aid-workers-access-people-in-need?_ga=2.174505509.649030077.1509621796-869235485.1498481421 (accessed 22 Jan. 2018).

2. Findings: Uncovering Diesel Dependency

Country and displacement diversity

The three countries surveyed – Burkina Faso, Jordan and Kenya – host refugees from crises that receive differing levels of international attention. The countries' size and geography vary considerably, as does the ease of getting around within them. They exhibit differing levels of state capacity and willingness to support the humanitarian community. For example, the presence of humanitarian organizations is higher in Jordan and Kenya than in Burkina Faso. This is due to the larger number of refugees in the former two countries and their use as regional hubs for the humanitarian community. This means higher expenditure on all aspects of energy in these two cases. Table 2 shows the differences in some of the most important metrics that should be kept in mind throughout the analysis.

Table 2: A brief comparison of Burkina Faso, Jordan and Kenya, 2017 data

	Burkina Faso	Jordan	Kenya
Total population of concern to UNHCR (and to UNRWA in the case of Jordan)[I]	32,676	1,090,812*	514,867
Primary countries of origin for displaced people	Mali[II]	Syria, Palestine, Iraq[III]	Somalia, South Sudan, DRC, Ethiopia[IV]
Refugees per 1,000 nationals	1.75	126.6	9.31
Humanitarian aid**	$48.2 million	$724.3 million	$340.2 million

* The majority of the 2,175,491 refugees have full Jordanian citizenship. Here we have only accounted for the 370,000 living in refugee camps.
** Humanitarian aid to Burkina Faso and Kenya also includes famine relief to the national population.

Notes
[I] UNHCR (2018), *Global Trends: Forced Displacement in 2017*; and UNRWA, 'Where We Work', https://www.unrwa.org/where-we-work/jordan (accessed 5 Nov. 2018).
[II] UNHCR (2017), 'UNHCR Burkina Faso Factsheet', June 2017, http://reporting.unhcr.org/sites/default/files/UNHCR%20Burkina%20Faso%20Factsheet%20-%20June%202017.pdf (accessed 12 Dec. 2017).
[III] UNHCR (2017), 'Jordan Factsheet', January 2017, https://reliefweb.int/sites/reliefweb.int/files/resources/JordanFactSheetJanuary2017-FINAL.pdf (accessed 12 Dec. 2017).
[IV] UNHCR (2017), 'Kenya: Registered refugees and asylum-seekers', http://www.unhcr.org/ke/wp-content/uploads/sites/2/2017/11/Kenya-Statistics-Infographics-31-October-2017.pdf (accessed 12 Dec. 2017).

Table 2 continued: A brief comparison of Burkina Faso, Jordan and Kenya, 2017 data

	Burkina Faso	Jordan	Kenya
Humanitarian aid per capita (total population)*	$2.5[V]	$74.7	$6.8
GDP per capita	$649.72[VI]	$4,087.97[VII]	$1,455.36[VIII]
Access to grid electricity (% of population)[IX]	19.2%	100%	56%

* Humanitarian aid to Burkina Faso and Kenya also includes famine relief to the national population.

Notes

[V] Humanitarian aid flows from UNOCHA's Financial Tracking Service, UN population estimates.

[VI] World Bank (2017), 'Burkina Faso', World Bank Open Data, https://data.worldbank.org/country/burkina-faso (accessed 12 Dec. 2017).

[VII] World Bank (2017) 'Jordan', World Bank Open Data, https://data.worldbank.org/country/jordan (accessed 12 Dec. 2017).

[VIII] World Bank (2017), 'Kenya', World Bank Open Data, https://data.worldbank.org/country/kenya (accessed 12 Dec. 2017).

[IX] World Bank (2017), 'Access to electricity (% of population)', World Bank Open Data, https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS (accessed 12 Dec. 2017).

This chapter investigates the energy use of humanitarian agencies in the three countries with specific reference to the existence of policies on energy use, the use of diesel and petrol in generators, the use of diesel and petrol in vehicles, and the use of grid electricity for offices.

Policies

Overall, the findings show a policy vacuum when it comes to accounting for and reporting on the energy use of humanitarian organizations. Only eight of the 21 organizations that responded to the questionnaire had a policy for training or advising staff on reducing energy consumption.

The policy vacuum matters because substantial energy savings can be achieved simply through changing behaviour, whether reducing the use of air-conditioning or switching off computers and lights when daily work is finished.[44] Policies alone are not enough to change behaviour. A persuasive message can be relayed concertedly and successfully by management even without a formal policy. Conversely, the best policies cannot be effective without buy-in from leadership, accountability of managers and widespread cultural acceptance within the organization concerned. Nevertheless, having appropriate policies can be a significant factor in instigating and institutionalizing behaviour, as well as in encouraging shifts in attitude or energy consumption.[45]

---

[44] These issues are explored in more detail in an accompanying toolkit for humanitarian agencies. Grafham, O. and Lahn, G. (2018), *Powering Ahead*, toolkit for the Moving Energy Initiative, December 2018, https://mei.chathamhouse.org/resources/toolkits.

[45] For example, Petty and Cacioppo (1981) suggest that 'lasting behavioural change relies on people consciously engaging with and elaborating on the subject matter of the persuasive message'. Petty, R. and Cacioppo, J. (1981), *Attitudes and Persuasion: classic and contemporary approaches*, Dubuque, IA: William C. Brown, cited in Jackson, T. (2005), *Motivating Sustainable Consumption*, report to the Sustainable Development Research Network, p. xi, http://research3.fit.edu/sealevelriselibrary/documents/doc_mgr/922/Jackson.%202005.%20Motivating%20Sustainable%20Consumption.pdf. There is also some evidence from the corporate sector that suggests that organizations can 'do well by doing good'. Some claim that having a sustainability policy can not only improve environmental impacts within a company, but also over the long term improve stock market and financial performance. However, there is also a contrasting school of thought that holds that adopting environmental and social policies can destroy shareholder wealth. In its simplest form, this argument is that sustainability policies amount to an additional cost that reduces overall profit margin. All these arguments are summarized in Eccles, R., Ioannou, I. and Serafeim, G. (2012), 'The Impact of a Corporate Culture of Sustainability on Corporate Behavior and Performance', Harvard Business School Working Paper, 9 May 2012, 12-035, http://trippel.sdg.no/wp-content/uploads/2014/09/Eccles-HBR_The-Impact-of-a-Corporate-Culture-of-Sustainability1.pdf (accessed 3 Mar. 2018).

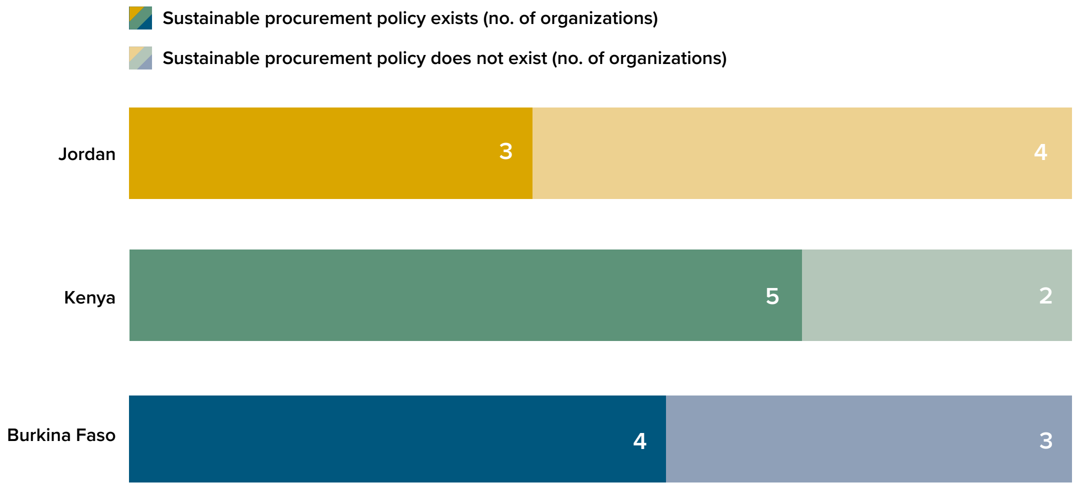
In all three countries, fewer organizations reported having provision for training staff in managing energy consumption, as Figure 4 shows. A small number of those surveyed had a full programme of training in this area, mostly overseen by their headquarters and offered to field offices on request (although in no cases was training obligatory). Other organizations offered partial training for staff. For example, one organization trained its drivers on best practice in economizing fuel consumption, but did not train 'regular' members of staff on use of energy or wider sustainability issues. Most organizations lack real expertise in this area and look to their headquarters for guidance. In some cases, organizations are keen not to introduce policies on this subject, because they believe (correctly or incorrectly) that they have neither the resources nor the time to implement or enforce the potential measures.

Figure 4: Prevalence of training for staff in managing energy consumption, 2015–16

Source: Data collected during survey and interviews with humanitarian organizations. Further information available from the authors.

The picture is slightly better when it comes to sustainable procurement policies. The survey revealed that 12 of the 21 surveyed organizations had policies in place that prioritized energy-efficient equipment, in particular relating to the purchase of fuel-efficient vehicles and energy-efficient light bulbs. Figure 5 shows the breakdown across the three target countries.

Figure 5: Prevalence of sustainable procurement policy, 2015–16



Source: Data collected during survey and interviews with humanitarian organizations. Further information available from the authors.

The majority of the organizations used specialized software for their financial reporting, including for reporting on energy-related expenditure such as on diesel and grid electricity.[46] Although simple methods (such as pen and paper) can often be the best in difficult humanitarian contexts, there appears to be a relationship between the use of more advanced methods of recording energy consumption and implementation of energy-aware policies.[47] It is easier to circulate information through large humanitarian organizations when systems are in place that are shared between field offices and headquarters.

Less clear is the accuracy of the original data being fed into the system. The research suggests that many organizations have little awareness of their energy expenditure or usage despite having systems that collect data on these subjects. In some cases, there appears to be no communication or coordination between those in headquarters who are responsible for amalgamating data and those in field offices who manage energy expenditure.

Box 3: The energy vision and roadmap of Médecins Sans Frontières

To our knowledge, Médecins Sans Frontières (MSF) is the first humanitarian organization to begin putting together a comprehensive energy vision and roadmap. It has embarked on one of the most systematic and ambitious attempts to reform energy use at the organization level. MSF's Operational Centre Brussels (OCB) issued a wide-ranging report at the start of 2018, based on data collected from 114 MSF projects around the world, which outlined actions to address the biggest challenges facing the organization.

[46] However, seven of the 21 organizations that were able to answer this question relied on manual Excel entry or pen and paper.
[47] However, such a relationship is not necessarily causal and such organizations could simply be better resourced overall.

Twenty-two out of 27 missions (81 per cent) reported information related to energy, with data collected from three sources: the Logistics Reporting System (LRS), the assets list and financial records. Table 3 below illustrates some useful key indicators that can outline the picture of energy use.

Table 3: Indicators of interest and level of reporting in MSF Logistics Reporting System (LRS)

Indicators	% of projects submitting indicator data
Surface area (m^2) of health structures	3
Surface area (m^2) of MSF warehouse	6
Price for one unit of fuel	6
Kilometres driven	26
Quantity of fuel used	26
Energy safety incidents	10
Generator service schedule	31
Critical power breakdowns	28
Generator running hours	5
Power back-up presence	11
Generator fuel consumption	5
Electrical equipment damaged	29
Equipment protection	11
Team comfort (in relation to electrical means provided)	11
Reliability of city power	31
Medical structure power consumption	2
Number of beneficiaries	3

A key component of the strategy has been to identify the scale of what MSF does not know, and Table 3 also shows that having a system is no guarantee that information will be reported accurately and efficiently. The OCB report points out that 'the reporting systems in place are not used systematically, which undermines their potential to inform decisions'.

These difficulties are not unique to MSF. Almost all organizations surveyed face similar issues but lack the data to report on them. Working under crisis conditions with a remit to save lives means that logging data on energy use will not be a priority for staff. By identifying these challenges, MSF recognizes institutional capacity issues and is taking steps to address them.

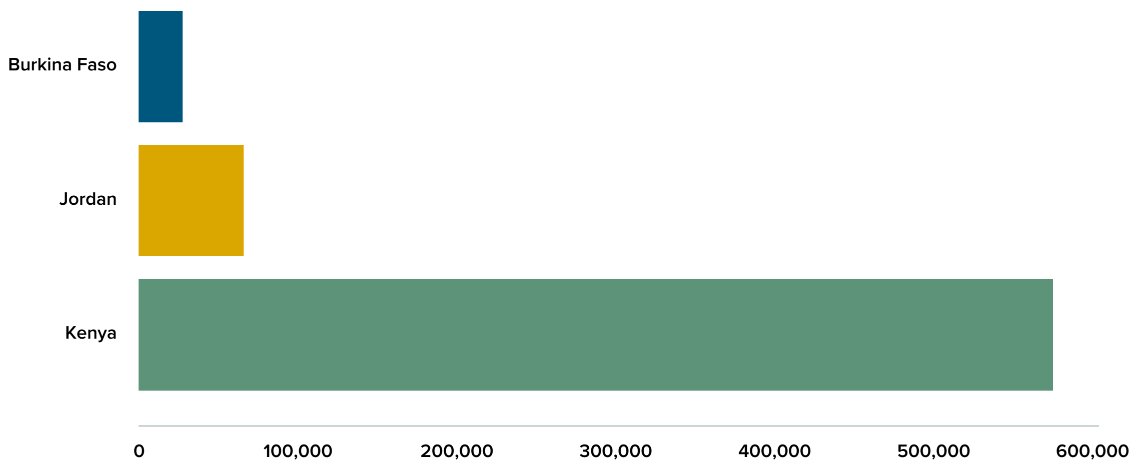
Source: Médecins Sans Frontières (2018), 'OCB Energy Vision', http://innovation.lakareutangranser.se/?portfolio=ocb-energy-vision.

Use of diesel and petrol for generators

Humanitarian agencies spend large amounts of money on conventional stand-alone electricity generators and the diesel and petrol for powering them. In the absence of reliable grid power, generators are necessary for pumping water, powering offices, powering temperature-controlled storage of food and equipment in warehouses, and running medical and educational facilities.[48] Although many refugees in Burkina Faso, Kenya and Jordan also rely on diesel generators to power businesses, earn additional income or run appliances,[49] this section covers only the use of generators by humanitarian agencies.

The total spending on diesel and petrol for the seven agencies surveyed in Kenya was nearly $4 million per year (although spending by individual agencies varied over a wide range). As Figure 6 shows, this means that the average amount spent on diesel and petrol for generators by the humanitarian organizations was around $571,000 a year – equivalent to over $5,000 per staff member. Figure 6 also shows that expenditure on fuel for generators was much higher in Kenya than in the other two countries.

Figure 6: Average spend ($/yr) by humanitarian organizations on diesel and petrol for generators in each country, 2015–16



Source: Data collected during survey and interviews with humanitarian organizations. Further information available from the authors.

