Global Perspectives on Community Energy for a Just Transition

The case for UK-Africa Community Energy Twinning

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CESET
Community Energy and the Sustainable Energy Transition in Ethiopia, Malawi and Mozambique

About this report

This report has been commissioned by Community Energy Systems and Sustainable Energy Transitions in Ethiopia, Malawi and Mozambique (CESET) which has an aim to facilitate the deployment of Community Energy Systems for a just transition in East Africa while understanding the kind of benefits that they provide to communities and their possible unintended negative impacts. CESET has three objectives:

- Objective 1: To develop a theoretical framework to understand the diversity of CESs in East Africa and their role in delivering energy transitions;
- Objective 2: To deliver a systematic body of empirical evidence on what works and how it works for CESs in East Africa, examining the institutional, technological, financial, and socio-political challenges of implementation; and
- Objective 3: To build research capacity for a long-term, human-centred programme of research on CESs in East Africa.

These objectives are structured in three-cross cutting themes: the diversity of CESs, the need to unpack community in CESs, and situating CESs within the broader political economy of energy in the country and the region.

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Executive Summary

Community Energy Systems (CES) offer low carbon, affordable and secure supply of energy and promise to play a key role in climate change mitigation and adaptation efforts as well as contributing to universal access to all. Both the UK and Africa can benefit from the principles of community energy systems, albeit in different ways. In the UK, the focus has been on transitioning to low-carbon energy in a manner that promotes social equity and local empowerment while in Africa the emphasis is on providing essential energy access while fostering sustainable development and community resilience. A just transition through community energy systems recognises the diverse needs and contexts of different regions, ensuring that the shift to renewable energy is inclusive and equitable on a global scale. This report examines the potential for a community energy twinning initiative between UK and African CES to address energy access challenges and promote sustainable development.

With approximately 600 million people in Africa lacking access to electricity, particularly in rural areas, innovative solutions such as minigrids and decentralised energy systems are essential to meet the continent's electrification goals. Minigrids are a viable alternative to extending national grids, providing reliable, affordable electricity in remote regions. Despite their promise, economic barriers—such as a lack of access to financing— hinder the deployment of these systems, and systems that do not integrate community dynamics suffer sustainability challenges. Inclusive governance and financing models that integrate the needs of local communities are needed to ensure the sustainability and effectiveness of these initiatives.

The proposed CES twinning initiative focuses on fostering partnerships between successful community energy projects in the UK and emerging leaders in renewable energy access in Africa. This collaboration aims to fund and implement minigrid solutions in underserved areas, leveraging the expertise and resources of UK projects to support energy access initiatives abroad. The initiative seeks to enhance local energy infrastructure while facilitating bi-directional knowledge exchange, allowing partners to learn from each other's experiences, challenges, and best practices in community-led renewable energy efforts. By promoting collaboration, the twinning initiative aspires to empower communities, improve energy resilience, and drive sustainable development across regions.

A discussion asks how best to facilitate partnerships between established UK CES and African mini-grid developers and how to structure financial support, research, and knowledge exchange initiatives to ensure the success and sustainability of these collaborations. To support these efforts, key policy recommendations are outlined including establishing bilateral agreements between the UK and African nations to facilitate cooperation, creating joint funding programs to pool resources, implementing tax incentives for investors, and promoting knowledge exchange initiatives.

The report concludes that collaboration between UK and African CES presents a unique opportunity to address energy inequities and promote climate justice. By leveraging shared knowledge, technology, and resources, these partnerships can enhance energy resilience in underserved communities while contributing to global efforts to combat climate change. The outlined strategies and recommendations aim to create a supportive framework that fosters investment, encourages community engagement, and empowers local populations, ultimately paving the way for a just and equitable energy transition.

1. Introduction: Community Energy Systems and the Just Transition

The global energy landscape is undergoing a profound transformation, driven by the urgent need to address climate change, enhance energy security, and foster sustainable development. At the heart of this transformation lies the concept of a "just transition"—an approach that seeks to ensure that the shift towards a low-carbon economy is inclusive, equitable and fair for all stakeholders, particularly those most vulnerable to the impacts of both climate change and the energy transition itself.

Community energy systems (CES) have emerged as a vital component of this just transition. Characterised by local ownership and participation, CES offer a promising pathway to democratise energy systems, empower communities, and generate social, economic, and environmental benefits at the grassroots level. From rural villages harnessing solar power in sub-Saharan Africa to urban cooperatives driving wind energy projects in Europe, CES projects are diverse and context-specific, reflecting the unique needs and aspirations of the communities they serve.

This section outlines the framework for understanding the intersection of community energy and a just transition. We begin by examining the "energy trilemma" in both the Global North and South, which highlights the challenges of balancing decarbonisation with ensuring universal access to energy, in an affordable manner. Following this, we explore the principles of a just transition and the importance of democratising energy systems to achieve fair and inclusive outcomes, before outlining various perspectives on the role of community energy in advancing a just transition and describing the objectives and methodology of this report.

1. The energy trilemma

As world population continues to grow exponentially, becoming more urbanised and affluent, the demand for electricity is expected to rise significantly, potentially doubling by 2050 [1]. Investment in energy infrastructure is crucial to meet this surging demand, with requirements estimated at nearly USD $50 trillion between now and 2050 [2]. With such substantial investments at stake, the methods of resource allocation and frameworks for deployment and operation of energy infrastructure becomes paramount.

Addressing this rising demand involves navigating the "Energy Trilemma," which encompasses three interlinked challenges: energy security, energy sustainability, and energy affordability. These challenges often imply trade-offs, as prioritising one can impact the others. Energy security focuses on ensuring reliable access to energy sources, energy sustainability emphasises reducing environmental impacts and promoting renewable sources, and energy affordability aims to keep energy costs manageable for consumers and industries.

Arguably, the most pressing of the trilemma is the environmental impacts of energy use, which produces 80% of carbon emissions globally [3]. In 2023, the world experienced the hottest summer in 2000 years [4] and this unprecedented heatwave highlighted the ongoing urgency of addressing climate change. Rising global temperatures, caused primarily by greenhouse gas emissions from human activities, have led to increasingly frequent and severe heatwaves, droughts, storms, and other extreme weather events. The impacts of climate change are wide-ranging, affecting ecosystems, economies, and societies worldwide. The need to transition to renewable energy sources that offer sustainable alternative to fossil fuels, safeguarding the planet and ensuring a liveable future for generations to come has become more pressing than ever.

While much of the discussion around the Energy Trilemma traditionally focuses on countries and their national performance, its principles are equally applicable to cities, large organisations, and individual projects. Understanding and addressing the Energy Trilemma is essential for shaping a resilient and sustainable energy future that balances the demands of growth, equity, and environmental stewardship.

