



ISSC 'Transformations to Sustainability' Programme Concept Note

Africa - Low carbon energy transitions that meet the needs of the poor

Introduction and Sustainability Challenge

The African Sustainability Hub is hosted by the African Centre for Technology Studies (ACTS) in Nairobi, Kenya and brings together research and policy organisations working in the field of sustainability and development issues. The hub is a member of the 'Constructing Pathways to Sustainability' network led by the STEPS Centre at the University of Sussex. This network focuses on both understanding and constructing pathways to sustainability across three areas: water and waste in sustainable cities; low carbon energy transitions for the poor; and sustainable agricultural and food systems for healthy livelihoods. It draws on cutting-edge social science from Africa, Latin America, East and South Asia, Europe and North America, connecting researchers and knowledge partners from across each region to learn across regions and disciplines in the broader search for transformations to sustainability.

ACTS and the other members of the Africa Sustainability Hub, especially the African Technology Policy Studies (ATPS) and Stockholm Environment Institute (SEI), are focusing their current attention on **low carbon energy transitions that meet the needs of the poor**. Specifically the hub is interested in undertaking research that interrogates the extent to which dominant business models do, or do not, create 'pathways' towards enhanced access to clean lighting and cooking solutions for the poorest communities in Africa.

Despite the efforts put into promoting renewable energy alternatives, the penetration rate of these technologies remains limited. For example, the penetration rate of bio-digesters in Kenya and Rwanda is below 0.3% of the technical potential available in these countries per year (Tigabu et al, 2015). Projects are often characterised by a failure to attend to the social practices that characterise either local cultural practices around energy consumption (e.g. specific culinary practices like standing up to cook or using specific sized pots) or linked energy services (e.g. heating and lighting homes and repelling insects from cooking fires, not just heating pots as new, energy efficient stoves often focus on).

Although millions of dollars have been pumped into assisting those living at the base/bottom of the pyramid to transit from inefficient energy use to more efficient and cleaner energy use, few results can be shown (Negro et al, 2012; Bhattacharyya and Subhes 2012). We would argue that the main reason why the dominant business models have not been effective is because of the dominance of the wrong underlying assumptions leading to

lock-in and path dependency of these business models. **What has been lacking is more understanding of the social, cultural and political understandings of the technologies and their introduction into homes and businesses in Africa.** If we are to move towards low carbon economies in Africa, there is also a need to change the underlying assumptions to ensure a more socially responsive and inclusive approach. There is also a need to understand the political economy of low carbon development at national and regional levels on the continent as this drives research, investment, and uptake of the technology on the continent (Newell et al., 2014).

Indeed, scholarly work engaging directly with the issue of energy access in Africa to date is dominated by work in the field of Energy Policy (with occasional contributions from Development Studies and Geography). As a recent systematic review of this literature (led by scholars at Sussex) demonstrated (Watson et al., 2012), the literature is characterised by a range of disparate and uncoordinated efforts with little of high enough quality to contribute to more systematic learning. Studies consist of project-by-project, or policy-by-policy “barriers” type analyses, with a predominant emphasis on financial and technical barriers. Cultural and political considerations are significantly under represented and there is a complete lack of any attempt at systemic analysis. In many of these analyses, there is an increasing use of the term “enabling environment” to describe the context that facilitates change. This tends to be a catch-all term for anything beyond financial or technical barriers. There is little in the way of any comprehensive articulation or explicit theorising of what constitutes such “enabling environments”.

In this concept note we propose a research agenda that challenges the dominant assumptions that underpin current approaches to low carbon energy access in Africa. Instead, we propose a set of three alternative assumptions that need to be tested via empirically grounded research. These assumptions focus on the social, political, and cultural factors associated with traditional business models relating to the sourcing, distribution, use and disposal of low carbon technologies intended for the poor. They are:

1. The current dominant business models are market oriented but not private sector ‘owned’

Dominant business models for the introduction of low carbon energy technologies for the poor in Africa are primarily focused on creating viable **markets** for new or existing technologies. Specifically, the models focus on innovative forms of marketing (e.g. door to door community sales) or financing (e.g. pay-as you go or pay to charge) of low carbon energy technologies. However, these are not market driven models per se because the underlying driving force of these models – and their success – is dominated by the financial and technical support of non-governmental organisations (NGOs) and development partners.

2. The low carbon energy technologies in use are technically, economically and environmentally more efficient

Most of the low carbon energy technologies introduced for the poor by these NGOs are sourced from countries outside the African continent. These technologies are then marketed to the local communities, with the argument that they are considerably more efficient than the technologies currently in use within these communities. In many cases such technologies are more efficient – technically and environmentally – than those currently in use.