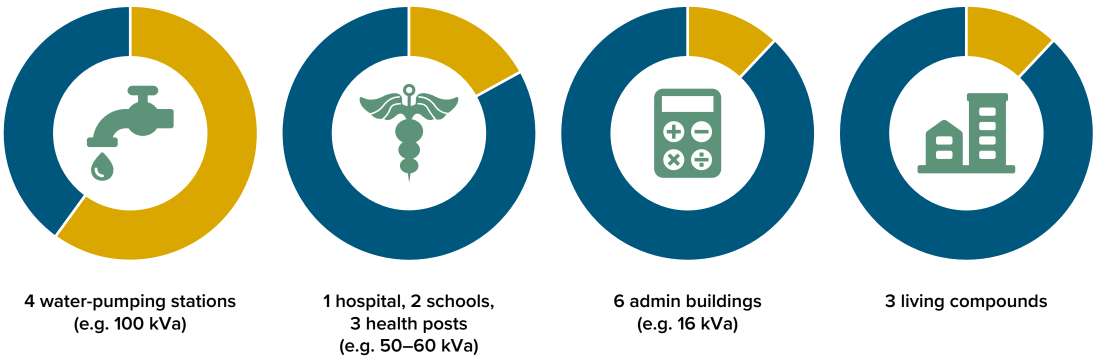
The amounts spent in real terms and per staff member were much lower in Jordan and Burkina Faso. In Jordan, virtually the entire population is connected to the grid – as are the largest refugee camps[50] – which means that all the major humanitarian organizations use grid electricity

[48] Among other activities. Table 5 lists many activities currently run through diesel generation.
[49] Corbyn, D. and Vianello, M. (2018), *Prices, Products and Priorities: Meeting Refugees' Energy Needs in Burkina Faso and Kenya*, Research Paper, London: Royal Institute of International Affairs, https://www.chathamhouse.org/sites/default/files/publications/research/2018-01-30-meeting-refugees-energy-needs-burkina-faso-kenya-mei-corbyn-vianello-final.pdf.
[50] Jordan has several large Palestinian refugee camps that were established in the 1950s and 1960s, and that have effectively become towns. Baqa'a refugee camp is the largest, with over 101,000 residents. The largest Syrian refugee camps, Zaatari and Azraq, are also grid-connected.

as their primary source of energy.[51] In Burkina Faso, the overall levels of access to electricity are extremely low. For example, only three relatively small diesel generators operate in Goudoubo refugee camp (two of which power water-pumping facilities and are sized at 10 kVA and 15 kVA).

Most organizations working in the two main refugee camps in Burkina Faso do without electricity. This shows the highly unequal energy access situations across humanitarian settings. Although this study could not break down the end-use function of diesel generation, water pumping appears to figure prominently in many sub-Saharan African refugee camps. Figure 7 highlights the case of Nyarugusu refugee camp in Tanzania, where end use has been verified and 60 per cent of diesel generation is taken up by water pumping.

Figure 7: Share of diesel budget per end use in Nyarugusu refugee camp, Tanzania, 2017



Source: Fohgrub, T. (2018), 'Options for Diesel replacement in refugee camps' – Case Study Nyarugusu, UNITAR (reproduced with permission).

On top of annual payments for fuel, the humanitarian agencies surveyed also paid for the installation and maintenance of generators. Breakdowns were frequent in Burkina Faso and Kenya, where unreliability of power was identified as a major problem. Most refugee camps do not have energy or electrical engineers on site (although there are exceptions to this where major projects are taking place, such as in the camps in Jordan). For example, one of the larger organizations in Burkina Faso spent around 12 per cent of its diesel and petrol budget on maintaining generators.[52]

It is also widely acknowledged that most diesel generators in the humanitarian system are run inefficiently (and that therefore a greater number than necessary are required to meet overall capacity), or are oversized for their intended purpose (thus consuming more diesel than necessary and shortening their lifespan). One engineer at a humanitarian organization said that 'generators are routinely run in an inefficient and unproductive fashion throughout the humanitarian system'.[53] In the Dadaab refugee camps in Kenya, UNHCR runs 99 generators to meet camp facility

[51] World Bank (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. Not all populations within the two refugee camps are currently connected to the grid, although this is the ambition (see Box 6).
[52] Based on data collected during surveys.
[53] Correspondence with senior technician in a large humanitarian organization.

requirements (not households or businesses); many of these have been found to be operating well below optimal utilization levels.[54]

This implies not only capital inefficiency (too much capacity installed) but also operating inefficiency, because underloaded generators use more fuel per kilowatt hour (kWh) and are more likely to break down.[55]

Some agencies, recognizing the high cost of reliance on diesel generation, have begun to try alternatives. Box 4 describes the case of WFP's food-storage facilities in remote locations in Afghanistan.

Box 4: WFP's hybrid power supply system in Herat

The World Food Programme (WFP) has worked in Afghanistan since 1963. In 2016, the agency helped over 82 million people worldwide,[56] primarily in rural areas lacking a stable supply of food, including 3.5 million in Afghanistan.[57]

WFP itself estimates that vehicles and generators account for over 50 per cent of its emissions, with diesel generators providing 40 per cent of the electricity used by WFP globally.[58] In the northern city of Herat in Afghanistan, WFP runs a medium-sized bagged-storage facility for holding foodstuffs before distribution.[59] It costs WFP $212,324 per year to maintain the facility; most of this sum is spent on purchasing diesel for generators that provide electricity and power cooling facilities.

As part of its effort to reduce costs, WFP invested $528,948 to install a hybrid wind/solar/diesel-powered system that has vastly reduced the operational cost of the facility. Full payback on the initial investment is expected to be achieved within 5.2 years. It is estimated that over its lifetime (15 years) the system will save nearly $900,000, enough to feed nearly 13,000 children in school for a year. It will also save nearly 250,000 kg of carbon, which is equivalent to removing 22,000 WFP cars from the road for one day.[60]

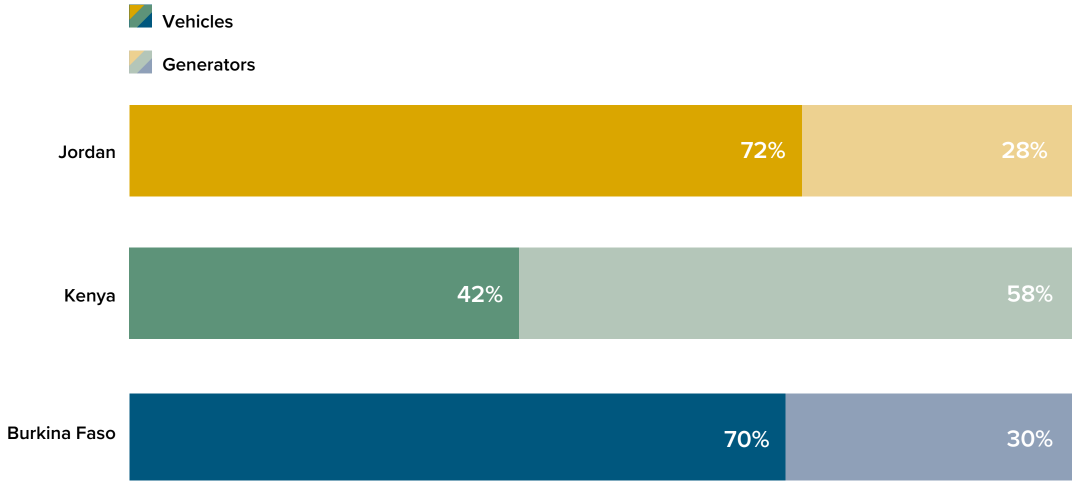
Monitoring of costs and savings has proved key to the initiative's success. A dashboard has been designed that illustrates all of the financial analysis behind the installation and keeps a rolling tally of indicators on the efficiency and performance of the system. This 'gamification of energy reduction' (where staff are encouraged to recognize energy use and do better in the future)[61] enables the sustainability team at the WFP headquarters to describe clearly how initial investments are being used and recouped.

[54] Okello, S. (ed.) (2016), *The Energy Situation in the Dadaab Refugee Camps, Kenya*, Research Paper, London: Royal Institute of International Affairs, https://www.chathamhouse.org/sites/files/chathamhouse/publications/research/2016-05-19-mei-energy-situation-dadaab-refugee-camps-okello-final.pdf.
[55] Ibid.
[56] WFP (2017), *The Year in Review 2016*, https://docs.wfp.org/api/documents/WFP-0000019183/download/?_ga=2.109871109.1442158712.1532793740-1688446537.1532793740 (accessed 4 Jun. 2018).
[57] Ibid.
[58] Conversations with WFP engineering staff.
[59] WFP (2018), 'Countries: Afghanistan', http://www.wfp.org/node/3191 (accessed 4 Jun. 2018).
[60] Conversations with WFP engineering staff.
[61] This is how the dashboard was described by a senior WFP engineer.

Use of diesel and petrol for vehicles

The research for this paper suggests that use of diesel and petrol for vehicle fleets is often equal to or greater than that for generators. Figure 8 shows the comparative split between uses of fuel for these purposes in the three countries studied.

Figure 8: Diesel and petrol use, vehicles vs generators (litres/yr), 2015–16

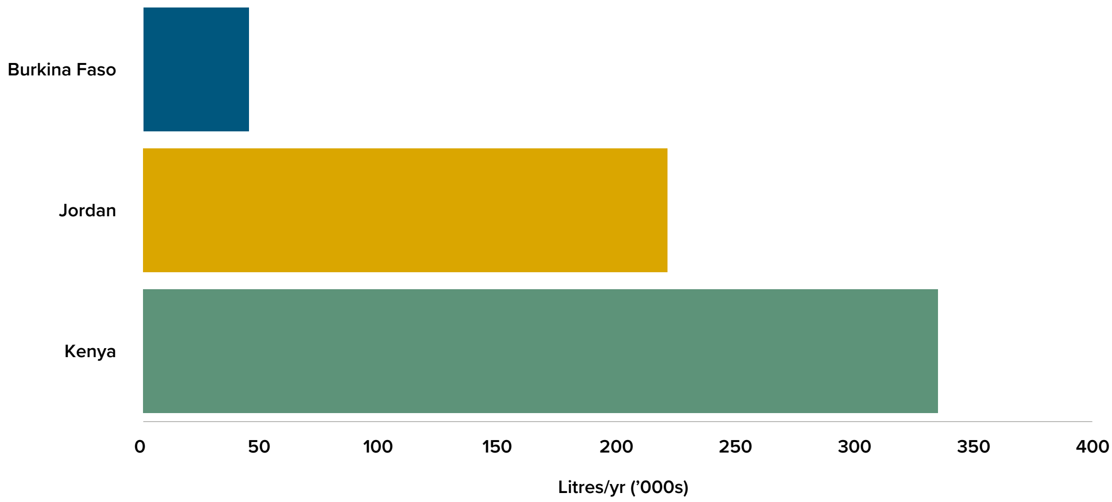


Source: Data collected during survey and interviews with humanitarian organizations. Further information available from the authors.

Each of the 21 humanitarian organizations surveyed used large amounts of diesel and petrol for vehicles. The heaviest use was in Kenya, with the average usage per organization reaching 335,000 litres a year. In Jordan, where humanitarian organizations own the highest number of vehicles per staff member out of the three countries, this figure was roughly 220,000 litres a year (see Figure 9).

Several factors contribute to this high expenditure. In Jordan most humanitarian staff are based in Amman, which means that vehicles regularly shuttle back and forth between the camps and the capital city. This is possible because Jordan is a small country and the main Syrian refugee camps in Zaatari and Azraq can be reached by road from Amman in a few hours. However, this practice contributes to congestion, emissions and costs. Box 5 gives one example from an organization not included in the survey, illustrating how the costs of essential deliveries alone (which are likely to be paid for via fees to a logistics company, with fuel costs hidden) would add to these figures.

Figure 9: Average use of diesel and petrol for vehicles (litres/yr) by a humanitarian organization, 2015–16



Source: Data collected during survey and interviews with humanitarian organizations. Further information available from the authors.

Box 5: 'Oil for water'

Throughout 2016 Jordan hosted informal camps in Rukban and Hadalat (known as 'the Berm'), on the border with Syria, to deal with a large new wave of Syrian refugees. As one element of the emergency support provided, these vulnerable people received a ration of 5–13 litres of water per person per day (well below the UNHCR standard of 20 litres).[62] One major humanitarian organization revealed that transporting this water required around 16 tanker round trips per day from the Ruwaished water treatment plant, located 246 km and 104 km away from the camps respectively. Based on this information, it is estimated that trucks were travelling 7,126 km per day to transport this clean water.[63] Assuming each tanker uses 30 litres of diesel per 100 km (although the efficiency of older vehicles is likely to be lower), this required over 65,000 litres of diesel per month – at a cost of roughly $32,500 for the fuel.[64] There may have been no immediate alternative,[65] but this case gives an idea of the kinds of energy costs borne by humanitarian organizations, and the extent of their reliance on vehicles and fuel.

[62] This is partly because Jordan is one of the most water-scarce countries in the world. The 2016 Maplecroft Water Security Index has listed it as the third most water-insecure country in the world.

[63] Even in places where water is relatively close to the humanitarian site, agencies often pump water into trucks to be delivered. The pumps are normally powered by diesel generators.

[64] This calculation is based on similar trips to Azraq, assuming that trucks carry a load of 38 m^3 of water, and is based on the cost of diesel in June 2016 in Jordan at $0.50/litre.

[65] That was the case for Azraq camp, where trucks delivered 35 litres per person per day until October 2015, when a borehole was drilled at the camp. UNHCR (2015), 'UNHCR Jordan Factsheet: Field Office - Azraq Camp (December 2015)', https://reliefweb.int/report/jordan/unhcr-jordan-factsheet-field-office-azraq-camp-december-2015 (accessed 10 Jun. 2016).

Kenya is a major host of humanitarian operations, but its experience differs from that of Jordan in several respects. In Kenya, unlike in Jordan, a larger number of staff are based at or within the refugee camps rather than in the capital. This reduces the amount that agencies spend on vehicles, but increases the amount spent on internal flights and on diesel generators to power agency operations. Nevertheless, agencies still spend more on diesel and petrol for vehicles in Kenya than they do in the other two countries surveyed, likely due to Kenya's size and the remoteness of the major camps. For example, journeying from Nairobi to the Dadaab and Kakuma camps by road takes around eight hours and 15 hours respectively (compared with one to three hours for key sites in Jordan), and involves travelling through difficult terrain.

In Burkina Faso, most humanitarian operations are much smaller – the ones surveyed had an average of 57 employees, compared to 193 in Kenya and 294 in Jordan. Having fewer people and smaller operations means fewer journeys and less expenditure on diesel and petrol (although the seven organizations surveyed were still making journeys of around 12,000 km in aggregate every week).[66] The analysis suggests that each vehicle travelled an average of 116 km per week, with some travelling around 200 km a week and some travelling distances as low as 50 km a week. In cases such as the latter, it is questionable whether ownership of a vehicle is really justified compared to renting – which would surely be cheaper and more energy-efficient.

It is clear that poor fuel efficiency of vehicles is a problem for humanitarian agencies.

The survey was not able to generate enough data on the fuel efficiency of vehicles to offer a comprehensive comparison of the three countries. Nonetheless, based on secondary sources and anonymous auditing of existing operations, it is clear that poor fuel efficiency of vehicles is a problem for humanitarian agencies. For example, in Jordan the fuel efficiency of four-wheel-drive vehicles (perhaps those most often associated with humanitarian activities) varies from around 5.5 km per litre (18.2 litres/100 km)[67] to around 3.8 km per litre (26 litres/100 km).[68] As a comparison, new diesel 4x4s on the market in 2018 are reported to operate at a highest fuel efficiency of 23.81 km per litre (4.2 litres/100 km).[69]

In 2011 WFP introduced an internal carbon tax on vehicle purchases in the organization. This incentivizes the choice of the most efficient vehicles and provides revenue for a fund to which country offices can apply to reinvest in other efficiency measures (see Box 14 in Chapter 4).

Finally, two issues affecting humanitarian fuel use and with national implications came to light: fuel quality and fraudulent fuelling practices. While Kenya and East African countries more broadly are moving towards European fuel standards, in Burkina Faso and Jordan fuel quality and vehicle emission standards are a cause for concern. In Jordan, the diesel on sale has a high level of sulphur, with the emissions reported by UNEP at around 9,300 parts per million (ppm),

---

[66] Also consider that fuel is more expensive in Burkina Faso than in Jordan: in October 2017 prices (per litre) were $0.73 in Jordan and $0.95 in Burkina Faso. See World Data Atlas (2018), 'Burkina Faso – Pump Price for Diesel Fuel', https://knoema.com/atlas/Burkina-Faso/Diesel-price (accessed 7 Mar. 2018).
[67] UN EMG (2017), anonymous peer review available from authors on request, p. 68.
[68] Ibid., p. 46.
[69] Sust-IT (2018), 'Diesel 4x4s running costs - miles per gallon (mpg), fuel efficiency/emissions', https://www.sust-it.net/miles-per-gallon-mpg-fuel-efficient-cars.php?type=4x4&fuel=diesel. Although differences in terrain and driving practices can significantly affect actual efficiency levels. Trucks – which can of course carry bigger loads – are reported to get as little as 1.6 km per litre (62.5 litres per 100 km) according to UN EMG (2017), anonymous peer review available from authors on request, p. 68.

which has negative implications for air quality and human health.[70] In Burkina Faso, the most common level is 2,000–3,000 ppm.[71] In contrast, in Europe diesel fuels with sulphur content above 10 ppm are being phased out. Although the availability and costs of low-sulphur diesel fuel still need to be ascertained, an audit of one large agency suggests that it should be possible to negotiate the supply of 350-ppm-sulphur diesel fuel in Jordan at least.[72]

Similarly, although the survey did not ask any questions about fraudulent fuelling practices, the issue was mentioned by several interviewees as a common concern for humanitarian agencies. Fuel smuggling and fuel adulteration (the watering down of fuel or replacement of genuine fuel with cheaper alternatives) remain problems in all three countries, and they impact the quality and emissions of fuel used. Anecdotally, in several cases fuelling stations have been known to syphon fuel off into jerry cans and replace it with adulterated fuel.