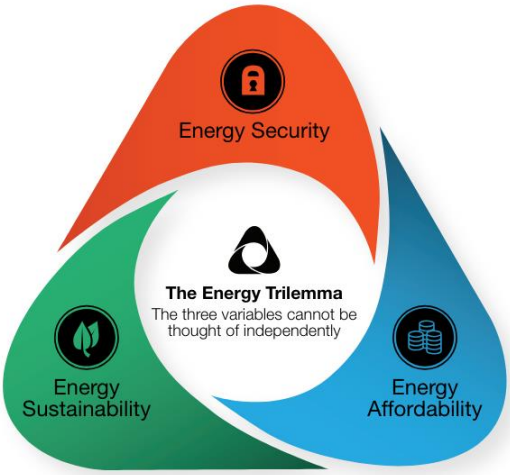

Figure 1 The Energy Trilemma [1]

The challenges of the Energy Trilemma manifest differently across the globe. High-income countries typically have high levels of energy access but face significant pressures to decarbonise in line with climate change targets and to ensure energy security amidst geopolitical tensions affecting fossil fuel supplies. Countries in this region are investing heavily in renewable energy technologies such as wind, solar, and nuclear power, alongside energy storage solutions, to reduce dependency on fossil fuels. Recent geopolitical conflicts, particularly wars impacting major fossil fuel suppliers, have underscored the vulnerability of energy security in these nations, prompting emphasis on energy independence and diversification of energy sources [5]. To address these issues high income countries are investing in energy efficiency measures and smart grid technologies to optimise energy use and integrating a higher share of renewables into the energy mix.

In contrast, low and middle-income countries in the global South face a different set of challenges. Many countries in this region have limited access to reliable and affordable energy, which hampers economic development and exacerbates poverty. The primary objective for these nations is to increase access to energy, especially in rural areas, expand energy generation capacity to support industrial growth, improve living standards, and enhance overall development. While there is a growing interest in renewable energy, fossil fuels remain a significant part of the energy strategy due to relative affordability and availability. However, the push for economic development through increased energy generation must be balanced with the global imperative to mitigate climate change, posing a complex dilemma for policymakers in the Global South.

2. A Just transition, renewables and the democratisation of energy

A "just transition" refers to the concept of shifting from a fossil fuel-based economy to a sustainable, renewable energy-based economy in a way that is fair and equitable for all stakeholders, particularly workers and communities that are most affected by the transition [6]. A just transition is seen as essential to achieving broad public support for climate action. It acknowledges that while the shift to a low-carbon economy is necessary to address climate change, it must be done in a way that is inclusive, fair, and just for all segments of society. The term embodies several key principles outlined below:

Social Equity: Ensuring that the benefits of the transition to a green economy are shared widely and that the burdens do not disproportionately fall on disadvantaged communities. This involves addressing social inequalities and ensuring that vulnerable groups are protected and supported.

Economic Equity: Providing economic opportunities and support for workers and communities that may be negatively impacted by the transition away from fossil fuels. This includes retraining programs, job creation in new industries, and economic diversification strategies to ensure that workers have access to good, sustainable jobs.

Environmental Justice: Addressing the historical and ongoing environmental injustices that have disproportionately impacted marginalized communities. A just transition aims to reduce pollution and environmental degradation in these communities, ensuring they benefit from clean energy and improved environmental health.

Participatory Governance: Involving a broad range of stakeholders, including workers, communities, businesses, and governments, in the planning and implementation of the transition. This participatory approach ensures that the voices of those most affected are heard and considered in decision-making processes.

Sustainable Development: Promoting policies and practices that not only address climate change but also contribute to sustainable development goals, such as poverty reduction, improved health outcomes, and educational opportunities.

Resilience and Adaptation: Building the resilience of communities to withstand the impacts of climate change and economic disruptions. This includes investing in infrastructure, social safety nets, and adaptive capacity to ensure communities can cope with and recover from changes.

Renewable energy plays a pivotal role in achieving a just transition due to its potential to democratise energy systems and equitably distribute the benefits of the energy transition. Unlike traditional fossil fuel-based energy systems, which are often centralised and controlled by a few large entities, renewable energy sources such as solar, wind, and hydro power can be harnessed in a more decentralised and community-driven manner. This shift not only supports environmental sustainability but also promotes social and economic equity.

Renewable energy also provides opportunities for job creation and economic diversification, crucial elements of a just transition. The renewable energy sector is labour-intensive, often requiring local labour for installation, maintenance, and operation of renewable energy systems. This creates jobs that are not only sustainable but also geographically distributed, offering employment opportunities in regions that may have been economically depressed by the decline of fossil fuel industries. Moreover, the skills required for renewable energy jobs can be accessible to a wide range of workers, including those transitioning from traditional energy sectors, through targeted retraining programs. In addition to economic and health benefits, renewable energy fosters resilience and adaptability in communities. Decentralised renewable energy systems can enhance energy

security by reducing vulnerability to external shocks such as geopolitical conflicts or fossil fuel supply disruptions. Communities with their own renewable energy sources are better equipped to maintain power during such crises, contributing to greater overall resilience.

Participatory governance is a cornerstone of integrating renewable energy into a just transition. Involving local communities, workers, and various stakeholders in the planning and implementation of renewable energy projects ensures that the voices and needs of those most affected are prioritised. This inclusive approach not only builds trust and support for renewable energy initiatives but also ensures that the benefits are distributed more equitably.

3. Perspectives on the role of community energy in a just transition

The broad definition of community energy adopted by this report[1] encompasses communities with shared energy-related interests, deploying collective actions that democratise the energy sector. This definition highlights the potential of community energy to generate diverse perspectives on energy and bottom-up-led actions that challenge existing forms of coloniality embedded in current energy systems. CES distinguish themselves by fostering grassroots innovations and developing new institutions and practices aimed at envisioning a society free from fossil fuels. They can drive the energy transition while ensuring social justice, linking energy policy to broader equity gains and addressing multiple Sustainable Development Goals (SDGs), such as poverty reduction (SDG1), inequality reduction (SDG10), and climate action (SDG13) [7].

One motivation for CES stems from opposition to the deployment of renewable energy technologies. Research indicates that at local levels, this has been more substantial than anticipated and, in many cases, this resistance stems from feelings of disempowerment regarding local rights and entitlements linked to specific projects. Arguments follow to establish governance structures and organisational formats that are participatory, inclusive, and considerate of the lived experiences of local communities [8].

