



**Equity in a
sustainable energy
transition:**

**the importance
of people & place**

Briefing Report

**Digital Society and Economy
Interdisciplinary Research Theme**

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Introduction

The intersection of the climate and fuel crises raises critical questions about one of our basic utilities - energy - which is vital for health, wellbeing and to the functioning of our society.

The energy crisis has deepened over the last two years under the UK Energy Price Guarantee (EPG), with the average annual gas and electricity bill significantly increasing in the last year (gas 141% and electricity 96%) leading to growth in energy poverty and inflation.

There has always been inequality in energy use, with older people, for example, not being able to keep warm, and those on lower income not being able to afford energy for the basics: cooking, washing, cleaning as well as keeping warm. Within the UK and global energy landscape, those with higher incomes are often high users of energy, and their energy use impacts climate change more so than those on lower incomes.

The UK energy market is unique in comparison to other sectors, in that the consumer incurs all the risk. For example, costs are incurred because of supplier failure and instability of new energy technologies, and there is limited agency in terms of options to reduce costs.

It is clear new approaches are required to create net zero infrastructures and successfully deliver services equitably. Times of crisis can create opportunities for radical thinking, but there is also a need for responsible innovations that protect citizens and communities – ones which couple the infrastructure with the people. It is key that a whole systems approach is considered, whilst also exploring local energy markets, energy citizenship and peer-to-peer opportunities. With the cyber-physical infrastructure – including smart meters and thermostats – there are both opportunities and risks associated with connectivity and extracting insights from data.

To explore these many interlinked issues surrounding the so-called ‘just transition’, the Digital Society and Economy Interdisciplinary Research Theme in the College of Social Sciences organised a workshop to bring together diverse speakers, exploring a ground-up citizen and community perspective to the energy transition. We hosted 4 expert contributions, followed by a roundtable discussion with all the workshop attendees.

During the workshop, many different themes were discussed, including climate resilience in the development of homes and neighbourhoods that connect people, place and environment in equitable ways. We considered the importance of data humanism and democratising our future energy economy; the argument being to take a people and community-centred approach for an inclusive, prosperous, sustainable and equitable energy transition.

This report will explore the key points made by the expert contributions, synthesize the workshop discussions as a whole with respect to the challenges posed by the speakers, and propose some recommendations regarding future policies and research directions.

Challenge 1: Designing Net-Zero Homes with Community Wellbeing Built-in

“Net-Zero Homes as Localities of Households, Neighbourhoods, and Natural Environments”
Professor Bridgette Wessels, University of Glasgow

The energy economy and how this links with the basic needs of society have been under-researched and taken for granted. Due to various current-day political economic conditions, they are both now under threat and need to be looked at more critically by those in the academy. Energy needs to be understood not from an individualistic point of view (framing people as ‘users’ of space), but instead through thinking about the new demands on households (e.g. medical needs, ageing, young families, intergenerational etc) and how these intersect with climate change.

In tandem with this shift, it is also crucial to consider homes as adaptable and flexible to human, digital and natural environments, and how natural spaces are part of home and how we dwell. We need to recognise home as a complex cultural phenomenon involving dwelling spaces, relations amongst household members, artefacts, technologies, and economic, social and environmental hubs and networks where people feel safe, comfortable and at ease.

As such, work has been undertaken to develop a new framework which addresses how homes can be socially and environmentally shaped to dwelling that is net-zero by considering the following four concepts:

- 1. Integration:** identify household needs and sustainable practices to develop a household-centric approach.
- 2. Adaptation:** embed relations between home, neighbourhood, and environment so household-centric approaches to sustainability are supported in the context of wider structural change.
- 3. Innovation:** support innovation in industry and shape the development of net-zero homes and neighbourhoods.
- 4. Conversion:** convert the potential for homes to be net-zero by default elsewhere that can be adapted to people and place.

The Crichton Trust worked on the Ladyfield Site – 22 hectares of undeveloped land 2.5km south of Dumfries – to create a sustainable, adaptable housing model informed by people, place and planet. They used this 4-step framework in the strategy. University of Glasgow collaborated with the Crichton Trust on the Integration step by co-creating connected homes with households to support wellbeing in a rural location. The pilot project explored how digital connectivity, data-driven services, and home life are interconnected in shaping sustainable living.

In summary:

- A framework that has people, place and planet understood through a relational lens of dwelling means that there is a potential for creating ‘net-zero by default’ ways of living.
- ‘Net-zero by default’ means embedding designs and adaptations in homes that meet (1) net-zero targets, (2) climate ambitions, and (3) the needs of households to live well.
- The Ladyfield model provides a radical new vision in its holistic and relation approach to housing types, neighbourhood proximity, access to work, education and health in lived neighbourhoods.
- This model helps move climate change approaches beyond narrowly understood electrical and carbon neutral technologies into working with communities, neighbourhoods, and home in meaningful, connected and sustainable living.

