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Whole Systems Networking Fund:

Working to Improve Equity, Diversity and Inclusion Across Energy Research

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Overview

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The Whole Systems Networking Fund (WSNF) is a unique research fund that seeks to improve Equity, Diversity and Inclusion (EDI) in energy research. It aims to broaden both the people and institutions that the UK Energy Research Centre engages with, connecting new partners and amplify fresh voices in the conversation around our future energy system.

In this report we provide a brief overview of the WSNF and then provide a summary from each of the projects awarded during this iteration of the fund.

Introduction to WSNF

UKERC previously ran the WSNF in Phase 3 (2014 -2019), during which the key focus was building gender parity in energy research. At its conclusion, 80% of the funding had been allocated to projects led by women.[1] Due to its success, the fund was delivered again in UKERC Phase 4 (2019-2024).

Direction for the fund was provided by an independent Steering Group composed of 16 members that represent a range of disciplines, career paths and stages, within energy research. The Steering Group advised on priorities for the fund and were responsible for the final selection of successful projects.

Throughout 2021, we conducted a range of activities to consult the wider community on how best to use the fund and a decision was taken to broaden the scope of the programme. The call theme was 'advancing Equality, Diversity and Inclusion (EDI) in energy research' which could be adhered to in several ways, for example through research topics, project partners, stakeholders involved, beneficiaries, or activities conducted. In the previous round of the WSNF we ensured that early career researchers (ECRs) could lead projects and this is something we continued to maintain, as it can be hugely impactful for careers.

The specific aims of the fund were to:

- Improve EDI across the energy research space,
- Widen participation to share experience across disciplines and the four UK nations,
- Undertake collaborative research with non-academic partners to investigate policy-relevant challenges that could be solved through a whole systems approach,
- Offer career enhancement opportunities for ECRs.

The call for proposals ran from Jan-April 2022, allocating up to £400,000 of UK Research and Innovation (UKRI) to fund projects via grants that ranged in value up to £60,000.

1 Burns, W, Watson, J and Longuere, K. 2019. Progressing new voices and gender balance in energy research. Access here: https://ukerc.ac.uk/publications/gender-balance-in-energy/

Keen to reach a diverse audience, the fund was communicated via the website and social media, with a particular focus on connecting with entities on X (formerly Twitter) that represent underrepresented groups. This engagement was undertaken alongside consultation activities, the delivery of a webinar to inform and support potential applicants, and communication of the scheme via the UKERC website and newsletter.

Overall, 30 proposals were submitted, seven of which were awarded funding, with project teams welcomed into the consortium.

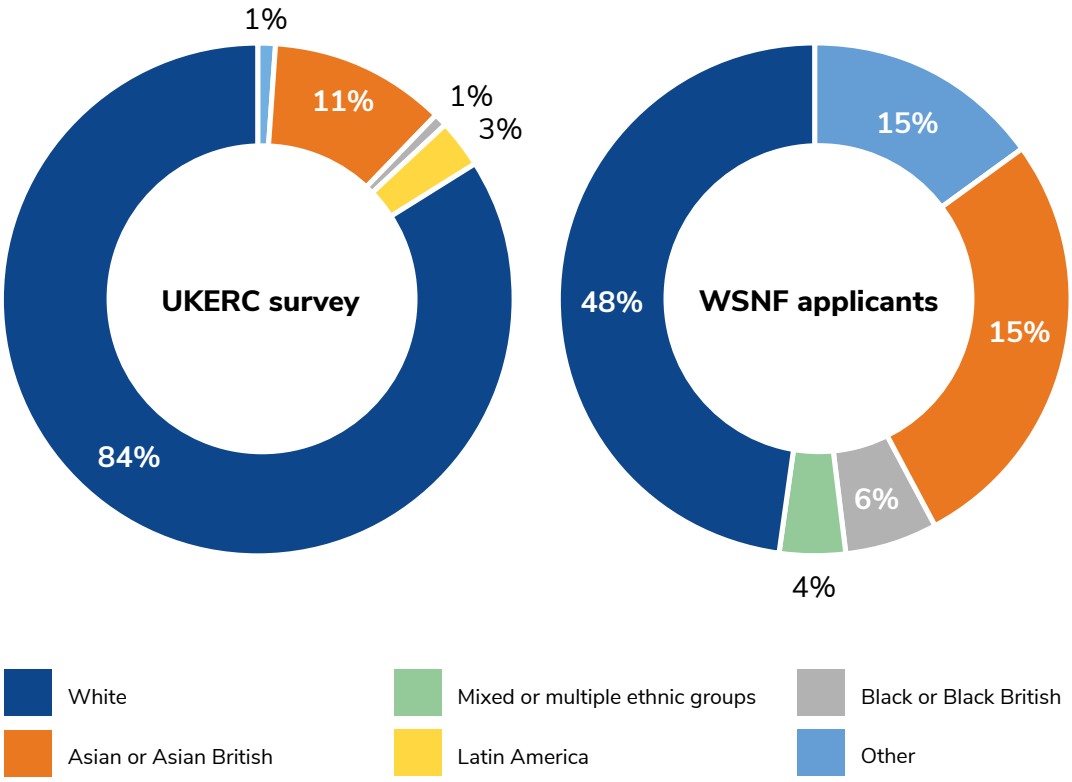
Data analysis

At the point of application to the WSNF in 2022 we asked projects to complete diversity monitoring forms, thereby capturing data from 48 prospective applicants, of which only two were affiliated to UKERC.

In 2023, we also initiated a UKERC wide EDI survey, participation in which was both anonymous and optional, this was circulated to all individuals who are currently or have been associated with UKERC phase 4, achieving a response rate of 41% (77 responses). Below is a brief comparison of these data sets, highlighting how the WSNF was successful in meeting its aims.

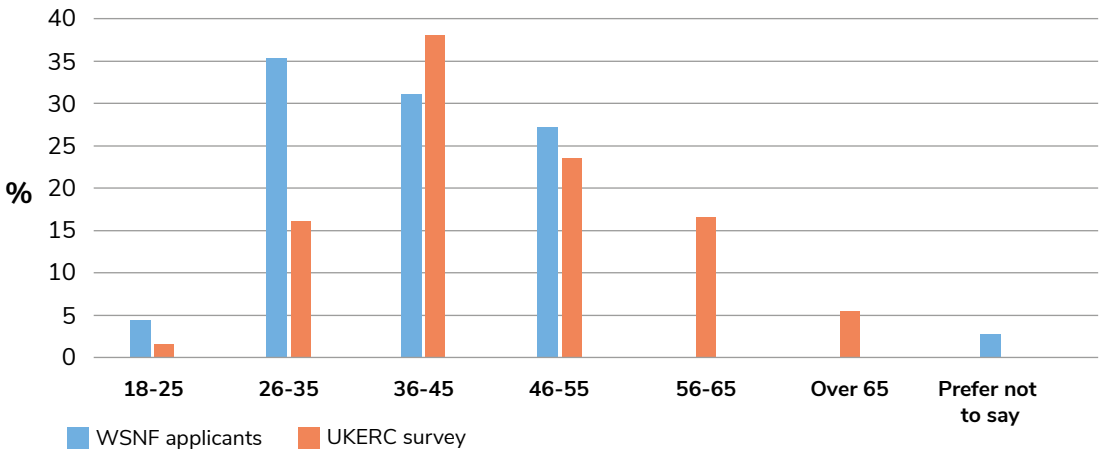
Whilst some of the categories used in WSNF applicant survey and the UKERC survey were slightly different in some instances, below we provide a brief comparison of key aspects from the two data sets, looking at ethnicity, age, gender and disability.

Figure 1. Comparison of ethnicity data



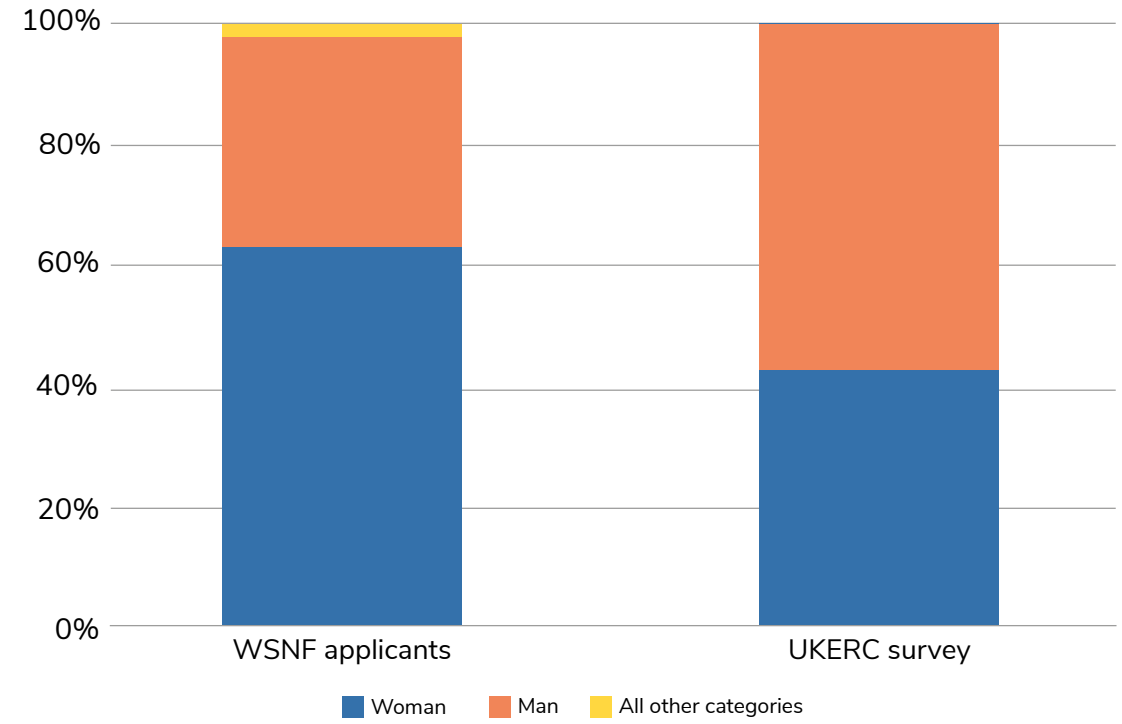
From the data comparison it is clear that the WSNF was successful at reaching a more ethnically diverse group of individuals than those represented in the UKERC consortium. In the UKERC survey only 16% of respondents selected minority ethnic groups, whereas in the WSNF applicant data this had increased to 52%.

