Humanitarian Engineering and Energy for Displacement (HEED)

Working towards modern, affordable & sustainable energy systems in the context of displacement

Recommendations for researchers and practitioners

December 2020

Acknowledgements

This working paper is drawn from presentations and discussions that emerged during the 'Agency of Change: Energy in the Displaced Context' digital Conference held on Wednesday 4th November 2020. The conference was organised by the Centre of Data Science, Coventry University on behalf of the GCRF EPSRC Humanitarian Engineering and Energy for Displacement (HEED) project.

The conference planning committee consisted of Prof. Elena Gaura, Dr Alison Halford and Stefan Haefner, with support from Joel Gibbs, Dr Jonathan Nixon (Faculty of Engineering, Environment, and Computing, Coventry University) and Prof. Heaven Crawley (Centre for Trust, Peace and Social Relations, Coventry University). In addition, the following colleagues contributed to the Conference on the day: Chas Morrison, Melania Tarquino (Practical Action), and Prof. James Brusey, Sheena O'Brien, Dr Nandor Verba, Brandi Jess, Rjaa Ashraf and Dimitar Stoyanov (all from Centre for Data Science, Coventry University).

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More details on the HEED project can found at http://heed-refugee.coventry.ac.uk

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Executive summary

This report summarises the discussions that took place between practitioners, academics, policymakers and the HEED team during the HEED working conference on Wednesday 4 November 2020. Drawing upon a range of expertise in the field of social science, humanitarian and renewables engineering and computer science, conference participants sought to identify potential solutions, innovative responses and best practices to increase access to safe, sustainable and affordable energy in the context of displacement.

Context

The UNHCR's Clean Energy Challenge (2019) aims for all refugee settlements and nearby host communities to access reliable, sustainable and modern energy by 2030.[1] To achieve this goal, humanitarian responses will need appropriate guidance and data on creative approaches and new technologies to deliver improved energy solutions in the displacement setting. The implementation of safe, renewable and affordable energy into refugee camps and internally displaced encampments means re-thinking the way that energy systems are designed, maintained and owned to build the capacity and resilience of communities. Adopting a long-term approach in energy planning that focuses on addressing the rights of refugees and other displaced populations (for example those who are internally displaced), options for shared community assets and drawing upon the energy needs and aspirations of displaced people could generate greater self-reliance and pathways for social development and economic opportunities.

1 UNHCR. (2019) Clean Energy Challenge.

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Recommendations

Design protocols for improved energy delivery

Energy design protocols that seek to be cross-cutting, inclusive and integrated require socio-technical systems that encourage community resilience and capacity building. Adopting energy design protocols that draw upon community knowledge to build robust demand patterns ahead of system design can result in systems that are flexible and responsive to rapid changes in community needs. Community governance can increase opportunities for ownership and engagement but require human and data-centred energy systems that shift solutions from top-down imposed decisions to community-generated strategies.

- **Use community knowledge to build robust demand patterns ahead of system design**: Sharing energy data with displaced communities during the planning stages of the project can establish a local understanding of solar systems, the gap in skills required for maintenance and community expectations of the long-term sustainability of interventions.
- **Build connections with manufacturers during the planning stage**: Including energy manufacturers and suppliers when designing a protocol will increase opportunities to provide long term energy management and control systems to ensure optimal use. This could also encourage manufacturers to be involved until the systems' end of life.
- **Adopt an interdisciplinary approach as technology-based surveying and data collection benefit from social science epistemology**: Although most technological devices, apps and services record data, there are issues around informed consent and whether it is understood sufficiently, especially amongst a vulnerable population. Adopting an interdisciplinary standpoint could encourage computer scientists and engineers to reflect more on the ethical aspects of adding a sensor on energy products in the humanitarian context.

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Capacity building of practitioners, academics, and energy stakeholders

Improved energy solutions that are instrumental in improving security, nutrition, education, livelihoods, health, and environment require a greater emphasis on building the capacity of all energy actors in the displaced setting. Introducing training programmes that support access to reliable, cleaner energy increases the range of skills available in displaced and host communities, which amplifies opportunities to develop self-reliance, human security and wellbeing. Capacity building includes raising awareness of the environmental advantages of a transition to clean energy solutions to address misconceptions and encourage more engagement in SDG7 and SDG13 in the displaced setting.

- **Energy stakeholders to see energy as a service, not only a system**: Framing energy access as a service, as well as a system, positions displaced people as service users, rather than dependents. Acknowledging displaced people as service users when explaining the purpose and level of commitment to communities about new energy interventions means they are seen as energy actors who are integral to the sustainability of future systems.
- **Productive uses of energy for generating income relies on overcoming multiple barriers, not just energy access**: Energy services that seek to increase economic self-reliance and community resilience need to consider a more comprehensive package of support to overcome structural barriers, such as business mentoring and skills; access to finance; access to appliances; market linkages; and apprenticeships.
- **Community skills development training is integral to delivering improved energy services**: The inclusion of training packages, such as employing refugees as 'energy apprentices' for simple repairs, fault reporting and maintenance, aids in future proof energy interventions.

Understanding the needs and aspirations of displaced communities in their use of energy.

To produce socio-technological design protocols that respond to and respect the energy needs and aspirations of displaced people shifts solutions towards renewable energy systems that meet displaced populations' energy needs for cooking, lighting and power in an equitable, inclusive framework. Arguably, in the humanitarian context, gender and access to energy is often focused on women as service users, and there is little discussion on ensuring gender equity through democratising energy policy in contexts of displacement. Collecting data that supports gender mainstreaming, alongside a more sustainable approach to energy, humanitarian engineering and new technologies, can promote greater gender equity, autonomy and dignity for people living in displaced settings.

- **Advocate ways refugees can 'thrive, not just survive'**: The right for refugees to work outside of the camp make it easier for displaced persons to develop sustainable sources of income. If refugees in the camps have the freedom to move and work between camps and host communities, consider the viability of energy interventions that share costs and benefits between refugees and host communities.

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- **Encourage collective buy-ins by culturally sensitive approaches to representation, which respond to and respect the energy needs and aspirations of displaced people**: A culturally sensitive approach means projects considering if there are overburdening or unrealistic expectations on what participants and/or local management are expected to engage with or deliver when implementing community co-designed and owned energy interventions.
- **Avoid gender silos by engaging men and women in discussions around energy to combat inequality and patriarchy**: At the onset, plan group discussions that open up space for men to understand how energy solutions impact at different levels and ways according to gender. When promoting energy solutions that improve opportunities for women, consider how to provide opportunities for women to be designers of energy schemes, maintainers, and suppliers of energy services.

Moving forward

To achieve a transition from needs-based energy solutions to energy interventions that address the needs *and* aspirations of refugees and internally displaced people requires connections between researchers, humanitarian energy practitioners and energy suppliers. We hoped the conference would offer a platform for exchanging experiences and learning with other similar projects, as well as hearing from researchers, designers and practitioners in the humanitarian energy sector about how to translate needs into the best interventions. Allocating time in the conference for feedback on the direction of future energy research and projects generated the following recommendations around new ways of thinking about community governance methods and systems in a humanitarian setting.