Another motivation is a drive towards democratisation of the energy transition. The decentralisation of energy production allows communities to have greater control over their energy resources, fostering local ownership and participation. CES, where local stakeholders invest in and benefit from renewable energy installations, exemplify this democratisation [9]. These projects empower communities by giving them a stake in their energy systems, reducing reliance on external providers, and keeping economic benefits within the local area. This local control is particularly beneficial for marginalised and underserved communities, which historically have had limited access to energy infrastructure and decision-making processes. This model not only supports the rapid deployment of renewables but also addresses issues of social equity, economic opportunity, and environmental justice [10]

CESET has shown that community energy compels a re-evaluation of conventional views on energy transitions and their potential for fairness. Achieving zero-carbon, climate-resilient futures must be integrated with social development initiatives that account for the varying vulnerabilities affecting communities' ability to adapt to climate impacts. This necessitates moving beyond a sole focus on energy transitions to guaranteeing that these transitions are equitable and inclusive [11]

However, the advancement of CES has encountered numerous challenges that hinder their ability to lead the transition to cleaner, modern, and affordable energy. Several critical

[1]Based on the definitions used by the CESET team

factors impede progress, including the absence of supportive regulatory frameworks and incentive packages, limited knowledge regarding effective business models, weak commitments from stakeholders, and insufficient community involvement [12]. Research has shown that CES face a range of socio-economic, environmental, and institutional issues during both implementation and adaptation. A significant obstacle is the dominance of institutions that favour centralised energy systems, with government agencies, private companies, and utilities frequently at the forefront of this resistance [13]. Additionally, CESs may be hindered by technical challenges, including a lack of necessary equipment, technical knowledge, and expertise [14]. High upfront costs compared to existing national-grid alternatives represent another major barrier, making it difficult for communities to invest in and adopt these systems [13]. Challenges facing the self-governance of community energy include economic and financial challenges, legal issues, socio-cultural conditions, and micro-political struggles, including conflicts that may arise within the community [15]. Addressing these multifaceted challenges is essential for unlocking the full potential of CESs in fostering sustainable energy transitions.

CES also play a critical role in the debate between green growth and degrowth. Degrowth and post growth perspectives advocate for "the planned reduction of energy and material throughput to restore balance with the planet, meanwhile reducing inequality and improving human well-being". Degrowth advocates suggest that without addressing issues of ownership and consumption, a green growth approach merely shifts from fossil fuel depletion to depletion of resources like copper, lithium, and cobalt, and large-scale renewables owned by multinational corporations fail to benefit impoverished communities [16]. Scholars describe CES as "Collective and politically motivated renewable energy projects", that can "potentially become blueprints for a turn towards a degrowth practice that will foster the democratisation of renewable energy production" [17]. However, other research suggests that while community renewable energy projects have introduced thousands to alternative economic models, there is little evidence of significant changes in attitudes towards technology, consumption, or equity, and for more radical change (toward degrowth frameworks), strategies are needed for greater inclusion of less affluent participants, resistance to commodification, and prevention of these projects from being absorbed by the dominant political and economic systems [18].

4. Report objectives

This report aims to provide a global perspective on CES through examining such systems in UK and African contexts, exploring the role that community energy initiatives play in fostering a just transition. We then explore the opportunity for greater cooperation between these two CES contexts, specifically proposing the concept of CES twinning, leveraging financing for African minigrids through UK CES projects, and the associated knowledge exchange and global citizenship that this would foster.

The report has been informed through expert interviews of CES practitioners in UK and Africa and relevant literature. In Section 2, we examine approaches to Community Energy in the UK and Africa, while in Section 3 we propose ways in which global CES cooperation can occur, outlining motivations, how it would work and a case study example as well as potential challenges to the approach. Policy recommendations are given in Section 4.

2. Approaches to Community Energy in the UK and Africa

Both the Global North and Global South can benefit from the principles of CES, albeit in different ways. In the Global North, the focus is on transitioning to sustainable energy in a manner that promotes social equity and local empowerment. In the Global South, the emphasis is on providing essential energy access while fostering sustainable development and community resilience. A just transition through CES recognises the diverse needs and contexts of different regions, ensuring that the shift to renewable energy is inclusive and equitable on a global scale. This section outlines the progress being made in the UK community energy systems, and minigrids in Africa.

2.1 UK Community Energy Systems: Status, Progress and Trends

In the UK, the transition to renewable energy has been driven by the need to reduce carbon emissions and achieve sustainability targets. UK CES emphasise local ownership and control over energy resources, promoting energy democracy and reducing dependence on large, centralised energy providers. This approach not only fosters a sense of community involvement and empowerment but also helps to address social inequities by ensuring that the financial benefits of renewable energy projects are shared locally.

2.1.1. Historical context

Community energy initiatives have proliferated across the UK since the late 1990s, with around 300 community organisations currently running energy generation projects and others engaged in demand-side activities [19]. This growth is part of a broader decentralisation of the UK's energy system. Despite operating within a centralised energy framework, community energy groups have carved out a niche by learning, collaborating, and seizing opportunities created by changes in government regulations and technological advancements. Over the past three decades, liberalisation and privatisation of the energy sector, along with rapid developments in renewable energy technologies, have provided a fertile ground for small-scale energy generation, enabling community energy groups to thrive.

- **1970s-1980s**: The oil crises of the 1970s spurred interest in alternative energy sources. Early community energy projects were often small-scale, experimental, and focused on energy efficiency and self-sufficiency.
- **1990s:** The rise of environmental movements and increasing awareness of climate change led to a surge in renewable energy projects. Communities started to organise more systematically around wind, solar, and biomass projects.
- **2000s**: Government policies and incentives, particularly in Europe, such as feed-in tariffs (FiTs) and renewable energy targets, catalysed the growth of community energy projects. Technological advancements and cost reductions made renewables more viable.
- **2010s-Present**: The focus has broadened to include not just renewable energy generation but also energy storage, smart grids, and energy efficiency measures. Policy support has varied, with some regions experiencing rollbacks in incentives, while others continue to innovate.

2.1.2. UK CES Characteristics and Status

UK CES have primarily arisen from groups of environmentally conscious individuals wanting to make a difference in their community. Through accessing government grants or raising capital through share offerings, they have been able to secure financial resources to build and operate renewable energy systems, generally hydro, wind or solar. Through selling electricity to the grid or individual customers the projects recoup the initial investment and

offer a return on investment. CES in the UK adopt various ownership and organizational structures, including:

- **Cooperatives**, where members (often local residents) own shares in the project and have a say in its operation;
- **Community Interest Companies (CICs),** non-profit organisations designed to benefit the community rather than shareholders;
- **Trusts and Foundations**, structures that often focus on long-term sustainability and reinvest profits into community projects; and
- **Public-Private Partnerships**: Collaborations between community groups, private companies, and public bodies to develop and manage energy projects.