Figure 2. Comparison of age data



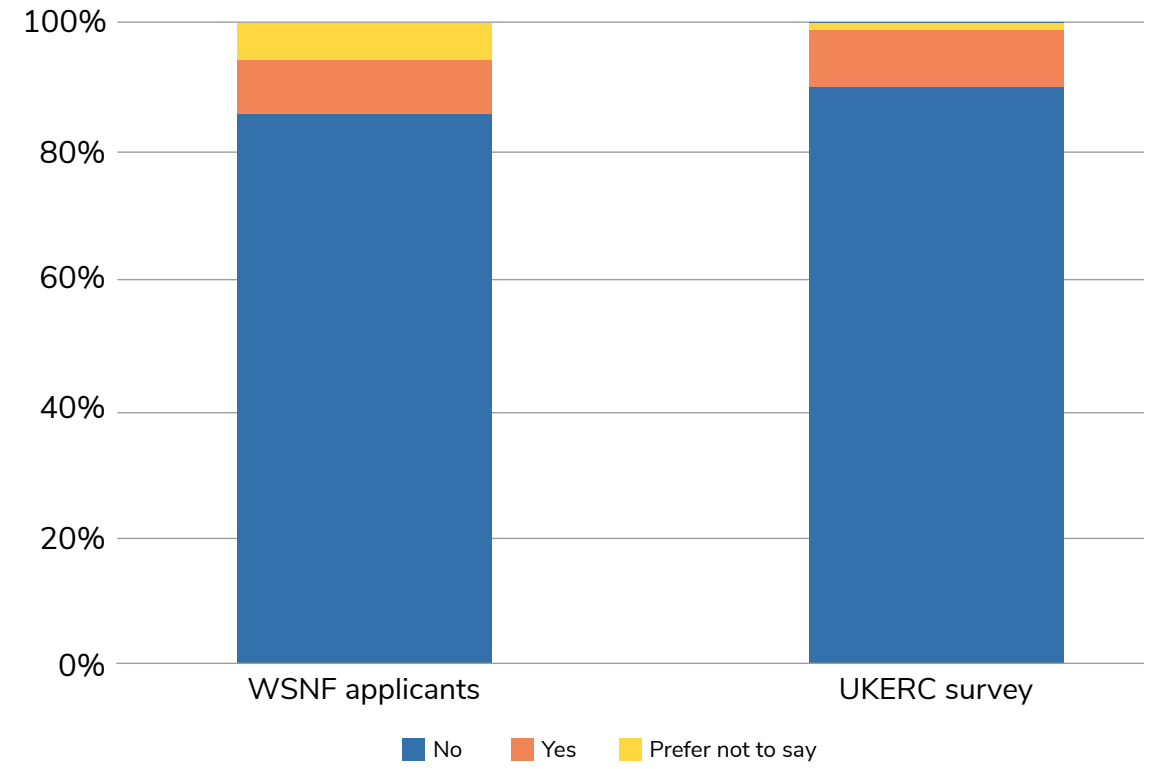
From comparison of the two data sets it is apparent that the cohort of WSNF applicants were younger than those represented in the UKERC consortium, this is commensurate with a key target for the WSNF being ECRs

Figure 3. Comparison of gender identity data



There is a clear difference in the gender balance of the WSNF applicant and UKERC survey data, with 63% of WSNF applicants identifying as a woman as compared to 42% in the UKERC survey. Also 2% of the WSNF applicants selected ‘all other categories’ which encompasses he categories of 'non-binary', 'prefer to self-define' and 'prefer not to say', whereas in the UKERC survey these categories were not selected.

Figure 4. Comparison of disability data



When comparing the data obtained around disability it is clear there was a smaller difference between the WSNF applicant data and the UKERC survey than for the other categories, 9% of the WSNF applicants reported that they had a disability as opposed to 8% from the UKERC survey. There was however a larger difference between those selecting prefer not to say, with 6% of WSNF applicants selecting this as opposed to 1% for the UKERC survey respondents.

Summary

By comparing the two data sets it is clear the WSNF successfully reached a more ethnically diverse group of applicants than that reported in the wider UKERC survey. The WSNF also continues to build on the success of the programme run in Phase 3, by attracting more women applicants. Interestingly the data does not identify a difference between reported disability, which highlights that further efforts need to be made in this area to reach and support applicants with disabilities when applying for the WSNF.

- The success of the fund has shown that with appropriate targeted actions, such as identifying key organisations, providing sufficient time to advertise the fund, and delivering activities such as informative webinars, it is possible to reach individuals who are typically underrepresented in energy research.

- It should also be noted that all successful projects were welcomed into the UKERC consortium with access to all the training, events and networking opportunities that this affords. Thereby helping to build connections and networks both within, and external to UKERC, helping to raise the profiles of the project leads and teams.

Energy, Health, and Happiness

Project leads: Eleanya Nduka and Modupe Jimoh, University of Warwick

The global pursuit of inclusive energy access and a carbon-neutral society could fall short if rural households in developing countries remain excluded from these advancements. It's crucial to recognize that energy poverty has a concealed and often overlooked impact on women and children, a reality frequently masked by studies that rely on aggregated data.

Women, in particular, bear the heaviest burden, spending countless hours labouring over three-stone fires for cooking in developing regions and venturing far into the bush to gather firewood. These demanding tasks severely limit their participation and earnings in the labour market compared to men. However, comprehending the extent of women and young children's disproportionately adverse experiences arising from energy poverty necessitates a comprehensive and in-depth investigation. Consequently, this project aims to provide insights into the effects of cooking energy usage on the physical and mental wellbeing of mothers and their children. Furthermore, we examined the detrimental impact of carbon monoxide exposure on children's development.

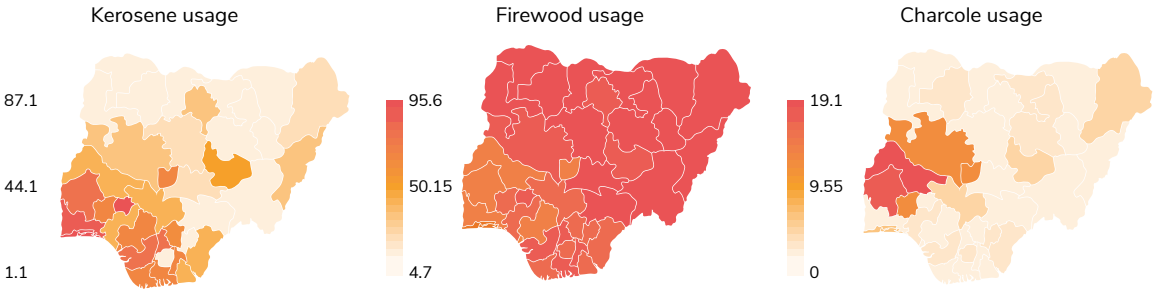
Figure 5. Images of cookstoves both indoors and outdoors

Methodology

Study Location

This research was conducted in Nigeria due to its distinctive energy poverty predicament. A staggering 83.2% of the population still depends on air-polluting fuels and cooking technologies (predominately three-stone fires), which pose an alarming threat to public health. Our data collection efforts were primarily concentrated in Ebonyi and Enugu, where a substantial proportion of households use air-polluting cookstoves.

Figure 6. Cooking fuel usage across Nigeria



Data Collection and Analysis

To effectively conduct our study, we developed a structured questionnaire that was approved by the Humanities and Social Sciences Research Ethics Committee at the University of Warwick. A computer-assisted personal interview methodology was employed for face-to-face interviews, conducted from May to August 2023. The participants were mothers with at least one child between the ages of one and four.

The initial data collection phase focused on obtaining information regarding households' primary and secondary sources of lighting and cooking, associated expenditures, average meal cooking durations using cookstoves, and the physical locations of their kitchens. Additionally, we collected data on participants' physical and mental health, including satisfaction levels with lighting and cooking equipment, overall happiness, and perceived quality of life.