3. The low carbon energy technologies in use are utilised more because they are valued – both socially and most importantly economically

Due to the low purchasing power of the intended communities, these non-governmental organisations usually arrange for micro financing mechanisms to facilitate communities in acquiring these technologies. In paying for the technologies, the community or households who buy the technologies tend to have more ownership of the technologies compared to communities that get the technology for free.

Testing these assumptions requires a critical empirical analysis of the entire value chain, including the actors, power dynamics, institutional arrangements as well as political economy that constrain or enable the effective utilisation of these technologies. The outcome from the analysis will inform policy and practice supporting dominant and less dominant business models to enhance pro-poor pathways to sustainable low-carbon energy access.

Hub Partners

Over the years the Africa Sustainability Hub partners have carried out a number of projects aimed at promoting low-carbon energy technologies in Africa at both household institution levels. These have highlighted the complexity and inadequacy of the current underlying assumptions and resulting business models. Here we outline key projects and their findings from each of the partners that provide insight into the problems inherent in the dominant business models.

African Centre for Technology Studies (ACTS)

The bioenergy and solar home systems technological innovations that are currently being introduced in Africa are mainly sourced from China, India and other emerging economies in Asia. For instance, under the *Piloting scalable models for clean energy access* project, the cook stoves and lighting models are developed in India for use in Africa. We have found that these technologies are often not suited to the African context as they fail to deal with socio-cultural spatial specificities, which can explain their low adoption rate. This is despite research that suggests such technologies – Asian Driver Technologies – should be more inclusive for the poorest populations in Africa (Chataway et al, 2014).

Moreover, our research on grassroots innovations in Africa with the *East Africa climate innovation network* suggests that there are several low carbon technologies being developed and adapted by the poor at the grassroots level. Since these technologies are developed at the grassroots level, it is arguable that they incorporate local social-cultural aspects that are necessary for their success. However, these innovations do not attract investment for up-scaling mainly because they do not meet the standards and criteria that facilitate support from financial institutions and donors. This mirrors the arguments of the Appropriate Technology movement (c.f. Schumacher, 1973). Despite the initial AT movement being widely critiqued (Kaplinsky, 2011) there is increasing recognition of the importance of user induced and designed innovation (since von Hippel, 1994) and the power of modern grassroots innovations (see <http://www.grassrootsinnovation.org/>) for inclusive innovation in developing economies.

We would argue that our research highlights the need to consider the interface between three academic and policy fields of thought relating to user innovation, grassroots innovation and the influence of Asian Driver Technologies to better understand the pathways of the dominant business models for low carbon technologies in Africa and their impact on the poorest in society. It also speaks very clearly to insights from socio-technical

transitions on the need to understand the co-evolutionary nature of innovation and social practice, as well as insights from geography on socio-spatial contingencies.

African Technology Policy Studies Network (ATPS)

The ATPS's Phase VI and VII strategies strongly promote the development of renewable energy technologies from the grassroots to the national and regional levels. ATPS in collaboration with its partner, the University of Sussex, conducted a research project on Pro-poor Low Carbon Development: Improving low carbon energy access and development benefits in Least Developed Countries (LDCs) from 2012-2014 (Byrne et al, 2014). The two-year project assessed the roles that System Builders play in fostering the uptake of Solar Home System (SHS) technologies in Kenya and provided policy implications and lessons for low carbon innovation centre-based approaches. There are estimated to be in excess of 300,000 SHSs in Kenya sold through a vibrant private market that is considered one of the most dynamic per capita solar markets historically. Key outcomes from the research study show that the rhetoric used to describe the successful growth of these markets has erroneously sustained the notion that they have been private sector led under an enabling environment. However, important SHS innovations have been driven or facilitated by donor involvements throughout the local supply chain, along with detailed understanding of user needs and desires. Interventions to widen, deepen, and enhance low carbon energy access need to be sophisticated and systemic. Such interventions should attend to the entire local supply chain; find, understand and raise demand for low carbon energy innovations; build capabilities that support development towards local innovation systems, including at the policy level; and do so in ways that are reflexive in relation to the local (evolving) context. Closer attention to those in poor and marginalised groups could yield effective low carbon energy innovations that are more likely to be pro-poor. To achieve this closer attention, we would argue that it is better to include the poor and marginalised pro-actively in innovation processes.