- **Enhance contextual understanding of improved energy access in the humanitarian setting through greater dialogue between energy practitioners and academics:** More opportunities are needed for knowledge exchange between practitioners and academics with requests for joint research studies, webinars and forums that fostered connections.
- **Future research projects to give greater focus on governance of energy systems that include ways to finance, alternative ownership models, and can adapt to changing demands**: If private sector companies have an evidential base that demonstrates the willingness and feasibility to pay for energy, along with the capacity to deliver an affordable, renewable system, it could encourage a choice of electricity infrastructures in displacement settings. Projects that can envision energy systems that enable economic growth and generate income for displaced people could be transferable in other settings and context.
- **Publish academic findings and data in an accessible style on non-traditional platforms and formats**: Although there was still a demand for outputs that reflect traditional academic pathways, such as journals, there were also requests for shorter, more practical papers aimed at practitioners. Underpinned by academic rigour, these papers would share data in more accessible formats, for example, infographics, webinars, short one-page reports.

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HEED: Project background, timeline, and installations

Without better data on current energy consumption, systems, and lived experiences, practitioners, policymakers, and humanitarian NGOs are faced with considerable barriers in delivering cleaner and more cost-effective energy sources in displacement settings.[2] The Humanitarian Engineering and Energy for Displacement (HEED) project aimed to address the gaps in data by implementing energy interventions in three refugee camps in Rwanda (Gihembe, Kigeme, and Nyabiheke) and a settlement for people displaced by the earthquake in Nepal. These two countries provide very different environmental, policy and social contexts within which to better understand energy uses, needs and aspirations in contexts of displacement.

> 'Throughout the project, I felt a sense of empowerment supported by the capacity of the project and the way the project is driving science to 'do good'. But I also felt enormously humbled, realising how much we don't know about the lived experience of displaced communities in engineering, how many answers we don't really have, and how much those answers are needed now. I think this project has been the most enriching experience of my career so far'.
>
> HEED's Principal Investigator, Professor Elena Gaura, Coventry University

2 Lahn, G. and Grafham, O. (2015). Heat, light and power for refugees, saving lives, reducing costs.

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Project timeline

Stage 0: Project award and contractual set-up, team forming, project management tools, initial team workshop with in-country partners.

Stage 1: Mapping and baseline survey of current energy context in the camps. A series of activities to better understand the availability, use and projected aspirations around energy in camps, including qualitative and quantitative data collection.

Stage 2: Community Designathons. Workshops in Nepal and Rwanda with the communities. Energy intervention designs informed by the quantitative and qualitative research. Establish Energy for Displacement Protocols with various stakeholders. IoT systems design for deployment.

Stage 3: Energy Systems Implementation. Translate Stage 2 outputs into technical specification, systems simulation and design, identifying and working with local suppliers, systems installation and IoT devices deployment.

Stage 4: Analysis, dissemination, and handover. Learning, reflecting, empowering.

Rwanda

With a population of just over 12 million, 2019 saw Rwanda host around 145,000 refugees, mainly from Burundi and the Democratic Republic of the Congo (DRC)[3] of which 80% live in six camps. 75% of refugees are women and children. Since 2018, the Government of Rwanda (GoR) has supported an entry point for the inclusion of refugees through four key structures: access to documentation; joint GoR-UNHCR livelihoods strategy; national education; and health systems.[4] In addition, in 2019, the Rwandan Government committed to including energy and environmental preservation as a mechanism for refugee integration.[5] As a result, the UNHCR in Rwanda is working towards meeting the UNHCR's Clean Energy Challenge to ensure that all refugee settlements and nearby host communities can access affordable, reliable, sustainable and modern energy by 2030. In providing improved energy systems, this could offer refugees with alternatives to camp living, encourage self-reliance, and provide economic opportunities to build capacity.[6] However, there are still barriers to refugees accessing socio-economic opportunities, resulting in many camp-based refugees being reliant on humanitarian funding for basic needs, including access to safe, reliable, and modern energy, which is reinforcing continuing dependence.

3 UNHCR (2019). Global Focus: Rwanda end year report 2019.

4 Ibid. According to the UNCHR in 2019, 100% of refugees were individually registered and children under 12 months were issued with birth certificates. A majority of refugees have access to primary health care, with 90% of school-age refugee children enrolled in the national education system.

5 ibid

6 UNHCR (2019). Rwanda Country Refugee Response Plan 2019-2020.

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The majority of camp-based refugees in Rwanda have little or no access to electricity and lighting and basic three-stone fires, mud stoves, and firewood are still the main source to meet their cooking needs.[7] Although alternative sources of energy, such as solar microgrids, clean energy cookstoves and solar lighting, are increasing in use by camp-based refugees, there are still issues surrounding implementation, cost and long-term sustainability.[8] One of the key challenges in developing, building and maintaining electricity infrastructure in the displaced setting is humanitarian agencies work on short budgeting cycles, which too often stymies private sector long-term service agreements (Lehn and Grafham, 2015).[9] Nevertheless, as GoR continues to work towards integrating refugees into national systems, improved access to energy will play a key role in supporting refugee inclusion within the host community.

HEED worked with communities in the following areas:

Gihembe Camp, Gicumbi District, Northern Province. Created in 1997, Gihembe is one of the longest-established refugee camps in Rwanda, with a population of around 12, 250.

Gihembe, Rwanda

Installations	Data collected
Eight regular solar streetlights; Four advanced solar streetlights providing both night-time lighting and ground-level socket	Participatory planning with the community and camp governance institutions; the impact and utility of no-cost charging of small electronic devices for refugees; role of communal lighting on security and wellbeing.

Kigeme Camp, Nyamagabe District, Southern Province. Established in 2012 as a response to a sudden influx of refugees from the DRC as they fled violence between government forces and rebel militias. Kigeme Camp is home to around 21,000 refugees.

7 Practical Action (2020). Ensuring refugee camps in Rwanda have access to sustainable energy.

8 ibid

9 Lahn, G. and Grafham, O. (2015). Heat, light and power for refugees: saving lives, reducing costs.

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Kigeme, Rwanda

Installations	Data collected
PV-battery micro-grid to supply electricity to a playground and two nursery buildings.	The benefits and limitations of common energy resource when shared between 3 main users; insights into community priorities for energy in the context of Early Years education.
Sensors based cooking behaviour study with 20 households	Data collected on stove efficiency and user preferences; cooking temperature profiles for clay stoves cooking fuel supply in camps

Nyabiheke Camp, Gatsibo District, Eastern Province. Since the early 2000s refugees from the DRC have been arriving at Nyabiheke Camp; it is currently hosting to around 14,300 refugees.[10]

Nyabiheke, Rwanda

Installations	Data collected
One Standalone Solar System supplying electricity for a community hall	Longitudinal solar energy generation, distribution and consumption (at appliance level) in a communal building; identifying: consumer behaviour, light usage and other enabled uses; effectiveness of energy systems over-sizing to allow for aspirational and creative use of energy by communities; pathways to community mobilisation to exploit surplus energy.
40 mobile solar lanterns	Insight into the frequency of use, mode of lantern use (static vs mobile; indoor vs outdoor), distances travelled by household at night, type of usage in-doors; understanding to what extent mobile lanterns are gendered.