Our investigation also examined various lifestyle factors such as dietary habits, smoking, alcohol consumption, and exercise routines. We further collected household demographic information, including marital status, educational attainment, employment status, age, and monthly household income. To gauge the household's asset ownership, composition, consumption patterns, and living standards, we employed a 10-item poverty probability index tailored for Nigeria by Innovations for Poverty Action (IPA, 2022).

We utilised a Rad-57 CO-oximeter to measure carbon monoxide levels in the respondents' and their children's bloodstream, providing an additional layer of data. Alongside this, our study also assessed cognitive development skills of preschool-aged children by exploring five cognitive development domains: communication, gross motor, fine motor, problem-solving, and personal-social skills.

Figure 7. Carbon monoxide reading being taken from a child using a Rad-57 CO-oximeter

Figure 8. Incidence of poverty and cooking energy predicting happines

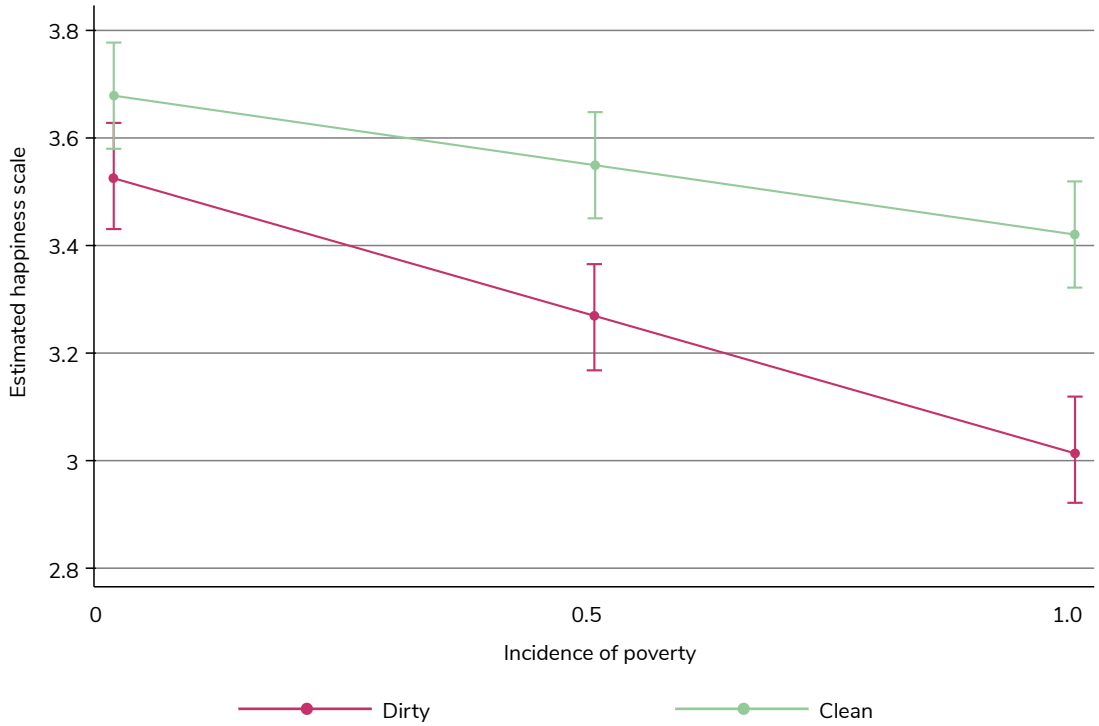
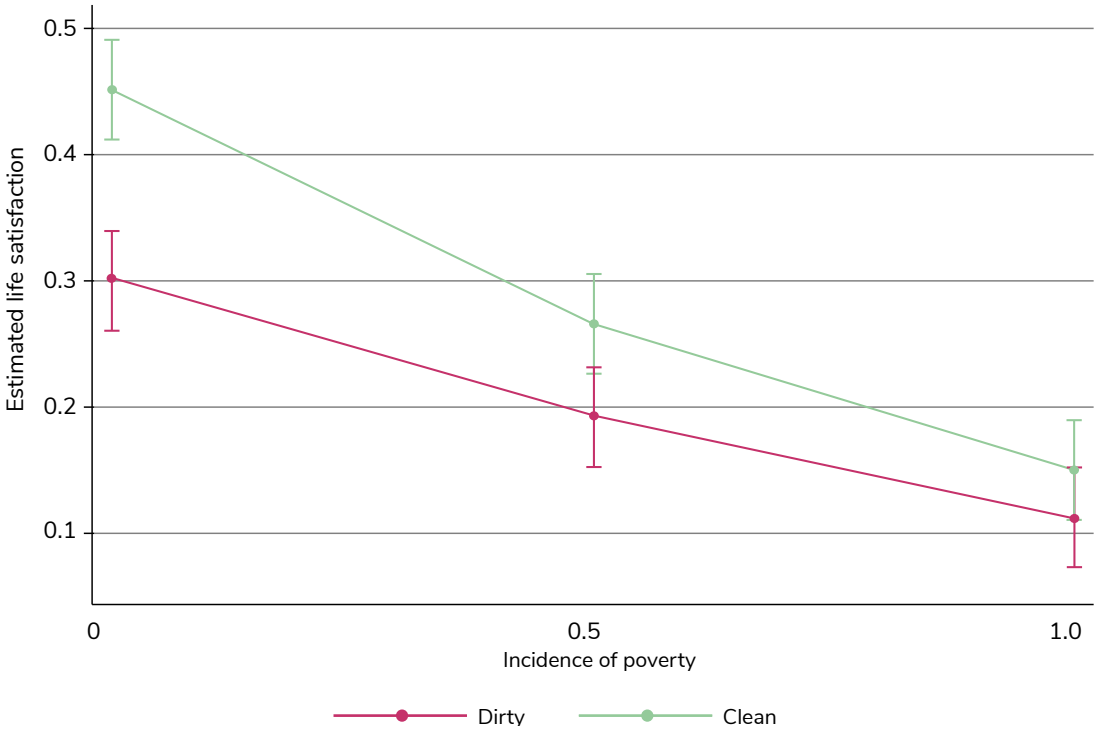


Figure 9. Incidence of poverty and cooking energy predicting life satisfaction



Results

- We find a positive relationship between increased clean cooking energy usage and women's happiness levels. For every unit increase in clean energy usage (moving from air-polluting fuels to clean energy), happiness is expected to increase by 0.56 points on the five-point happiness scale.
- Figure 5 illustrates that as the incidence of poverty increases, a noticeable divergence emerges in self-reported happiness levels between clean and dirty cooking energy users. In the context of life satisfaction n Figure 6, the gap between these two groups of energy users converges as poverty incidence rises.
- We found that a 1% increase in carbon monoxide levels in the blood was found to be detrimental to both women's health and happiness, with a 0.10 point decrease in health and a 0.16 point decrease in happiness on the five-point happiness scale.
- Our analysis revealed that if every woman in the population were to transition to clean cooking energy, psychological distress and perceived stress levels would collectively decline approximately by 5.00 and 4.20 points compared to a scenario where no one utilises clean cooking energy.
- In addition, preschoolers with higher carbon monoxide levels in their bloodstream exhibited reduced development across various domains, including communication, motor skills, problem-solving, and personal-social ability.
- A robust and consistent correlation was also observed between mothers' mental health and their children's cognitive development across all three measurement scales employed in the analysis.
- In conclusion, our investigation underscores the substantial and detrimental impact of air pollution on children's health outcomes, highlighting the need for widespread adoption of clean cooking technologies to protect the wellbeing of both women and children.

Outputs

- A journal paper entitled Energy, Health, and Happiness (under review)
- A journal paper entitled Air Pollution, Child Health and Cognitive Development (under review).
- A symposium themed “Energy and Wellbeing Symposium” on 30 March 2024 in Enugu, Nigeria.

Recommendations

- Policymakers and stakeholders must prioritize initiatives aimed at enhancing household energy access and promoting a shift towards clean cooking practices, particularly in rural regions where reliance on dirty fuels and exposure to indoor air pollution remain prevalent issues.
- To increase public awareness, targeted campaigns should be launched to educate women and communities about the detrimental mental health consequences of using dirty cooking energy sources.
- Policymakers should embrace gender-sensitive approaches that cater to the unique needs and challenges faced by women in relation to cooking energy.
- The documented negative impact of carbon monoxide (CO) exposure on the cognitive development of preschool-aged children underscores the urgency of prioritizing efforts to curtail indoor air pollution and minimize CO exposure, especially in settings where young children reside.
- Policies should focus on vulnerable populations, such as low-income communities and children living in polluted areas, by implementing targeted interventions and support measures to address disparities in exposure and health outcomes.

References

IPA (2022) Poverty probability index. Available at https://www.povertyindex.org/country/nigeria

Energy Modelling for All

Project leads: Lirong Liu, Nyanee Silva and Xinyao Liu, University of Surrey

The Energy Modelling for All project was launched to improve diversity and knowledge in the field of energy modelling, through sharing knowledge and information with individuals from a wide range of backgrounds.