Challenge 2: Building Local-Rural Community Energy Infrastructures

“Community Energy Transitions: Orkney and Crichton Trust”

Professor David Flynn, University of Glasgow

With the modern-day crisis in fuel poverty, it's important to unlock network capacity, remove inefficiencies and build in community values in energy infrastructure using smart approaches to demand-side. Optimisation needs to not just be an engineering or finance question; it needs to take into account the community's behaviour surrounding energy use and the available local infrastructure.

Citizen empowerment is critical; it's important to have a clear articulation of the public's response in relation to infrastructural changes. There is a lot of risk and uncertainty at the consumer level – we need to reduce these in order to influence people and support them to make energy transitions.

Case study: A UKRI-funded project in Orkney looking at community energy needs and resource usage found that there is sufficient local energy production, but it doesn't always match the demand – as such, there is frequent curtailment of wind power production due to lack of local demand. This means that there is an Active Network Management zone managed by SSEN to prevent excess production. A new strategy was proposed which matched high wind / curtailment

events with decreasing and then increasing the local electric vehicle charging station demands, so as to better spread the production and concentrate it on a green energy solution which worked for that local community, without having to lose the wind electricity produced.

Case study: A collaboration between University of Glasgow and the Crichton Trust, based in Dumfries, resulted in an energy audit of the campus and residents, and formulated some decarbonisation scenarios and opportunities. The project aimed to know people better, understand the possibilities of the site, and create a digital infrastructure with holistic ambition. Underutilisation of buildings were identified, as well as a deeper understanding of local imbalances in energy distribution, and identification of heat pumps retrofitted inappropriately. Potential future scenarios linked to this audit included peer-to-peer energy trading, smart contracts, and real-time models.

In summary:

There were 3 main lessons learned:

1. There is significant potential to address local fuel poverty, energy resilience and energy network constraints through intelligent demand-side response.
2. Regulatory frameworks and commercial licenses need to reflect sustainable and community driven KPIs.
3. The Digital Energy Economy requires RRI (Responsible Research and Innovation) and Trusted Research to deliver equity, equality and security in a sustainable energy transition.

Challenge 3: Balancing Privacy & Efficiency in Social Housing Energy Systems

Digitalising Social Housing Energy Transition with Cyber-Physical Systems and IoT
Dr Ahmad Taha & Dr Mahmoud Shawky, University of Glasgow

Scotland has ambitious climate goals which demand urgent action for emissions reduction of 75% by 2030, 90% by 2040, and net-zero emissions by 2045. The key problem for Scottish social housing associations is in meeting the Scottish Housing Quality Standards (SHQS) and the Energy Efficient Standards for Social Housing (EESHS2) – which is to ensure the housing is EPC (Energy Performance Certificate) B or higher by 2032.

A University of Glasgow project looked at digitising the social housing energy transition with cyber-physical systems and IoT addressed:

1. Efficacy of retrofitting solutions
2. Inefficient energy usage
3. Privacy and comfort levels
4. Scalability

The project measured indoor environment parameters (energy usage, temperature, CO₂, heating, motion, light etc); outdoor environment parameters (temperature, humidity, etc); and appliance-level energy consumption. The components on the designed system included deployed sensors, LoRaWan gateways, Boston-

IoT network, University of Glasgow 5G Centre edge servers, data visualisation and analysis, and a closed feedback loop to the user.

The research looked at the relationships between energy and people's behaviours in the households. The proof-of-concept project lasted 6 months, with 2 houses as focus. Behaviour was recorded for 3 months and then the researchers applied retrofitting solutions for 3 months while measuring the impact of the solutions implemented. Readings were collected from all devices in the house, then analysis was performed to make recommendations for supporting changing behaviour.

There were concerns around privacy, which is key to the question of how we can integrate AI to make recommendations without making the data move outside of the house. The sensors are very costly so alternative solutions must be sought to make the process scalable.

In summary:

- There is a huge importance to draw from engineering and social sciences together in addressing the needs of Scottish social housing during the energy transition.
- EPC is only the first step towards decarbonisation, there is much more to be done in ensuring an equitable whole-systems approach that factors in the building operation and energy citizenship.
- Security and privacy standards must be taken into account, including understand which algorithmic protocols are used and how these can be ensured to follow regulations.
- Costs of digitisation must be balanced with the scalability of projects like this, and in order to ensure affordability in the social housing sector.

Challenge 4: Providing Energy to Those Who Cannot Afford it

A Foodbank, but for Electricity and Gas

Matthew Cole, Fuel Bank Foundation; Chair of Fuel Poverty Scotland

The Fuel Bank Foundation provides a foodbank, but for electricity and gas. They help:

1. People who pay in advance for their energy with a prepayment meter
2. Households that aren't connected to the mains gas network and have to bulk buy fuel to heat their homes, and
3. People with multiple issues that require resolution.

