ENERGY AND SOCIETY
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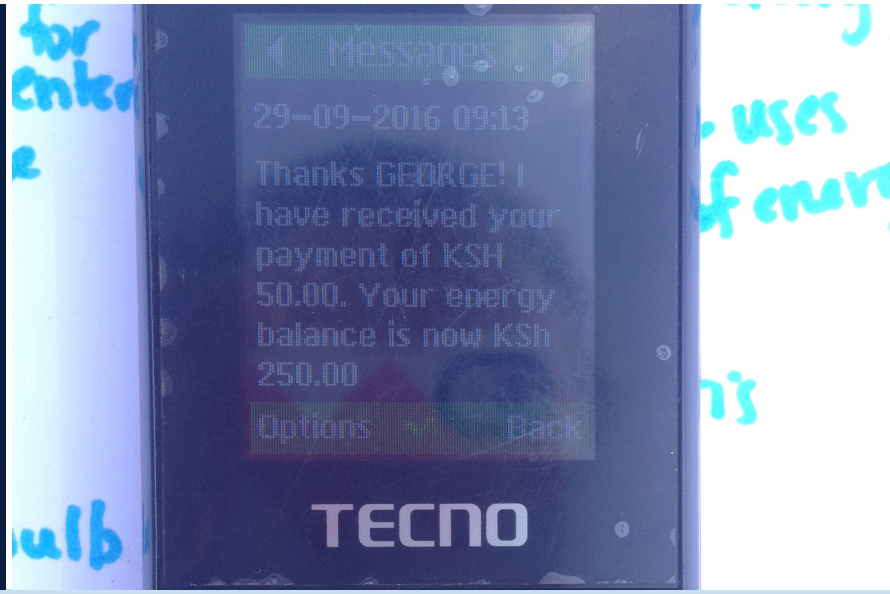

The Value of Energy Data in the Global South

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Summary

Data is considered to play a critical role in realising the UN's Sustainable Development Goals (SDGs), including Goal 7, to "ensure access to affordable, reliable, sustainable and modern energy for all." Employing the 'big data revolution' for sustainable development has seen efforts to identify and prioritise the most significant areas for investment, and efforts to monitoring and track progress toward achieving the SDGs.

Drawing on our research on energy data in Kenya and broader questions surrounding the role of data in development and society, this research brief outlines key questions and opportunities in the study and use of energy data in the Global South. We discuss how new approaches to collecting, curating, sharing and communicating data can play a central role in supporting holistic development centred around access to sustainable energy. We suggest that these approaches can help to ensure that the social and economic value created from energy data directly benefits energy users and is developed within a governance framework that pro-actively addresses privacy concerns as well as equitable access.

EPSRC
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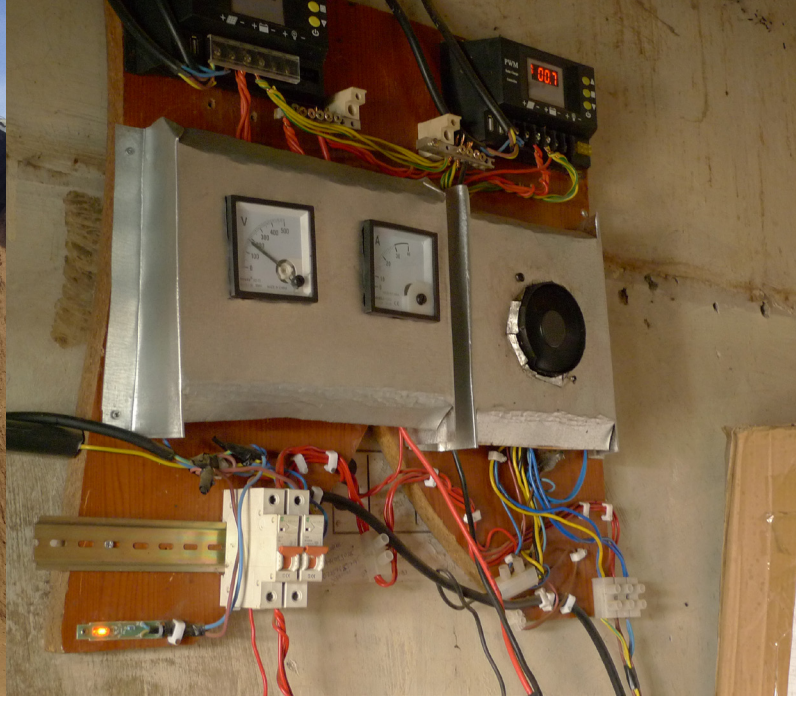
Energy, Data and Essential Services

Energy is a "nexus issue" in development. Improved energy access can be a stepping stone to better health services (electrifying public clinics), better education (electrified schools and homes) and livelihood opportunities (electrifying tools, machines and businesses). Off-grid solar power is beginning to prove itself as a viable solution to energy poverty, requiring relatively low capital investment while providing a range of social and economic benefits.