10 UNHCR (2020) Population Statistics: Rwanda – January 2020

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Nepal

Nepal is located at the junction of the Indian and Eurasian tectonic plates, making it especially prone to earthquakes. In 2015, the Gorkha earthquake and subsequent landslides affected 31 of Nepal's 75 districts, saw 8,856 people dead, and around 750,000 private houses damaged or destroyed. According to the Internal Displacement Monitoring Centre, over 29,000 people are still internally displaced in Nepal. As individuals may be displaced several times during a natural disaster, out of the 121,000 new disaster displacement cases (movements, rather than people) more than 98,000 of them were the result of the 2019 monsoon rains, which brought the most rain recorded in a decade and resulted in flooding and landslides.[11]

In Nepal, HEED worked with internally displaced people in the Khalte area of Uttargaya Municipality in the Rasuwa district. The camp is an informal settlement, which was formed after the earthquakes of 2015 and hosts around 220 households, with 90% of the camp population Tamang. Tamangs are one of the largest indigenous groups in Nepal, with their own distinct language, culture and social structures. In May 2019 thunderstorms affected the displaced encampment. Several homes were destroyed, making thirteen families homeless, and several electric power lines were brought down that resulted in a loss of electricity to the residents.

Khalte Nepal

Installations	Data collected
Seven advanced solar street lights	Understanding the impact and benefits and behaviour changes brought about community lighting.
Electrical appliances use monitored in 20 households	Household and community energy profiles to enable the design of more efficient energy systems (generation, transmission, and distribution).
Footfall monitoring	Documented electricity usage, its costs and sufficiency in grid-connected sub-metered scenarios for displaced populations.

11 Internal Displacement Monitoring Centre (2020). Grid 2020 Global Report on internal displacement.

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Conference aims, design, and themes

HEED Conference Wednesday 4th November 2020

10:00–16:00 (GMT)

The aims of the conference:

- A platform for exchanging experiences and learning with other similar projects, as well as hearing from researchers and practitioners in the humanitarian energy sector.
- Showcase HEED's findings on community co-design processes and engage practitioners in HEED's planning tools for sustainable energy interventions.
- Consider how data and evidence base built during the project can assist practitioners engaging with refugees to co-produce energy solutions.
- Gain a greater understanding of the lived experiences and practices of displaced communities in their use of energy.

Originally, the conference was to be hosted face-to-face at Coventry University, but due to COVID-19, we moved the event online. Shifting to a digital platform allowed us to make significant changes to the programme to deliver a working conference with breakout groups making the event more participatory. The purpose of these breakout groups was to encourage collective consideration of how data and evidence gathered during humanitarian research projects, such as HEED, can assist actors in the energy sector in improving practice in implementing energy solutions. More than 45 people, including representatives from NGO's, social enterprises, humanitarian agencies and academics, participated in the event.

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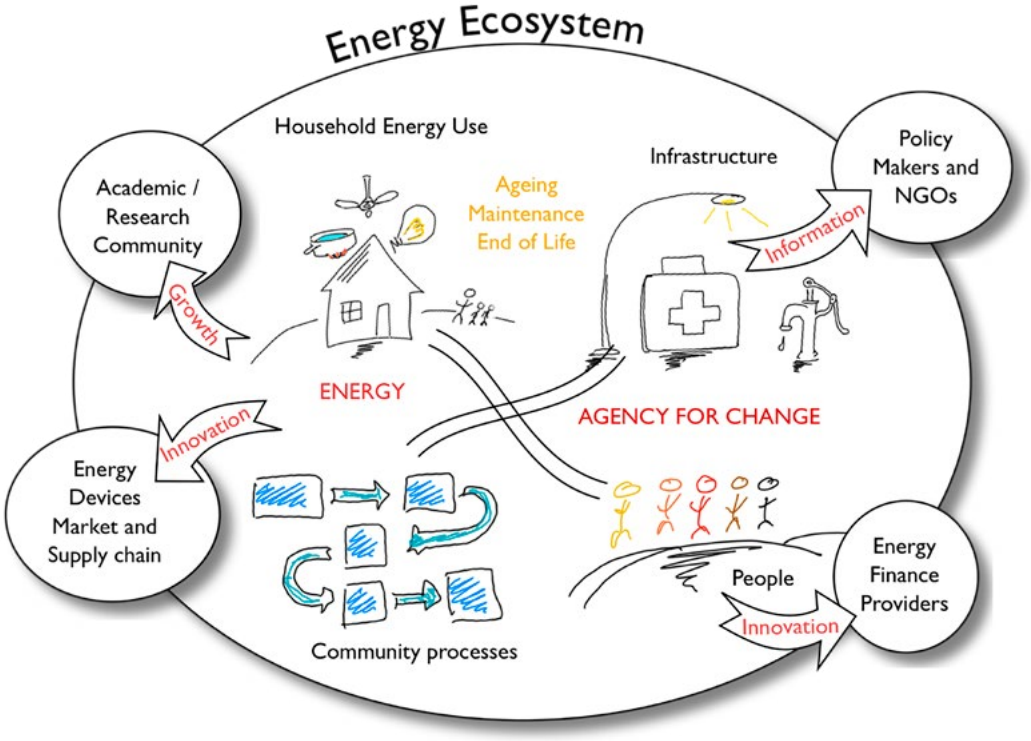

During the day, feedback was gathered from participants to identify key principles, values, and considerations for future energy access projects. From these conversations, we hope that the resulting interventions seek to be as impactful, resilient, sustainable, flexible, and inclusive as possible given the political and policy contexts in which refugees and displaced populations are embedded.

Programme

The conference began with opening words and exercise on intention setting by conference facilitator, Stefan Haefner, who previously organised and hosted conferences for UNITAR and SAFE.

Introduction and Welcome

Professor Elena Gaura, as HEED Principal Investigator, welcomed participants and introduced the format of the conference, including how the presentations and breakout groups centred around the three sessions with related themes:

1. Design protocols for improved energy delivery
2. Capacity building of practitioners, academics, and energy stakeholders
3. Understanding the needs and aspirations of displaced communities in their use of energy.

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Session One: Design protocols for improved energy delivery

Dr Thomas Fohgrub: Introduction to the Global Perspective – HEED Conference

Dr Thomas Fohgrub, in his role as head of GPA, introduced to the participants the key challenges that are faced by humanitarian agencies in implementing sustainable, renewable, and reliable energy. He acknowledged that there is still much to be done as energy is not a formal priority in humanitarian assistance, with displaced people often excluded from national or international energy-access agendas. Thomas spoke about the impact of underfunding on energy in displacement settings and how the lack of expertise and capacity was a barrier in planning or implementing sustainable energy solutions. He suggested that more detailed data on humanitarian needs and solutions could be instrumental in delivering energy systems that responded appropriately to the needs of displaced communities. Thomas concluded with an overview of the purpose of the GPA Steering Group and Coordination Unit and their work on advocacy, monitoring, policy, and reporting.

