Exploring International Community Energy Synergies

A PESTLE Analysis

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	Scotland	Malawi	Interlinkages / collaboration
Political	**Policy Support and Challenges: UK** **Supportive Policies:** community energy (CE) is recognised for its potential to align with UK climate targets and decentralised energy ambitions [1],[2]. Mechanisms designed to support UK climate policies, like Feed-in Tariffs (FiTs), have historically supported CE. **Challenges:** Recent policy shifts, including the withdrawal of FiTs, have destabilised the sector [1], creating uncertainty about the government's long-term commitment to CE initiatives and leading to a decline in new CE projects.	**Policy Support and Challenges:** **Government Support:** The 2018 National Energy Policy and associated Malawi Renewable Energy Strategy (MRES) promotes off-grid electrification through decentralised renewable energy solutions [6]. Donor Support: Government policies have been backed by a range of donor programmes that include a focus on community energy systems and creation of an enabling environment for private sector involvement [7]. **Regulatory Framework**: The Malawi Energy Regulatory Authority (MERA) has developed a Regulatory Framework for Mini-Grids (2020),	Both countries have a history of policy support for community energy systems and distributed renewables. Implementation has been enabled through a range of government facilitated grant/subsidy mechanisms. Fluctuations in the political environment and financial support available have created uncertainty and hindered implementation in both countries. Policy maker knowledge exchange platforms would allow sharing of experiences on renewable energy and community energy policy

	Scottish Government The Scottish Government shows greater support for CE UK [2], in particular finance through its CARES grants programme maintained by Local Energy Scotland. One positive feature of this programme is loans for project development which are converted into grants if the project fails. **Regulatory Barriers** Regulatory complexity in energy markets creates significant challenges for CE projects, particularly regarding grid access and power purchase agreements [3].	allowing for different ownership models, including community-based trusts and cooperatives [8]. **Rural Electrification Efforts:** The Malawi Rural Electrification Program (MAREP), funded through a 4.5% energy levy, aims to extend grid-based and off-grid electrification [7]. The focus has been primarily on grid extension and progress has been slow, with many rural areas remaining unconnected [9]. **Challenges:** Political Uncertainty: The political environment in Malawi is turbulent and plagued by corruption allegations [1]. National Energy Policy and renewable energy specific policy updates are overdue and supporting policies regarding grid-connection and metering of distributed renewables are yet to be completed. Complex Licensing & Tariffs: Mini-grids must comply with tariff regulations set by MERA, but high compliance costs and slow approval processes deter community-led initiatives [7].	development (and their interlinkages). Supporting research could include refreshing the evidence base for community energy policy support in both contexts – collating international experiences and lessons learnt – linking community energy to delivery of national climate, economic and social targets. The regulatory, licensing and electricity trading arrangements are very different between the countries. This creates an opportunity for exploring comparative advantages for accommodating/supporting innovation community energy systems and considering the afterlife position of community energy assets.

[1] https://www.afrobarometer.org/publication/ad522-malawians-dissatisfied-with-government-efforts-on-corruption-want-swift-action-against-corrupt-officials/