Renewable energy revenues have driven most community energy business models, with supply-side energy generation initiatives providing the primary source of income. These revenues have enabled surplus funds to support various environmental and social projects, including energy efficiency and demand management activities. Such projects deliver major social benefits to local people, with fuel poverty work by CESs yielding at least a 9:1 social return on investment [20]

Despite their successes, community energy systems face several challenges including regulatory hurdles with inconsistent policies and regulations creating uncertainty and barriers to entry; securing funding and investment for projects, particularly for smaller communities; and communities often lacking the technical know-how needed for complex energy projects [21].

The Community Energy State of the Sector [22] offers valuable insights into the UK community energy sector. The most recent report, published in early July 2024 emphasises the sector's growth and diversification and reveals that the sector is generating more renewable electricity, creating jobs, and boosting local economies. It also shows increased public engagement with energy efficiency and efforts to reduce energy bills and alleviate fuel poverty. Despite a healthy pipeline of new projects and innovations, the sector faces barriers that need addressing to unlock further potential. The findings are based on survey responses from community energy organizations and supplemented by previous surveys and research. Figure 2 shows key facts and figures from the report.

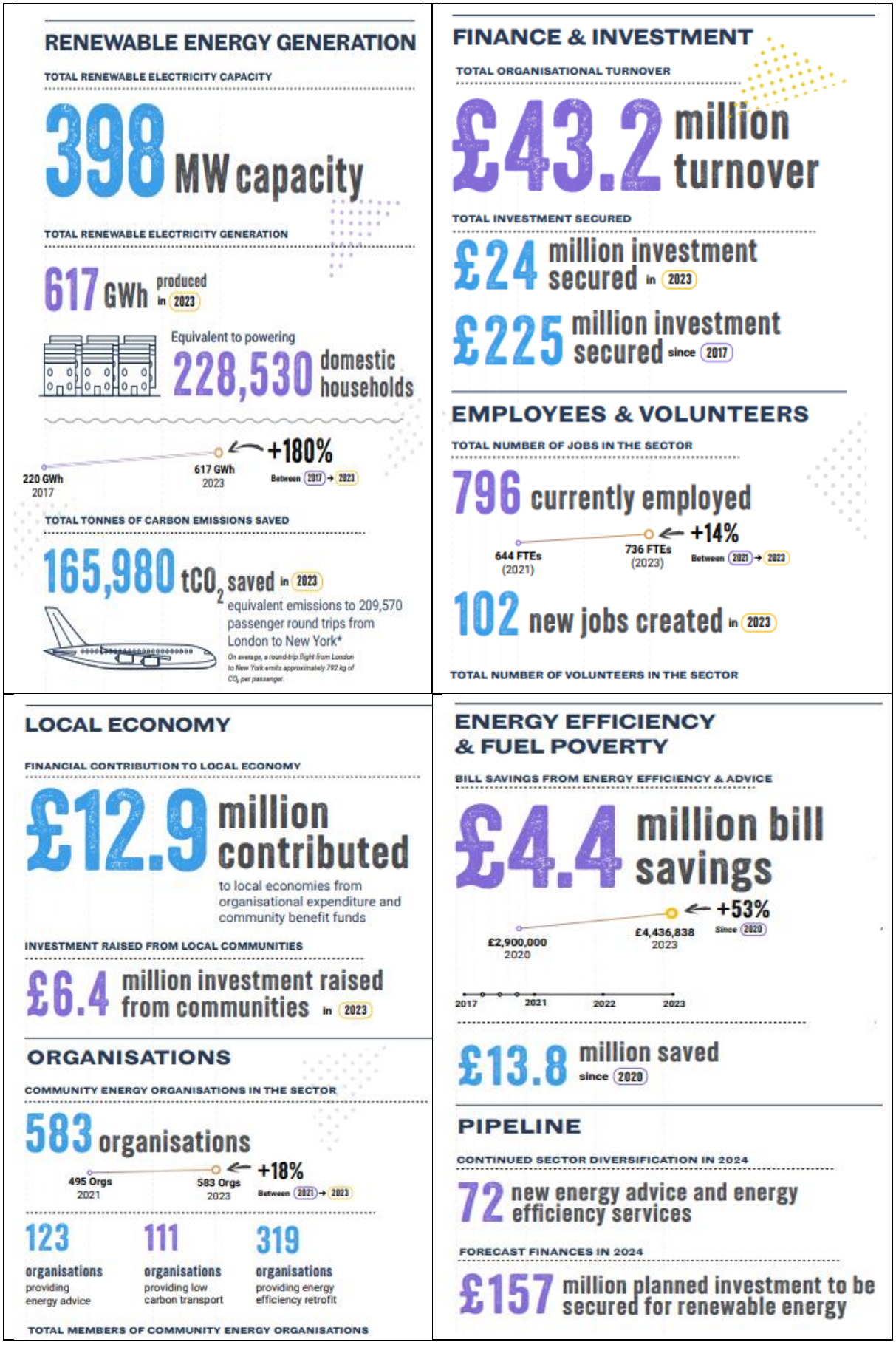

Figure 2: Key stats on Community Energy in the UK 2024 REF

2.1.3 Policy Impact on UK CES

Past and future policy directions for community energy in the UK have seen significant variation, with differing levels of support across the nations. When and where available, government grant funding has been crucial for the establishment of UK CES, however the most significant advancement for community energy came with the introduction of the Feed-In Tariff Scheme (FiTS) in 2010 [23]. This scheme was the first government price support mechanism specifically targeting small-scale renewables, marking a major step forward for community energy.

Following this, the publication of the government's Community Energy Strategy in 2014 [24] was a high point for community energy. However, subsequent political changes in the UK led to the FiTS and other public policies becoming much less supportive of community energy, resulting in a significant slowdown in new projects. This is unsurprising given that central government significantly structures the UK energy market. For new actors to enter and thrive in this market, government support is crucial to 'unlock' it. Since energy projects require high upfront capital and have long payback periods, market and policy stability are essential for reducing investment risks [25].

Scotland and Wales have benefited from different funding regimes, the most significant being the CARES funding in Scotland [26], which provided greater opportunities for sector growth. In England, the closure of the Rural Community Energy Fund to new applications in 2022 [27] left projects without access to development funding, except in areas where local governments, like the Greater London Authority and some London boroughs, maintained Community Energy Funds.