To find out more: Humanitarian energy practitioners LinkedIn group, Global Plan of Action website

Keynote – Professor Ben Sovacool: Re-thinking Energy Poverty and Best Practices for the Governance of Distributed Renewable Energy Access

Professor Ben Sovacool is Professor of Energy Policy, University of Sussex Director of the Centre on Innovation and Energy Demand, United Kingdom, Professor of Business & Social Sciences, Aarhus University, and Director of the Centre for Energy Technologies, Denmark. Professor Ben Sovacool began by reflecting on how if we wish to expand energy access to improve the life opportunities of some of the world's poorest communities we would benefit from asking how interventions are structured, what are their benefits, and what are the continuing challenges. He commented on how small-scale renewable energy technologies such as solar panels, cookstoves, biogas digesters, micro-hydro units, and wind turbines could be critical in accessing clean, reliable, and affordable energy. Drawing upon in-depth exploration of case studies in Bangladesh, China, India, Laos, Indonesia, Malaysia, Mongolia, Nepal, Papua New Guinea, and Sri Lanka, Ben discussed the complexity of technologies, energy services and governance. He explored 'successful case studies alongside failures' and suggests that energy access should be seen 'multi-scalar; multi-institutional; multi-sectoral, and multi-dimensional'. Therefore, policy, business models, gender, and governance needs to be considered, as well as technology, to produce substantive shifts in delivery.

Professor Elena Gaura: HEED Journey

HEED Principal Investigator and Professor of Pervasive Computing, Coventry University, Professor Elena Gaura started by explaining how HEED addresses gaps in knowledge with its case studies based on primary fieldwork with displaced people, humanitarian workers and energy providers. By showing synergies between SDG 7 and IoT using intelligent measurement, she contends HEED is contributing to reframing debates in humanitarian energy, engineering and computer sciences. Elena commented on how community designathons and working with camp communities collected data that centred around how to address the energy needs and aspirations of communities and help untangle long-standing concerns about the use of renewables and new technology.

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She noted that in capturing technical information on how energy from communal renewable systems is used in camps, alongside documenting the lived experience, resulted in the construction of the RERT tool. Elena also advocated for projects to provide opportunities for training and skills that can respond to a marketplace for renewable energy suppliers and increase self-reliance, self-determination and autonomy for many refugees and displaced people and communities.

Session Two: Capacity building of practitioners, academics, and energy stakeholders

HEED Co-Investigators Presentations

Professor Elena Gaura: Energy, Refugees and the Internet of Things: How success looks like when one's Internet of Things becomes the Internet of lanterns, cookstoves, footfalls and solar systems in harsh environments

Professor Elena Gaura spoke about the importance of collecting 'data with the people, not for the people'. She explained how field data has high acquisition cost, low yield, high value and generally low intrinsic knowledge content by itself. However, longitudinal qualitative research can add context, validation and meaning to much of the sensor data collected and support data imputation strategies. Similarly, self-report and sensor-data based study results rarely match, but sensors-based monitoring would uncover unusual individual, community and systems behaviours more often than not. Elena concluded that when we use sensors in the context of energy, we need to shift thinking from "monitoring a technical system" to "quantitatively observing a socio-technical compound" – where the interactions of people and objects are the most interesting part of the measurement challenge.

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Dr Jonathan Nixon: Off-grid Solar-battery Systems in Rwandan Refugee Camps

Dr Jonathan Nixon, HEED co-investigator, focused on lessons learnt from the introduction of a PV battery micro-grid to supply electricity to a playground and two nursery buildings and one Standalone Solar System supplying electricity for a community hall. He suggested three key structures that could assist future projects in delivering a similar energy system. Firstly, establish, manage and meet community energy demands in new ways.

One suggestion Jonathan made was to build flexible modularity without increasing complexity to enable up/down scaling. This forethought would aid energy systems to respond to fluid situations and changes in downstream applications and energy demands. Second, he suggested before implementing the interventions, pre-assess site and the market-established products available in local host communities. Third, improve monitoring systems to support communities and improve post-intervention evaluations by using sensor systems that can distinguish system outages (scheduled and unscheduled), faults, maintenance and communications issues, are low-cost and use simple information technology to support fair sharing and access of a community energy resource.

Professor Heaven Crawley and **Dr Thomas Yeboah**: Lighting the way: The impacts of solar lighting on refugee security, self-reliance and integration in Rwanda

Professor Heaven Crawley, HEED co-investigator and presenting of behalf of herself and Dr Thomas Yeboah, HEED research fellow, shared how improved energy provision, in particular solar lighting, can increase security and self-reliance for displaced populations. She explained how the provision of solar streetlights facilitated night-time economic activities, allowing households to increase the number of hours they stay awake as their time become more productive and/or enjoyable. Solar lighting enables students to study/revise after school and supports others for whom access to energy is vital for their studies: for example, University of Rwanda students returning to the camp during the COVID-19 pandemic.

Heaven also noted that energy access is highly gendered: one consequence of more light is that women work longer hours whilst men spend more time socialising. She concluded with the ways in which light have impacted on social interactions within the camps, with an increase in informal/social activities, such as weddings, people cooking and eating together, as well as formal community activities including dancing classes, extra-curricular teaching and leaders meeting at the community hall in Nyabiheke. There was also a greater feeling of community pride and 'belonging' associated with the provision of solar lighting, which encourages a collective connection between themselves and where they live.

Breakout sessions

Participants discussed the following topics with HEED team:

- Internet of things (IoT) for energy
- What are the ethical issues that need to be considered when we undertake energy-related research and interventions with displaced populations?
- What are the barriers for refugees using power provided in communal spaces?

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- What are the social impacts of energy provision on communities in the displaced context?
- To what extent can improved access to energy address gender inequality?
- Technological support for social sciences research

Session Three: Understanding the needs and aspirations of displaced communities in their use of energy.

Panel Discussion 'Why data matters?'

- **Thomas Fohgrub** is the head of the coordination unit for the Global Plan of Action for Sustainable Energy Solutions in Situations of Displacement (GPA) and is co- steering the Clean Energy Challenge. To find out more about Thomas's work use the link
- **Kat Harrison** is the Director of Impact and leads the energy work at 60 Decibels. 60 Decibels works towards making it easy to listen to the people who matter most through Lean Data(SM). To find out more use the link
- **Edwin Kibanya** is an Associate at 60 Decibels based in Nairobi, in this role he has worked on multiple off-grid energy customer insights research projects.
- **Heaven Crawley** leads the UKRI GCRF South-South Migration, Inequality and Development Hub (MIDEQ) and is Professor of Migration at Centre for Trust, Peace and Social Relations. To find out more use the link

Breakout Sessions

Participants discussed with the HEED team the following topics:

- The science and practice of emerging community governance for energy systems in refugee camps
- The politics of energy for displaced communities
- Longevity and resilience of energy interventions
- To what extent can improved access to energy address gender inequality?
- What practical measures can promote community engagement during the design, implementation, systems uptake and operation processes of renewable energy systems?