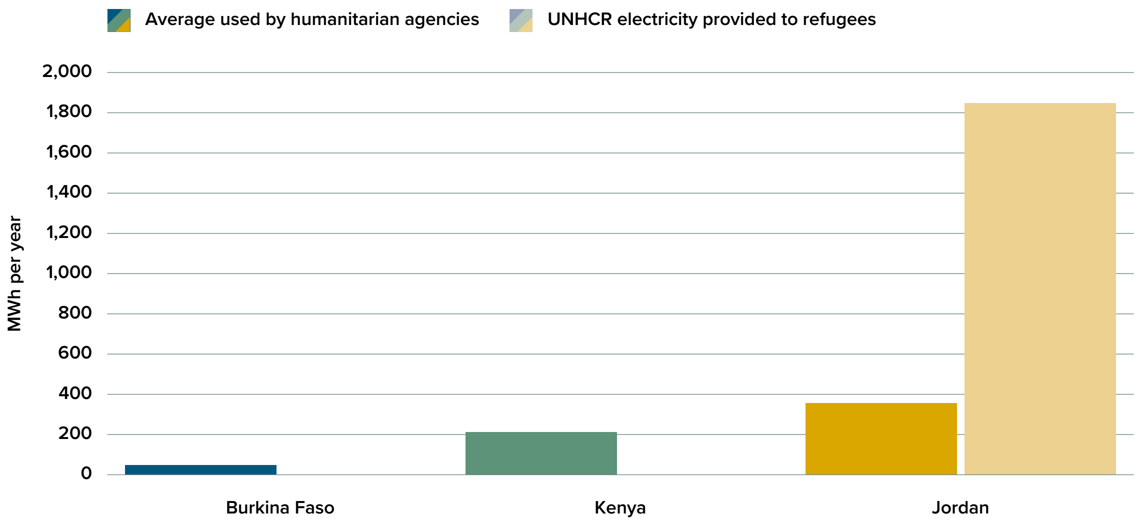
Use of grid electricity for offices

Most of the humanitarian organizations surveyed had multiple offices, and in several locations their consumption of grid electricity was substantial. In Kenya and Jordan, the larger agencies typically had six or seven offices (although one agency had 53 offices in Kenya). This generally meant having one headquarters in the capital, and numerous smaller offices at strategic points around the country. In Burkina Faso, the smaller organizations tended to have two offices (one headquarters and one field office) and the larger ones three or four (one headquarters and two or three field offices). This distribution of offices, and the larger humanitarian presence in Kenya and Jordan, is partly a reflection of the number of conflict-affected people (of which there are fewer in Burkina Faso) and partly a reflection of the fact that Jordan and Kenya act as regional hubs for the humanitarian community.

Figure 10 shows the average electricity use of the humanitarian organizations surveyed in the three countries. The stark difference between them is not only a reflection of the size of operations. Jordan's electricity grid provides higher-quality connections and covers a greater proportion of the country than the grids in Kenya and Burkina Faso. In Jordan, officially 100 per cent of the population is connected to the national grid, compared to 19 per cent and 56 per cent in Burkina Faso and Kenya respectively.[73] Many field offices in Jordan use grid electricity – unlike their counterparts in Burkina Faso and Kenya, which either use no electricity or rely on diesel generators.

[70] This is 'chiefly due to the fact that imported crude is sour and little refining effort is made to desulphurize the fuel'. See UN EMG (2017), anonymous peer review available from authors on request, p. 46. Jordan has ambitions for setting ultra-low standards in this area, but several commentators are sceptical about the likelihood of this reform happening before wider changes to the subsidy regime are undertaken. See Youssef, M. and El-Abyad, A. (2015), *Fuel Quality Roadmap for Arab States*, Centre for Environment and Development in the Arab Region and Europe (CEDARE), March 2015, http://web.cedare.org/wp-content/uploads/cedareimages/sulfur_roadmap_final.pdf; and Hamdi, M. R. (2008), 'Diesel Quality in Jordan: Impacts of Vehicular and Industrial Emissions on Urban Air Quality', *Environmental Engineering Science*, 25 (9), pp. 1,333–43.
[71] Most diesel vehicles and diesel fuel supplies in Burkina Faso are imported from Côte d'Ivoire and Senegal, and so the standards for diesel in the latter two countries are a strong influence on the standards in Burkina Faso. See Malins, C., Kodjak, D., Galarza, S., Chambliss, S. and Minjares, R. (2016), *Cleaning Up the Global On-Road Diesel Fleet: A Global Strategy to Introduce Low-Sulfur Fuels And Cleaner Diesel Vehicles*, Paris: Climate & Clean Air Coalition, August 2016, https://wedocs.unep.org/bitstream/handle/20.500.11822/21552/Cleaning_up_Global_diesel_fleet.pdf?sequence=1&isAllowed=y.
[72] UN EMG (2017), anonymous peer review available from authors on request, p. 73.
[73] Although Kenya's electrification progress has been transformational. See Kuo, L. (2017), 'Kenya's national electrification campaign is taking less than half the time it took America', Quartz Africa, 16 January 2017, https://qz.com/882938/kenya-is-rolling-out-its-national-electricity-program-in-half-the-time-it-took-america/ (accessed 10 Dec. 2017).

Figure 10: Average grid electricity use by sampled humanitarian organizations, MWh/yr, 2015–16 data*



* Data for UNHCR (yellow bar) are for the period November 2016–April 2017.
Source: Data collected during survey and interviews with humanitarian organizations, with some additional evidence collected from sustainability reports.[74]

The light yellow bar in Figure 10 shows the electricity provided by UNHCR to refugee populations, as opposed to that used by agencies themselves. The data provided by UNHCR are for the period November 2016–April 2017, and predate the introduction of solar farms at Azraq and Zaatari (see Box 6). These solar farms were installed in response to demand from camp inhabitants who had come from Syria, a country that had reached nearly 100 per cent grid access prior to the outbreak of the conflict in 2011.[75] Unsustainable grid electricity bills (substantially increased by informal household and business connections) for the Zaatari camp, combined with recognition that reliable power supply is closely linked to social stability, prompted the UN and its implementing partners to give much greater attention to power provision, cost-saving measures and the development of payment-based mechanisms. Box 6 details the first ever attempts to install solar plants at scale to serve refugee camps. The plants, erected at the Azraq and Zaatari camps in Jordan, have reduced bills and enabled UNHCR to expand access to power for refugees.

[74] Very limited data were received on electricity use from Kenya-based organizations that responded to the survey. Data for electricity use in offices in Kenya were therefore estimated by extrapolating from just one data point that listed office energy use at 81 kWh/m²/year in a 3,267 m² office serving 200 employees. Energy use for the other six organizations was then estimated by scaling this value of 1,323 kWh/year/staff member in proportion to the number of staff employed by each organization. It was further assumed that electricity use by the regional headquarters accounted for the vast majority of electricity use by the organization in the region.
[75] Syrian energy access in 2014 was calculated at 96 per cent. World Bank (2018), 'Access to electricity (% of population)', World Bank Open Data, https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=JO-BF-KE-SY&name_desc=false (accessed 10 Feb. 2018).

Box 6: Grid connections and solar farms at Azraq and Zaatari in Jordan

The two largest refugee camps in Jordan are Zaatari (opened in 2012, population in May 2018 approx. 83,000) and Azraq (opened in 2014, population in May 2018 approx. 43,000). Both initially benefited from connections to the national grid for their respective base camps, from where most humanitarian organizations operate their offices. At Zaatari electricity for street lighting was also supplied from the local grid, while at Azraq street lights were powered from the grid or with stand-alone solar-lighting connections. Azraq also used diesel for its supermarket, hospital and some other facilities. Sustainable and safe electricity supply for households was quickly identified as a high priority by UNHCR, which manages the camps.

In Zaatari, UNHCR found itself faced with exorbitant electricity bills and dangerous electrical connections due to informal access by refugees to the street-lighting network. In early 2015, UNHCR managers and engineers disconnected the network, as the infrastructure simply could not handle the demand. Alternatives for supplying household energy needs were required. Many people in the camp with the means to do so, for example those with small businesses, bought their own diesel generators. However, access was uneven and unregulated. UNHCR developed a new energy strategy for Zaatari which aimed to introduce safe, sustainable and cost-effective energy, including the use of solar power. The upgrade of the electrical network was a critical next step in returning electrical access to households. With funding from the Czech government, the medium- and low-voltage network around the camp was upgraded by December 2016. With all shelters in Zaatari connected to the new network, electricity was rationed to six hours each day in order for UNHCR to manage the financial cost of electricity charged at the local commercial rate.

Compared to Zaatari, Azraq is a controlled environment in which there is less economic activity, and whose inhabitants have lower levels of income. Until 2016, the Syrians living in Azraq did not have electricity; this severely affected living standards given the region's high summer temperatures and cold, harsh winters. This was a key issue of discontent among the community. The numbers of residents in Azraq also increased in 2016 when Syrians began arriving from the border area known as 'the Berm'. Through 2016 and 2017, UNHCR connected households to low-voltage electricity lines (funded predominantly by the Saudi Fund for Development), allowing families to operate fridges, televisions and fans, as well as to have light inside the shelter and charge phones – the latter of which is critical for communicating with family and friends separated by the war.

To align with Jordan's National Green Growth Plan (which seeks to place the country on a sustainable, green growth path to 2025), and also reflecting the expected financial and environmental benefits, UNHCR ensured that its electricity strategies included plans for renewable energy at the camps. In May 2017, UNHCR switched on a 2-MW solar photovoltaic (PV) plant in Azraq camp. A 12.9-MW plant, funded by the German government, opened at Zaatari the following November; this was the world's largest solar plant in a refugee camp. The Azraq and Zaatari solar plants enable UNHCR to cover increased electricity use from households through 'net metering', reducing the total bill for grid electricity by the amount produced and fed back into the grid from the solar plants.

These are the first solar plants to be erected at refugee camp sites, and the experience offers some valuable lessons. Both involved new types of partnerships and the use of humanitarian aid funding of 'legacy assets' built to outlast the refugee-hosting period. The partnerships also pioneered a new approach to financing. IKEA Foundation funded the entire capital costs of the Azraq solar farm project (€8.75 million, partly through the profits from IKEA stores' sales of LED light bulbs). The Azraq installation is currently saving UNHCR around $2 million each year since being upgraded to 3.5 MW in September 2018 through additional funding from the Saudi Fund for Development. Once the solar plant is upgraded to 5 MW and is operating at full capacity, this will increase these savings, further reduce CO_2 emissions and cover 70 per cent of Azraq's energy needs. The Zaatari plant is expected to reduce annual CO_2 emissions from the camp by 13,000 tonnes and is saving UNHCR around $5.5 million per year.

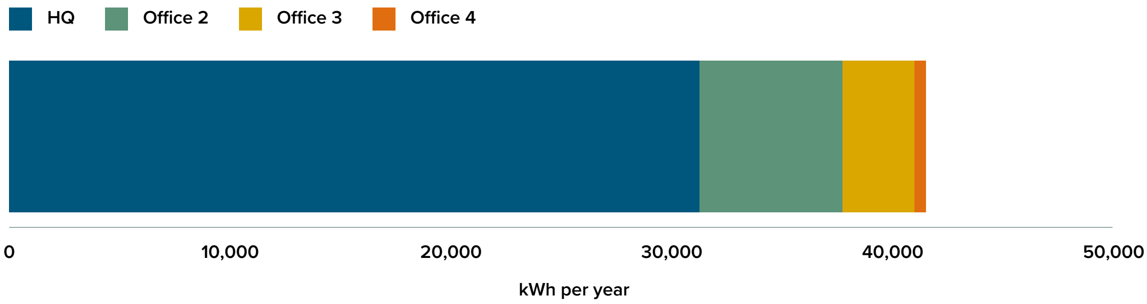
Source: Information provided by UNHCR Jordan, 2018.

The relative pricing of energy types also makes a difference. As one report puts it, 'the low cost of diesel and the high cost of electricity in Jordan make it significantly more cost effective to use a diesel boiler for heating than the use of electricity', given that humanitarian agencies are charged commercial rates for electricity.[76] An environmental performance peer review by the UN's EMG in 2017 estimated that moving from diesel boilers to electrical systems would cost one organization over $14,000 per year.[77] This suggests that reform is needed at the national level in order to create the right incentives for change from consumers.

One area of similarity across all three countries surveyed was the fact that the grid electricity use of country headquarters was generally markedly higher than that of field offices. In Burkina Faso and Kenya, this was because the field offices were rarely connected to the grid (and were therefore reliant on diesel generators) and because the number of functions being powered was in any case very low. Energy used in these settings was primarily for powering computers, lights and air-conditioning units, although many of the field offices surveyed lacked one or more of these facilities. For example, many field offices in Burkina Faso used pen and paper, and there was a clear need for more reliable power to be provided to field operations to improve the quality of facilities and staff conditions. Figure 11 shows the energy use of one humanitarian agency of average size in Burkina Faso, broken down by its different offices. It reveals a pattern of electricity usage that was also reported by several agencies surveyed, with grid connection in the headquarters but very limited access outside the capital.

[76] UN EMG (2017), anonymous peer review available from authors on request.
[77] Ibid., p. 42. This is a conversion from JOD 10,000, which is based on JOD 1=$1.41044 (exchange rate on 17 December 2017).

Figure 11: Grid electricity use of a typical agency in Burkina Faso, broken down between usage in different offices, 2015–16, kWh/yr

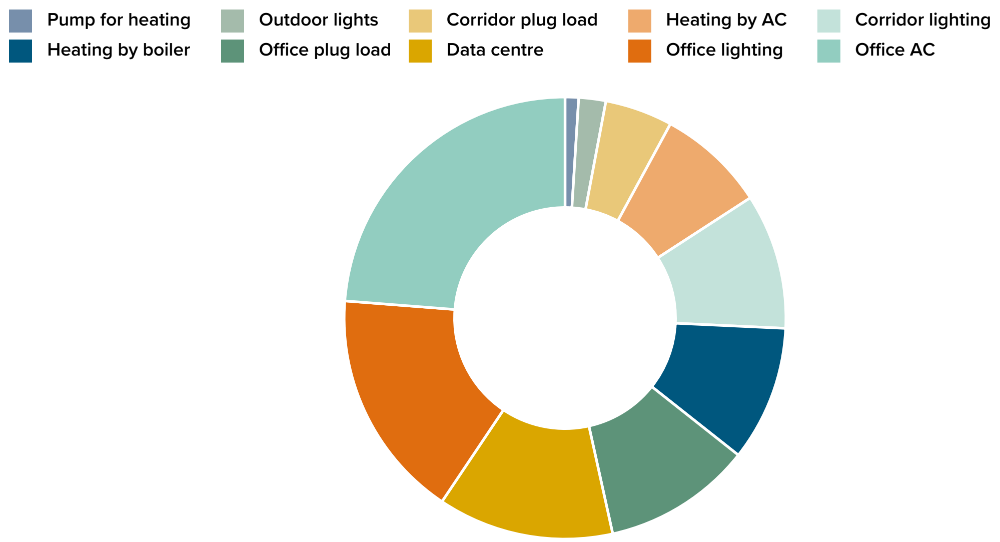


Source: Questionnaire data collected during survey of humanitarian organizations in Burkina Faso.