Looking forward, the new UK government ambitious and practical commitment to achieving net-zero emissions is evident in its targets, such as achieving 'clean power by 2030', doubling onshore wind capacity, and quadrupling solar capacity. This approach includes the early removal of the Conservatives' ban on onshore wind in England and the introduction of the Local Power Plan, which places people at the centre of the energy transformation. The policy promises up to £1 billion annually for local climate action, with £400 million allocated for low-interest loans to communities and £600 million in grants for local authorities, signalling a robust future support framework for community energy [28].

2.1.4 UK CES Outlook

The future of community energy in the UK looks promising with the increasing urgency of climate action driving more communities to explore renewable energy solutions, while innovations in energy storage, smart grids, and digitalisation are making community energy projects more viable and efficient. The sector has grown larger, with established projects generally having secure revenues. Additionally, the sector has developed economies of learning, which allows some new community renewable projects to proceed despite cost pressures. There is renewed interest in energy projects from local authorities, and synergies between civic and community energy actors have been recognised in cities like Plymouth, Swansea, and Edinburgh.

Research suggests that the UK community energy sector has the potential to diversify beyond its current focus on renewable electricity generation and energy efficiency into new areas such as demand-side flexibility, mobility, and heat. Achieving this vision will require significant actions by both national and local governments, in conjunction with the ongoing efforts of the community energy sector itself [29].

2. Minigrids in Africa as Community Energy Systems

The energy landscape in Africa is undergoing significant transformation, with a growing emphasis on renewably powered decentralised energy solutions like minigrids and solar home systems to address the continent's energy challenges. The international community's support and financing are vital to enable Africa to leapfrog to cleaner energy technologies without hindering its development goals. This necessitates a rethinking of traditional infrastructure models and the exploration of various governance and ownership arrangements, including cooperatives and public-private partnerships, in tandem with government and business sector involvement. The role and opportunity for CES within this context is both considerable and impactful.

2.2.1 Africa's energy access challenge and minigrids as a solution

Central to Africa's energy challenge is the monumental task of achieving widespread electrification, with 600 million people, or 43% of the total population, lacking access to electricity. Achieving universal access to affordable electricity by 2030 requires connecting 90 million people annually, three times the current rate. While extending national grids is the most cost-effective and practical solution for nearly 45% of those gaining access by 2030, in rural areas—where over 80% of the electricity-deprived population resides—minigrids and stand-alone systems, primarily solar-powered, are the most feasible solutions [30].

Minigrids, defined as systems with central generation providing wired connections to customers not connected to the national grid, offer a low-cost, low-carbon solution to this challenge. They are emerging as a promising solution for rural electrification in areas where extending the main grid is cost-prohibitive [31]. In 2020, 47 million people worldwide were already connected to 19,000 mini-grids, of which at least 2,577 are operational clean energy mini-grids [32]. To achieve the overarching objective of universal access to electricity by 2030, an additional 180,000 mini-grids need to be built to supply electricity to 440 million people [33]. These mini-grids provide reliable and high-quality electricity, proving to be a viable option for rural populations, thereby playing a crucial role in addressing Africa's energy access challenge.

However, the deployment of minigrids in Africa faces significant obstacles that hinder their widespread adoption and effectiveness. These barriers are categorized into political, economic, and technical challenges highlighting their complex nature.

Political Barriers: Policy frameworks often do not support minigrid development, prioritising large-scale energy projects instead. Regulatory uncertainty and bureaucratic hurdles can delay projects and increase costs, deterring investment. Additionally, ambiguous service area coverage and complex regulatory approval processes create legal uncertainties and discourage private sector investment. Clear, supportive policies and streamlined approval processes are essential to encourage both public and private sector engagement in minigrid initiatives.

Economic Barriers: Many rural and low-income households cannot afford the connection fees and ongoing electricity costs, limiting the customer base for mini-grid projects. Subsidies intended to make electricity more affordable can create financial imbalances that hinder the economic feasibility of minigrids. Access to finance is a significant barrier, with many minigrid initiatives struggling to secure necessary capital due to high perceived risks and limited availability of affordable financing options. This financial shortfall stifles innovation and limits the scale-up of successful projects.

Technical Barriers: Challenges related to power quality and technical expertise are significant concerns. Voltage fluctuations and interruptions can lead to user dissatisfaction and reduced trust in minigrid solutions. Additionally, a critical shortage of locally trained technicians limits the ability of communities to independently manage and sustain their energy systems, making them reliant on external expertise, which can be costly and logistically challenging.

2.2.2 Minigrid Economics

Minigrids require substantial upfront capital to construct and install the systems, including developing ancillary infrastructures to make the project viable. Sustaining the systems functionality over the project life requires an additional, continuous, reliable revenue stream. Sufficient funds are needed for ongoing operations, maintenance, and effective management of the systems.

Off-grid renewable energy systems have historically encountered sustainability challenges. While donor capital has been deployed to develop energy infrastructure, the absence of a financially sustainable business model has frequently led to insufficient resources for maintenance or the replacement of components [34]. This deficit in ongoing funding and adequate business models has, in turn, resulted in the deterioration of systems over time. Ensuring sufficient resources are available to cover the costs of operation, maintenance, and management is crucial for long-term sustainability. Such costs can be covered with revenues from connection fees and electricity sales, and where available, from subsidies or donor support. Ensuring a reliable and ongoing source of revenue is vital to the project's sustainability.

The financing of minigrids in Africa primarily relies on public funding sources such as grants from governments, development finance institutions (DFIs), donor agencies, and foundations. Most committed financing to date has come from grants and developers' balance sheets, with limited debt financing available. Results-Based Financing (RBF) has gained popularity among developers and private investors as it improves returns, reduces risks associated with early-stage debt or equity financing, and potentially unlocks private capital, assuming investor confidence in the developer's ability to deliver electricity connections [35].

Access to such finance is a significant economic barrier to the deployment of mini-grids in Africa. The severe lack of funding, coupled a lack of subsidy, creates financial imbalances that hinder the economic feasibility of these projects [36]. The lack of access to finance not only impedes the initial deployment of mini-grids but also stifles innovation and limits the scale-up of successful projects, ultimately slowing progress toward universal electricity access. Despite approvals totalling USD 2.07 billion by March 2020, only 13 percent of these funds had been disbursed, leading to delays in project advancement. The mini-grid market also faces a lack of pure commercial financing due to its limited scale, unclear regulations, developers' limited project track records, and residential consumers' low power demand and ability to pay.

Despite these challenges, there is a financial return to be had from minigrids. The African Minigrid Developers Association reports that minigrid revenues are consistently growing, and operational costs are dropping. Average Revenue Per Use This trajectory indicates that the industry is approaching financial viability. For example, the minigrid market in Nigeria offers potential annual revenue of US$8 billion and Minigrid developers here report 15%–20% returns on successful projects [37]

2.2.3 Are minigrids Community Energy Systems?

Minigrids can indeed be considered a form of CES, with alignment especially evident in their ability to deliver tailored energy solutions to meet the specific needs of local communities, often in remote and underserved areas. The fundamental principles of CES, such as local ownership, participatory governance, and a focus on sustainability and community benefits, resonate with the operational and organisational models of many minigrids in Africa.