Fifteen years ago, the World Bank identified a lack of consistent, reliable data on poor people's energy consumption as a major barrier to improved energy services in poor countries. Today, innovations in hardware and software are allowing energy service companies across the developing world to generate, collect and analyse ever increasing quantities of data on domestic and small business energy consumption from poor customers.

In East Africa, telecommunications and information infrastructures have created an enabling environment for a new generation of smart energy companies that make data analytics a key part of their business. Decentralised solar energy solutions - from micro-grids to solar home systems - that integrate mobile phone technology with solar power infrastructures are creating unique energy solutions adapted to the limitations of resource-poor communities. Moreover, the combination of these infrastructures with the widespread penetration of mobile payment systems like M-Pesa have made the region fertile ground for innovation and experimentation by 'smart energy' companies, and have led to an explosion in the quality and quantity of energy data being collected. Today's off-grid energy companies are able to collect and analyse data on energy generation and consumption in real time. Using cloud-based software services, micro-grid managers can monitor the performance of the system, identify maintenance issues and track the energy use and payment patterns of individual customers.

To date, however, there has been little public discussion about how this energy data is collected, managed, understood and shared, or how value from energy data is realised in local and international innovation ecosystems. There are critical questions to be asked about emerging inequalities in access to information. There are also immense opportunities in the application of digital technologies that promise to make energy services more affordable and accessible and to generate new kinds of value from data for communities themselves. Understanding the pathways into these futures requires new ways of understanding what data systems mean and what kinds of assumptions underpin them, as well as new approaches to designing data systems that fit with people's practices and incorporate their values.



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The Pro-Poor Energy Data Narrative

Off-grid energy companies in sub Saharan Africa are setting new precedents for the collection and use of data. They are collecting data on energy use and expenditure and using this data to attract investment, to develop flexible infrastructures that are more reliable and more economical than ever before, and to provide renewable energy as a service. In this context energy data is becoming a core driver of social and economic change.

The collection of energy data promises to make energy services affordable and accessible. The pay-as-you-go (PAYG) model employed by off-grid solar companies is extending the delivery of modern energy services to those who have previously lacked access to electricity. These companies recognise the broad applicability of the PAYG model for people with limited and unreliable incomes and the potential for data collected through new, connected technologies to generate new insights into customer needs and practices. The learning and opportunities opened by PAYG energy data are contributing to a vision for energy service provision that is broadly accessible, economically affordable and tailored to individual customers. At the same time energy data is being linked to the creation of new opportunities for employment, education and gender empowerment, as companies and investors are looking at how this model might be expanded into other sectors.

Energy data assumes significant value for energy companies as they work to produce proprietary knowledge about the current and future needs, interests and behaviour of their customers with a view to developing new goods or services. In a pro-poor energy data narrative, the value is passed onto poor customers through increased access to additional goods and services.