Economic	**Business Model Viability** CE organisations in Scotland face challenges in developing robust business models due to high upfront costs, reliance on grants and limited access to private finance [4]. CE in Scotland has been a fertile ground for innovation, as projects seek to diversify from projects relying only on energy generation revenue streams. Examples include combining energy generation with energy efficiency services [1], peer to peer energy sales to local customers, providing flexibility services to grid operators, are emerging as key strategies [5]. **Financial Barriers** Difficulty in accessing affordable finance is a critical barrier, compounded by a lack of investor familiarity with CE and an underdeveloped financial ecosystem for non-commercial business in the UK (Cairns et al., 2023). The research underscores the importance of public sector lending collaboration within the third / social sector to generate finance. It also highlights the value of some niche commercial lenders which, in	**Business Model Viability** Most community energy (CE) projects in Malawi rely on international donors for initial capital, as access to private sector financing is limited [7]. Even with full capital grant subsidy, most continue to struggle with financial sustainability, particularly due to low-income levels limiting their ability to pay tariffs, making financial sustainability difficult for CE operators. The availability of widespread, affordable, cellular internet access has enabled business model innovation, particularly around Pay-As-You-Go (PAYG) models that accommodate the financial fragility of the customer base. In addition, a major focus for CE projects is encouraging commercial electricity use (e.g., agriculture, small businesses, cold storage, irrigation) to improve financial viability. A lack of financing mechanisms limit PUE expansion however. **Financial Barriers** Malawi's financial institutions do not offer concessional loans for CE projects, making it difficult for communities to raise capital. Low ability to pay from end customers and no subsidy mechanisms mean investors and banks view CE projects as high-risk, leading to low investment appetite.	Although operating in very different financial environments, CE projects in both countries share common challenges - reliance on grants and building viable business models - and revenue streams. Practitioner knowledge exchange initiatives would create a space for sharing these experiences and business model innovations. Supporting research could include analysis of CE financing mechanisms in Scotland (in the UK context) - blending public and private capital - and relevance/adaptability to the Malawian context. In addition, more detailed comparative analysis of business model innovations could inform practitioners and policy makers in both countries - technology unlocking new revenue streams, and initiatives that stimulate demand and promote entrepreneurship. Climate Justice/Resilience and climate/green finance provide a potential source of funding for CE in Malawi – analysis of how this could

	specialising in green or sustainable financing, have also supported CE. **Economic Multipliers** CE projects can stimulate local economies by retaining energy expenditure within communities and creating jobs (Braunholtz-Speight et al., 2020). **Community Benefit Funds (CBFs)** In addition to community led energy projects, communities are increasingly benefitting from developer led energy projects. A CBF is a voluntary fund that a project developer or owner(s) donate into, based on a pre-agreed package of community benefits, to be provided to one or more communities.	**Economic Multipliers** CE projects in Malawi can enable wealth retention (reducing reliance on imported fuels and services) and provide skilled and unskilled employment opportunities in installation, operation, and maintenance, though skills shortages remain a challenge. CE projects (particularly minigrids) often stimulate increased economic activity, particularly in small businesses and the agriculture value chain. For example, local entrepreneurs invest in hair salons, grocery shops, cafes, bars, maize mills, sunflower seed presses – depending on minigrid capacity. Constraints exist from the remote and rural locations of CE projects – e.g. investment in agriculture value chain (refrigeration, processing) requires access to external markets to generate revenues.	fulfil a similar role to FiTs in Scotland could help unlock finance in Malawi. Finally, with increasing focus on developer led renewable energy projects in Malawi, the concept of community benefit becomes more relevant, creating an opportunity for analysis of translatability of CBF models to the Malawian context.
Social	**Community Engagement** CE is driven by grassroots efforts, with a strong focus on environmental issues, social equity and community empowerment. However, for many CE projects, human capital remains a significant challenge. Common issues relate to possessing	**Community Engagement** Many CE projects in Malawi involve community participation in governance, operation, and maintenance. Collectivism is ingrained within community development in Malawi. This derives from the dominant cultural tradition of Umunthu (Malawi's variant of Ubuntu) *where a person takes other peoples' problems and turns them into his or her own so that he or she can help them accordingly* [10].	In both countries, CE projects are grass-roots efforts, focussing on local development priorities. In Malawi this collectivism is a cultural norm and exists across many areas of community development, operating with very limited financial or built capital, and focussing more on social, human, natural, cultural and political capital (O'Leary et al., 2012). Sharing experiences of