Minigrids play a pivotal role in addressing the energy trilemma—balancing energy security, environmental sustainability, and economic development. By leveraging renewable energy sources, minigrids provide a low-cost, low-carbon solution for rural electrification, which aligns with the CES goal of promoting sustainable energy practices. The deployment of minigrids can facilitates community involvement and ownership, ensuring that energy solutions are not only technically appropriate but also socially and economically beneficial for the communities they serve. The economics of minigrids often require innovative financing solutions, similar to those needed for other CES initiatives.

However, the level of community agency and engagement with minigrids varies across Africa, depending on the context and the ownership model. These can range from government-owned to private sector and cooperative models, each providing different levels of community buy in and engagement throughout the project. The predominant paradigm for minigrid deployment in Africa currently follows a private sector approach, where a minigrid developer interacts with the community as a business would with customers, selling electricity. While this model ensures professional management and operational efficiency, it does not strictly adhere to the CES framework of local ownership and participatory governance. In contrast, cooperative and social enterprise models with significant community involvement can enhance local empowerment and ensure that the benefits of electrification are more broadly shared within the community[2].

This variation underscores the importance of integrating insights from fully community-owned CES in the UK to inform community minigrid deployment in Africa. Such collaboration can help ensure that minigrids maximise community benefits while addressing the principles of a just transition, prioritising local needs, and fostering sustainable development.

[2] Discussed more fully in the other CESET report in this series “Power to the People: do with or do for? Exploring Community Agency in African Minigrids”

3. Proposing Community Energy Twinning

In this section we propose fostering global citizenship and addressing climate justice through a community energy twinning scheme between UK CES and African minigrids. We outline the motivations for such cooperation, provide an overview of the proposed approach through a case study example and present a discussion to encourage debate.

3.1 Motivations for global cooperation in CES

The transition to sustainable energy is a pressing global challenge that requires innovative solutions and collaborative efforts across borders. As communities in the UK and Africa seek to address energy access, climate change, and social equity, a community energy twinning scheme offers a unique opportunity to foster mutual learning and cooperation. Key motivations for driving global collaboration in CES are outlined below. By understanding these motivations, we can better appreciate the potential impact of twinning initiatives on both local and global scales.

Policy Drivers

The transition to sustainable energy systems is supported by various international agreements and national policies aimed at addressing climate change and promoting renewable energy. Frameworks such as the Paris Agreement emphasise the need for global collaboration to reduce greenhouse gas emissions. Additionally, the UK government has shown interest in enhancing its role in international development, particularly through partnerships that facilitate research, knowledge exchange and technical assistance in renewable energy initiatives such as Innovate UK's Energy Catalyst [38] and the UKRI Global Challenges Research Fund [39]

Global Citizenship

The concept of global citizenship encourages individuals and communities to see themselves as part of a larger global community, emphasising shared responsibilities for social justice and environmental sustainability. A community energy twinning initiative between the UK and African minigrids embodies this spirit by promoting collaboration across borders. It empowers individuals to engage with the challenges of energy access and climate change, fostering a sense of global solidarity and mutual learning. By participating in such initiatives, communities can enhance their understanding of global interdependencies, encourage civic engagement, and cultivate a sense of collective responsibility toward sustainable development.

Climate Change and Climate Justice

The Industrial Revolution, which began in the UK, ignited the widespread use of fossil fuels and initiated significant climate impacts that we continue to confront today. As one of the highest emitters of carbon emissions historically, the UK bears a considerable responsibility for the climate crisis. Paradoxically, it is often the most vulnerable communities—particularly rural communities in Africa—who suffer the most from climate change, despite having contributed minimally to the problem. These populations face dire challenges, including limited access to reliable energy and heightened exposure to extreme weather events.

A community energy twinning scheme offers a pathway to address these injustices by promoting climate justice. Such initiatives ensure that marginalised communities gain access to the resources, technology, and support necessary to develop resilient energy systems. By sharing best practices and innovations from the UK, such as community-led

renewable energy projects, African communities can enhance their energy resilience and advocate for policies that reflect their specific needs. This collaborative approach fosters transformative outcomes, allowing both partners to learn from each other's experiences and challenges, ultimately paving the way for equitable solutions to the global climate crisis.

Research and Knowledge Exchange

Twinning initiatives can significantly enhance the sharing of technical knowledge and operational best practices between UK and African partners, thereby strengthening local capacity to manage and maintain energy systems effectively. Organising exchange visits is another valuable component, allowing community members and stakeholders to experience each other's projects first-hand, which fosters deeper understanding and collaboration. Additionally, these collaborative projects can open avenues for joint research initiatives, exploring innovative solutions and documenting outcomes to inform future policies and practices. By engaging in mutual learning and knowledge exchange, both UK and African communities can benefit from enhanced expertise and innovative approaches to energy challenges.

3.2 Case Study example: Sustainable Hockerton and Community Energy Malawi

The case study below aims to give an example of how a Community Energy twinning project might work in practice.

3.2.1 Sustainable Hockerton

Sustainable Hockerton, located in the East Midlands, UK, is a pioneering community energy project motivated by concerns about climate change and environmental sustainability. The initiative began in the 1990s with Hockerton Housing Project looking at low energy housing, which lead to Sustainable Hockerton, a group of community members forming a cooperative society to investigate and develop a community-owned renewable energy project.

The community successfully raised funds to purchase a wind turbine through a cooperative society structured as a "Society for the Benefit of the Community." They managed to raise £235,250 through a share offer, with additional support coming from member loans. This allowed them to buy a second-hand 225kW wind turbine, demonstrating that community-driven renewable energy projects are financially achievable. The project relied heavily on UK policy support through the UK Feed-In-Tariff available at the time.

Key features of the cooperative include:

- **Share Ownership:** Each member owns a minimum of 250 shares, which grant voting rights and the share of the asset remains the fixed value of the share. a share of the assets. Shares provide an interest payment decided annually by the directors, typically between 5-8%. At set up Shares could be either withdrawable or transferable. Transferable shares were then chosen for tax advantage. Withdrawable shares must be sold back to the cooperative, ensuring the coop can manage its finances. Transferable shares allow for tax incentives under the Enterprise Investment Scheme (EIS), which helps members reduce their tax bill.
- **Financial Governance:** The cooperative is governed by financial rules set by the Financial Conduct Authority (FCA) for cooperatives. Despite initial challenges, such as the long community engagement process and managing the risks associated with purchasing a second-hand turbine, the financial aspect of the project has been robust.
- **Community Benefits:** Surplus from the wind turbine are predominantly distributed within the local community, geographically defined as the parish of Hockerton. The

wind turbine has now been paid off and generates approximately £65,000 annually. The cooperative currently has £300,000 in the bank, with surplus funds accumulating for future projects.