Critical Perspectives

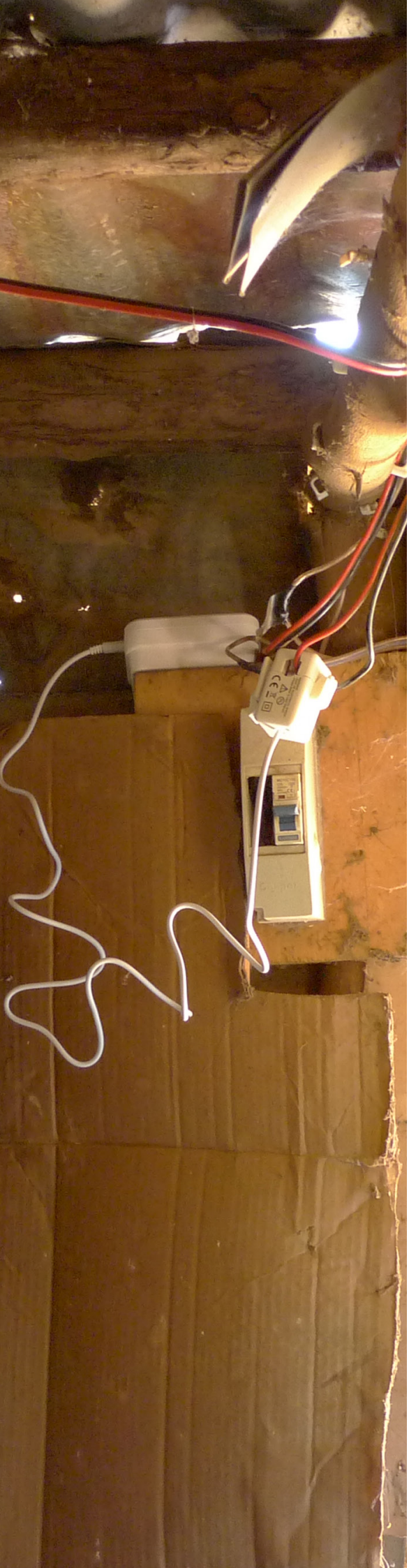
In a more critical narrative data is also a commodity: something that companies produce and extract value from for commercial gain. In East Africa energy data is collected as a side-effect of providing a paid-for service, such as PAYG electricity. Data is frequently collected, used, managed, analysed and applied in ways that consumers and other stakeholders — from smaller indigenous businesses to investors, governments and international aid donors — do not understand, and in ways that grant them little or no access to a rich source of information.

In both developed and developing countries, ordinary users have little means of discovering what personal data they are disclosing or the purposes to which it is being put, for example when data is sold on to other companies with a view to marketing new products and services or when it is used as the basis for consumer credit scores. This introduces new forms of data inequity and information asymmetry to the litany of challenges facing poor people in the Global South.

In Europe, attempts to roll out smart energy meters have met with controversy and public anxieties about privacy, control and management in the home, and have sparked new debates about designing energy monitoring and payment systems in a more participatory framework. Across East Africa, by contrast, smart payment meters are being installed as an increasingly basic component of decentralised energy infrastructures, with little public scrutiny or attention.

Smart off-grid solar companies operating in East Africa recognise the value of data for better understanding their customers' needs and interests, as well as for the creation of improved risk models that could stimulate further investment in solar energy. Despite these opportunities, human resource and technical constraints prevent companies from realising the value of their own data assets. In addition, the absence of widely accepted standards for the collection, management, and pooling of data across the global off-grid solar industry acts as a brake to innovation and introduces potential risks.

Data is never simply an asset, it is also a source of reputational and financial risk, since it can be lost, leaked or stolen, often with dire consequences. The regulatory environment for companies working within Europe is due to become more challenging once the EU General Data Protection Regulation (GDPR) comes into force in 2018, since this will further strengthen and unify data protection for individuals. While data protection in the Global South is less comprehensive, regulation is steadily increasing in Sub Saharan Africa and both commercial and non-commercial actors stand to benefit in the longer term by adopting international standards.



New Opportunities for Data Sharing

Emerging markets for off-grid energy in the Global South are creating data silos. The bulk of energy data is retained by companies responsible for supplying or managing energy and energy payment. Increased competition between energy companies is severely limiting the potential societal and economic value of such data, and we see two significant opportunities for expanding beyond the existing constraints.

The first involves data sharing between companies. Our assumption is that the benefits which stem from a broader understanding of the market and of currently unmet needs are greater than a potential loss of competitive advantage. A second opportunity is offered by granting individual users better access to their own energy data. This can allow them to make more informed decisions around entrepreneurship, social innovation and engagement with outside organisations.

Alternative models of data management and data governance are required to realise the social and economic value of energy data in the Global South. Currently, there is a huge socio-technical divide between different data holders and datasets, most notably the confidential data held by commercial energy providers, the development data gathered by NGOs, and the open data that is published by governmental bodies. Data pooling across sectors can contribute to models that drive forward service delivery to the underserved, especially if unconventional partners become involved in rolling out energy infrastructure.

One pathway for better sharing of data is to establish new, multi-stakeholder consortiums in which local actors curate and co-produce shared data assets to address pertinent local concerns. These consortiums will need to develop principles, frameworks and realistic expectations for data pooling in regional data hubs. Investment in data infrastructure will need to address a range of challenges, including secure storage of personal data; robust mechanisms for ensuring access is properly controlled; and support for collecting, hosting, archiving and analysing streaming data from sensors.