	sufficient time, skills and knowledge within the local community [1]. However, the inclusivity of CE initiatives varies, with some projects failing to engage marginalised groups effectively. **Public Perception** Growing awareness of climate change enhances public support for CE. However, misconceptions about its scalability and efficiency remain barriers to wider adoption [1]. **Collaborative Networks & Social Capital** Partnerships with local authorities, businesses and other communities are pivotal for CE diffusion but often depend on strong social capital [3]. CE networking and coordination organisations and initiatives are well established and relatively well resourced in Scotland.	Village committee structures are common for managing local planning and development, including energy projects, but human capital gaps, particularly technical and financial, are a major challenge. There is a colonial history to community energy in Malawi, with several prominent examples of systems developed by pre-independence missionaries. Many current projects are initiated and funded by international NGOs, potentially implementing external notions of the 'right' solutions – doing 'for' not 'with' [11]. **Public Perception** Some scepticism can exist in rural communities due to past project failures, often caused by poor maintenance, lack of community training, and donor-driven initiatives that fade after funding ends. However, the chronic lack of affordable, reliable energy access in the country drives continued engagement by community leaders with energy projects. **Collaborative Networks & Social Capital** Traditional leaders are key influencers in rural areas and help promote community buy-in for CE projects. The highly decentralised local governance structure, with development priorities raised at village level, represented upwards into Area, then District development committees, allows for diffusion and dissemination. However,	engaging communities and identifying and mobilising different types of assets/capital could provide valuable insights to practitioners in both countries. Different approaches to Gender Equity and Social Inclusion (GESI) could be a key theme. Collective examination of how the community energy proposition started and progressed in the two countries – drawing lessons on how community energy may progress in future. This could be developed into formal, bi-directional, capacity building programmes with supporting work that captures and communicates the impact and scalability of CE projects in both contexts.

		social capital plays a major role in the ability of communities to take projects forward. Specific CE support networks are limited in Malawi but exist with well established renewable energy networks that	
Technological	**Innovation in Energy Systems** Generally CE projects have limited technological innovations due to limited resources. Historically (and driven by UK financial incentives) the focus has been on electricity generation projects with grid-connection and power purchase agreements (PPAs). There are examples of CE organisations integrating emerging technologies such as smart grids, battery storage and flexibility as they explore new business models [2]. This has included a growing focus on the demand side – promoting local consumption via electric transport and heating – and the concept of Smart Local Energy Systems (SLES). Limited access to technical, skilled professionals and capital remains a challenge for many CE initiatives [3].	**Innovation in Energy Systems** Malawi's community energy projects mostly rely on basic solar PV and small-scale hydro systems, with several examples of frugal innovation [12,[13],[14], utilising local resources and basic, self-built technology. In many cases, energy systems may be deployed in a small-scale, highly distributed way (e.g. portable solar products, solar home systems, clean cooking solutions) Most CE projects are focussed on remote, rural communities. Energy systems serve specific local needs. There is no grid interconnection for electricity generators, limiting scalability and energy-sharing opportunities. Some CE projects have introduced demand side innovation: solar-powered irrigation, maize mills, refrigeration, and mobile charging stations, but these are still in early stages [12]. Many CE projects depend on external technical expertise, often from NGOs or universities, which	In both countries, there is a need for CE projects to try and understand how available technology and innovations can meet local needs and support business model challenges. The communities rely on external partnerships to access technology and expertise, but this can often be difficult to resource and obtain. International networks and availability of knowledge resources could support this in several areas. E.g. Sharing experiences of partnership models – exploring opportunities for international partnerships. Bi-directional learning on technical innovations arising in different