Initially, the goal was for members to receive their investment back after 20 years. However, after 7-8 years of successful operation, the cooperative's directors consulted with members on whether to reinvest profits into more renewable projects or return the investments. A majority chose to reinvest, while others preferred to withdraw their funds. This flexibility has allowed the cooperative to continue growing and supporting additional renewable energy initiatives.

In recent years, Sustainable Hockerton has expanded its renewable energy initiatives beyond the initial wind turbine project. These expansions include three local solar PV arrays totalling 86kW installed between 2014 – 2015. These solar systems are owned by Sustainable Hockerton, helping the community increase its generation capacity and spread financial risk. The projects were funded through a combination of loans from cooperative members and revenue generated from the wind turbine, demonstrating the community's ability to reinvest in sustainable energy solutions. This strategic reinvestment not only enhances energy resilience but also aligns with the community's commitment to environmental sustainability and local empowerment.

3.2.2 Community Energy Malawi

Community Energy Malawi (CEM) is a leading renewable energy organisation in Malawi, inspired by the vision of providing "Affordable and sustainable energy for Malawian communities." CEM focuses on promoting access to energy and productive use of clean energy for over 90% of Malawians who are not connected to the national grid. Formed as an output of the Community Energy Development Programme (CEDP) with support from the Scottish Government under the Malawi Renewable Energy Acceleration Programme (MREAP) , CEM has established itself as a significant player in Malawi's renewable energy sector.

From 2011 to 2015, CEDP implemented 46 projects across 12 districts, comprising 103 different systems including solar lighting for health facilities, schools, Community-Based Organisations offices, solar potable water pumping stations, and clean cooking centres. These initiatives impacted 78,875 people and gained recognition, achieving finalist status in the Association of Project Management "Social Project/Programme of the Year" and being highly commended in the Energy Institute's Awards-Community Initiative Award.

Building on this pioneering work, CEM has expanded its reach, implementing projects in 17 districts and impacting over 100,000 people. Some of the notable projects include:

- 80kW Solar Mini-Grid: Providing 1,029 connections.
- Sun Ovens: Replacing firewood use in rural bakeries operated by women-led cooperatives.
- Pay as You Go (PAYGO) Model: Supporting rural entrepreneurs with energy installations for productive uses and distributing solar lanterns and solar home systems.
- Community Capacity Support: Helping communities initiate their own energy projects.
- Policy Development: Actively participating in the formulation of energy policies in Malawi.

CEM is licensed by the Malawi Energy Regulatory Authority (MERA) as a mini-grid operator and renewable energy technologies supplier/installer. It operates as an NGO with a

subsidiary social enterprise, CEM Trading Ltd, working with individuals, communities, and organisations passionate about renewable energy.

CEM's strategy for deploying off-grid renewable energy systems focuses on ensuring long-term sustainability across technical, economic, and social dimensions.

- Technical Sustainability: Achieved by deploying high-quality technical solutions, establishing a viable maintenance and operations framework with supporting revenue streams, building local technical capacity, implementing remote monitoring, and providing ongoing technical support.
- Economic Sustainability: Ensured through the social enterprise approach and business modelling of ongoing costs and revenues. Minigrids provide a revenue stream that supports the technical maintenance of the systems.
- Social Sustainability: Central to CEM's model is community engagement. By working closely with community and local authority structures, CEM ensures a collective sense of ownership and alignment of energy systems with local priorities.

CEM's comprehensive approach has made significant strides in promoting sustainable and affordable energy in Malawi, demonstrating the potential of community-driven renewable energy projects to transform energy access and improve livelihoods. CEM have approval for 5 new minigrid sites in Mchinii district and is looking for finance to implement them.

3.2.3 Twinning Hockerton and Mchinji

Sustainable Hockerton, with its successful track record in community energy projects and surplus revenue from its wind turbine and solar PV systems, is well-positioned to contribute to the global energy transition through a twinning initiative with Community Energy Malawi (CEM) in the Mchinji district. This collaboration would focus on funding and implementing a 20kW minigrid in Mchinji, one of the five new minigrid sites approved by the Malawi Energy Regulatory Authority (MERA).

Sustainable Hockerton could utilise surplus revenue to provide co-funding which would match an international donor grant for CAPEX to build a new minigrid. This financial commitment could be structured as a patient capital equity investment in CEM, ensuring sustainable and mutually beneficial returns. Depending on the performance of the minigrid, members of Sustainable Hockerton could potentially receive a 5% return on their investment, aligning with their community-focused ethos while supporting a critical renewable energy project in Malawi. The social and environmental impact of the investment would hold equal importance for the UK community energy investor.

Beyond financial support, the twinning initiative would facilitate a robust exchange of knowledge and technology between Sustainable Hockerton and CEM. Regular visits between the UK and Malawi would enable sharing expertise on solar PV installation, maintenance, and optimisation, fostering direct learning experiences and strengthening technical capabilities on both sides. Sustainable Hockerton would share its insights and best practices in community-led renewable energy projects, including strategies for maximising efficiency and reliability in solar PV systems. Additionally, Sustainable Hockerton would leverage its networks within the UK community energy sector to raise additional funds for CEM projects, providing financial support and increasing awareness and engagement around global energy justice issues.

3.3 Discussion

The example above illustrates how a community twinning project might look, but in order to scale and offer a meaningful impact on minigrid deployment in Africa, questions remain

around what resources and frameworks are required to facilitate and maintain partnerships, how to structure financial support, and how best to develop other collaborations such as Knowledge Exchange and research. It is out of the scope of this position paper to comprehensively answer such questions, but discussion points are mooted below to inform future dialogue.

Facilitating and maintaining partnerships

Twinning initiatives would work best with established organisations both in the UK and Africa. Newly established CES in the UK may be more focused on generating immediate financial returns for their shareholders, potentially making them less inclined to invest in international projects with longer payback periods. Older, more established CES in the UK are more likely to have surplus funds having mostly paid off their initial investment and are eager to invest in new projects. Similarly, in Africa, more established minigrid developers would be preferred partners, holding a track record and financial management experience to reduce risk. Such an approach may exclude smaller players or individual community projects in the short term.