The main aims of the project were:

- To build a network of under-represented groups to engage with energy modelling from varied disciplines and sectors.
- Establish a platform with open learning resources to provide easy methods of engaging with energy modelling tools.
- To host a series of events with interactive learning, engagement and mentoring from energy modelling practitioners and develop a supportive peer community, to enable diverse groups to use energy modelling to solve practical problems.

The project team conducted two in-person workshops at the Centre for Environment and Sustainability (CES), University of Surrey. The workshops were conducted by academic experts from CES, and attendees came from academia and the private sector.

Project outputs

The project and its activities created the following outputs:

- **An energy modelling network:** a LinkedIn group (www.linkedin.com/groups/12843195/) and a mailing list of those interested in energy modelling was created to engage with a diverse international community. There are over ninety members in the network to date (Aim 1). A social media account was set up on X (twitter.com/energymod4all).
- **Online learning platform**: A website (energymod4all.org/) for the project was created with information on energy modelling tools and open learning resources. The site also hosts a blog, relevant presentations and articles on the topic (Aim 2).
- **Face-to-face knowledge sharing events:** Two in person workshops were organised to share energy modelling tools with a non-expert participants representing a diversity of disciplines and levels of experience(Aim3).

Workshops and technical content

Life cycle analysis, input-output analysis, techno-economic analysis, and optimization models were covered in the first workshop in June. Participants agreed the presented content was well-organized and accessible to people with no previous modelling expertise.

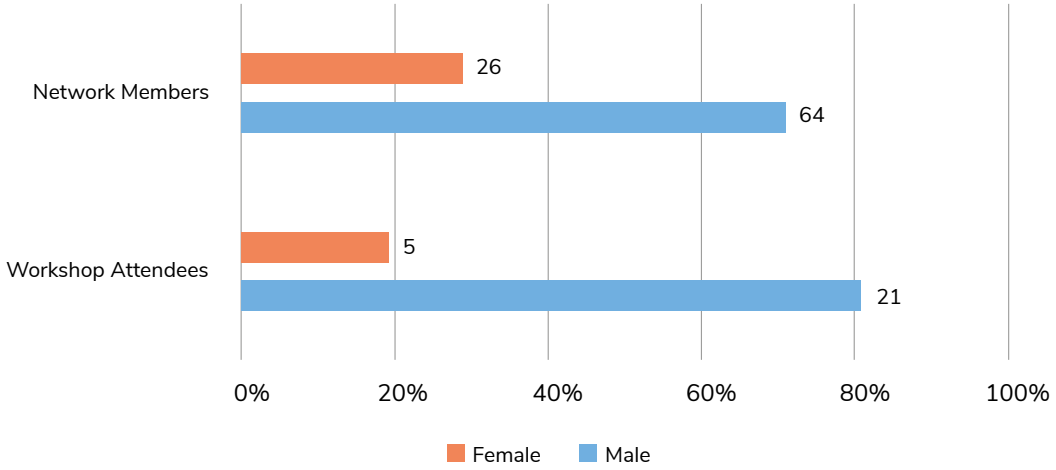
The second workshop in October included several presentations by University of Surrey researchers, covering case studies and energy modelling tools. A presentation on optimisation in electric power systems models was also delivered by a guest speaker from the University of Cardiff. Feedback from the workshops highlighted that many attendees were interested in further learning and exploration of more advanced energy modelling concepts.

Figure 10. Attendees at the second Energy Modelling for All skill building workshop

Diversity and engagement

As can be seen from the detail in Figure 1, only 26 (29%) of the 90 network members were women. In looking at underlying reasons for this discrepancy in gender, it should be noted that whilst the global workforce includes 39% of women, according to a study covering 28 countries only 16% are in the traditional energy sector globally (IEA, 2019). The field of energy modelling follows this trend, and it further indicates that a better propagation strategy is needed to attract more women to gradually address this gender imbalance. The attendees at the two workshops were mostly men (84%) with only five attendees that were women (16%). Some women who had registered to attend, cancelled their registration for the in-person workshops due to weather conditions or changes of arrangements. Yet it seemed that those who were network members were less likely to participate at in-person events. More incentives could be provided to encourage the engagement of potential women energy modelling users, such as covering for travel expenses.

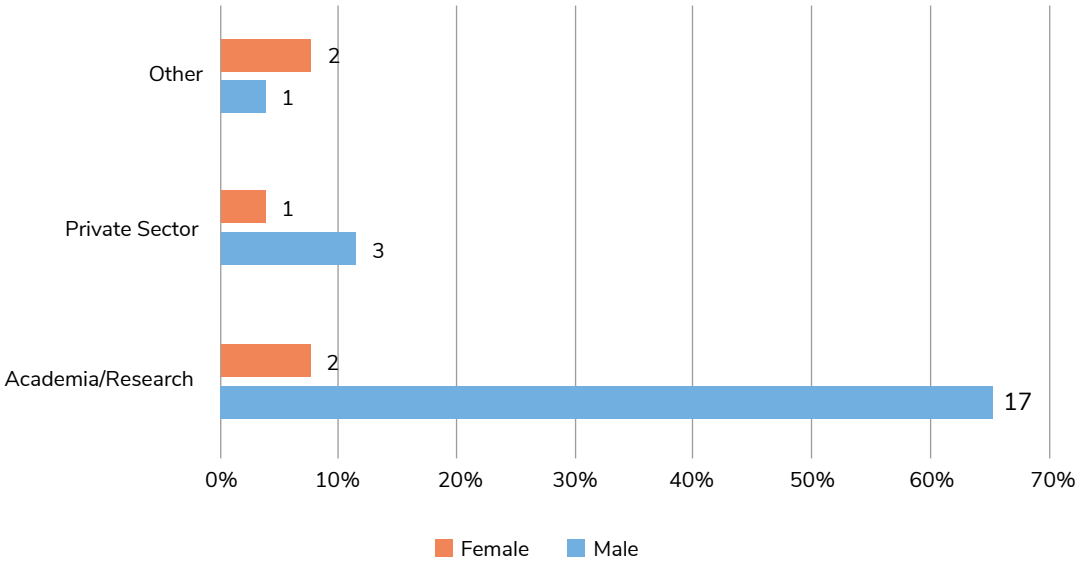
Figure 11. Workshop attendees and network members by gender



The network and the workshops included individuals from various disciplines, most of whom had not previously used energy modelling techniques. The majority of attendees (73%) came from academia as shown in Figure 12, and of these only 12% were women. This is quite low considering the gender balance of the academic community. The event information was shared publicly on LinkedIn and social media channels, however, offline communication was mostly through academic networks. It was observed that though some business groups were contacted, the interest drawn was mostly from academia or researchers in industry. In the non-academic sector, 43% (3/7) of the attendees were female.

The attendees included researchers, students, academics, consultants and administrators as shown in Figure 13

Figure 12. Sector and gender of workshop attendees



42% of attendees were postgraduate students. Plausible explanations could be that PhD students are more eager to explore energy modelling methods for use within their own disciplines and research domains. 38% of total attendees were in the age range 25-34 years and 65% were in the age range 25-44 years, which included students and young professionals.

Figure 13. Word cloud of the occupations of workshop attendees

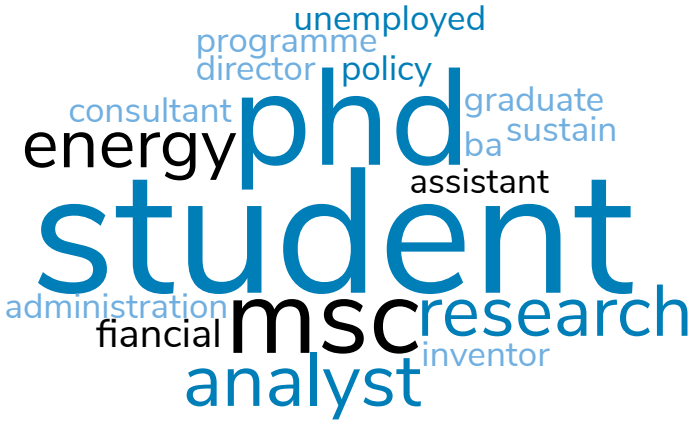
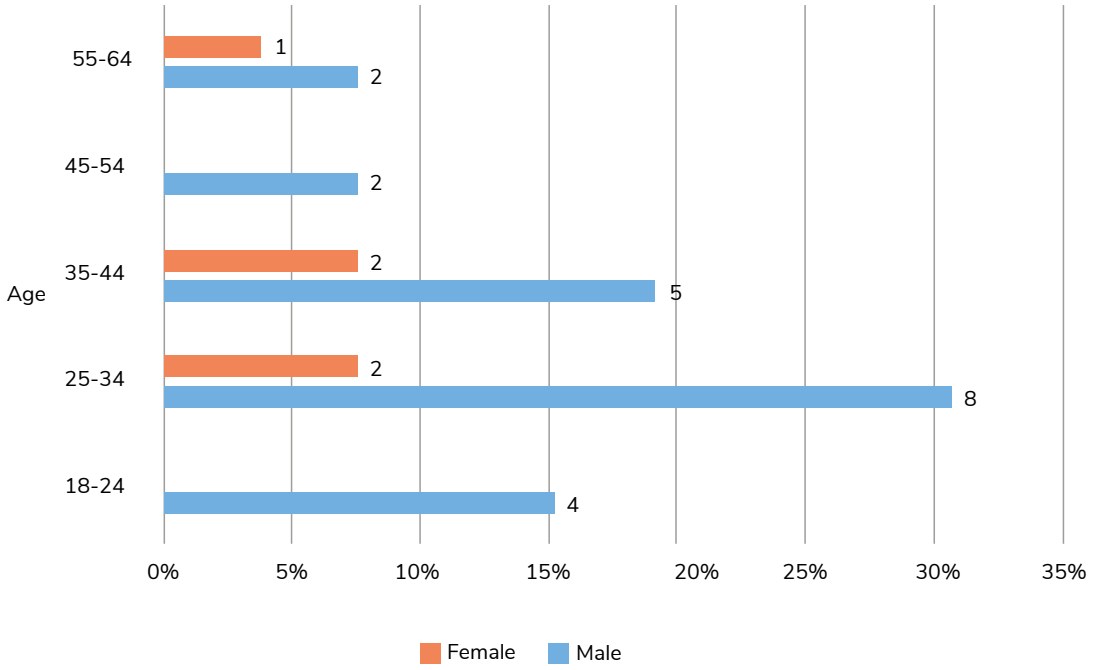