Harvesting of breakout session, evaluation & closing lead by Stefan Haefner.

Breakout group findings and recommendations

Theme 1: Design protocols for improved energy delivery

Breakout Group 1/1: Internet of things (IoT) for energy

The participants explored how data can support the emergence of group governance of energy as a common pool resource (CPRM), in refugee camps and other displaced population contexts. The common assumption in "data as evidence' circles is that data, when exploited correctly is a decision enabler. This assumption is well accepted in most contexts but has not been sufficiently verified in humanitarian energy areas. The group debated the following hypothesis: when adequately presented to end-user and stakeholders of technological systems, information extracted from real-time system data supports collaborative decision making as well as underpinning all CPRM principles.

Key discussion points

- The collection of operational data for any system has a (high) cost associated with it (due to the cost of sensors and data processing), and often when energy systems are designed, sensors are left out. Even when data from digital components inherent to energy systems is already available poor connectivity and wireless signal dropouts (common in humanitarian settings), can make data collection difficult. However, sensor data can assist in systems health monitoring, the maintenance of systems and fault prediction, system optimisation to avoid degradation, and it can feed forward to future design of new systems.
- Sensor cost can be high for companies, which means they normally leave sensors out. But over time, the data can be useful in improving design justifying costs.

- Systems tend to fail, and we need to understand why. Sensor data can help to identify the failure modes and even predict failure. Rather than relying on community signalling of faults and requests for maintenance, sensor data can drive alerts and automate the way maintenance and repairs are deployed on community energy systems.

Breakout Group 1/6: Technological support for social sciences research

HEED proposed various technological solutions to the question "how do we obtain evidence to support social science research (e.g., using pervasive computing sensors and devices) beyond surveys and individual case studies". Is this a worthwhile aim? What are the real requirements? What are the potential problems with this approach?

Key discussion points

- Greater communication between disciplines would be useful in deciding how the engineers can best support social sciences. Projects would benefit from asking whether technological solutions (ex. measurement devices) are the only way to address technological issues. Technical information on how energy from communal renewable systems is used in camps, alongside capturing the lived experience, could assist in understanding the dynamic and purposes around data collection and address gaps in knowledge.
- Technological support for data collection in humanitarian settings means utilising newer methods; for example, 60 decibels report say 80% of data gathering is through mobile phones. However, this would mean working closely with local recyclers and companies to make the phones available to displaced communities. There is also a need to address varying policies on data collection in different parts of the world and whether to adhere to GDPR principles even though the data is being collected in locations with weaker restrictions. Being aware of these issues and performing state of the art data curation is crucial.
- Sometimes there is a conflict between self-reporting and the collected (objective/sensor) data. Data scientists and engineers would benefit from understanding the motivation for participants to respond in a certain way is not straightforward.
- Open data that adheres to common standards is key in reducing the effects of data islanding and gaining the full benefits data can offer.

Breakout Group 2/1: The science and practice of emerging community governance for energy systems in refugee camps

Ownership of assets by refugee communities/groups of any kind is not currently the norm. The session explored what may be best practice approaches to pilot, embed and scale-up models for ownership, governance and sustainable use of energy installations deployed by donor projects or indeed constructed through research and development initiatives. How do we approach governance? When and whom do we work with? What are known roadblocks to successful ownership? How do we prepare communities to own and govern? Is there publicly available best practice? If not, how can we ensure lessons from projects are published and heard?

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Key discussion points

- What is meant by community ownership in the displaced context as there is little empirical data on implementations in the displacement setting. Too often, project design happens before the community is involved.
- How do you approach governance when the political framing of displaced people differs between countries? There are difficulties when displaced people are across borders; for example, they may be close to sources but cannot access energy due to governmental policies.
- Key to community ownership is planning for the short and long term funding of energy services. This requires projects to ask difficult questions about the extent to which community ownership can support and address the challenge of financing grid systems. In addition, issues of liability need to be resolved before deploying interventions – such as a duty of care for the systems, identifying stakeholders and feasibility of multi-tiered ownership.

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Breakout Group 2/3: Longevity and resilience of energy interventions

Energy interventions in displaced settlements have often rapidly fallen into disrepair and disuse (e.g. due to faults, non-optimal usage patterns, degradation, theft, informal modifications, systems not being fit for purpose – i.e. over-under sized – and a lack of maintenance, locally available parts/funds for repair, and local skills and responsibility and knowledge for fault reporting). This breakout group draws on the lesson's learnt during the HEED project to explore how resilient systems can be implemented to improve the longevity and success of energy access interventions.

Key discussion points

- Long term survivability of these systems requires technical maintenance. Reduce maintenance costs by projects training end-users and technicians within the camp on how to use the equipment and maintain it respectively. Often, small technical problems become bigger if they are not dealt with timely.
- Also, teams can consider planning that includes small, private enterprises that can provide funding, technical support and parts.
- Refugees need to use the energy systems in innovative ways so that they become a source of long-term profit for the communities and hence, become more resilient to 'shock'.
- Often systems become a financial burden for suppliers instead of giving them profit. The suppliers also need to be more flexible in the payment methods and move away from charging high upfront costs and be more involved in the systems till their end of life.

Recommendations

Use community knowledge to build robust demand patterns ahead of system design: Community engagement at the beginning will increase the chances of secure, sound and effective energy utilisation after deployment and support plans for systems sustainability. Before the installation of energy interventions, promote and develop community ownership and self-governance ethos and practice. Consider sharing data with displaced communities during the planning stages of the project. Sensor data in the hands of the community can establish a local understanding of solar systems, the gap in skills required for maintenance and community expectations of the long-term sustainability of interventions.

However, community governance is more than giving people a voice. Partners can be useful as part of an inter-disciplinary framework that takes account of the political, social and economic contexts. Develop an energy design protocol that includes carefully considered partnerships (private and public, informal and formal) that can assist in facilitating community ownership. Prepare to be flexible at the design stage and expect appropriate trade-offs at the design stage, so desired functionality is balanced against implementation challenges and community expectations.

Build connections with manufacturers: Quantitative and qualitative data collected from and about energy systems should include suitability and life-cycle assessment of a product for the refugee camp context. Shared with energy suppliers, this could improve future designs, pre-empt potential problems and limitations and give valuable insights into consumer behaviour.

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One way to aid and support the engagement of manufactures is to standardise sensor data. Sensor data acquisition as a standard function will make it easier to allocate energy resources and increase the likelihood of use of these systems – presently and in the future. Including equipment suppliers in design protocol could generate long term energy management and control systems to ensure optimal use, increase the lifetime of the systems and encourage manufactures of the value of being involved till the systems' end of life.

Technology-based surveying and data collection benefits from social science epistemology: In the humanitarian context, social science approaches to ethics can support technologic data collection including how data is translated, used and fed back to the community. Although most technological devices, apps and services record data, there are issues around informed consent and whether it is understood sufficiently, especially amongst a vulnerable population. Adopting an interdisciplinary standpoint could encourage computer scientists and engineers to reflect more on the ethical aspects of adding a sensor on energy products, for example, in the humanitarian context. In seeking for socio-technological solutions to energy systems, technical information on how energy from communal renewable systems is used in camps will capture the lived experience of the community and individuals.