To facilitate the transferability of data, tools, experience and governance practices, we propose the establishment of a federated network of cooperating regional data hubs. To underpin such a network there will need to be business/service models that incentivise non-traditional data providers to share their data assets. Finally, while the model should accommodate the commercial interests of companies, economic development needs to be balanced by a public data commons that promotes the interests of civil society.

New Opportunities for Data Collection

The application of digital technologies to the remote monitoring of off-grid energy systems and domestic energy consumption in Sub Saharan Africa raises important questions around ethics, ownership, data literacy and participatory design. We propose that attempts to engage with these questions demand a new focus on high resolution data about the consumption of, and payment for, off-grid energy. This may demand new collaborations with and between the commercial organisations that current collect and handle this data.

New sources of quantitative and qualitative data are vital in creating a holistic picture of the context in which energy is consumed and leveraged for other activities and communicating this picture to specialists, experts and wider publics. This may include data obtained by new Internet of Things technologies, such as Low Power Wide Area Networks (LPWANS) and small embedded computing devices. These allow relatively low cost network hardware to collect and aggregate data from large numbers of cheap, battery operated sensors. Measurements of environmental indicators such as water quality, air pollution, and light levels can offer real time intelligence and decision support, allowing analysts to identify a variety of different patterns with predictive value. In the developed world, such technology is being adopted by citizen-science groups for environmental sensing, and there is untapped potential for deploying it as a community resource in the Global South, owned and operated by non-commercial actors.

Meanwhile, qualitative data obtained through ethnographic research and participatory design methodologies with end users and organisations help us to better understand the cultural, social and economic factors which affect the uptake and viability of off-grid energy provision. Our research in Kenya, for example, has included a material analysis of networked devices, data loggers, online platforms, tools and databases; interviews with companies and institutions dealing in pay-as-you-go home solar systems, pay-as-you-go technology and investment, as well as tech start-ups, universities, NGOs and consultancies; and it has included participatory design workshops with communities living on Mageta Island (Lake Victoria). Innovations in the ways in which data is collected and communicated create new possibilities for generating value for individuals and communities; for example, to make electricity supply and demand more visible, to relate energy use to social practices, to develop locally-relevant services, and to share and compare data to learn about more effective and creative ways to use energy.

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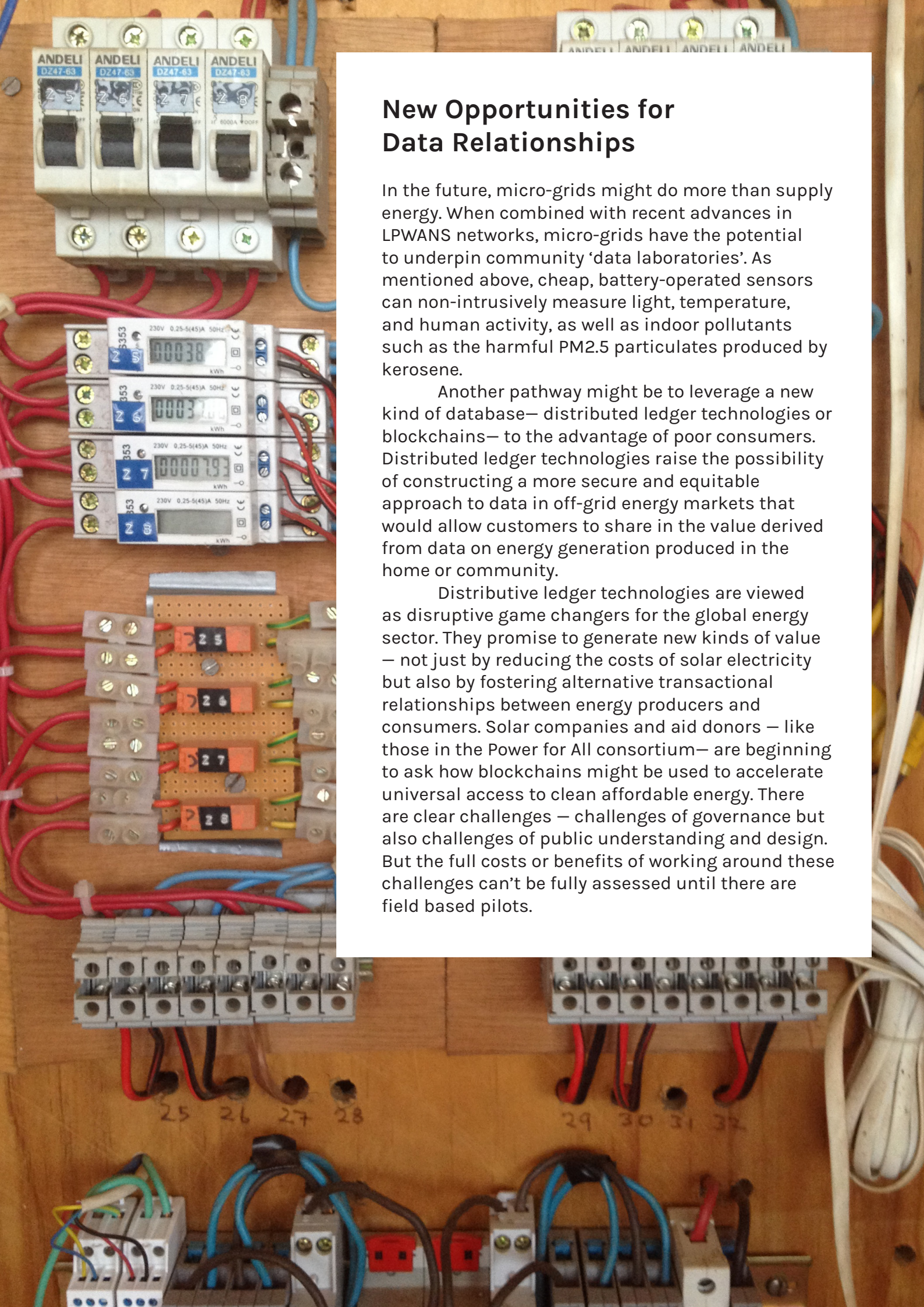