Figure 14. Ages of workshop attendees



Workshop feedback and future plans

A survey was conducted after each of the workshops. Feedback from the surveys showed that all participants were satisfied with the material presented in the workshops and conveyed interest in applying the methods to their own work. Most participants expressed their interest in acquiring more learning resources. Many were keen to have more interactive learning opportunities. All attendees responded that they would recommend such workshops to colleagues.

Comments from participants on what they enjoyed most from the workshops:

"Learning about new methods, working through problems and meeting people from a range of backgrounds"- energy policy analyst.

"Seeing for the first time how energy modelling is so relevant for decisions that affects our lives"
– administrator.

"Interesting tools and presentations... some ideas can help me expand my research area"
– PhD student.

For future activities, to increase engagement from women and underrepresented genders, it may help to have discussions with audiences and networks prior to an event, so that a needs assessment can be carried out to increase and tailor interest to these groups. Increased engagement with women's groups and online events may also help reach a wider audience.

Conclusion

The project has met the aim of creating a network of persons from diverse backgrounds and disciplines interested in energy modelling, through an online community and mailing list, including workshop attendees. It has also created engagement through events to share knowledge, and created a platform to share resources through the website and social media.

Only 29% of our network members and 12% of our workshop attendees are female, which is lower than expected. However, women who were members of the network were less likely to join in-person events. Meanwhile, our current networks and event advertising channels are academia-biased, especially towards young PhD students and researchers. For participants at the workshops, most of them were interested in continuing engagement with energy modelling through mentoring and further learning. It is hoped that the content created for these events and the website will continue to inform and engage on energy modelling topics.

For future implications, new event propagation strategies and bespoke incentives designed for women participants are encouraged to increase gender diversity in this area.

References

Energy and Gender – Topics—IEA. (2019). Retrieved 27 November 2023, from https://www.iea.org/topics/energy-and-gender

Energy SHINES

Project leads: Zareen Bharucha, Global Sustainability Institute and Rihab Khalid, University of Cambridge, and Aled Jones, Global Sustainability Institute

Project participants: Rosie Robison, Sarah Royston, Mel Rohse and Felicity Clarke, Global Sustainability Institute

Energy SHINES (Energy Social sciences and Humanities Insights for Non-Energy Sectors) was a partnership led by Anglia Ruskin University's Global Sustainability Institute in collaboration with the University of Cambridge, working with five external stakeholder organisations: the National Health Service, Yorkshire Water, Cambridgeshire County Council, the UK Government's Office for Product Safety and Standards and the Royal Institute of British Architects.

Each of our partner organisations face significant and unique challenges as they transition to net zero. Energy SHINES responded to three gaps in traditional approaches to help address these challenges.

- Firstly, evidence and insights used to inform energy transitions have traditionally been drawn from technical STEM disciplines, excluding insights from the social sciences and humanities (SSH). This matters, because net zero transitions involve decisions and collective action by people who use energy systems, and these cannot be managed through technological fixes alone.

- Secondly, technical disciplines are mostly dominated by men, women made up just 14.5% of UK engineers in 2021.

- Finally, a significant amount of energy-related research and knowledge transfer has focused on energy use or production. However, non-energy sectors such as those represented by the Energy-SHINES partners – water, healthcare, and local government, for example – play a vital role in energy systems, and are therefore key to successful societal transitions to net zero.

We responded to these gaps through a placement-based project that ran from January to September 2023.

Placement processes

Our placements involved each of our partners articulating one particular challenge that they wished to address as part of their transition to net zero. We then set up an open call for applications from women doctoral researchers working within SSH disciplines. We provided funding for a paid five-week placement for each researcher at the partner organisation. During their placement, PhD and early career researchers were supervised by a key contact and supported by an academic member of the Energy SHINES team. The advantage to our participating partners was the provision of highly trained, professional SSH researchers working on an applied problem that was an active focus in the organisation's net-zero work. The 'draw' for participating researchers was the ability to showcase SSH expertise within an applied, non-academic context, achieve real impact within a time-bound and relatively tractable project,

and network with non-academic stakeholders with an active interest in applying SSH to net-zero challenges.

Each researcher used the placement to provide an SSH-informed response to the host organisations' particular net zero challenge. The placements were preceded by a one-day 'policy challenges' workshop in February 2023, where the hosts discussed their challenges with a wider group of women doctoral researchers, and where placement-holders were able to receive input and recommendations from their peers in advance of starting their placements.

The challenges our placement-holders tackled included:

- **For the Office for Product Safety and Standards:** The implications of net zero for product safety
- **For the Royal Institute of British Architects:** Developing a policy position on the Net Zero Carbon Buildings Standard
- **For the NHS Transport team:** Contributing to the development of a globally ambitious programme to persuade staff, patients and visitors to choose sustainable travel options
- **For the NHS Digital Healthcare team:** Understanding the carbon impacts of digital healthcare
- **For Cambridgeshire County Council:** Understanding how circular economy principles can help reduce household waste
- **For Yorkshire Water:** Raising consumer awareness of energy- and water-saving targets.

Figure 15. Group shot of attendees at a project meeting

Outputs from the project

Each placement-holder conducted desk-based research, spoke to key stakeholders and researchers on existing perspectives, solutions and resources, and searched the research literature directly. Placement-holders were given free rein to proactively develop the best approach to tackling the specific energy challenge they were working on, in consultation with the placement host. In several instances, this meant fundamentally expanding or changing the terms of reference for the placement, reframing the hosts' challenge to better account for an SSH-informed understanding of the challenge.

Each of the placement holders produced two policy briefs at the end of their placements. The first was a targeted response to the placement hosts' unique net-zero challenges. The second was a wider reflection on the sector-wide challenges exemplified by the host organisation, and how an SSH lens could help to tackle these.

These second, public briefs can be accessed on the UKERC website . Each demonstrates an SSH perspective on the unique challenges articulated by our partners. The process of writing the briefs was supported by a series of workshops with a professional writing facilitator, who provided expert guidance on the process and craft of academic writing for non-academic audiences.

Our completed project has demonstrated how early career SSH researchers can make a significant and unique contribution to net zero work in large organisations, and that bringing SSH- energy perspectives to non-energy organisations can generate critical insights to help support net-zero transitions. As a project for women researchers, led by women, Energy-SHINES made an important contribution to the field of energy research by creating space for women's perspectives and expertise in a traditionally male-dominated arena. By amplifying women's voices and bringing a critical SSH lens, the project contributes to influencing policy and practice towards greater inclusivity and diversity.

Equality, Diversity and Inclusion in Energy Systems: community and gender perspectives

Project leads: Federico Caprotti and Kerry Bobbins, University of Exeter, and Whitney Pailman, University of Cape Town

The Equality, Diversity and Inclusion in Energy Systems: Community and Gender Perspectives (EDI-GEN) project aimed to address key challenges in building future energy systems. Its main aim was to focus on community needs as defined by community members themselves, and to emerge and value narratives by community members, as a way of informing energy system policymaking.

Our key focus was on disadvantaged urban communities, notably those living in informal settlements (South Africa) and in one of the least wealthy urban areas in the UK. EDI-GEN prioritized women's narratives, as women and children bear the brunt of energy system inequalities. EDI-GEN's policy-facing activities focused on moving towards integrating and interfacing these voices with policy and other relevant stakeholders.

The project, engaged with low-income communities in Plymouth, UK, and Cape Town, South Africa. These communities were chosen because of their engagement with the key question of how to make sure that energy systems are responsive to (and informed by) community needs. Needs are a crucial point of focus, sidestepping the technocratic nature of energy interventions and policies that are parachuted into communities 'from above'. Indeed, approaches that do not listen to community needs do not recognize the importance of the local community context in the process of designing energy systems. At the same time, EDI-GEN also recognized that crucial learning opportunities exist when establishing dialogues between different communities, approaches, experiences, and innovations, which is why a key area of focus was on the interfacing of different stakeholders (see 'results' below)

Aims

The purpose of the EDI-GEN project was to tackle the key issues of how to build future energy systems that:

- are responsive to the needs of local communities, especially the most socio-economically disadvantaged;
- integrate the experience of community members who are usually sidelined, excluded or silenced in the energy policy process.