We did not investigate how this energy was being used in headquarters; however, existing sources show that there are substantial opportunities for efficiencies. The breakdown shown in Figure 12 is drawn from an audit for a large humanitarian organization in Amman that was produced as a result of a free service offered to organizations by the EMG Peer Review Process.

It shows that 70 per cent of energy consumption for headquarters can be reduced through measures such as making buildings more airtight, using efficient lighting, making technical improvements to boilers and cooling systems, operating data centres at higher temperatures, and using power management for computers. Figure 12 demonstrates that primary energy usage is for lighting and air-conditioning, which is the case for other organizations too. Although the information was gleaned from a comprehensive energy audit, some useful information could also be obtained through smart-metering systems; such systems would quickly validate the case for low-energy appliances.

Figure 12: Energy cost distribution in headquarters for large agency in Amman



Source: Adapted from anonymous peer review of the headquarters of a large humanitarian organization in Amman, Jordan, undertaken by Sustainable UN in 2016.

Summary of findings

Bearing in mind the limitations of the survey, the results obtained show a widespread dependence on inefficient diesel generation to power operations, as well as significant fuel cost and emissions issues in transport. Electricity use and buildings efficiency, particularly in main country offices, may also present opportunities to cut costs.

Box 7: How much could the humanitarian sector save globally?

During our research, we were often asked how much we believed the humanitarian sector to be paying for diesel globally. Most agencies do not openly report such information, which is usually only partially available internally. We therefore focused on gathering the best data we could from the three countries where we had the closest contacts with humanitarian agencies: Burkina Faso, Kenya and Jordan. Even then, data were incomplete and available only for 21 agencies in total. To extrapolate from these numbers to generate a global figure can produce only a rough estimate, which we hope will be improved upon as more data become available.

To estimate total annual expenditure on diesel in the sector, we first took the percentage of diesel spending relative to total spending in 2017 (5 per cent) for one large agency in Kenya which had the most comprehensive data. This estimate was supported by UNEP's REACT study of diesel use in electricity generation by UN peacekeeping forces globally; and by the general split between generation and transport uses of diesel as revealed by our research. To arrive at a global total, we then applied this 5 per cent figure to the total humanitarian funding allocation for 2017 of $24 billion (this includes government and private funding, including that provided to the International Red Cross and Red Crescent Movement but not funding provided to local NGOs or public-sector bodies). This gave us a figure of $1.2 billion as the estimated total annual global expenditure on fuel oil.

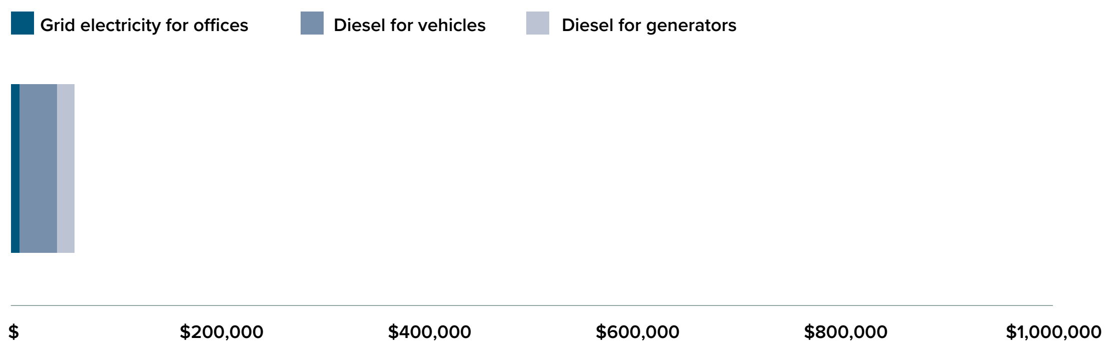
Grid electricity costs will vary wildly from country to country depending on context and tariff, so we have not included these in the estimate. However, for some agencies, based on the audits that we have seen, there will be huge savings to be made in this area.

To arrive at a figure for potential annual operational savings, we looked at the experiences of humanitarian agencies with pilot projects that reduced fuel use for a) generation and b) vehicles. To estimate the breakdown between spending in the two categories, we used the totals reported for fuel use in generation and vehicles by each of the surveyed agencies as a rough proxy for a global percentage split in use. This gave us shares of 52 per cent of spending for generation and 48 per cent for vehicles. We then applied these ratios to the $1.2 billion.

We reduced fuel spending for electricity generation by 74 per cent (a percentage derived from a WFP pilot study). We first reduced the estimate for total spending on electricity generation by 37 per cent for demand-side savings based on WFP's findings (including both behavioural change and the use of more efficient technology). While WFP reported that savings of 'up to 80 per cent' were achievable by replacing diesel with renewable energy generation, we took the more conservative figure of 60 per cent. An 'efficiency first' approach was assumed, so 60 per cent was deducted from the remaining expenditure number (i.e. after the 37 per cent reduction). Then, we reduced fuel spending for vehicles by 10 per cent (a percentage derived from the findings from UNICEF's fleet-sharing pilot scheme). This resulted in projected savings of $4 million on the global fleet's estimated annual operating cost of $40 million. The estimated savings in generation and vehicle fuel use resulted in a total potential saving, at 2017 prices, of just over $517 million per year.

Humanitarian agencies looking after roughly 32,000 displaced people in Burkina Faso use very little energy – especially outside the capital, Ouagadougou (see Figure 13). As a result, many lack access to equipment, such as computers and fans, that would help them do their jobs. Comparatively large amounts of money are spent on pumping water and running vehicle fleets, so there would appear to be options for investment and management improvements in these areas that could free up funds for improving energy access in field offices.

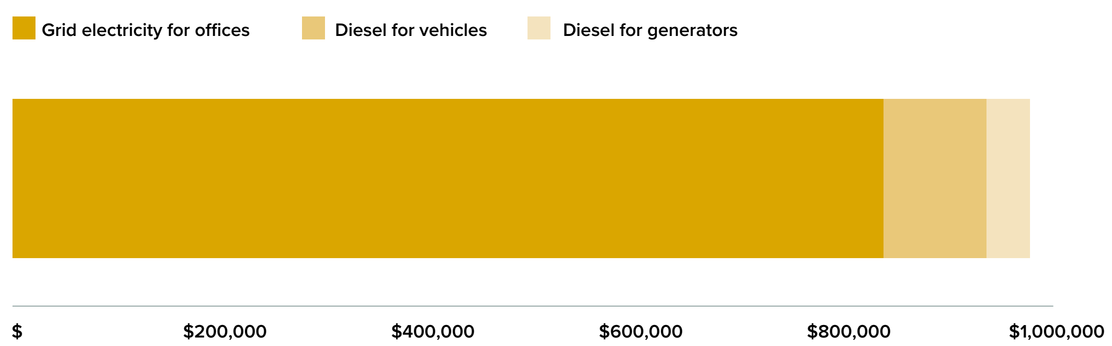
Figure 13: Overall energy spending comparison for Burkina Faso, 2015–16 data



Source: Data collected during survey and interviews with humanitarian organizations, with additional evidence collected from sustainability reports.

In Jordan, as Figure 14 shows, humanitarian agencies are mainly connected to the national grid, although they also spend substantial amounts on diesel to provide a back-up to the national grid, heat buildings and run vehicle fleets. There has been crucial progress in reducing electricity bills through the use of solar power at the two main Syrian refugee camps in the last few years, but the timing of the survey means that these gains are not represented in our data. The potential for energy savings now lies chiefly in managing vehicle fleets and improving the energy efficiency of head offices in Amman, as well as sub-national offices in Irbid, Jerash, Ajloun and others.

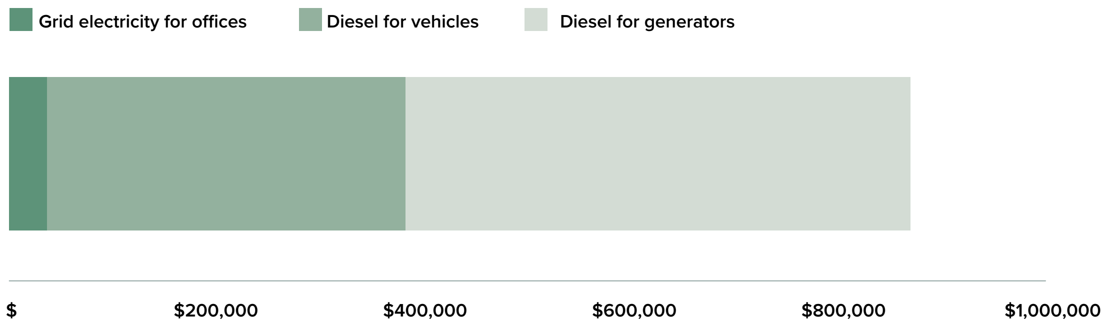
Figure 14: Overall energy spending comparison for Jordan, 2015–16 data



Source: Data collected during survey and interviews with humanitarian organizations, with additional evidence collected from sustainability reports.

Kenya probably offers the single most convincing case for attention to sustainable energy supply. Agencies in the country spend large amounts of money on diesel for generators and vehicles. The amount spent on electricity from the grid is also substantial, the majority of which is used only in the headquarters of the agencies.

Figure 15: Overall energy spending comparison for Kenya, 2015–16 data



Source: Data collected during survey and interviews with humanitarian organizations, with additional evidence collected from sustainability reports.

3. Observing Common Challenges: What Isn't Working?

Humanitarian organizations in Burkina Faso, Jordan and Kenya confront a wide range of challenges that work against cleaner, cheaper and more sustainable delivery of energy. This chapter looks at the way in which payment incentives are structured in refugee camps, the lack of capital for new investments, the mismatch between energy supply and demand, the inadequacy of maintenance arrangements for power facilities, and the lack of fleet management in respect of vehicle use by humanitarian agencies.

Although these are deemed the most significant issues, several more context-specific challenges are better explored in reference to technical assessments, where detailed management plans can be articulated to reduce risks and overcome challenges. These are articulated in Table 4.

Table 4: A selection of energy delivery challenges and possible solutions

Challenge	Possible solution
Demand uncertainty and volatility	Better data collection could define more appropriate management frameworks.
Theft and vandalism of energy equipment[I]	Similar solutions could be adopted for solar installations to those currently employed for diesel generators. Fostering community engagement and ownership could also help.
Importing equipment and obtaining necessary permits for systems and products[II]	Communication could be coordinated with local and national government, prioritizing national suppliers and ensuring adequate time for delivery.
Geographic, topographic and climatic conditions	Any materials and products identified for potential use in challenging displacement settings could be tested in similar conditions.

Notes
[I] Lahn and Grafham (2015), *Heat, Light and Power for Refugees*.
[II] Interviews with NGO respondents. This was considered a particular problem for agencies in Burkina Faso.

This is not to say that such challenges are smaller, or that the possible solutions shown in Table 4 will always be adequate or correct in every setting, but rather that such challenges can be overcome with the right amount of attention and sufficient coordination between humanitarian organizations, private-sector providers and government. In contrast, the five problems identified below are generally considered to be of primary importance for further study.

A confused incentive system in refugee camps

In Kenya and Burkina Faso, strategic oversight of energy and environmental policy is missing. This presents a major obstacle to reforms and savings. In both countries, UNHCR's supply section has negotiated agreements to purchase diesel in bulk from a national supplier.[78] Yet this section of UNHCR is not in a position to evaluate alternative methods of electricity generation properly.

The management of the diesel purchased under these arrangements is turned over to a designated implementing partner – usually an NGO – that looks after the receipt and storage of the fuel and distributes it to other partners that provide services in the camps. The current 'frame agreement' for the provision of diesel in Kenya's Kakuma camp alone covers supplies worth $5.5 million per year.[79] (In both countries diesel for electricity is treated entirely separately to that used for transport, which is overseen by the fleet management section and has its own issues – as shown later in this chapter.)

The primary benefit of this system is that implementing partners in the camps receive a relatively reliable flow of fuel to power their basic operations and programmes. By buying in bulk, agencies save money and reduce the costs of transporting fuel. The system is tried and tested, and familiar to both UNHCR and other humanitarian providers. Despite some areas of concern,[80] recent reports from external auditors of UNHCR in Kenya have largely concluded that the arrangements are satisfactory and that fuel delivery is working well in Kakuma and Dadaab refugee camps, especially when it comes to controlling for theft, saying:

> … effective controls were implemented to ensure that the quantity of fuel ordered was delivered, monthly stock takes were undertaken and consumption reports were prepared. The Representation had also put in place the necessary infrastructure for fuelling purposes and was regularly monitoring fuel consumption of vehicles and generators.[81]

Despite this, the responses of implementing partners to questions about their energy accounting practices suggest several problems.

UNHCR allocates an amount of fuel to each implementing partner in regular instalments and according to each partner's estimate of its previous usage. This leads to partners overestimating the amount of energy that they use, as they never want to be in a position of not having enough fuel. The fact that implementing partners do not pay for their own fuel use also means that they lack the incentive to save it. This 'black hole' relating to energy was apparent throughout the survey, with numerous responses to the question of fuel efficiency running along the lines of: 'It is the responsibility of another UNHCR partner.'[82]

In addition, a lack of technical expertise means that solutions are not designed appropriately for the context. Generators are oversized, there is no metering of consumption, nor are any efforts made to promote energy efficiency. At the same time, the perception of fuel being 'free' makes it difficult to incentivize behavioural change.

---

[78] This is an example of what the UN system calls 'frame agreements', where preferred suppliers are identified and can then be reused on a regular or ongoing basis without the full tendering process that is normally undertaken in procurement.
[79] Office of Internal Oversight Services, Internal Audit Division (2017), 'Audit of the operations in Kenya for the Office of the United Nations High Commissioner for Refugees', Report 2017/34, p. 7, https://oios.un.org/page/download/id/673 (accessed 7 Feb. 2018).
[80] Although largely positive, the audit highlighted that the representation should confirm the fuel density on delivery given the high incidences reported in local media of adulterated fuel where 'part of the diesel is siphoned out of the fuel tankers and replaced with low quality kerosene which is cheaper than diesel'. Staff in Dadaab and Kakuma were not aware of this risk and also lacked equipment to measure density and temperature of the fuel. Ibid., p. 7.
[81] Ibid., p. 7.
[82] Survey respondents from Burkina Faso and Kenya.

Lack of capital

Humanitarian organizations in all three countries expressed interest in renewable energy to reduce diesel use,[83] but the most frequently cited barrier to change was the capital required for introducing new systems.

Most organizations work on the basis of one-year budgets that leave limited flexibility and room for investments in energy system change.[84] Taking advantage of investment opportunities offering multi-year payback periods does not often fit with the financial and operational delivery models used by humanitarian organizations. Many do not understand the full lifetime costs of their energy infrastructure (see Box 8), nor do they have a system for financing investments based on annual savings. Agencies rarely hire (or seek help from) experts to look at possible alternatives to the status quo. Organizations that have more flexibility in their budgeting, including the International Committee of the Red Cross and Médecins Sans Frontières, have made upfront investments in energy and water efficiency on the basis of multi-year payback. For some organizations, even when such investments are made, repayments can often accrue to central funds rather than to the office that makes the saving. This weakens the incentives to adopt renewable energy projects and reduces interest in active maintenance and upkeep.

Box 8: Understanding levelized cost of energy

Levelized cost of energy (LCOE) is the most common way of measuring the cost of the power supplied over the lifetime of an investment, and of comparing different generation options. LCOE is generally understood to calculate the lifetime cost of the infrastructure (capital expenditure plus operational expenditure) divided by the total volume of energy produced, resulting in a price per megawatt hour or kilowatt hour.

In many humanitarian organizations there is little understanding of the actual LCOE of their energy supply, since they only recognize spending in one-year budget cycles. Most organizations surveyed spend a smaller amount up front on installation of diesel generators, but pay a larger amount for diesel every year.

UNHCR is doubly restricted as a result of its budget structure. For example, if one country operation took a donation to build a solar plant, it would have to relinquish the same amount of money (from other activities) to headquarters.