Theme 2: Capacity building of practitioners, academics, and energy stakeholders

Breakout group 1/2: What are the ethical issues that need to be considered when we undertake energy-related research and interventions with displaced populations?

This breakout group reflected on the ethical issues associated with undertaking research with displaced populations and in delivering energy interventions to communities for whom access to energy is limited and whose experiences and life chances are shaped by their experiences of displacement. The focus was on issues of informed consent, clarity around project aims, objectives and what is/isn't possible, the use of visual methods and images and the process of engaging (and disengaging) with community leaders and others with an interest in the outcomes of the work.

Key discussion points

- Sustainability – what if sustainability of energy interventions deployed in camps, by projects, cannot be achieved? What are the repercussions? What strategies are implemented to 'Do no harm'? The local energy economy needs to be built second and the technical systems last. Think of energy systems as community assets to be used- Common Pool Resource management principles – from the onset of project planning.
- The priorities and expectations may differ between researchers, agencies and refugees. To encourage engagement, clarity is needed on project aims, and what is required of the community, researchers and other stakeholders.
- Some locations are over-researched and not necessarily representative of challenges found in other contexts. Be respectful about time commitment when bringing the community together to co-design.

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Breakout Group 1/3: What are the barriers for refugees using power provided in communal spaces?

System interventions providing energy access in communal spaces are often oversized due to lower than anticipated power consumption, as evidenced by the HEED project. This session explored the technical, social and environmental causes for low community utilisation of energy systems when made available.

Key discussion points

- Introducing community ownership as an important aspect of energy design protocol includes managing expectations on how the interventions will be used. However, while HEED showed evidence on how displaced people may take ownership of some of the inventions, there was still more work to be done on encouraging communities to use surplus energy.
- Design workshops are necessary, not only to discuss the scale of the energy system but also the longevity and impact of the energy intervention on the community. Questions to be addressed at the workshops would need to be around the maintenance of the facilities for a longer time and the extent (limitations) these interventions are likely to improve the livelihood of the people.
- Workshops could make space for discussions around paid-for services or at least alternatives to free distribution/free access and how people would engage if there were not so much a payment option. This could generate a community-driven mechanism for building commitment and fostering 'ownership' of energy interventions. For example, 'payment' can take alternative forms (e.g. in-kind such as volunteering/labour). Employing professional translators rather than on-site workers at workshops could assist in communities feeling able to express their concerns more freely.
- Be pro-active in generating support for entrepreneurship as part of the planning of energy interventions (rather than just expecting it to happen due to improved energy access).

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Breakout group 2/5: What practical measures can promote community engagement during the design, implementation, systems uptake and operation processes of renewable energy systems?

This session was focused on the lessons learned during several key stages of the HEED project around potential practical measures that humanitarian energy programmes can take to embed inclusive approaches that increase the likelihood of building sustainable energy systems: from the importance of employing local community mobilisers since early stages of the project, to co-design tables with key stakeholders and groups of refugees, inaugural events and dissemination campaigns, training of local technicians to maintain the systems in the long-term, among others.

Key discussion points

- In the HEED project, employment of mobilisers were not initially considered, but they became key in all stages of the project delivery. Training and employment of local technicians to maintain systems for a year reduced the need for installers and engineers to travel to the camp as they could solve issues.
- Community mobilisers acted as 'gatekeepers' working with the community to engage with new technologies and were active in disseminating information and providing insights into cultural practices. For example, HEED found that some of the energy approaches that were initially envisioned could be applied but some needed flexibility and adaptation to local conditions. There is also a need to address existing power structures or find ways to break down harmful ones in the camps.
- In Rwanda, although PA tried to recruit women as community mobilisers, there was only one female applicant. In Nepal, recruitment resulted in having one woman and one man as mobilisers.
- There was a major challenge in synthesising the available data into design choices and decisions. Decisions in the field, including negotiations that sought the most equitable solution, raises issues around what seems fair by the community and matched their expectations.

Recommendations

Energy stakeholders to see energy as a service, not only a system: In framing energy as a service, this could create an ecosystem, which encompasses market-based approaches, energy generation, energy use, and community engagement to build capacity and capability of displaced communities. Constructing energy access as a service, as well as a system, challenges unequal power structures between institutions and displaced communities, as displaced people are seen as service users, rather than dependents. Energy as a service will question what energy access for all means for refugees and internally displaced communities in regards to life chances. There could also see more time spent by research projects and NGO's when explaining the purpose and level of commitment to communities about new energy interventions as this positions them as integral to the sustainability of future systems.

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Productive uses of energy for generating income relies on overcoming multiple barriers, not just energy access: Energy services that seek to increase economic self-reliance and community resilience need to consider a more comprehensive package of support – business mentoring and skills; access to finance; access to appliances; market linkages; and apprenticeships. In doing so, this could generate incomes, allowing people to afford and access energy for personal and professional usage.

Skills development training is integral to delivering energy services: Build into the project ways to address the lack of local understanding of solar systems and gaps in skills (education, technical, enterprise, business planning, etc.). Implement training/skill development in camps to future proof interventions; e.g. 'Energy apprentices' for simple repairs, fault reporting and maintenance. Community engagement and understanding is important, but robust infrastructures to maintain energy interventions cannot be reproduced in one-off workshops (although these are still useful). To avoid creating a silo and to increase successful implementation, community ownership of interventions requires connections to be made with refugee committees, boards or a council (elected) representing the different groups.

Theme 3: Understanding the needs and aspirations of displaced communities in their use of energy

Breakout group 1/4: What are the social impacts of energy provision on communities in the displaced context?

Displaced communities receiving energy provision and opportunities for lighting find their lives are impacted in various expected and not so expected ways. This session explored the major impacts relating to community and family relations, social space, gender roles, psychology, domesticity and identity.

Key discussion points

- What happens if people are asked to move from the camps? Can they take the equipment such as the microgrids, solar-powered lights with them?
- Who is accountable if something goes wrong or after when this project ends? Who has the longer-term responsibility of these camps? Government? Project funders/facilitators? Is governance management of local groups always the best option?
- The feeling of security and safety increase with more lighting. Vandalism and theft of equipment was not an issue in the HEED camp, but training to maintain lighting is more of an issue (which requires funding).
- Refugees in Rwanda are more attached to the camps than the ones in Nepal; Nepali people culturally live in one area, and they are not prone to moving. The people in the Congolese camps in Rwanda cannot leave because the Rwanda government will not allow them to leave – they are not considered as citizens. This also has implications for whether the camps appear permanent.

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Breakout group 1/5 and 2/4: To what extent can improved access to energy address gender inequality?

Developing sustainable energy structures that can respond to gender inequality of displaced communities means going beyond the distribution of solar lanterns or cookstoves in refugee camps. It requires interventions to challenge, and ultimately transform, energy practices in displacement settings in ways that reduce, rather than increase inequality for displaced populations. This group will discuss possible structural changes and applied strategies that meaningfully consider or understand the realities of energy-poor displaced women and the technologies that are most suited to address their needs.