Crucially, the voices of poor communities, and specifically of women in these communities, are those who are the least likely to be heard, and to therefore have an influence on energy policymaking. EDI-GEN aimed to turn this on its head: to be sustainable, future energy systems need to integrate evidence-based, community-sourced perspectives and experience at the levels of planning, development, policy, and evaluation.

To achieve the overarching aims above, the project's objectives were to:

1. Establish a dialogue between local communities in Plymouth and Cape Town, and policymakers, focused on mechanisms and outcomes for informing policy;
2. Develop mechanisms for community-based EDI-informed energy policymaking;
3. Communicate these mechanisms to UK, South African, and international policy, and broader cross-sectoral and cross-disciplinary audiences;
4. Track and evaluate the impact of our approach and project outputs.

Figure 16. Qandu-Qandu an informal off-grid settlement situated under the formal electricity grid

Approach

The project was based on in-depth qualitative research that was comparative in nature, and that was also focused on engaging with local communities.

In Cape Town, EDI-GEN engaged with the Qandu-Qandu informal settlement community. Qandu Qandu is an extension of the existing and partially informal Khayelitsha area of Cape Town and was founded in 2018. At the time of formation it had no grid access and still lacks it at the time of writing. The community actively collaborated with various actors, including UK and South African universities, local solar energy utilities, the municipality, and others.

In Plymouth, EDI-GEN worked with the Plymouth Energy Community (PEC), a social enterprise actively involved in community empowerment through the development of energy infrastructure (solar farm), international infrastructural financing mechanisms (share raises), energy advisory services (insulation), and mentoring and training for residents, landlords, businesses, and Plymouth City Council. Plymouth Energy Community aims to bridge the gap between energy policy and community needs in a socio-economically challenging context, emphasizing a commitment to local community requirements

Findings

EDI-GEN generated several key findings, of relevance to both national and international policymaking audiences. These are summarised below.

Enabling environments for testing off-grid innovations and business models

Within the broader context of infrastructure provision in the 'off-grid city', innovative pilots present an opportunity to test innovation for coupling energy services with livelihood opportunities and recognising off-grid solar as a legitimate form of energy access. This can fill a significant gap in service delivery for urban informal settlements within the city and beyond.

For innovations like off-grid solar mini-grids to become a more lasting feature of urban infrastructure, continuous improvements are needed to provide higher tiers of energy access, through sustainable financing models, developing supportive community structures for the local businesses and including off-grid solutions as part of a suite of municipal service delivery options.

The role of finance in supporting off-grid innovations

There is a role for targeted grant and innovation funding to support the funding landscape for niche innovations. There is a need for municipalities to effectively support solar innovations by directing finance and subsidies into off-grid energy projects. In the South African case, for example, this could mean systems aimed at integrating new energy token pilots into off-grid energy projects and reviewing the application of the Free Basic Alternative Energy (FBAE) that is made available to households in formal residential areas.

Community-focused business models

Community engagement lies at the heart of our recommendations, recognizing the invaluable insights that informal communities possess regarding their unique needs. It is imperative to work collaboratively with the local community to better understand the local context, which includes the affordability context, existing energy sources and infrastructure as well as the types of businesses in the community. This underscores the imperative to continuously consult with community members for effective service delivery.

Fostering women's empowerment in the energy sector

Empowering women is a priority within our recommendations. Women often serve as the caretakers in their communities and possess an innate understanding of community needs. To support livelihood opportunities for women entrepreneurs in informal settlements, we propose facilitating the formation of cooperatives and other, similar community organizations in these communities. In addition, we recommend providing financial grants to bolster small businesses active in the least wealthy urban areas.

The need for diverse off-grid solutions based on community needs

Recognising the diverse needs of communities, we encourage the coexistence of a variety of off-grid options. For instance, the case of the solar tower installations in Qandu-Qandu underscores that some community members prefer standalone systems. These standalone systems enable them to proactively address issues without the need for extensive consultation, aligning with their specific requirements. A 'user-centric', needs-based approaches should be adopted for developing solar enterprises and understanding the entrepreneurial journeys, ideas, but also the constraints faced.

Transparent communication on municipal constraints

Transparent communication with the community regarding municipal constraints is vital. Many residents in Qandu-Qandu, for example, remain uninformed about the reasons behind their lack of electricity, which may be attributed to the municipality's limited interaction with the community. Effective communication can bridge this gap and foster understanding. This may mean widening the scope of municipal energy and other service-delivery departments, to include elements of community engagement and communication via community meetings as well as social media campaigns.

Figure 17. Community engagement on renewable energy systems in Qandu-Qandu

Exploring Applications for Energy Grants in West Yorkshire

Project Team: Ruth Bookbinder, Lucie Middlemiss, Mark Davis and Anne Owen, University of Leeds

This project emerged out of an incidental finding from previous UKERC project, 'Net Zero Neighbourhoods, Whole Person Whole Place'. While analysing who applies for energy grants in the UK, the project found extremely high numbers of applications among low-income homeowners with Asian backgrounds in post-industrial cities, such as Bradford. (Owen et al. 2023) We therefore set out to explore the factors driving this high number of applications using the relational framework that we developed in our other project. (Bolton et al. 2023)

Methodology

The Asian community in Bradford has been the subject of multiple academic studies and is consequently research weary and suspicious of external researchers. We therefore worked with a local housing association as a trusted local actor to reach out to homeowners and offered homeowners vouchers to compensate for their time and mitigate the impact of asking people for unpaid labour. Through door-to-door recruitment and letters advertising our project, we recruited 18 people to interview. Some interviews were conducted on the phone and representatives from the housing association conducted the remaining interviews in person.

The interviews followed a semi-structured format, covering how people found out about the grants, the application process, getting the measures installed, and their general reflections on the process. Depending on the interviewee's preference interviews were conducted in English or Urdu, which was most interviewees' first language.

Findings

An immediately striking finding from our interviews was that while everyone we approached had started the process of getting work done in their homes, a third of interviewees did not get measures installed. The reasons for not having works done ranged from language barriers, to concern that the measures would be inappropriate for their homes (and risk future problems with damp). We suggest that while information about the schemes spreads relationally, there is insufficient relational work after the initial recruitment stage to carry people through the entire process.

Several interviewees found out about the grants through pamphlets advertising subsidised works in the mail or via door-to-door recruitment campaigns. Door-to-door campaigns appeared to be particularly effective as they involved a personal interaction in the person's first language. Three interviewees (half of the people who did not get measures installed) cited language barriers as a reason for not getting works done. In addition, we spoke with one person who managed the application process on behalf of his mother who does not read English and does not feel comfortable speaking English. After his mother received a pamphlet advertising free boilers in the post, he contacted the tradesperson, checked the paperwork and was present

for the installation. Trust in tradespeople is an essential part of people feeling comfortable in having works done in their homes (Bolton et al, 2023), and a language barrier is a critical barrier for establishing trust with tradespeople. The son referenced previous instances of tradespeople trying to take advantage of his mother and was an essential intermediary to building trust with the tradesperson installing boilers under the scheme. In this case they were happy with the work done and recommended the tradesperson to other family members who were eligible, underlining the importance of relational networks in recruiting potential recipients.

Instances from other interviews further demonstrated the role of children in assisting their parents with getting energy efficiency measures installed. One interviewee noted that his mother had asked him to look into getting insulation installed because he is the child "that gets things done". Another person, who sat in on the interview with his parents, asked why they had not asked for his help with the application, as they said that they had dropped out of the application process due to the language barrier. These examples reinforce the value of family members who are able to undertake the relational work necessary for people to feel comfortable enough to progress with having measures installed. We also suggest that children who were born in or grew up in the UK are likely to have a better sense of their family's entitlements, giving them further confidence to seek out or engage with opportunities to improve the comfort of their homes.

This understanding of the entitlements was significant as it was clear that our interviewees were unaware of the specific grant that the measures were funded by. Instead, applications would provide relevant details to demonstrate their eligibility for the scheme to the tradesperson who handled the rest of the application process. This finding is important as it indicates that people engaged with these grants as part of social policy more broadly as opposed to being part of distinct energy policies, which is how these schemes are designed.

Implications and outputs

Our findings have two major implications for energy policy. Firstly, interviewees' lack of awareness of particular schemes indicates that information about these schemes could be better distributed as part of details about broader social entitlements. Secondly, the rates of people dropping out without having measures installed suggests that more resources need to be directed towards supporting people through the application process to ensure that they trust the scheme and the tradespeople who will be carrying out the work. Interviews with representatives from energy companies that fund measures under the Energy Company Obligations scheme, drew attention to the critical role of local councils in identifying neighbourhoods to target. Our findings suggest that trusted local agencies could also play a role in improving take up rates of grants.

We see this project as the 'second part' in understanding applications for energy grants within these communities, following the first stage of identifying the high rate of applications. An essential next step would involve reaching out to the tradespeople who manage the application process and install the works to understand the relational work that they undertake through this process and better identify where people are dropping out of the schemes.