However, UNHCR can overcome this challenge with advance planning and the engagement of appropriate expertise. For example, the IKEA Foundation's partnership with UNHCR entailed no special arrangements but instead was planned into the budget for three years in advance of its commencement; as a result, the partnership did not have to compete with other budget priorities. In another example, the German government's partnership with the Jordanian government (see Box 6) directed funds entirely through the Jordanian government, relying on close collaboration with UNHCR to ensure that the project benefited both the agency and the refugees that the project was supporting. It is also possible for UNHCR country offices to increase budget space

[83] This finding was consistent with the 24 semi-structured interviews undertaken as part of Lahn and Grafham (2015), *Heat, Light and Power for Refugees*.
[84] Ibid., p. 34.

in a given area, in order to accommodate unforeseen projects (although this requires approval from headquarters, which can be challenging to obtain).

In fact, even when payback arrangements that would remove the need for upfront costs are in place,[85] many humanitarian organizations are still unable to proceed with solar power or efficiency upgrade projects that would save them money. This is because procurement departments often cannot commit to such agreements over the required periods, due to the perceived risk that they will be unable to guarantee payments. Humanitarian organizations therefore need to have 'money in the bank' or guarantees from a trusted lender or donor before beginning a renewable energy project. These 'loan guarantees' could provide a solution to the difficulties of signing long-term agreements in the sorts of unstable and unpredictable situations inherent to humanitarian response. Box 9 explains how this might work.

Box 9: A financier's perspective on guaranteeing a loan for sustainable energy investment

In one country example we heard about, a study by a local investment fund showed that a solar farm of 3 MW would generate approximately $1.9 million in savings each year for a large humanitarian organization, with a payback period of four to five years. To be able to finance the project, the fund needed some form of guarantee that it would receive repayments on its investment from the client. This could be in the form of loan guarantees, loan insurance, or insurance for client payments for a duration of up to 10 years (if the agency wished to make smaller periodic repayments than those implied by a four- or five-year payback schedule). The same could be achieved if a donor were to assist the humanitarian organization in making the repayments, given uncertainties over the latter's year-on-year funding. After the capital investment were paid off, the organization would own the solar assets and pay a far smaller annual fee for upkeep and maintenance, or would have gained the expertise to carry out maintenance in-house.

In some cases, it is possible that investments would be paid back within one year. In the example of USAID-funded audits of retrofitting needs in Jordanian public buildings (see Box 15), the average payback period for energy-saving measures was under one year. Such audits could be facilitated through the existing EMG Peer Review Process. The obstacles to UN agencies taking advantage of similar investments may simply be lack of awareness, lack of expertise and the inability to move savings from one planned budgetary area to another. The same calculations may apply to large buildings run by agencies.

In the long term, reform of the way budgets are structured is needed if the country offices of humanitarian organizations are to be empowered and incentivized to use their own resources to make needed investments.

[85] For example, a solar system could be installed with no upfront costs to the humanitarian organization, reducing operational expenditure by 90 per cent. For the first five years (or whatever duration was agreed), the amount paid back to the installer could be agreed to match the current levels of expenditure. After that period, the organization could reduce its operating expenditure because the 'debt' for the solar system would have been paid.

Mismatch between supply and demand – inefficient loading and distribution

One of the key challenges for any electrical system is how to match the demand from users in a given location with adequate supply. To ensure that power is always available, systems are generally built to exceed the capacity needed to meet peak demand. However, estimating the peak demand in humanitarian settings can be fraught with difficulty. In many such settings, there is the added complication of needing to maintain the critical load at all times (for example, to power a refrigerator in a health clinic that contains vital medicines). To service annual peak demand, a single generator needs to be significantly oversized compared to the average and minimum loads. UNEP estimates that for a small office in a tropical climate, demand can vary by 90 per cent over a 24-hour period, and that peak summer demand can be 30 per cent greater than peak winter demand.[86] Operating a generator at well below capacity for long periods also physically damages the equipment, raising maintenance costs and shortening its lifetime. All of this means that 'single generator systems are inherently inefficient'.[87]

UNHCR manages 99 generators to meet the requirements across the various Dadaab refugee camps in Kenya; the power rating of these generators ranges from 10 kVA to 455 kVA. Survey work for the MEI found that many of these generators were performing well below their optimal levels, with some overloaded and others systematically underloaded.[88] A high proportion of diesel is wasted due to the inefficiency of such systems. This problem is by no means unique to Kenya, with respondents from all three countries surveyed highlighting efficient operation as a challenge.

One engineer for a humanitarian organization characterized the problem of power inefficiency in the field by saying that 'the devil is in the detail – and the distribution system'.[89] Beyond oversizing, the primary problem is excessive losses of the electricity generated, due to cable resistance and leakage.[90] Tackling all of this requires technical expertise that is often lacking in humanitarian agencies.

Poor maintenance of energy systems

If humanitarian organizations are failing to optimize the performance of simple generators, how would they cope with the more advanced technology needed for sustainable energy systems? Introducing new energy systems (including those based on renewables) is likely to require new transmission and distribution systems as well as new connections. However, many of the engineers surveyed suggested that there was a widespread misunderstanding around the maintenance challenge for solar power and other renewables. Most solar systems use a type of battery that requires only basic monitoring rather than active maintenance. Newer technologies are often designed with a specific end use in mind, and have remote monitoring so that an alert is sent directly to the maintenance team if something goes wrong. But these systems often rely on phone networks, which can be unreliable in humanitarian settings. Solar systems can also be disconnected by those with a vested interest in increasing diesel use – such as vendors

---

[86] UNEP (2017), 'United Nations Electricity Supply Partnership, Programme Document, Version 2.0 for consultation', p. 27.
[87] Ibid.
[88] Okello (2016), *The Energy Situation in the Dadaab Refugee Camps, Kenya*.
[89] Conversation with senior engineer at a major humanitarian organization.
[90] UNEP (2017), 'United Nations Electricity Supply Partnership, Programme Document, Version 2.0 for consultation', p. 29.

and intermediaries in the diesel supply chain. One frequently cited issue is the presence of dust, mud or sand on the surface of solar panels, which is normally easily remedied. But a more serious problem is that systems are often designed and installed to very poor standards, using the cheapest possible equipment. In these examples, systems stop functioning after six to 12 months, with the blame attributed to dust and inhospitable conditions when in fact regular monitoring of performance and working conditions could avert such failures.

In order to structure adequate maintenance arrangements, agencies need to identify people who will carry out the maintenance. Many respondents identified lack of capacity and skills in the energy sector as the primary barrier to providing better energy services. Methods of overcoming this could include doing more to institutionalize technical knowledge, and conducting proper cost–benefit analysis within agencies. However, the necessary recruitment by humanitarian agencies of technical teams for the maintenance of systems seems a distant prospect.

Many respondents identified lack of capacity and skills in the energy sector as the primary barrier to providing better energy services.

By far the most effective solution would be for new systems to be maintained through contractual arrangements agreed with private-sector providers when equipment is purchased. In such circumstances, this would be about more than simply maintaining the equipment. Instead, it would be about transferring the risks of ownership to the private provider so that the company was paid for the performance of the asset over time rather than for its delivery. Thus, companies would not have to be told to maintain equipment; doing so would be in their interest. Other options are also outlined in Table 6.

Any arrangements would need to be clear on accountability or responsibility for product end-of-life or recycling services. While the aid and development communities are rolling out an increasing number of distributed lighting interventions, the disposal of equipment such as batteries that can be dangerous to health and the environment has received little attention. This is changing. For example, in Cox's Bazaar, Bangladesh, IOM, UNHCR, the Asian Development Bank (ADB), the Bangladesh Rural Electrification Board (BREB), Caritas, Oxfam, the Bangladesh Rural Advancement Committee (BRAC) and others are installing solar street lighting in camps in accordance with a street-lighting master plan. The organizations are working with the ADB and others to develop recycling solutions for these products, as well as for the hundreds of thousands of solar lamps distributed to households. At the moment, the plan is to create small businesses that can repair the lamps and act as depots for larger companies to collect batteries and electronics for recycling. Provision for dealing with end-of-life issues for new technologies is essential, and there are likely to be a number of possible solutions in different country contexts.

Lack of fleet management

There are two main approaches to vehicle-fleet management: the decentralized approach, in which field offices are responsible for the procurement or rental, operation and disposal of vehicles; and the centralized approach, in which the organization's headquarters procures the vehicles and provides guidelines for their utilization, maintenance and disposal.[91] Most humanitarian organizations we spoke to pursued the *decentralized* model. This finding is consistent with the experience of the majority of humanitarian organizations around the world.[92]

Although decentralized systems may be easiest to implement, centralized ones can reduce costs[93] and improve fuel and vehicle efficiency.[94] For example, one study demonstrated seven negative consequences from UNHCR's decentralized strategy, including overaged and oversized fleets, few incentives to dispose of vehicles for maximum revenue, a lack of standardization between offices, a prevalence of small-scale procurement that limits the opportunity for economies of scale from suppliers, limited understanding of costs, and low levels of investment in fleet management training.[95] UNHCR's move to a centralized model of fleet management in its 2014–18 Internal Leasing Programme has led to an 11 per cent reduction in fleet size, a 21 per cent decline in the age of its vehicle fleet, a 21 per cent reduction in procurement costs (saving $5 million per year), and increased standardization among the fleets (variations between which have decreased by 34 per cent).[96] Pooling fleets among agencies could lead to further efficiency gains (see Box 10).

Box 10: UNICEF's 'Fleet Sharing Proof of Concept'

In June 2017 the United Nations Children's Fund (UNICEF) was awarded the Fleet Forum 'Best Transport Achievement Award' for demonstrating that fleet sharing in humanitarian settings can achieve large cost savings, improvements in driving behaviour and reductions in the overall number of vehicles required in the fleet.

The United Nations Population Fund (UNFPA) Innovation Fund funded three organizations – UNFPA itself, UNICEF and the United Nations Development Programme (UNDP) – to implement a 'Fleet Sharing Proof of Concept' scheme across five pilot countries: Laos, Lesotho, Mongolia, Pakistan and Zambia. This involved the three agencies pooling 124 vehicles across the target countries into a single fleet. This fleet was then managed through an online booking system combined with a vehicle-tracking system. Individuals requiring a vehicle booked it online, and details of the journey were logged by the tracking system. This automatically showed where trips by different groups and individuals could be combined, thus reducing the number of vehicles needed.

---

[91] The literature also defines a hybrid model that mixes these two approaches, as well as a fourth model whereby vehicles are hired, leased or rented when required from an external agency. See Pedraza Martinez, A., Stapleton, O. and Van Wassenhove, L. N. (2011), 'Field vehicle fleet management in humanitarian operations: A case-based approach', *Journal of Operations Management,* 29(5), pp. 404–21; and Balcik, B., Beamon, B. M., Krejci, C. and Ramirez, M. (2010), 'Coordination in humanitarian relief chains: Practices, challenges, and opportunities', *International Journal of Production Economics*, 126 (1), p. 21.

[92] This is perhaps more common because it mirrors the decentralized nature of the humanitarian system. See Kunz, N., Van Wassenhove, L. N., McConnell, R. and Hov, K. (2015), 'Centralized vehicle leasing in humanitarian fleet management: the UNHCR case', *Journal of Humanitarian Logistics and Supply Chain Management*, 5 (3), pp. 387–404.

[93] Pedraza-Martinez, A. and Van Wassenhove, L. N. (2013), 'Vehicle Replacement in the International Committee of the Red Cross', *Production and Operations Management*, 22 (2), pp. 365–76; and Eftakhar, M. (2015), 'Fleet Management in the Humanitarian Sector', *Decision Sciences*, 46 (2), pp. 447–53.

[94] Kunz et al. (2015), 'Centralized vehicle leasing in humanitarian fleet management'. Besiou et al. suggest that decentralization may present the best results in the context of a particularly large humanitarian emergency. They find that a higher level of decentralization improves flexibility and decision-making in disasters and acute emergency response. Besiou, M., Pedraza-Martinez, A. J. and Van Wassenhove, L. N. (2014), 'Vehicle Supply Chains in Humanitarian Operations: Decentralization, Operational Mix, and Earmarked funding', *Production and Operations Management*, 23 (11), pp. 1950–65.

[95] Kunz et al. (2015), 'Centralized vehicle leasing in humanitarian fleet management', pp. 393–95.

[96] Ibid., pp. 397–98.

The pilot scheme tested the ease of use of the system, users' willingness to adopt it, the effectiveness of the technology, and the quality of the data and analysis delivered.

The resulting analysis showed that vehicle use dropped dramatically and that, in effect, fleets had been 10–15 per cent larger than necessary before optimization. There was also a high level of improvement in driving behaviour in all the countries; for example, with regard to speeding, excessive acceleration, sudden braking etc.

The payback period for the early-stage costs – including hardware and installation, administrative set-up and training, as well as the monthly service subscription fee – was realized in a matter of months. UNICEF estimates that rolling out this system throughout the organization could cut costs by as much as $4 million per year.[97]

[97] Fleet Forum (2017), '2017 Fleet Forum Best Transport Achievement Award', 16 June 2017, http://www.fleetforum.org/2017/06/16/2017-fleet-forum-best-transport-achievement-award/.

4. Taking Advantage of Common Opportunities: What Can Be Achieved?

Ending the 'diesel first' mindset

In almost every humanitarian situation in which a diesel generator is in operation, there is a cost case (as well as an environmental one) for the hybridization or solarization of the energy infrastructure. The falling costs of renewable energy solutions, particularly solar, mean that renewables are becoming increasingly price-competitive against diesel generators when costs are factored in over the lifetime of such systems. Of course, the competitiveness of alternative energy will depend on a number of factors: local cost differences relative to diesel fuel and grid electricity; fuel transportation distances; regulations governing the sector; import tariffs; and standards of local market development. Nonetheless, payback times tend to be in the range of two to six years, depending on these factors and existing generator efficiency levels.

It has been predicted that the levelized cost of electricity from solar photovoltaic (PV) systems – now almost a quarter of what it was in 2009 – is set to drop by a further 66 per cent by 2040.[98] Such projections are starting to be replicated in assessments taking place in humanitarian settings. In 2017 a study comparing solar PV with traditional energy sources in three refugee camps in Kenya, Jordan and Turkey projected a consistent price reduction of over 50 per cent per kWh by switching to solar PV.[99]

A common response from the humanitarian sector is that it simply is not practical to think in terms of the lifetime of a solar panel because refugee situations are temporary. However, the average lifetime of a refugee camp is 18 years.

Humanitarian operations are often located in remote parts of the hosting country without access to the electricity grid, and camps may be deliberately located as far away from other urban centres as possible. Delivering diesel and petrol to generators raises the costs of electricity.[100] For example, Kakuma refugee camp in Kenya is approximately a 15-hour drive from the capital, Nairobi, and the journey crosses areas widely considered to pose a security risk.

[98] Bloomberg New Energy Finance (2017), 'Global wind and solar costs to fall even faster, while coal fades even in China and India', 15 June 2017, https://about.bnef.com/blog/global-wind-solar-costs-fall-even-faster-coal-fades-even-china-india/ (accessed 10 Mar. 2018).

[99] In terms of absolute price, this translated to a reduced average energy cost of $0.14/kWh, compared with up to $0.35/kWh for diesel and $0.50/kWh for electricity from the grid. Corresponding annual cost savings would reach $45,000 in Sanliurfa, Turkey; $140,000 in Zaatari, Jordan; and up to $2 million in Dadaab, Kenya. Additionally, annual emissions would drop by around 1,000 tons of CO_2 in Turkey and Jordan, and over 15,000 tons in Kenya. Ossenbrink, J., Pizzorni, P. and van der Plas, T. (2018), 'Solar PV systems for refugee camps: A quantitative and qualitative assessment of drivers and barriers', Group for Sustainability and Technology, D-MTEC, ETH Zurich, https://www.ethz.ch/content/dam/ethz/special-interest/mtec/mtec-department-dam/news/files/solar-pv-in-refugee-camps (accessed 10 Feb. 2018).

[100] However, developing countries in Asia, led by India, have made significant progress in allowing their populations to access electricity via their national grids, and the electrification rate in the region reached 89 per cent in 2016, up from 67 per cent in 2000. China reached full electrification in 2015, while 100 million people in Indonesia and 90 million in Bangladesh have gained access since 2000. Electrification efforts in sub-Saharan Africa outpaced population growth for the first time in 2014, leading to a decrease in the number of people without access in the region. See International Energy Agency (2017), *Energy Access Outlook 2017*, https://www.iea.org/publications/freepublications/publication/WEO2017_Special_Report_Energy_Access_Outlook_ExecutiveSummary_English.pdf (accessed 8 Jan. 2018).