The Foundation found that:

- 41% of the people supported had a critical need for energy, such as managing respiratory problems that get worse in the cold, and powering electrical medical equipment.
- 81% of the 18-35 year olds who were on emergency credit, or were about to run out of money to top up, have children at home.

People are acutely aware of how much energy is used and how much it costs because they need to use it – they do understand the transition, but can't always take part. However, with Fuel Bank Foundation's support, 91% felt that they were able to cope better financially, 59% reported improvement in physical wellbeing and 61% reported an improvement in mental wellbeing.

Despite this, however, 75% of people helped still face self-disconnection at least once a month. As a result, people have to turn to very tough decisions – to sex work and gambling as mechanisms to shake off the energy crisis.

In summary:

Key conclusions which must be taken into account:

- Demand for help with paying for energy is increasing, despite support measures introduced.
- Living without energy is now becoming the norm for many.
- The Fuel Crisis existed before COVID and before the Ukraine-Russia war. Therefore, long-term, strategic action is needed.
- The fear and the reality of living without heat has impacts beyond energy.
- We have a surplus of energy in the UK which doesn't get to people.
- Energy should be an enabler.

Workshop Synthesis

It is clear that the intersection of the climate and fuel crises is raising critical questions about energy - which is vital for health, wellbeing and to the functioning of our society.

This workshop explored new approaches to create net zero infrastructures which also consider how to deliver services energy equitably. Times of crisis can create opportunities for radical thinking, but there is also a need for responsible innovations that protect citizens and communities – ones which couple the infrastructure with the people.

The challenge presentations and subsequent roundtable discussion pointed to the need for a whole-systems approach to energy, which takes into deep consideration both the current political economic circumstances as well as the lived experiences, behaviours and expectations of citizens.

In synthesizing the workshop topics, the below key points could be considered as those which were highlighted as most pertinent during the discussions, and should be incorporated into future work on equitable approaches to a sustainable energy transition.

Consumer control (and lack thereof)

- Self-disconnection is not a choice; predatory behaviours result in fuel poverty.
- People don't always recognise their vulnerability with fuel poverty – there are dire economic and social consequences which are not always immediately clear.
- There is a broad perception of transitions ('just' or otherwise) happening to you rather than with you.
- The role of charities is crucial in helping people realise and understand changes, and incremental changes are important and effective.
- People take pride in their independence and resilience.
- Practical implementations are critical to rethink relationships, services, products and processes, and helps people to understand and be agentive and make decisions.

Accountability around energy strategy needs to be reappraised and changes made

- Companies should be regulated with respect to having critical obligations towards delivery
- The angle of productivity and well-being at home could be a way into encouraging the government to make changes and support energy transitions.
- Energy should be a utility with a universal provision in the same way digital connectivity should be.
- Decisions are well intended but not always well informed – the energy sector has a damaging nervousness around making decisions surrounding transitions which are equitable.
- Interventions need to be at different levels: we need a multi-layered approach to lobbying which requires a more holistic understandings of when and where to intervene.
- There is a surplus of energy, but the problem is with the strategy around delivery and resource allocation, for which we need new approaches and innovations.
- Energy provision accountability needs to be enforced in terms of practice.

Workshop Synthesis

Researchers need to adapt to new energy cultures in their investigations

- There is a critical role of social sciences researchers into projects on energy systems and transitions; it cannot be left to scientific and economic analysis.
- There's been an energy culture change: the economy was based on products, now the focus is on process and social and environmental life of services – there is a shift towards grand challenges and interdisciplinarity.
- There is an increasing need for more understanding of social consciousness and energy life-cycles from the perspective of citizens and consumers.
- How poverty and social participation are understood need to be configured by bringing in deeper understandings of what people want to do and how they want to contribute; we need to think about different configurations of energy use.
- This is an exciting time to look at energy transitions and the potential of digitalisation but there are also significant concerns which arise when a people-centred approach is not taken.
- 'Just transition' is a dynamic and very complex term; to some people it is a toxic term when it doesn't apply to them. It is crucial to consider how we approach these terms and get stuck on them when attempting to move the agenda forward constructively.

Possible futures:

In summary, the questions of consumer control and accountability in energy strategy need to be brought together when being addressed, to ensure energy provision is equitable for all. This also includes better and more efficient production and distribution of energy.

In terms of research, a new progressive focus on energy needs to be developed with an interdisciplinary research agenda, in order to inform new strategies and practical actions across the energy field.

Finally, insights about possible futures can be gained from innovative initiatives such as the Crichton Trust's Ladyfield site, in terms of utilising frameworks which concurrently consider integration, adaptation, innovation, and conversion.

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