We are in the process of writing up our findings to submit for publication in the new year. In the meantime we have begun sharing our findings with policy makers, hosting meetings with representatives from the Department of Energy Security and Net Zero, and the UK Infrastructure Bank.

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EXPO-ENGAGE: Facilitating participation in air quality citizen science

Project leads: Jo Garrett, University of Exeter; Rachel Hale, Cardiff University; Sian de Bell, University of Exeter, and George Kirkham, University of Oxford

Achieving net zero emissions targets in the UK is essential to combat the climate crisis. This will require major changes in the way that we live, so citizen support will be essential. Citizen science is one way of engaging communities with energy transitions.

However, those living in deprived areas are less likely to participate in citizen science (Pateman et al. 2021), despite being more likely to live in areas of low environmental quality (Briggs et al. 2008). Additionally, cities tend to receive most attention in terms of air quality, but many smaller communities also have localised areas of low air quality (BBC News 2021).

EXPO-ENGAGE is aiming to address these issues, co-producing an approach to facilitate participation in air quality citizen science for those living in deprived areas. We have been working with communities in Camborne and Redruth in Cornwall and Caerphilly in South Wales to do this.

What have we been doing?

Since January 2023, we have carried out three main activities. We began by creating a map of stakeholders in our two study areas who might be interested in air quality citizen science. This included organisations who might be working directly to improve air quality, such as local councils, but also those that might be concerned about air quality as an issue e.g. schools. Then in the summer we spent some time in both our study sites, surveying local people, asking them about their perceptions of air quality in the area and what would enable or prevent them from taking part in air quality citizen science. Finally, we went back to our stakeholder map and invited stakeholders from both areas to take part in a workshop to set out a plan for air quality citizen science in their local area.

Figure 18. Public engagement stall in Caerphilly with maps and banners

Figure 19. Stakeholder workshop in Caerphilly, October 2023

What have we found so far?

Overall, just over 80 people took part in the survey. In Cornwall, slightly more people said they perceived air quality in the area to be good rather than bad. The opposite was true in Caerphilly, where slightly more said that they perceived the air quality there to be bad. Most participants at both locations said that air pollution in their area was a risk to health. Despite expressing this concern, most said that they had not taken any actions out of concern for air pollution. For those people who did report taking action, we grouped these into three categories: avoiding outdoor air pollution e.g. avoiding busy roads; improving indoor air quality e.g. by opening or closing windows; and activism e.g. writing to their MP.

More participants said that they were interested in measuring air quality in Caerphilly than in Cornwall. In Caerphilly, the main barrier mentioned to participation in measuring air quality was lack of skills or knowledge, whereas in Cornwall, it was lack of time.

People identified that receiving training and having access to equipment were the key factors that would enable them to measure air quality, with training being prioritised in Caerphilly and equipment in Cornwall.

Figure 20. Perceived barriers to taking part in air quality citizen science

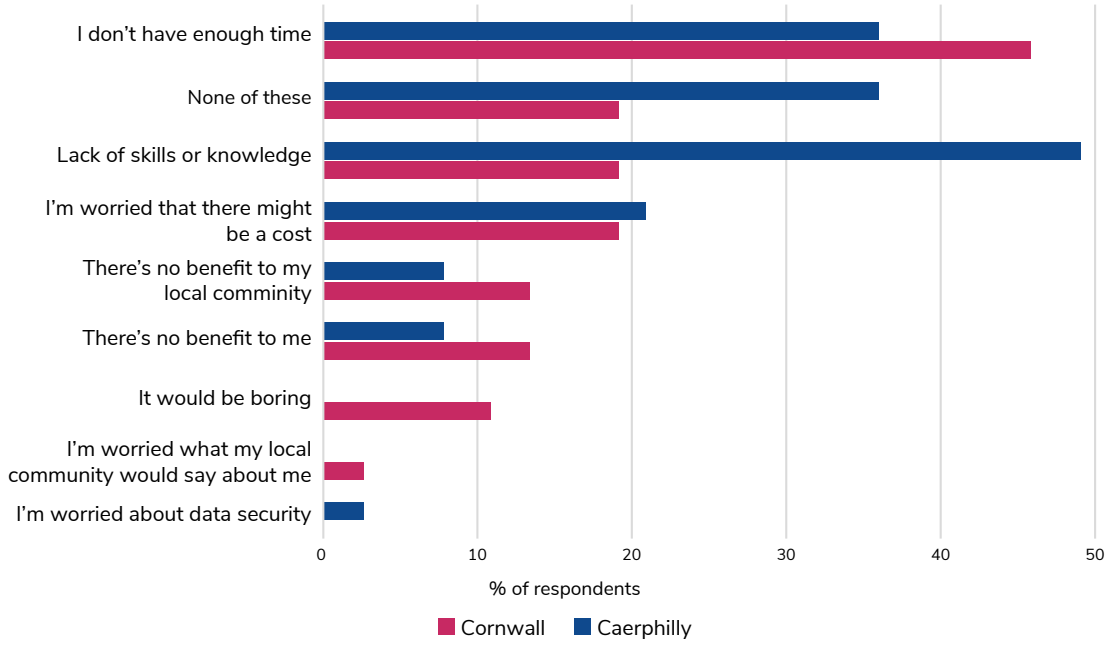
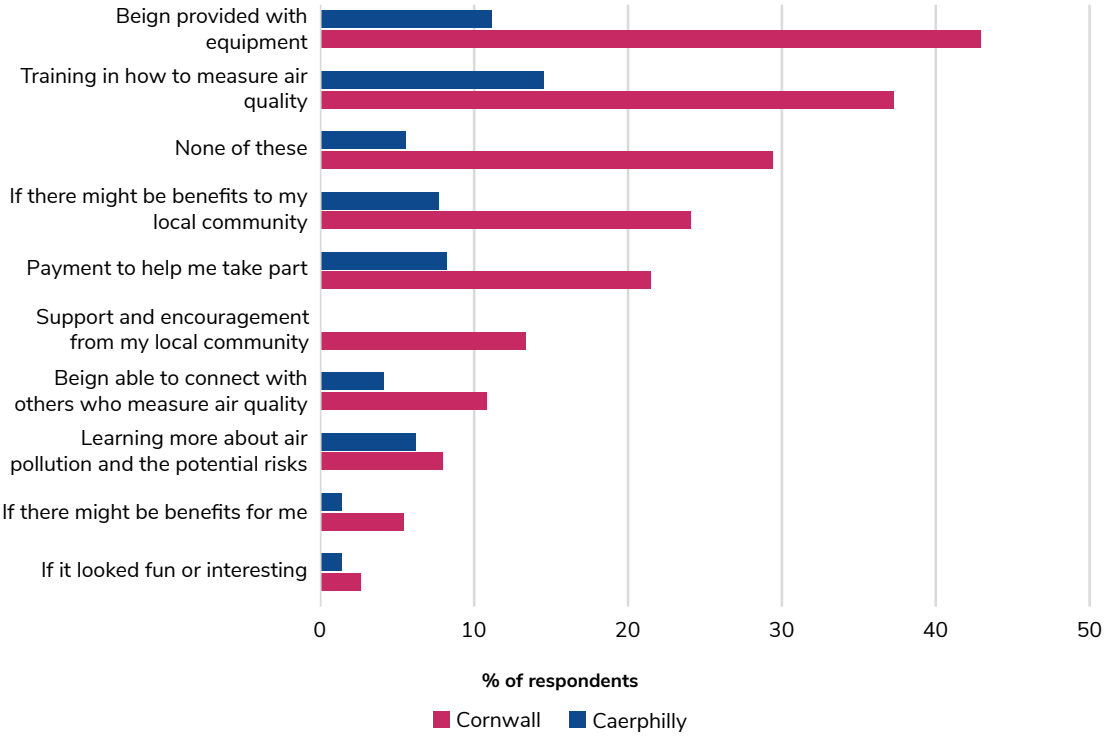


Figure 21. Perceived facilitators that would enable people to take part in air quality citizen science



Discussions in the workshops were wide-ranging, but some similar points were raised by stakeholders in each. Inclusivity, and how to achieve this, was one major topic. Stakeholders in both areas felt that a range of groups, such as those with different health needs, or different ages, needed to be included. They gave suggestions on how to achieve this, for example meeting people where they are, and holding events at different times and places. Some specific suggestions for projects were put forward; schools were discussed in both workshops, whether as focal points for interventions, or as places where it might be possible to engage large proportions of the community.

Where are we now?

Now that we have finished running workshops, we are developing a research plan for each local area, to be shared with stakeholders for further input. We are also publicising the project: we have developed a website and blog (expoe-engage.co.uk) and have been presenting the project at different events, such as the UKERC Annual Assembly.

However, our main focus is working with stakeholders in each study area to identify avenues for further funding. We have received funding from Learned Society Wales (https://ukerc.ac.uk/project/net-zero-neighbourhoods/) to work further with stakeholders in the Caerphilly area and are considering applications for other opportunities such as the GW4 Generator Fund. We want to maintain the momentum of the project and relationships we have built with stakeholders, so that once we have finalised the research plans, we can put them into action.