The challenge in remote and emergency operations remains to end the 'diesel first' mindset. This requires a strong business case. A common response from the humanitarian sector is that it simply is not practical to think in terms of the lifetime of a solar panel because refugee situations are temporary. However, the average lifetime of a refugee camp is 18 years.[101] All the interventions described in Table 5 pay back the original capital investment within no more than 7.4 years, and several pay it back within one year. Overall, the huge potential of renewables remains largely untapped, although Box 11 gives an example of the increasing appetite of the humanitarian sector for investigating solar-powered water-pumping solutions, which demonstrate attractive payback periods.

Box 11: The Solar and Water Initiative's field visit to refugee settlements in northern Uganda

The Regional Office of the International Organization for Migration (IOM) in Nairobi coordinates a Global Solar and Water Initiative that aims to demonstrate the potential for solar-powered water pumping to be widely adopted by the humanitarian sector. The European Commission Humanitarian Aid Office provides funding, while an interagency technical working group including IOM, UNHCR, UNICEF, Save the Children, World Vision, Oxfam and the Norwegian Refugee Council provides guidance, advice and practical expertise.

In January and February 2017, the initiative conducted climatic, hydrological and other technical assessments in 12 refugee settlements, across five different locations in northern Uganda (Kyriandongo, Adjumani, Moyo, Yumbe and Arua). Engineers then identified 23 unequipped boreholes with high potential for mechanization. The studies recommended motorizing them all with either solar stand-alone or solar-diesel hybrid systems able to jointly supply 2,550 cubic metres (m^3) per day, or water for 170,000 people (or up to 6,050 m^3 per day, or water for 403,000 people, if the pumping time of generators for hybrid solar-diesel schemes were to be extended during the night).

The initial capital cost of solarizing the boreholes is estimated at $1.3 million, $460,000 more than the capital cost of installing diesel generators. This means that, on average, the capital cost of the solar-powered solution is $20,000 higher per water-pumping point. However, the economic analysis showed an average break-even point for the solar investment of only 1.1 years, and an average reduction in lifetime expenses (capital costs plus all the others) of 66 per cent compared to a diesel investment. In other words, the cost of the solar systems proposed is one-third that of their equivalent diesel-generator ones.

Source: Llario, A. (2017), 'Visit report to Uganda – February 2017', Global Solar and Water Initiative, available on request from solarquery@iom.int.

[101] See Appendix A.

Another factor is that the vast majority of countries hosting large humanitarian missions also have high solar PV potential. On average, the solar capacity of the top 10 refugee-hosting countries is twice that of the United Kingdom.[102] In the right location, there is similar potential from other renewable energy sources such as wind (for example, in Kakuma refugee camp in Kenya) or small hydro (for example, in Nepal).

The availability of containerized mobile solar/hybrid solutions which may be appropriate for transitory and temporary humanitarian situations is increasing.[103] This technology has proven reliability, is operated easily and is not significantly more expensive than rooftop- or ground-mounted solar systems, while the containerized nature of the product reduces the cost and difficulty of assembly since the solution is typically delivered pre-assembled, configured and tested to reduce on-site labour. These solutions will allow increasingly standardized products to enter the market, which may prove attractive for humanitarian organizations with strict procurement policies, further reducing costs and easing maintenance challenges.

Table 5 lists some of the typical functions of humanitarian agencies and details case-specific costs associated with powering these functions using diesel. It also lists the capital investments required for introducing sustainable energy solutions, and the new operating costs that would produce savings for agencies.

[102] The former falling as low as 1.3 m^2 per household, compared to a UK requirement of 3.9 m^2 for the same kWh output. Modelling assumptions for this configuration can be found at http://globalsolaratlas.info/knowledge-base/how-it-works (accessed 14 Dec. 2017).
[103] Containerized solutions normally refer to systems that are included in a box or container. Such solutions can include inverters, transformers, batteries, back-up generators, sophisticated control systems and pre-installed security systems, all housed in a prefabricated building. Many companies are now offering these solutions.

Table 5: A cost case for switching away from diesel – selected cases[I]

Function	Example of sustainable approach, including size of system	Running cost	Capital costs needed to introduce solution	Operating costs associated with sustainable change	Status of project
Water pumping[II]	The Global Solar and Water Initiative (see Box 11) investigated introducing solar or solar/hybrid pumps to 23 previously non-equipped high-yielding boreholes at five sites in northern Uganda.	The total sum required to install diesel-powered water pumps across the 23 sites was estimated at $840,000. The average life-cycle cost of 23 diesel water-pumping systems was estimated at $232,622.[III]	It was estimated that $1.3 million was required to install solar- or solar/hybrid-powered water pumps across the 23 sites. The average life-cycle cost of 23 solar or solar/hybrid water-pumping systems was estimated at $115,377.[IV]	Economic analysis shows that the solar or solar/hybrid solutions would bring an average lifetime reduction of installation, operation and maintenance costs of 66 per cent. The average break-even point for the 23 sites was estimated at 1.1 years.	Assessments were conducted in January and February 2017. Similar assessments were also conducted in South Sudan. The Solar Water Working Group technical helpline continues to offer a helpdesk function to support solar water-pumping solutions.
Warehouse storage	WFP installed a hybrid wind/solar/diesel-powered system – commissioned in February 2015 – to power its warehouse facility in Herat, Afghanistan (see Box 4).	$212,324 per year to keep in operation – largely for the cost of providing diesel to the generators that power electricity and cooling facilities.	$528,948 to install the new hybrid power system.	Ongoing savings of $57,391 per year with full payback in 5.2 years. Over the lifetime of the system (15 years), the hybrid power system is estimated to save nearly $900,000 for WFP.	Still in operation and performing as per initial expectations. Payback period is 5.2 years. Savings to date are $148,115.
Providing electricity to whole refugee camp	UNHCR installation of solar farm at Azraq refugee camp in Jordan – initially a 2-MW system in 2017, upgrading to 5 MW through 2018–21 in two phases of 1.5 MW.	Not applicable since refugees did not previously have access to electricity (although they were paying for diesel).	€8.75 million needed to install the solar farm.	Ongoing savings of $2 million per year for UNHCR compared to paying for the additional electricity from the national grid, and a reduction in CO_2 emissions by 2,240 tons per year. Overall payback of around 7.4 years, although when the project is expanded these savings will increase and further reduce CO_2 emissions.	3.5-MW system online.[V] After all three phases are complete, solar system will cover 70 per cent of Azraq camp's energy needs.

Function	Example of sustainable approach, including size of system	Running cost	Capital costs needed to introduce solution	Operating costs associated with sustainable change	Status of project
Medical facilities	The International Rescue Committee (IRC) runs a number of health clinics and hospitals in Kakuma refugee camp in Kenya. The Moving Energy Initiative worked with IRC and Kube Energy to install new solar systems in Clinics 5 and 6. A 36-KW system was installed at Clinic 6, and a 3-KW system at Clinic 5. Both systems include battery storage.	Clinic 6 previously spent $2,334 per month on diesel for power generation, or $22,008 per year. IRC did not previously have power at Clinic 5. However, IRC had planned to install a 10-kVA diesel generator to run 16 hours per day and provide basic power at Clinic 5. This generator would have cost $10,000 to install. It would have consumed approximately 450 litres of fuel per month, at a cost of $675 per month ($8,100 per year).	$200,000 was granted to Kube Energy to enable it to pay the capital costs of purchasing and installing the systems in collaboration with IRC.	Total energy costs, including maintenance and depreciation of the energy systems, have been reduced to $500 per month (for operation and maintenance). IRC will also reduce its fossil fuel consumption in these clinics by 100 per cent (around 72,000 litres annually). Overall payback (had the project been undertaken at cost to IRC) would have been just under five years (including the projected diesel costs at Clinic 5).	Solar systems were installed in June 2018 and, at the time of publishing, are still meeting 100 per cent of power needs. Spare capacity in the system means that there is room for IRC to upgrade its medical facilities and service provision at the clinics; or, alternatively, to develop connections with other enterprises near the clinics.

Function	Example of sustainable approach, including size of system	Running cost	Capital costs needed to introduce solution	Operating costs associated with sustainable change	Status of project
Office buildings	One humanitarian organization in Juba, South Sudan, has investigated installing a hybrid/solar PV system to provide 24/7 power to its offices. The system suggested in September 2017 would have a 292-kWp solar array and a 1,400-kWh battery bank.	The organization currently spends $33,000 a month to run its country offices.	The solar system would operate on a leasing model, so no large upfront costs would be needed.	The monthly energy costs would be reduced to $27,000, saving the organization £350,000 during the five-year lease, and reducing expenditure by $180,000 every year thereafter if the lease is renewed. The contract would stipulate a monthly payment of $20,500, together with residual diesel use equivalent to $6,600 per month.	Not yet commissioned. The organization could find no way of procuring the system without donor funding and special dispensation to proceed from its procurement division.
Education facilities/ schools[VI]	Alianza Shire increased the sustainability and efficiency of a training centre in Adi-Harush camp, Shire, Ethiopia, by upgrading the electrical connections (including protections) during field missions undertaken between 2014 and 2017.	Although connected to the grid already, the training centre paid €7,000 per year for the diesel generator that backs up its power supply.	Alianza Shire paid a total of €10,000 (including spare parts) for the materials and workforce for the project.[VII]	The time that the training centre uses the generator decreased by 30 per cent, saving around €2,000 per year.[VIII]	The training centre is still working well.

Notes

[I] The categories listed in this table are adapted from Franceschi, J., Rothcop, J. and Miller, G. (2014), 'Off-Grid solar PV power for humanitarian action: from emergency communications to refugee camp micro-grids', *Procedia Engineering,* 78, pp. 229–35.

[II] Llario, A. (2017), 'Visit report to Uganda – February 2017', Global Solar and Water Initiative, available on request from solarquery@iom.int.

[III] These figures are derived from authors' analysis of the data from Llario (2017), 'Visit report to Uganda – February 2017'.

[IV] Ibid.

[V] UNHCR (2018), 'Azraq Refugee Camp Fact Sheet', https://data2.unhcr.org/fr/documents/download/61996 (accessed 10 Jul. 2018).

[VI] All details supplied by Alianza Shire, http://www.itd.upm.es/alianzashire/.

[VII] This cost is supplied by Alianza Shire but also includes work connecting a primary school to the grid, so the actual costs are likely to be lower.

[VIII] Analysis from Alianza Shire.

Humanitarian energy use as a ‘baseload’ for improving broader energy access

Overhauling the energy practices and infrastructure of humanitarian organizations offers opportunities not only to improve their own energy use, but also to improve the energy access of refugees. If private-sector operators (for example, green mini-grid developers) were assured of payment for supplying electricity each month, this could incentivize them to take on the challenge of providing power to refugee households. This could create significant opportunities in terms of improved livelihoods, educational outcomes and general quality of life. Having the certainty of an anchor load (for those infrastructure assets that require a constant or regular supply of energy) from a buyer with a good credit risk profile would give confidence to suppliers and their investors/lenders, as well as reduce the level of contingency (or risk) that a business may have to build into its planned operations.

Given that around 90 per cent of residents of camps have the lowest possible levels of access to electricity,[104] and that many host communities around camps face similar challenges, there is also a large opportunity to expand access for displaced people once agencies have committed to purchasing a basic amount every month. Surveys undertaken for the MEI have already revealed that refugees in Kakuma, Kenya and Goudoubo, Burkina Faso place a high priority on energy access and are willing to pay for reliable provision.[105]

Box 12: Trialling new contractual arrangements

Written by Ben Good, CEO, Energy 4 Impact

In 2017, the Moving Energy Initiative (MEI) completed an evaluation of the feasibility of using private-sector ‘contract mechanisms’, particularly those relating to public–private partnerships, for Kalobeyei settlement in northern Kenya.[106] The evaluation reviewed both the existing infrastructure and the infrastructure planned to accommodate future growth in the camp’s population. Identifying the relevant ‘anchor points’ and assuming that the UN Refugee Agency (UNHCR) would pay for provision, the evaluation focused on identifying the most appropriate mechanism for supplying energy. A solar/diesel hybrid mini-grid solution would require more capital than a diesel solution, but the reduction in operational costs would mean a payback period of only four years. After this period, the costs for UNHCR would be significantly reduced.[107] Such a solution would improve electricity-supply resilience and reliability as well as allow flexibility in adapting future supply to fluctuations in the settlement’s population.[108]

The overall message is positive and suggests that such agreements could be beneficial to humanitarian agencies, based on the principle that energy is not a core competence of theirs and could be better managed by energy professionals.

However, if the idea is to create a business opportunity for private owner-operators of power

[104] Lahn and Grafham (2015), *Heat, Light and Power for Refugees*, p. 7.
[105] Corbyn and Vianello (2018), *Prices, Products and Priorities*.
[106] This settlement varies from its neighbour, Kakuma, in that it is a planned, mixed-community settlement, hosting refugees and Kenyan nationals. Given the planned nature of the community, there is significant potential for realizing energy savings by also planning for energy provision (demand and supply). Planning creates confidence and therefore mitigates potential risks, particularly those that are mitigated through a conventional response of providing overcapacity.
[107] Initial consultations have shown that, provided the revenue streams can be ensured and other concerns ameliorated, the private sector could finance the capital provision of the project.
[108] Each scenario considered would provide approx. 1,037 kWh/day of power to an institutional base load.

assets – with the owner-operators taking on the financing obligations and performance risk of the assets, and being paid on a per-kilowatt-hour basis – then there are also challenges to work through.

First, it is necessary to understand relevant regulations in the host country, and how these relate to different types of mini-grids and projects in refugee camps.

Second, the assessment needs to understand the balance between the anchor load (borne by the humanitarian agency) and household/small enterprise demand, the latter of which is more uncertain in terms of volume and price/payment risk.

Third, work is needed to understand how technical and safety issues associated with connecting (most often) flimsy shelters to an electricity source can be addressed.

Fourth, if it is considered that households will pay directly for the electricity they consume, then agreeing a tariff that is reflective of costs and understanding how to collect payment are significant issues. So, too, is understanding whether there should be any underwriting by an agency of the 'volume risk' from the households – that is, the risk that household demand will be lower than expected.

Fifth, if there is pressure to supply neighbouring host communities, then the economics of extending the distribution system in pursuit of potentially less certain demand will have to be considered.

Sixth, it may be necessary to take into account the special operating environment of an individual camp; for example, logistics considerations if it is in a remote location, safety and security issues, or the availability of local skills.

Finally, notwithstanding the average lifetime of a refugee camp, private-sector investors need to understand what would happen in the event of early closure of the camp. It is possible that the generating and storage assets could be economically redeployed, but this risk ('longevity risk' in Table 6) should be understood in advance. It seems unlikely that it will be possible to pass this risk wholly to the private sector.

A more detailed analysis of this issue is available in Patel, L. (forthcoming, 2018), *Infrastructure Management Contracts – Improving Energy Asset Management in Displacement Settings*, Research Paper, London: Royal Institute of International Affairs, https://mei.chathamhouse.org/resources/reports.

Table 6 shows some of the commercial structuring options for increasing private-sector participation in the supply of power in refugee camps, and in particular how risk is allocated between the parties in the different structures. The table presents a very simplified picture. Multiple variants of these structures are being applied in other contexts, and in an actual transaction the risks would be specified in much more detail. Nevertheless, the broad concepts are illustrated; moving from left to right across the table, the options become simpler and closer to current practice, but they also lose the benefits of a more wholesale transfer of risk and responsibility to the private sector.