New Opportunities for Data Relationships

In the future, micro-grids might do more than supply energy. When combined with recent advances in LPWANS networks, micro-grids have the potential to underpin community 'data laboratories'. As mentioned above, cheap, battery-operated sensors can non-intrusively measure light, temperature, and human activity, as well as indoor pollutants such as the harmful PM2.5 particulates produced by kerosene.

Another pathway might be to leverage a new kind of database— distributed ledger technologies or blockchains— to the advantage of poor consumers. Distributed ledger technologies raise the possibility of constructing a more secure and equitable approach to data in off-grid energy markets that would allow customers to share in the value derived from data on energy generation produced in the home or community.

Distributive ledger technologies are viewed as disruptive game changers for the global energy sector. They promise to generate new kinds of value — not just by reducing the costs of solar electricity but also by fostering alternative transactional relationships between energy producers and consumers. Solar companies and aid donors — like those in the Power for All consortium— are beginning to ask how blockchains might be used to accelerate universal access to clean affordable energy. There are clear challenges — challenges of governance but also challenges of public understanding and design. But the full costs or benefits of working around these challenges can't be fully assessed until there are field based pilots.

Recommendations

We propose four key areas of focus for future research:

1. The role of energy and energy-related data in improving the lives of people and addressing issues of equity and social justice in the delivery of services, especially in relation to the UN's Sustainable Development Goals.

2. A holistic perspective on 'data economy', in the sense of understanding factors that determine differential access to data, the persistence of 'data gaps' and the influence of geographical and political factors in the feasibility of using data for social benefit.

3. A consideration of how data can be collected in ways that respect the needs, rights and priorities of individuals.

4. The scope for developing institutional and governance frameworks that make the extraction of value from data more equitable.

Energy Data For All

Energy Data for All was a 6 month project funded by an EPSRC Global Challenges Institutional Sponsorship Grant. The project brought together researchers, students, SMEs and third sector organisations in Kenya and the UK to explore the value of energy data.

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ENERGY AND SOCIETY

Energy and Society is a network of University of Edinburgh social scientists whose research and innovation engage the multidisciplinary global challenges posed by energy transitions. Our research recognises that energy technologies and systems are social as well as technical. Global energy challenges demand attention to institutions and organisations, to nation states and markets, to cities and villages, to the knowledge and practices of experts as well as end users, to ethics, values and interests.

Our work is driven by a commitment to public engagement worldwide. We work to inform government decision-making by influencing planning and policy processes, to develop participatory methodologies and good practice principles for engaging with communities, and to bring social science insights to industry partners in the UK and Europe, as well as sub-Saharan Africa and South Asia. We are funded by, among others, the Research Councils UK, the UK and Scottish Governments, the UK Energy Research Centre and the Energy Technologies Institute.

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