Key discussion points

- Solar lights and microgrids did not necessarily improve gender relations. How can we implement interventions while empowering women?
- There are differences in concerns regarding lack of lighting: men worried about bumping into rocks, women worried about assaults. Improved lighting for females, more than males, addresses personal safety.
- Perceptions differ from men and women on the extent they each contribute to domestic work (a belief they do more than others may think?). For example, in Nepal, women and men both say they exclusively collect the water. Women's household work is often not seen as work, so it may be difficult for men to admit to doing some of the housekeeping type activities (e.g. collecting firewood).
- In Rwanda, a common saying is women are the heart of the family and men are the head of the family – this translates into men often overseeing and approving household changes, such as switching from firewood to renewable energy appliances. The introduction of domestic lighting does give women more time to complete chores but also saw women's working days become longer.

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Breakout Group 2/2: The politics of energy for displaced communities

Like all resources, access to energy is not equally distributed, and access to energy can be a source of conflict and competition, particularly within communities where there are limited resources overall. For those who are displaced within their own countries or elsewhere, access to energy can be tied up with the politics of humanitarian assistance and protection, issues of citizenship and belonging and national and international funding priorities. In other words, the decision to prioritise access to energy can be deeply political – and politicised. This session explored the politics of energy for displaced communities at the local, national and international levels with the aim of identifying opportunities for engagement with a range of actors outside the energy space to leverage access to energy for displaced communities.

Key discussion points

- Should projects put technological concerns first or community concerns first? There may be a struggle to get tech delivered if there appears to be conflicting demands in the political economy.
- To achieve the political impact of a project means shifting from energy delivery silos to a more integrated approach to energy interventions.
- National framework means looking at how we increase rights, including job creation, economic options, and parity of education. Improved access to energy offers opportunities but addressing rights first means sustainable, significant societal changes.

Recommendations

Advocate ways refuges can 'thrive, not just survive': The supply of energy in and of itself does not produce self-reliance, community resilience or enhanced capacity. During the initial planning stages factor into energy interventions that seek integration and the sharing of benefits between refugees and host communities. Implement the comprehensive refugee response framework (which promotes cooperation between governments, international organisations, NGOs and also the private sector) to develop more sustainable solutions jointly. If the right to work and move about freely is restricted for refugees, there is tension between the long-term aims of refugees becoming self-reliant and existing dependence on humanitarian aid. These rights to work outside of the camp make it easier for displaced persons to develop sustainable sources of income, which supports arguments for energy interventions to be shared between displaced and host communities. Refugee rights or lack of rights to economic opportunities act as a barrier to equity in access to affordable, sustainable, and modern energy between the host nation and humanitarian communities.

Encourage collective buy-ins by culturally sensitive approaches to representation, which respond to and respect the energy needs and aspirations of displaced people. For refugees and host communities to 'mutually empower each other, socially and economically' issues around representation need to be addressed. Research projects can be instrumental in addressing how refugees are perceived by host communities, which may or may not reinforce existing stereotypes and prejudices.

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In recognising the differing needs and aspirations of refugee communities when planning energy interventions, especially community-based ownership, consider if there are overburdening or unrealistic expectations on what participants and/or local management are expected to engage with or deliver. Informing people about the benefits of a project does not automatically lead to behavioural change. Instead, ask questions about whether displaced communities have been consulted sufficiently to gauge the level of enthusiasm and commitment.

Avoid gender silos by engaging men and women in discussions around energy to combat inequality and patriarchy. At the onset, plan group discussions that open up space for men to understand how energy solutions impact at different levels and ways according to gender. In Rwanda data collected by HEED showed that men initially thought energy interventions benefited communities equally, whereas women saw the difference. The energy interventions that have a greater impact on women than on men are not necessarily the interventions with the greatest positive impact on women. If data collected around gender and energy is framed exclusively as 'a woman's problem' it could increase discrimination and exacerbate gender inequality. Acknowledge and combat the unequal gender politics and economics between men and women, as men may control the expenditure of domestic goods, such as cookstoves and fuel, which impacts on women's ability to access goods. Promote energy solutions that recognise not only unequal practices for women as service users but provide opportunities for women to be designers of energy schemes and suppliers of energy services.

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Evaluation forms

At the end of the conference participants were invited to complete a survey consisting of three open-ended questions, via an online Google form.[12] The evaluation form was to gauge the impact of attending the HEED conference has on new ways of thinking about the delivery of energy systems in the displaced setting. The link for the form was distributed to attendees on the day of the conference and via an email on the following day (5 November).[13]

Question 1 What are you taking away from the conference day that will inform your current or future work/projects/thinking?

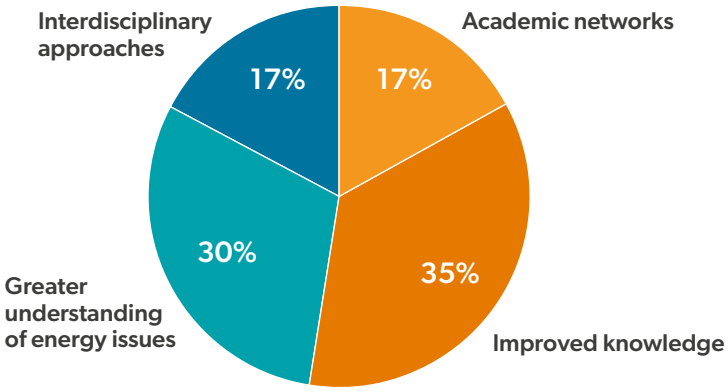
Key findings

- Most attendees felt that in attending the conference, they had either gained a greater understanding of energy issues or had improved their knowledge around energy in the displaced setting
- Several attendees commented that they had made connections that offered greater opportunities for collaboration and further discussions. Others suggested that discussions at the conference had inspired a re-think towards their work, with several noting that they would reference the social dimensions, as well as technical information, in future projects. Most commented that the conference focused on the importance of the relationship between energy technology, sustainability and community engagement

12 The survey was open from 3.45pm Wednesday 4 November till 5.00 pm on Thursday 5 November 2020. There was no obligation to submit a response and attendees could choose whether or not to answer the questions.

13 The data was analysed thematically, a qualitative research method that is useful for a range of epistemologies and research questions (Braun and Clarke, 2006). Twenty-one attendees contributed to the survey anonymously, with the responses given a number and recorded via a password protected Google form. This sample is not representative nor is the data generalised; instead, the findings give rich, meaningful insights into potential areas of future research and modes of dissemination.

Figure 1: Conference impact.

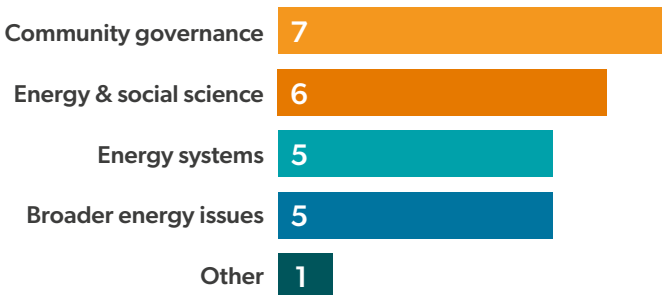


Question 2: What aspects of energy systems deployment should a "HEED 2" focus (assuming it would be a future research/practitioner/community project)?