Table 6: Commercial structuring options for increasing private-sector participation in the supply of power to refugee camps

	Concession	Build-own-operate (anchor load only)	Design-build-operate (anchor load only)	Design and build
Role of company	Owns and finances the assets, and charges anchor customer and refugees for power.	Owns and finances the assets, and charges anchor customer for power.	Supplies/installs the assets and manages long-term operations.	Supplies/installs the assets.
Role of public/ humanitarian agency	Buys power at a given $/kWh rate (possibly also with an availability fee).	Buys power at a given $/kWh rate (possibly also with an availability fee)	Pays the capital cost of the assets, and subsequently a given $/yr or or $/ kWh operation and maintenance fee.	Pays the capital cost of the assets, and subsequently operates the assets in-house.
Risk allocation				
Revenue risk – anchor customer demand volume	Shared	Shared	Public/ humanitarian agency	Public/ humanitarian agency
Revenue risk – household/ small enterprise demand volume	Company	Not relevant	Not relevant	Not relevant
Revenue risk – anchor customer credit/ payment	Public/humanitarian agency	Public/ humanitarian agency	Public/ humanitarian agency	Public/ humanitarian agency
Revenue risk – household/ small enterprise credit/payment	Company	Not relevant	Not relevant	Not relevant
Asset performance/ maintenance risk	Company	Company	Company	Public/ humanitarian agency, company
Longevity risk	Public/humanitarian agency	Public/ humanitarian agency	Public/ humanitarian agency	Public/ humanitarian agency
Technical specification risk	Company	Company	Shared	Public/ humanitarian agency, company

A final point to note is a potential issue around the alignment of incentives with respect to energy efficiency. As discussed elsewhere in this paper, in many locations there may well be an opportunity to save money and reduce carbon emissions by improving energy efficiency practices. Where this requires technical advice, it will be necessary to think about how to achieve this with a private operating partner whose financial incentive may be to maximize the amount of electricity sold.

Get the incentives right

There is currently little incentive, either in terms of reward or penalty, for the country operations of humanitarian organizations to reform their energy use. It is not possible to incentivize behaviours that cannot be measured, so transparency and better data are the first step in getting the incentives right. Yet doing this requires a commitment and ideally a target set by each organization's leadership.

Many leaders recognize that their agencies use too much fuel and would like to change institutional practices around energy use. However, agencies' costs are normally similar to those of other organizations working around them, and external pressure for reform – that is, from donors or host-country governments – is rare. Inefficient and wasteful practices have become the norm.

In several striking cases, including in Kenya and Burkina Faso, the single clearest barrier to doing things better is that many humanitarian organizations receive fuel distributions from whatever implementing partner is contracted by UNHCR to do so.

Ideally, all implementing partners would pay for the fuel that they use and would be able to transfer savings from fuel reduction to other areas of their work. UNHCR could consider ways to make individual humanitarian organizations responsible for their fuel allowances.

Changing this system requires a coordinated effort. With sector-wide targets for phasing out diesel for power generation and increasing transport efficiency by a target amount, it would be best if all organizations (UN agencies and implementing partners) were to move together. Distribution should be monitored and recorded, and implementing partners provided with incentives to maximize their efficiency. If such partners are able to provide the same level of services with less fuel, the savings could be recouped as part of their contract with UNHCR. It is possible that different models will be suitable for different types of camps, but in all cases tracking usage will be the first step.

Another way to reduce waste on a system-wide level would be to create an entity specifically tasked with doing so. For example, the establishment of a 'UN Utility' is one solution under discussion at the time of writing (see Box 13). Such a utility model would benefit from becoming specialized in humanitarian situations, and avoiding the bureaucratic hurdles that may be involved in contracts with external providers. However, the model suggests a supply-oriented role rather than one that seeks more holistic efficiencies, and there is a danger that it would miss out on the most cost-effective delivery, which may be from local businesses. An energy service company (ESCO) model may avoid some of these pitfalls. Under this model, the ESCO could house the technical expertise needed to conduct procurement for the sector; it could be self-funded through savings generated from efficiency improvements and renewable energy projects.

There will be some losers in a move away from diesel. Diesel retailers and distributors will have reduced income unless they are able to offer alternative services. The demand for local drivers may go down as aggregate vehicle use declines. But savings could also be rechannelled into improving energy access for households in camps, or in other areas deemed most urgent for displaced families and surrounding communities – these efforts could generate jobs.

Box 13: Is a 'UN Utility' the answer?

The United Nations Environment Programme (UNEP) is aware of the huge demand for energy from vulnerable populations, and of the large sums spent by the UN system on providing power in complex emergency situations.

One potential solution proposed is to create a 'UN Utility' with the ability to install and operate sustainable and high-standard mini-grids. It would be capable of operating on a full cost-recovery basis but also of providing subsidized and donated services as and where appropriate. Because a UN Utility would be part of the UN system, it would have an advantage over private companies in not being seen to be chasing a profit. Since the model would be intended to be demand-driven, it would work only where it was wanted. And, since the model would be intended to benefit countries with lower levels of energy access, it would also be filling a gap 'where electricity markets are too small, remote, undeveloped or unstable to support a standard market model'.[109]

This proposal would need to address several challenges. Given the UN system's inability to access commercial debt, a UN Utility would need to be able to structure a financial model built around government export-credit agencies, development banks or social investors. It would also need to resolve questions relating to cost-recovery protection for companies leasing equipment. Such an entity could in theory benefit from economies of scale in purchasing power, but it might also suffer from inflated staff costs in comparison with the local private sector. These are issues that are recognized and under study.[110]

Perhaps more fundamentally, questions would need to be asked about cost and principal–agent issues. Would a large multinational organization with no track record in the delivery of electricity be the most qualified actor to fulfil such a role, particularly when the private sector is already keen to play it and is actively seeking ways of engaging UN entities in better solutions? How would such an organization be regulated for effectiveness and commercial competitiveness when it would require the necessary expertise working from within it? The term 'utility' also still suggests an entity incentivized to sell power, when in some cases the best solutions may lie with improving infrastructure.

[109] UNEP (2017), 'United Nations Electricity Supply Partnership, Programme Document, Version 2.0 for consultation', p. 2.
[110] Ibid., pp. 66–73.

Facilitating institutional change in humanitarian organizations

Integrating sustainable development policies throughout humanitarian organizations needs to be a bottom-up process as well as a top-down one. While every organization needs to work according to its own context-appropriate capacity and culture, huge cost savings could be available to those able to structure the right management systems that can align incentives, generate the correct data, put expertise in the hands of the right managers and translate policies from headquarters to field level.

WFP estimates that it can save around 10 per cent of its expenditure on energy by enabling staff to change behaviour (for example, closing doors, turning off computers and air-conditioners), and up to 30 per cent by making existing equipment more efficient (for example, replacing light bulbs and air-conditioners). In some field offices, cost calculations have estimated that the potential for efficiencies is so large that a person could be hired only to close doors and turn off air-conditioners and their salary would be paid back twice over within a year.[111]

In order to make this change, humanitarian agencies would need to be supported in capturing better data on energy use. To do this, they need to be able to know that concerns about energy use are being adopted at headquarters and that an organizational approach has been established that embeds targets, performance objectives and training into its philosophy. Unlocking a virtuous circle of data-driven decision-making, accountability and policy within humanitarian organizations can offer huge potential for financial and environmental savings.[112]

Box 14: WFP's Energy Efficiency Programme and internal carbon tax

WFP Engineering provides small grants to the operations of the World Food Programme (WFP) to assist in implementing lost-cost energy efficiency measures. Through the Energy Efficiency Programme (EEP), a carbon levy was imposed on the vehicle fleet, which means that country offices that purchase new vehicles pay a tax that accrues to a central fund with the EEP team. Money from this fund is then distributed to WFP country offices as grants or loans. Most often the fund covers the full cost of energy surveys and up to 75 per cent of the capital costs for implementing energy efficiency and/or fuel-switching projects (including renewable energy installations) after meeting basic criteria.[113]

A reduction of approximately 1.6 per cent in energy use for the organization has been achieved from the $2.8 million invested in 40 greening projects in 13 countries. These will see an annual reduction in greenhouse gas emissions of around 2,600 tonnes of CO_2 and annual cost savings of $1.35 million, which WFP highlights as 'equivalent to providing 14,839 school meals for a year'.[114]

[111] Cost calculations performed by one humanitarian organization estimating the salary of a person in a low-income country at $2,000 per year and the efficiency savings forgone through leaving air-conditioning units on and doors open at $4,000 per year.
[112] These issues are investigated in more detail in the corresponding toolkit. Grafham and Lahn (2018), *Powering Ahead*.
[113] WFP (2017), 'Green Kit', WFP Innovation, https://innovation.wfp.org/project/green-kit (accessed 16 Dec. 2017).
[114] WFP (2017), 'WFP Energy Efficiency Strategy', https://docs.wfp.org/api/documents/28d04e720a2841bfbabff482af2b3773/download/ (accessed 16 Dec. 2017).

Get efficient

Large agencies and donors in Jordan and Kenya (particularly those whose regional headquarters are based there) might be able to replicate what has been done in large commercial or government buildings elsewhere. Box 15 explains the business case for efficiency and renewable energy investments in ministry buildings in Jordan. The government-wide recommendations of the study cited could also be applied to large humanitarian agencies. These are to:

- establish an overall energy committee and energy managers in each agency;
- collect basic information on energy consumption and the physical dimensions of buildings to enable benchmarking;
- procure energy audit services from a licensed energy auditor;
- use audits to set energy-savings goals;
- implement cost savings with a payback period of one year or less;
- monitor and evaluate progress in order to improve delivery, and consider investments in implementing actions with longer-term payback periods; and
- establish incentive schemes that encourage agencies to pursue energy-savings opportunities, and recognize and reward agencies and employees that implement energy-savings measures.

Box 15: Energy audits of government buildings in Jordan – could humanitarian headquarters do the same?

Between 2013 and 2016, the US Agency for International Development's Energy Sector Capacity Building programme carried out energy auditing and capacity-building for six government agencies in Jordan in order to develop a government-wide energy-saving action plan. The findings are highly relevant to large humanitarian agencies with offices in the country. The programme first carried out ASHRAE level II energy audits to identify conservation measures that could be implemented by each agency to generate cost savings.

The results showed that agencies could achieve 30–40 per cent reductions in electricity bills and 5–20 per cent reductions in fuel bills. The largest savings were available firstly from replacing existing lighting with LED lamps; and secondly from optimizing the use of air-conditioning through temperature setting, periodic maintenance and the installation of ambient heat recovery systems. The study showed that payback for all buildings would be within one year, and that thereafter the measures would generate thousands of dollars in savings for each entity. To date, the Ministry of Information and Communication Technology has invested in some of the recommended actions, including in renewable energy, from its own budget. Even though its staff increased by 25 per cent after the baseline measurements were conducted, in actual terms the ministry reduced its electricity bill by 20 per cent in the first year, for a saving of over $55,000. The efficiency interventions paid back on the initial investment in eight months, and at this rate the solar photovoltaic (PV) system will take four years to repay its investment.

Table 7: Projected energy and cost savings for energy conservation measures

Ministry/ agency	Saving in electricity consumption (%)	Saving in fuel consumption (%)	Overall energy bill savings (%)	Implementation cost (JOD and US$)	Annual savings (JOD and US$)	Payback period (years)
Ministry of Energy and Mineral Resources	39.7	12.5	40.3	JOD 22,860 ($32,153)	JOD 37,430 ($52,617)	0.61
Ministry of Foreign Affairs	32.3	8.5	32.6	JOD 45,500 ($63,997)	JOD 80,880 ($113,698)	0.56
Ministry of Industry, Trade and Supply	35.5	7.0	33.3	JOD 133,100 ($187,209)	JOD 122,220 ($171,812)	1.0
Ministry of Social Development	30.7	6.5	27.4	JOD 41,600 ($58,511)	JOD 51,500 ($72,396)	0.81
Ministry of Information and Communication Technology	31.2	6.1	29.6	JOD 32,540 ($45,768)	JOD 63,000 ($88,563)	0.52
Energy and Minerals Regulatory Commission	33.0	19.5	31.3	JOD 37,250 ($52,393)	JOD 41,000 ($57,636)	0.9

Source: ‘Energy Savings Action Planning for Government Buildings in Jordan’, Deloitte Consulting, July 2016.
USAID/Ministry of Information and Communication Technology case study, 2017.

5. Conclusions and Recommendations

We roughly estimate that around 5 per cent of humanitarian agency expenditure is dedicated to oil fuel and oil-fuelled generation – a share equivalent to $1.2 billion in 2017. The overall picture of energy use by humanitarian agencies is one of inefficiency and therefore wastefulness. This stands in contrast to the overall ambitions of the sector to do no harm, in terms both of global climate and local environment. The will to change is there, and several large agencies have made significant progress, but greater focus and resources are needed to make step changes in the way things are done and to bring the sector into line with the UN system's commitment to carbon neutrality.

The examples of good practice described in this paper show that it is possible to do things better, and in many cases to save valuable funds that could be diverted to core humanitarian ends. Drawing on the examples in this research paper, we estimate that achievable changes in practice and technology could reap the sector some half a billion US dollars in operational cost savings each year.

The solutions variously require capital, better data, governance reforms, new skills, partnerships with private firms and other entities, or changes in human behaviour. Implementing these changes will entail both top-down and bottom-up action. The following recommendations are for humanitarian agencies, the governments and donor agencies that fund them, and the governments of countries dealing with humanitarian crises.

Recommendations for humanitarian agencies

Commit at the highest level to reducing energy footprint in host countries under the 'do no harm' principle. While cost savings can act as the major driver for changing agency behaviour, humanitarian agencies should also own the moral argument for change. Coming out with strong messages and policies now could prevent reputational damage later, particularly as international attention increasingly focuses on the efficiency of aid and the footprint (including the emissions intensity) of international aid operations. The Global Plan of Action for Sustainable Energy Solutions for Situations of Displacement (GPA) offers a policy platform that shows high-level commitment.[115]

Tell donors how important the transition to sustainable energy and efficiency is for agencies. Donors respond to calls from the humanitarian agencies; they need to hear that energy is a priority area for improvement and how they can assist. Ideally, agencies' energy use needs to be linked to improved clean-energy access for beneficiaries. The GPA can also help as the forum for dialogues of this kind.

Begin rationalizing energy use by following a '3M' strategy:

- **Measuring** – collecting energy and emissions data.
- **Monitoring** – reporting on these data and identifying 'low-hanging fruit' where improvements would pay back an initial investment in a short period.
- **Motivating** – introducing emissions reduction targets as key performance indicators and encouraging entrepreneurial activities by country teams.

---

[115] UNITAR (2018), *The Global Plan of Action for Sustainable Energy Solutions for Situations of Displacement.*

In particular, strategy should include the following measures:

Identify where agencies are spending the most money across offices on logistics and operations. Only when energy use is understood is it possible to think through the best solutions. One way to begin would be to undertake agency-wide studies of energy use such as the recent effort by MSF. In terms of individual offices, including field offices, UN agencies can take advantage of the free environmental peer review system operated by Sustainable UN. For non-UN agencies that lack the funds to commit to an agency-wide process, it should be possible to identify the operations spending the most money on fuel and electricity relative to the number of employees/people being served, and to invest in audits and efficiency interventions that pay back within short time frames. These will demonstrate the case for scaling up investments agency-wide. Proven technical applications such as sensors that can help to monitor energy use, track spending and visualize savings may be useful. In countries where there is already an established energy services industry, locally based companies may be able to undertake work on buildings and be repaid on a performance-based contract costing no more than current annual bills.

Set targets for phasing out diesel for electricity generation across operations. There will be instances where diesel use remains essential for some years to come, but targets could be staggered to reflect the business case. This could begin with operations likely to be in place for many years, while putting in place strategies and coordinating with other parties over a list of service providers that could be brought in to improve and replace diesel usage at similar or lower cost relative to what is currently being paid. Where diesel remains the only economical alternative, and as a first step in all locations, agencies should invest in better maintenance (for example, cleaning or examining load efficiency). The savings would likely more than cover the costs of the additional salaries.

Set a target and timeline for improving the efficiency of agency vehicle fleets, and for investigating how journeys can be reduced. Sharing procedures trialled by some agencies should be implemented at scale. Procurement of vehicles should specify high-standard fuel efficiency. Fleet-management and vehicle-sharing schemes would have to be tailored to country conditions, but promising initial results suggest that further trialling is urgently needed. This would be extremely welcome in countries such as Jordan and Lebanon, where spending on vehicles is high compared with other locations and where the distances between frequently visited humanitarian sites are comparatively short.