Project impact

The fund provided the opportunity for an early career researcher to be PI alongside two early career co-investigators, giving us experience in winning funding, project management, line management and budget management, as well as designing and delivering our own project plan. The fund also provided a part-time research assistant role, providing them opportunities to have experience in a wide range of scientific research activities, including the ethics application, designing and carrying out a survey, contributing to workshop development and data cleaning.

The project allowed us to build on a pilot project collaboration and continue building and strengthening networks across the University of Exeter and Cardiff University as well as regional stakeholders and citizens.

https://www.expo-engage.co.uk/

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Intersectionality in the Careers of Ethnic Minority Energy Professionals

Project leads: Mehreen Gul, Heriot-Watt University and Dulini Fernando Aston University, with Asifulla Khan, Heriot-Watt University

This one-year project is investigating the under-representation of ethnic minorities in the energy sector as they progress through their career pathways. By interviewing ethnic minority energy professionals (EMEP) from academia and industry, the project aims to understand how ethnicity intersects with gender, social class and career stage in energy professionals' accounts of (a) career aspirations, (b) career barriers and (c) career strategies. The premise of the work was to develop knowledge and guidelines by developing an understanding of the formal and informal employment support that assists the career progression of EMEP.

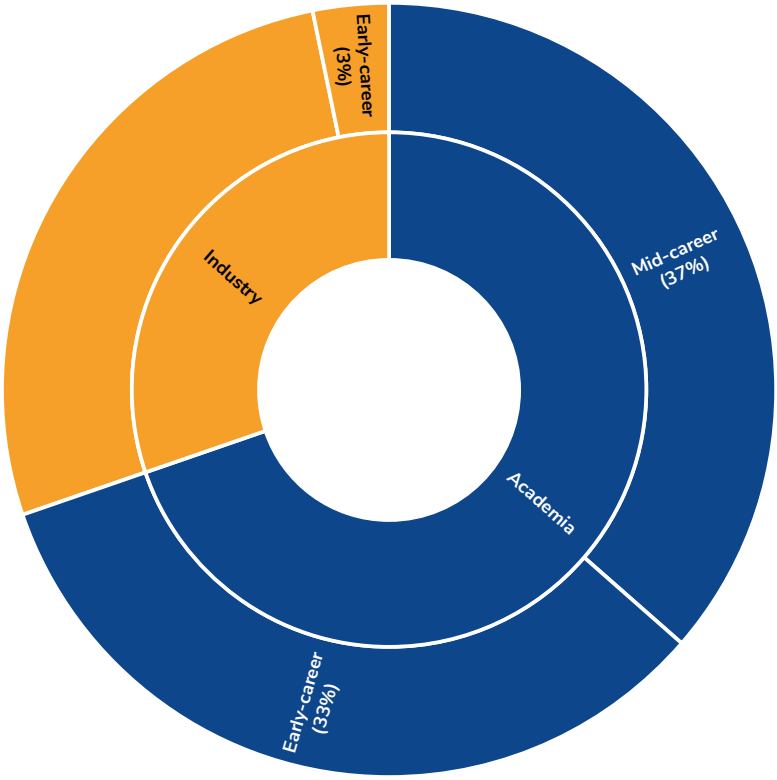
The key objectives are to:

- Illuminate diversity in the career experiences of EMEP, considering how experiences might differ for different ethnic minority groups, nationalities, social class backgrounds, and between men and women
- Share knowledge of the diversity in ethnic minority careers across relevant energy communities through relevant networking activities to move the EDI agenda forward

Progress so far

38 semi-structured interviews were conducted, comprising participants of Asian (25), Black (5), Middle Eastern (7) and Hispanic (1) ethnicities. The interviews were transcribed and analysed using the NVivo 11 software. Figure 1 presents the distribution of participants from academia and industry at different career levels with 70% from academia including 33% at early-career and 37% at mid-career level. In comparison, 30% of participants are from the industry, with 27% of them mid-career.

Figure 22. Early/mid-career participants from academia and industry



Findings

Career aspirations

The career aspirations of participants coalesced into five key themes: developing new things, doing challenging technical work, upskilling oneself, impacting communities, progression, and securing a permanent position.

Early career professionals expressed the desire for hierarchical advancement and permanency, although they were not sure whether they would be able to achieve this aspiration. Alternatively, mid-career professionals wanted to make meaningful contributions to society by various pathways, such as engaging actively in policy-making that improves energy access for communities with different genders and social backgrounds.

Further, respondents at all career stages intended to upskill and learn further. For instance, early career respondents from the industry aspired to upskill themselves by obtaining a professional chartership.

Career barriers

The respondents' accounts of barriers coalesced into five key themes:

1. Lack of role models

Almost all respondents expressed concern about diversity in senior positions. They felt that their chances of progression is limited due to their identity. In other words, they felt that their career imagination is constrained by not being able to see people like themselves in top positions.

2. Cultural fit

Participants who received most of their education in non-western contexts, suggested that linguistic and cultural challenges impacted their assimilation into work organisations. Some key words, accents and pronunciation were sometimes hard to comprehend constraining the development of relationships in the workplace. This further led to cultural bias and hence to nepotism where managers often preferred to collaborate with people with similar cultural backgrounds and/or linguistic capabilities. Linguistic and cultural capabilities were often taken as a proxy for competence in the energy industry and therefore many cultural outsiders felt that their competency is unfairly questioned.

Some Muslim respondents spoke about inability to participate in their organisation's pub culture due to their religious background. This was problematic because the pub was seen as a space where many important work-related issues are discussed, and relationships developed with significant implications for career.

3. Microaggressions

Microaggressions were particularly pertinent in the accounts of black respondents. For instance, one respondent was stereotyped with reference to his race and ridiculed in a job interview about his family structure due to cultural assumptions. Others mentioned overt incidents of racism in the industry. While it was not described as pervasive, it was seen as existent and dependent on who one happened to work with.

4. Structural racism

Respondents talked about structural racism in the energy sector where systems and practices perpetuated the oppression of minorities by not considering the fact that they do not have the same resources as their more privileged counterparts. For example, one respondent talked about how funding bodies' requirement to demonstrate links with the industry disadvantaged international applicants who do not have these links.Indeed, other respondents commented on how they see systems and structures continue to perpetuate white privilege.

5. Gender-based constraints

Some women discussed how they struggle to be heard and recognised as experts in an industry which is dominated by men.

Furthermore, they felt that they were frequently associated with classic gender-based stereotypes in formal organisational processes. For example, one female participant of African ethnicity expressed concerns about how, during a recruitment process, she was asked if she was planning to get married soon and have children. Given that childbirth calls for time off from work, candidates who are assumed to get married soon and have children are arguably disadvantaged in recruitment processes.

Career enablers and strategies

The respondents identified formal and informal support systems at different levels.

Regarding formal initiatives, the industry respondents distinguished between training: to enhance technical expertise, to enhance professional development skills, and to understand how things are run in the organisation. Where available, these were seen as extremely useful for work and careers in the energy industry.

The early career respondents in academia mentioned the effectiveness of training in networking and writing academic articles. These were considered necessary and especially useful for international respondents with little knowledge of the UK cultural context.

Equality, Diversity and Inclusion (EDI) initiatives were identified as helpful in creating a feeling of belonging and hope within the energy sector. However, EDI initiatives were at times seen as leading to perceptions of positive discrimination, and people were extremely concerned about being seen as hired solely due to their gender or ethnicity.

About informal support, participants talked about diverse teams, supportive colleagues and helpful line managers, highlighting how these made a big difference to their experience of work when available.

Good line managers were seen as providing informational and practical advice while also providing emotional support to cope with the challenges of work in the energy industry. Indeed, inclusive teams and devoted line managers were seen as having the potential to buffer respondents from the constraining effects of cultural barriers in many cases.

With regard to strategies, the respondents talked of silently tolerating experiences of exclusion and othering, while working hard to prove their worth, maintaining a learning orientation, and interacting with other colleagues to develop their networks. Some respondents attempted to develop their cultural understanding at social and organisational levels to facilitate relationship building. Certain industry participants talked about learning from their colleagues via observation.

Suggestions for improvement

We have identified six suggestions for improvement:

1. **Removing structural barriers** by providing EMEP with network opportunities to collaborate with industrial and government organisations for developing research ideas.
2. **Removing gender-based constraints** by providing childcare facilities and nursing rooms for parents during work hours, and childcare for additional work outside of office hours.
3. **Eradicating bias** by adopting a hiring strategy that follows the anonymisation of candidate names to remove unconscious and cultural bias.
4. **Improving cultural fit** by developing a program of training and events to create awareness of diversity and enhance cultural tolerance and understanding.
5. **Increasing role models** by conducting fair promotions considering candidates from all ethnicities, genders, and sexualities to increase diversity in top management teams.
6. **Mentoring at all levels** to be provided to ensure that members are aware and trained to implement their skills in the required situations.

Future work and dissemination

Work is underway on a plot for a four-star journal article, a policy brief on intersectionality in the barriers faced by EMEP, a digital manual on 'EMEP' career stories and the project website featuring key outputs. A dissemination event and a graphic art installation on 'diversity in 'EMEP' is also planned.

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