Key findings

- Alongside community governance, some attendees felt more research is needed on designing highly robust energy systems.
- More research on the financing of energy systems is needed, alongside understanding to what extent displaced communities can benefit from community-owned and maintained energy interventions.
- One question that could be a significant interest for future IoT projects in energy 'Where can the new data collection and analysis methods (which have so far only been proved conceptually) fit into existing/wider energy project developments or humanitarian systems? The sensing technologies have been shown to work technologically (mostly), but their place and usefulness in the overall energy ecosystem are not yet identified/demonstrated'. There was also a request from practitioners for methods to answer questions such as: 'What specific impact does it [energy access] have on education, safety, health? How can the poorest people in the camp access energy?'

Figure 2: Themes.



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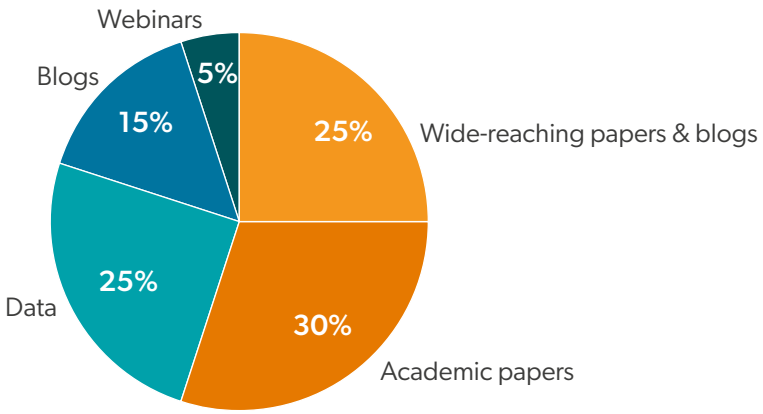
Question 3: How can the knowledge and the experience of the HEED team best support the sustainability of your energy projects? Please name concrete examples (e.g. papers / data / blog on specific topics)

Key findings

- There was still a high demand for academic papers, but equally alternative forms of dissemination were requested, such as reports and webinars. However, some attendees felt that data collected would be more useful if presented in a more accessible format and was shared through a paper or tool.
- Suggestions were given for alternative forms of dissemination and networking: '1 pager lesson learnt / 1 pager tips for good design'; 'guidelines based on the learnings from developed case studies'; 'open contact list with HEED roles that allow specific questions to be asked of specific people'.
- There was also a request for papers that captured how HEED negotiated the negative and positive experiences during the project lifetime as that could aid best practice for other practitioners in the future.

Figure 3: Dissemination.



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Recommendations

Enhance contextual understanding of improved energy access in the humanitarian setting through greater dialogue between energy practitioners and academics.

One constant theme that emerged was a request for more data on the lived experiences of refugees to improve the delivery and design of energy interventions. Indeed, much of the feedback commented that approaching energy access within a broader societal framework, such as gender, improved practitioner understanding of structural inequality as adding an additional discourse to academic literature. However, if as one attendee claims 'the needs perspective has been extensively covered', is there still a demand for more research on user perspectives?

By encouraging research projects to engage with practitioners at every level of the project, this could aid knowledge exchange on cultural norms and barriers when collecting empirical data as 'energy for development is not always the same as humanitarian energy and so different approaches are needed when in engaging with different stakeholders (e.g. Private sector)' (attendee 17). One way to build networks between practitioners and academics is 'joint research studies, regular webinars with scholars and other relevant stakeholders to share ideas and knowledge' (attendee 20). Another attendee (11) commented that 'connecting with other academics in the same sector can be difficult', which suggests that more opportunities are needed for those invested in improved energy access for all to meet through a regular forum.

Drawing practitioners and academics together also means raising questions about 'representation – give[ing] displaced communities a voice but also how can we decolonise energy systems, so they reflect the context and culture of users' (attendee 11). In other words, in sharing insights between practitioners and academics, we could see more advocacy for research that centres on community voices to produce reliable, modern energy interventions that reflect cultural context.

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Future research projects to give greater focus on governance of energy systems that include ways to finance, alternative ownership models, and can adapt to changing demands.

For some attendees, future energy projects would benefit from centering discussion around governance that incorporates sustainable and robust financial models: 'I think a key research topic would be "governance of the energy systems". It is really important to identify sustainable ways to finance and operate energy systems in displacement settings, ideally with a 'cooperative' approach (attendee 18)'. If private sector companies have an evidential base that demonstrates the willingness and feasibility to pay for energy, along with the capacity to deliver an affordable, renewable system, it could encourage a choice of electricity infrastructures in displacement settings. Projects that can envision energy systems that enable economic growth and generate income for displaced people is 'understanding better the user needs and provide an energy solution that can be easily extended to other people in need, grouped not only [displaced] people but also other people living in rural areas (attendee 21)'.

Publish academic findings and data in an accessible style on non-traditional platforms and formats.

Although there was still a demand for outputs that reflect traditional academic pathways, such as journals, there were also requests for shorter, more practical papers aimed at practitioners: 'I think journal articles are great to centre the topic and give it greater academic perspective, but I believe the policy reports, blogs and data channels are very important to help practitioners put things into perspective' (attendee 15). Underpinned by academic rigour, these papers would share data in more accessible formats, for example, infographics, webinars, short one-page reports. Interestingly, some attendees felt that there was a gap in the literature on 'papers (academic or practitioner-focused) with honest reflections on what worked and what did not' (attendee 6). By publishing papers that are transparent about the challenges of working in the displaced context, this opens up a new and exciting discussion on what it meant as a successful project.

Disclosing some of the difficulties that the project encountered, which may or may not be resolved during the project's lifetime, moves discourse from a hierarchy of tangible achievements to a more nuanced recognition of changes, however small, in the researched understanding of how to improve energy access for displaced people.

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Humanitarian Engineering and Energy for Displacement (HEED)

Since the introduction of the UNCHR global strategy on Safe Access to Fuels and Energy (SAFE) in 2014, humanitarian responses to refugees and internally displaced people (IDPs) have sought to deliver safe and sustainable energy provision. By focusing on the lived experiences of refugees and IDPs in Nepal and Rwanda to understand energy usage in refugee camps and settlements, the HEED project will develop, and contribute to, innovative responses which address demands for improved energy services.

Our research, led by key experts in the fields of engineering and social science, is looking for solutions that will provide crucial guidance on creative approaches and technologies to clean or fuel-efficient cookers, alternative and sustainable fuels, and solar-powered lighting, which will build the resilience of refugee communities.

Our partners

The HEED project, is led by an interdisciplinary team based at Coventry University, in partnership with the international development charity, Practical Action, and Scene Connect, a social enterprise strengthening communities through the development of ICT products.

Contact us

www.heed-refugee.coventry.ac.uk

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