Investigate the potential for switching to cleaner fuels. There are opportunities for large agencies to exercise their purchasing power to help develop the market for cleaner fuels. As shown, in Jordan and Burkina Faso the sulphur content of diesel is well above the European standard and thus damaging to air quality. The negotiating power and procurement strategies of large agencies, especially if procurement is pursued in collaboration between agencies, could help raise demand for lower-sulphur fuel and bring down its cost for the rest of the market.

Consider setting incentive and disincentive schemes at headquarters that encourage good practice across the agencies. WFP's application of a carbon tax on vehicle purchases to promote the progressive drive towards efficiency is one example, especially given that country offices can apply to the fund created from the tax for money for efficiency and renewable energy investments. Another option would be to hold a revolving fund at headquarters to which country offices could apply when seeking financing for efficiency improvements, and to ensure clarity over budgeting to allow country operations to redistribute fuel savings after they pay back to the fund.

Make energy a priority at headquarters and work with field office staff to integrate a culture of efficiency. The practical toolkit developed alongside this paper[116] suggests a series of practical steps that humanitarian agencies can take when addressing their energy consumption. Gestures of recognition such as an annual prize for greenest building or most improved operation in energy efficiency could help. Channels of communication to receive ideas from field office staff on how to improve efficiency (not necessarily just related to energy) and energy sustainability could open up opportunities for locally appropriate solutions.

Recommendations for donors

Require humanitarian agencies to provide a breakdown of their energy cost projections in budgets, backed up with assumptions about consumption and costs – this should also be clearly demarcated in reporting on actual expenditure.

Ask about fuel rationalization and energy strategies in talks with humanitarian agencies, and request updates on progress. While aid may be untied, it is in the interest of donors that it is used in the most effective way and does no harm, which means that energy use must be part of the conversation. The people who understand how much is being spent on fuel in humanitarian agencies all want to reduce emissions and move to more sustainable methods of delivering energy, but they need donors to show interest and ask for improvements.

Offer support to projects that unlock system change, and that enable models that can be adapted for replication. This could be in the form of initial financing for revolving funds to kick-start efficiency strategies in the humanitarian sector. There are ways in which donors could enable contractual relationships with energy service providers. Offering soft loans and repayment guarantees to project developers/financiers, for example, would be one way to enable change and to incentivize partnerships between the humanitarian and private sectors. Core Responsibility 5 of the Agenda for Humanity – 'Financing should be flexible, predictable and over multiple years so that actors can work toward outcomes in a sustainable manner' – provides a basis for this.

Consider contributing to a multi-country fund to de-risk the larger investments to transform large displacement operations. As the case of the large-scale solar projects in Jordan demonstrates, humanitarian projects can help offset the energy pressures on refugee countries and improve energy conditions for vulnerable people. A larger, targeted fund for sustainable energy in displacement settings would offer the chance to revamp and upgrade energy services at scale. For example, sub-Saharan Africa, where the humanitarian energy problem is most acute, has no precedent for this. A fund could be designed to drive innovative models and private-sector competition, as well as to bring down the costs of materials.[117]

[116] Grafham and Lahn (2018), *Powering Ahead.*
[117] Cohen, Y. and Patel, L. (forthcoming, 2018), *Innovative Financing for Humanitarian Energy Interventions,* Research Paper, London: Royal Institute of International Affairs, https://mei.chathamhouse.org/resources/reports.

Recommendations for host-country governments

Ask humanitarian agencies what steps they are taking to reduce their emissions and impact on host-country resources. One aspect of this should include whether humanitarian agencies are simply complying with government legislation around standards (especially emissions standards), or whether they are going beyond this and moving to levels of practice that are 'good' rather than simply 'compliant'.

Where possible, include sustainable energy as a priority area in humanitarian response plans (HRPs) and encourage aid in energy projects that will leave a positive legacy in-country. Take advantage of the evolving response and resilience frameworks to work with donor, humanitarian and NGO organizations to request attention to energy in the areas where most pressure is being felt nationally as a result of displacement crises. Where humanitarian operations are concerned, devise ways in which agencies and donors might work with governments to reduce fuel use, ease pressure on the grid and pollution; and consider how agencies and donors might work with governments to contribute to host countries' sustainable energy goals.

In cases of prolonged displacement/humanitarian presence, consider enabling infrastructure investments that will reduce energy and water demand in camps and harness local market expertise. There are now a growing number of building practices and technologies that would be far more cost-effective and environmentally sustainable over longer periods. Reaching consensus over the acceptability of such solutions for both governments and communities could bring mutual benefits. For example, the trialling of systems that provide more effectively for liveable temperatures, refrigeration and sewerage management at scale in camps could result in scale-up potential in local rural areas as well as relieving humanitarian costs.

Consider partnerships with humanitarian agencies operating in remote locations to improve energy access for rural areas. The 'anchor load' provided by a cluster of humanitarian agencies working in remote locations might open up possibilities for the electrification of rural areas. Camps are often located close to towns and villages; improving how energy is delivered to the former could open up significant benefits for the latter.

Appendix A: The Average Lifetime of a Refugee Camp

The figure of 18 years, used in this paper, for the average lifetime of a refugee camp is derived from Chatham House analysis of 2016 UNHCR Global Trends data.[118] The most widely quoted statistic on the subject is that the average length of time spent in a camp by a refugee is 17 years, referring to a 2004 internal UNHCR document.[119] As has been widely acknowledged, this figure is problematic.[120]

Consequently, this research paper sought a statistic reflecting the lifetime of a camp itself as opposed to the length of time typically spent there by a refugee. The camps we considered fell under the categories 'planned/managed camp' and 'self-settled camp', excluding 'transit/reception camps', 'collective centres' and 'individual accommodation', and also included only those with populations greater than 20,000. This produced a list of 97 camps. Opening dates were established for 60 per cent of these.[121] There then followed some extrapolation where, for example, the origin of the refugee population was known and hence its arrival date could be estimated using the timing of the event that caused its displacement. This increased to 80 per cent the proportion of camps for which an opening date was established. Most of the absent data related to camps in the Central African Republic, Sudan and Somalia. It was assumed that the camps were still open at the time of writing.

The average (simple mean) camp age was then calculated to be 18 years, with a median of 13 years, a minimum of one year and a maximum of 46 years. As noted by the World Bank,[122] the global average lifetime of camps shortens as the rate of camp creation increases. Thus, the recent population displacement as a result of the Syrian war has decreased the average camp lifetime.[123]

As these details imply, the method used to calculate the figure of 18 years acts only as a first analysis. It is hoped this paper will encourage more rigorous analysis, including centralized data collection.

---

[118] UNHCR (2016), 'Global Trends 2016 Annex Tables, Tab 15: Major locations and demographic composition of populations of concern to UNHCR, end-2016'.

[119] 'It is estimated that the average duration of major refugee situations, protracted or not, has increased: from 9 years in 1993 to 17 years in 2003'. UNHCR (2004), 'Protracted Refugee Situations', internal document, http://www.refworld.org/pdfid/4a54bc00d.pdf. This statistic is further quoted in UNHCR (2006), *The State of The World's Refugees 2006: Human Displacement in the New Millennium*, Chapter 5: 'Protracted refugee situations: the search for practical solutions'.

[120] For a discussion on this, see BBC World Service (2018), 'More or Less: Refugee Camp Statistics', http://www.bbc.co.uk/programmes/p03wgr2n.

[121] From sources including UNHCR camp reports, reliefweb.int, refworld.org, newspaper articles, interviews conducted by the MEI in camps, correspondence with UNHCR regional managers and satellite images.

[122] *'[A] decline in the average duration of exile is typically not an improvement, but rather the consequence of a degradation of the global situation'*. Devictor, X. and Do, Q. T. (2016), 'How many years do refugees stay in exile?', World Bank, 15 September 2016, http://blogs.worldbank.org/dev4peace/how-many-years-do-refugees-stay-exile (accessed 14 Dec. 2017).

[123] 'The number of people who are in protracted situations (over five years) [...] stands at 6.6 million. For those people, the average duration of exile is as long as 21.2 years. All these estimates are very sensitive to two situations: Afghanistan, where the crisis has been ongoing since 1979 and increases all averages, and the Syrian Arab Republic, which is relatively recent and lowers the averages.' Ibid.

Appendix B: Survey Questions

Section 1: General information

Q1: Please enter your name, position and organization.

Q2: On which country are you reporting data?

Q3: In what form do you record the logistical transactions of your organization relating to energy (flights, transport, fuel purchases, utility bills)?

Q4: In what form do you record the financial transactions of your organization relating to use of energy (flights, transport, fuel purchases, utility bills)?

Section 2: Overall use of diesel and petrol

Q5: Do you collect information about the amount of diesel and petrol used by your organization at a national level?

Q6: How much diesel and petrol does your organization use? (Please specify the time period and the units.)

Q7: How much do you pay for diesel and petrol? (Please specify the time period and the currency.)

Q8: In addition to the costs identified in Q7, do you pay a separate fee for transporting the diesel and petrol?

Q9: What is the total kWh produced by the diesel and petrol generators? (If you cannot obtain the answer to this question, please move on to the next question.)

Q10: What are the purchase and installation costs of your diesel and petrol generators? (Most recent figure would be acceptable.)

Q11: How much are you paying for maintenance of your diesel and petrol generators per annum? (Please specify the units and time period, and feel free to expand if desired.)

Q12: How much diesel and petrol is used on the below? Please specify the units and the time period.

Section 3: Overall use of other fuels and resources

Q13: What is the total volume of electricity used by your organization in the country in kWh per year? (This should be on top of any electricity generated from diesel expenditure listed in the previous section. It should include electricity used in programmes and projects as well as operations.) Please define the time period in your answer.

Q14: What cost do you pay per kWh for the electricity used? (If different at different locations, then please specify.)

Q15: How many offices does your organization operate in-country?

Q16: How much electricity does your organization use in its offices (for heating, cooling, lighting, computers etc.)? Please specify the time period, units and breakdown by office location if possible.

Q17: Do you have other notable expenditure on heating and/or cooking fuel (for example, gas)? If so, please specify if possible.

Q18: Does your organization record how much water it uses in-country?

Section 4: Travel

Q19: How many staff members work for your organization in-country? (Please specify full-time and part-time if possible, but do not include casual labour or contractors.)

Q20: What proportion of the staff are based on-site (i.e. at a refugee camp) if applicable?

Q21: Do you provide transport for those not based on-site (i.e. at a refugee camp) if applicable?

Q22: How many vehicles are in your organization's fleet in your country (please specify diesel vs petrol)?

Q23: Does the procurement policy of your organization set guidelines for the purchase of vehicles with energy efficiency standards?

Q24: Does your organization monitor the mileage of vehicles used?

Q25: Please estimate total monthly mileage for procured deliveries of basic goods including water and food (return journeys for delivery trucks).

Q26: Do you have a method of tracking international and domestic flights within the organization (both for people and for equipment/food etc)?

Section 5: Energy-saving measures

Q27: Do staff receive any energy awareness/efficiency training on reducing the energy used by the organization?

Q28: Does the procurement policy of your organization set guidelines for the purchase of energy-efficient equipment such as light bulbs and air-conditioning units?

Q29: Please give details of any other energy systems used in-country (for example solar lights; solar PV/hybrid systems; solar water pumps etc).

Q30: If you are implementing any sustainable or renewable energy systems, are you collecting data about the cost savings (or otherwise) associated with them?

Abbreviations and Acronyms

ADB	Asian Development Bank
BRAC	Bangladesh Rural Advancement Committee
BREB	Bangladesh Rural Electrification Board
DFID	Department for International Development
EEP	Energy Efficiency Programme
EMG	United Nations Environment Management Group
EMS	Emissions Monitoring Scheme
ESCO	energy service company
GPA	Global Plan of Action for Sustainable Energy Solutions for Situations of Displacement
ICRC	International Committee of the Red Cross
IFRC	International Federation of Red Cross and Red Crescent Societies
IOM	International Organization for Migration
kVA	kilovolt ampere(s)
kWh	kilowatt hour(s)
LCOE	levelized cost of energy
LED	light-emitting diode
LRS	MSF Logistics Reporting System
MEI	Moving Energy Initiative
MSF	Médecins Sans Frontières
MW	megawatt(s)
NGO	non-governmental organization
OCB	MSF Operational Centre Brussels
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
ppm	parts per million
PV	photovoltaic
REACT	Rapid Environment and Climate Technical Assistance Facility
SAFE	Safe Access to Fuel and Energy
SDG	Sustainable Development Goal
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNFPA	United Nations Population Fund
UNHAS	United Nations Humanitarian Air Service
UNHCR	United Nations High Commissioner for Refugees (UN Refugee Agency)
UNICEF	United Nations Children’s Fund
UNITAR	United Nations Institute for Training and Research
UNOPS	United Nations Office for Project Services
UNRWA	United Nations Relief and Works Agency for Palestine Refugees in the Near East
USAID	United States Agency for International Development
WASH	water, sanitation and hygiene
WFP	World Food Programme

About the Authors

Owen Grafham is department manager of the Energy, Environment and Resources Department at Chatham House.

Glada Lahn is a senior research fellow in the Energy, Environment and Resources Department at Chatham House.

Acknowledgments

The authors are grateful to the many organizations and individuals that have supported and assisted us during the course of researching and writing this paper.

Thanks are due to the UK Department for International Development (DFID) for its financial support for the MEI, and to Howard Standen in particular.

We are especially grateful to our consortium partners in the MEI. These include Ben Good, Laura Patel, William Mulehi, Alessandra Moscadelli and Joe Attwood at Energy 4 Impact. In particular, we are grateful for their work leading the consortium and delivering expertise from the field in Kakuma refugee camp. Similarly, we are grateful to Inoussa Traore, Mattia Vianello and Billy Yarro at Practical Action for their work in Goudoubo refugee camp in Burkina Faso. Thanks are also due to colleagues at UNHCR – Paul Quigley, Paul McCallion, Robert Arcidiacono, Yanal Almadanat – and to Elias Jourdi and Lama Gharaibeh from NRC. We are continually grateful for your support and your desire to improve.

We are grateful to all those who gave their precious time to answer our questions throughout this research. They include Garam Bel, Hossein Fadaei and Isabella Marras from UN SUN; Richard Smith from UNEP; Paul Quigley, Paul McCallion, Andrew Harper and Craig Sanders at UNHCR; Eva Mach at IOM; Georgina Stickels, Conor Fyans and Michaele Righi at WFP; Ghassan Naji at Agence Française de Développement; Andreas Thulstrup, Tina Mittendorf and Ilary Ranalli at FAO; Alain Oppliger and Laurène Bellevaux at the ICRC; and many others who preferred to remain anonymous.

The authors would like to thank all those who have provided feedback on various drafts of this paper and the accompanying toolkit. In particular, we appreciate the considered responses of our blind reviewers, and of Raffaella Bellanca at WFP, Elena Gaura from the University of Coventry, Alberto Llario at IOM, Thomas Fohgrub at the Global Plan of Action, Sarah Rosenberg-Jansen at Practical Action, Drew Corbyn from GOGLA, Maria Ten Palomares from MSF, Elizabeth Joyce from Engineers without Borders and Asanath Ndegwa from Oxfam.

Finally, we would like to thank our colleagues at Chatham House who have been involved in guiding, supporting and helping with this work. Rob Bailey, our research director, for his oversight and advice; and Harsh Lata, Neal Miller, Jessica Obeid, Sofia Palazzo-Corner, Yin Qing and Gemma Wardle for their hard work and diligence in supporting the research and data-building processes during this paper. Thanks also to Gabriela Flores for her support in helping to communicate guidance in the toolkit, and to Jake Statham for his usual methodical support in editing and overseeing the production process.

Any errors or omissions are the responsibility of the authors.

Independent thinking since 1920

Chatham House, the Royal Institute of International Affairs, is a world-leading policy institute based in London. Our mission is to help governments and societies build a sustainably secure, prosperous and just world.

Cover image: A convoy of trucks carrying humanitarian assistance provided by the World Food Programme to Southern Sudanese refugees drives in North Kordofan state, on 19 May 2017.

ISBN 978 1 78413 291 0

Typeset by Soapbox, www.soapbox.co.uk

This publication is printed on recycled paper.

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

Charity Registration Number: 208223