A matchmaking service could facilitate partnerships, with an online database of potential minigrid sites listing project partner, financial requirements, modelled payback periods and return on investments, and likely social impact. Collaboration agreements or Memorandums of Understanding (MoUs) would need to be developed to outline clear roles and responsibilities and manage expectations.

Finance arrangements

Financial support can take various forms, including grants, loans or equity shares in minigrid projects. UK CES can provide the necessary patient capital to initiate and expand renewable energy projects, ensuring that local communities have access to affordable energy. This investment model not only helps finance the development of infrastructure but also creates a sense of ownership and engagement among local stakeholders.

Minigrids are often perceived as risky investments due to uncertainties in revenue generation and demand, and UK shareholders may be concerned about the security of their investment and the potential of not getting their money back. To mitigate these financial risks, projects could secure backing from financial institutions or insurance companies that specialise in renewable energy projects. Detailed feasibility studies and business plans, supported by historical data on minigrid revenue and demand, can provide potential investors with confidence. Furthermore, offering investment guarantees or partial risk guarantees can protect investors against losses.

Fostering collaboration in Research and Knowledge Exchange

An important first step for these initiatives will be to define clear objectives and goals, such as improving technical skills, sharing best practices, and understanding local energy needs. Formal structures like MoUs and collaboration agreements should outline roles, responsibilities, and expectations to ensure accountability. Creating an online platform for continuous and structured knowledge exchange, including databases of research, case studies, and technical guidelines, can facilitate ongoing interaction and problem-solving. Encouraging peer-to-peer learning through exchange visits, internships, and training programs can enable practical learning and strengthen relationships. Leveraging local expertise from universities, technical institutes, and local governments can also provide valuable insights and enhance project relevance. Securing long-term funding for supporting knowledge exchange through grants, CES contributions, or support from international

agencies will be critical for sustaining these activities. Lastly, implementing a robust monitoring and evaluation framework will help assess the impact and effectiveness of the collaboration, allowing for continuous improvement.

Potential risks

Investing in projects located far from the investor's home base introduces challenges related to oversight and management. For local CES projects, stakeholders can be directly involved and quickly address issues as they arise. In contrast, the physical distance to African minigrid sites makes it difficult for UK stakeholders to monitor and intervene promptly. To overcome this, the projects can establish local management teams at the minigrid sites that work closely with the UK partners. Regular virtual meetings and bi-annual on-site visits, can ensure continuous communication and oversight. Additionally, leveraging technology for remote monitoring of the minigrid's performance can provide real-time data and facilitate prompt responses to any issues.

Ensuring the local community's buy-in and participation in the African minigrid projects (both in the UK and Africa) is critical for their success. There is a risk that the communities might not fully engage with or support the minigrid initiatives. The projects can adopt a participatory approach from the outset, involving the communities in the awareness raising, planning, implementation, and management stages. Conducting thorough community consultations and integrating local priorities into the project design can foster a sense of ownership and commitment. Continuous community engagement and education programs can further strengthen local support and participation.

Finally, changes in local regulations and policies may pose risks to the projects' viability and sustainability. To navigate regulatory and policy risks, the projects can work closely with local authorities and regulatory bodies to ensure compliance and secure necessary approvals. Building strong relationships with policymakers and advocating for supportive policies can also help create a conducive environment for the projects' success. Additionally, staying informed about potential policy changes and having contingency plans in place can mitigate these risks.

4. Policy Recommendations

To promote greater cooperation between UK and African CES, several policy recommendations are presented below, aiming to create a supportive framework that encourages collaboration, reduces barriers, and ensures mutual benefits.

Bilateral Agreements: Governments of the UK and African nations should establish bilateral agreements focused on renewable energy cooperation, outlining shared goals, joint funding mechanisms, and specific cooperation frameworks to support CES partnerships. These agreements can facilitate streamlined communication and collaboration between stakeholders in both regions, ensuring that projects are aligned with local needs and capacities.

Joint Funding Programs: A joint funding program designed to support CES twinning projects can pool resources from both UK and African governments, international donors, and private investors. This approach can provide grants, low-interest loans, and equity investments, lowering financial barriers and making it easier for community energy initiatives to launch and scale.

Tax Incentives and Subsidies: Implementing tax incentives and subsidies for UK CES investing in African minigrids can encourage participation and investment. By reducing the financial burden on investors, these incentives can stimulate greater engagement in cooperative projects that benefit both UK and African communities.

Knowledge Exchange Programs: Facilitating knowledge exchange programs, including academic partnerships, training workshops, and exchange visits, can ensure systematic and continuous transfer of expertise. Such initiatives will foster collaboration, allowing both regions to learn from each other's experiences, best practices, and challenges in community energy implementation.

Policy Harmonisation: Supporting policy harmonisation between UK and African countries will streamline regulatory processes for cross-border energy projects. By reducing bureaucratic hurdles, this approach can facilitate smoother project implementation and ensure that both parties are operating under compatible legal frameworks.

Risk Mitigation Instruments: Developing risk mitigation instruments, such as insurance schemes and guarantee funds, can protect investors against political, economic, and operational risks. These measures will increase investor confidence and encourage more stakeholders to participate in community energy projects.

Community Engagement and Ownership: Ensuring community engagement and ownership in CES projects, including requirements for local ownership and participatory decision-making, can enhance sustainability and social impact. This involvement will empower local populations and ensure that energy solutions meet the specific needs of the communities they serve.

Corporate Social Responsibility Initiatives: Encouraging UK companies to include CES partnerships in their corporate social responsibility initiatives can provide additional resources and expertise. This collaboration can enhance project visibility and support while aligning corporate goals with community development objectives.

Monitoring and Evaluation Frameworks: Lastly, developing comprehensive monitoring and evaluation frameworks to assess the impact of CES twinning projects will ensure accountability and highlight best practices for future efforts. By tracking progress and

outcomes, stakeholders can make informed decisions that enhance the effectiveness of ongoing and future initiatives.

5. Outlook

The potential for collaboration between UK and African community energy systems (CES) presents a significant opportunity to address energy inequities while promoting sustainable practices. By fostering partnerships through twinning initiatives, both regions can share knowledge, technology, and resources, ultimately enhancing energy resilience in underserved communities. Despite the challenges of distance, financial risks, and differing regulatory environments, strategic policies can mitigate these barriers and encourage greater cooperation. The outlined policy recommendations aim to create a supportive framework that facilitates investment, enhances community engagement, and promotes shared ownership in renewable energy projects.

As global efforts to combat climate change intensify, the collaborative spirit between UK and African CES can pave the way for innovative solutions that empower local communities and contribute to a just energy transition. By working together, these partnerships can not only strengthen energy access but also create lasting social and economic benefits, positioning both regions as leaders in the global movement toward sustainable energy.

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