		raises sustainability concerns. Technical training programs for solar PV, battery maintenance, and mini-grid operations are needed to reduce reliance on foreign expertise [12]. The small size of the sector and dependence on imports means technology costs/availability and supply chain limitations are major barriers for CE in Malawi [15].	contexts (on-grid vs off-grid, rural vs urban, high-cost vs low-cost). Co-exploration of frugal innovation as a model. Technology transfer & knowledge sharing on smart local energy systems and demand side innovations (PUE)
Environmental	**Alignment with Net Zero Goals** CE contributes to decarbonisation, aligning with the UK's 2050 net zero commitments [2],[4]. **Environmental Sustainability** CE projects often incorporate broader sustainability goals, such as biodiversity conservation and climate resilience measures [3]. **Grid Integration Challenges** The intermittency of renewable energy and grid congestion present operational challenges and barriers to entry for CE projects [3]. However, CE projects can also present an alternative model in areas of grid congestion – focussing on local	**Alignment with Net Zero & Climate Goals** CE projects in Malawi are driven primarily by energy access concerns; however, strongly overlap with environmental issues. Over 98% of Malawians rely on biomass (firewood and charcoal) for cooking, leading to severe deforestation and air pollution. Providing more sustainable energy supply has been a motivation for some CE projects. With high solar irradiance levels and good (localised) hydro resource, Malawi has strong potential for renewables based CE projects that reduce reliance on biomass. **Climate Justice and Adaptation** CE projects in Malawi are dealing with the consequences of climate change caused by wealthier nations. Malawi's 78% dependence on large-scale hydropower for national electricity generation makes the grid highly vulnerable to	Sharing experiences and learning about the impact of extreme weather events on communities in different countries. Promoting conversations on the societal impacts of climate change, gaining deeper insights of climate inequality Knowledge sharing and capacity building on deploying climate-resilient energy infrastructure and successful strategies for climate adaptation, mitigation, and community resilience from various contexts

	balancing of supply and demand and reducing grid requirements. **Climate Justice and Adaptation** CE projects in Scotland are often focussed on addressing the root cause of climate change by deploying renewables and supporting the shift to a low-carbon society.	climate change impacts such as droughts and floods [16]. This vulnerability extends to communities and local economies. CE projects may often be focussed on supporting agriculture and water access – adapting to changed weather patterns. CE projects utilising local renewable resources (particularly solar) can provide more resilient, reliable energy supply. But there is a need for formal adaptation strategies to withstand climate impacts. E-waste from RE products is a well-recognised challenge in Malawi [17].	Sharing knowledge on disposal of community energy assets and the water-energy-biodiversity nexus.
Legal	**Energy Market Regulations** Legal barriers, including complex licensing requirements and restrictive market rules, impede CE initiatives, particularly those looking to diversify beyond just generation and incorporate local supply [2]. **Ownership Models** A lack of a legal definition of CE means it is difficult to target policy at genuine CE organisations, such as grants, tax breaks and regulatory benefits [1]. Without a clear definition, there is a risk of "gaming the system", where commercial developers pose as community organisations to access subsidies or other incentives **Liability and Risk**	**Energy Market Regulations** The Malawi Electricity Act (2004) and Renewable Energy Strategy (2017) provides a legal basis for mini-grids and community energy [18],[19] and the Mini-Grid Regulatory Framework (2020) [8] established by the Malawi Energy Regulatory Authority (MERA) provides a framework allowing community-based ownership, public-private partnerships, and hybrid models. However, many projects struggle to comply with licensing and tariff regulations. CE projects face lengthy approval processes for licenses, deterring investment and slowing project rollouts. **Ownership Models & Legal Barriers**	CE projects in both countries face barriers due to ill-fitting regulatory and commercial frameworks, particularly those addressing electricity supply. Knowledge sharing and capacity building on community ownership structures—Scotland's experience with cooperatives and community trusts could inform Malawi's approach.

	Managing legal liabilities, especially in financing and project operation, is a significant concern for CE organisations [1].	Malawi also lacks a clear legal definition for CE organizations, making it difficult for projects to access policy incentives or tax breaks. While community ownership models exist and co-operatives are commonly deployed in agriculture projects, the co-operative model has not been deployed in CE and many projects struggle with governance issues, requiring long-term capacity building to ensure sustainability. Many CE projects rely on land donated by communities or traditional leaders, but the lack of clear legal agreements sometimes leads to disputes. **Liability, Risk & Consumer Protection** Unclear Consumer Rights & Tariff Regulations: While MERA oversees electricity tariffs, pricing structures for community-owned mini-grids are not well-defined, leading to inconsistent pricing and affordability concerns. There is no formal risk mitigation mechanism (e.g., insurance, subsidies) for CE investors, increasing financial uncertainty.	

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