The ATPS research study on **Enhancing Adoption and Diffusion of Climate Smart Clean Energy Technologies in Sub-Saharan Africa: Lessons from the Lighting Africa, the Africa Clean Cooking Energy Solutions, and Pro-Poor Low Carbon Development Projects** found that some development programs on energy in Africa such as the Energy Sector Management Assistance Program (ESMAP), the CDKN funded energy projects, as well as the World Bank funded energy projects among others have no doubt made significant contributions to improving the adoption rates of renewable energy/ low carbon energy technologies (especially solar and biomass related technologies) in the countries where they were implemented. While the wider social, economic and environmental benefits of these interventions cannot be gainsaid, the implications of these technologies for systemic improvements in the energy systems and infrastructures, as well as the wider co-benefits and spillover effects on sustainable development in the target countries require further research. Many technical and institutional challenges and costs of integrating these renewable energy technologies into the existing energy systems and markets of the target countries, as well as opportunities for systems, institutional and social innovations that can deliver sustainable and affordable access to renewable energy technologies while fostering socio-technical transitions in African countries and contexts remain unaddressed.

Stockholm Environment Institute (SEI)

SEI's various research on innovation and diffusion of technologies related to clean cooking

has highlighted the importance of understanding the needs, perspectives and decision-making processes of technology users. Current work focuses on understanding how individual behaviour, household dynamics and societal pressures serve to open up or close down opportunities for accessing clean cooking technologies.

Meanwhile, work on decentralised energy planning in Kenya points to high potential for involving local communities in decision-making processes to ensure development of the local energy systems meets local needs, improves energy access and is sustainable in the long-run. Such involvement could help to identify opportunities to overcome common challenges, such as low awareness, lack of confidence and limited access to new technologies that continue to hinder the diffusion of alternative technologies.

Finally, research in Sierra Leone on agro-energy investment seeks to consider the linkages, conflicts and synergies that arise when economic development and renewable resource development processes unfold in tandem. In this research, analysis centres around the relationship between the presence of an agro-industry in the rural settings and the different roles it plays in transforming communities.

Sustainable Alternatives

The insights above serve to cast doubt on the underpinning assumptions which dominate policy and practice. They point to a need to take seriously alternative approaches. These include, for example, pursuing inclusive design practices, encouraging developers to work closely with communities to explicitly influence design. Inclusive design might also include the technical up scaling of local low carbon technologies that are presently in use by the bottom of the pyramid. Capacity building needs to be at the forefront of policy makers' and practitioners' minds, working to build shared visions of what is needed and how it will be achieved, create meaningful networks of key actors and provide protective spaces to experiment with new ways of doing things (Byrne et al. 2014). Sustainable solutions to low carbon energy for the poor in Africa are plausible if communities' needs and interests are incorporated in the design of these technologies.

Pathways and Actors

The low carbon energy system in Africa has a wide range of actors who must be engaged in order to construct sustainable pathways towards influencing change associated with low carbon energy for the poor. We note that, a sustainable pathway entails taking into consideration the interests of all the actors along the value chain. These include the knowledge developers and users (policy makers, private sector, SMES at the grassroots level, NGOs, CBOs, CSOs, development partners including financing institutions, researchers etc).

Concerted efforts are therefore required to map these diverse networks of stakeholders and understand their respective roles (past, current and future) in driving pro-poor pathways to low carbon energy access in Africa. The successful operationalization of the Innovation Histories method by ATPS and STEPS in their examination of the solar home system in Kenya provides one means through which this might be achieved. The project's (and other STEPS projects') use of Participatory Impact Pathways Analysis (PIPA) techniques also provides a means through which networks of current and potential engagement with key actors might be realised.

To transition from the dominant pathways alluded to above – that focus on technology, environment and finance – towards sustainable pathways which better acknowledge social,

cultural and political factors, requires deliberate efforts that include, and are not limited to, needs assessment, experiments with inclusive design practices, capacity building and awareness creation amongst the stakeholders, and so on. These activities which the network will coordinate are aimed at influencing organisational and institutional change critical to influencing transformational change within the low carbon energy system.

Coproduction - Policy and Stakeholder Engagement

Given the continuing ambivalence of the policy regime to small-scale PV-powered electrical services, there remains considerable policy research, knowledge brokerage and policy advocacy work to do to persuade key stakeholders in both the private and public sectors to embrace renewable energy technologies as viable options for diversifying the energy systems in African countries. Alongside these political needs, there is still a tremendous amount of niche-development work to do in relation to SHSs, pico-solar, and the clean cook stove technologies. The history of the PV niche in Kenya for instance suggests that these kinds of work need to be done by coordinating actors, by actors who are positioned to structure practices and to build innovation systems (Byrne et al. 2014). Institutions with longstanding experiences in building capabilities for technological and innovation policy research, policymaking and implementation on the continent such as the African Technology Policy Studies network (ATPS), ACTS, and National Councils/Commission on Science, Technology and Innovation have significant roles to play in fostering favourable policy environments for leapfrogging the transitions to low carbon pathways in Africa. Specialised technology incubators such as the Climate Innovation Centre (CICs), UNFCCC's Climate Technology Centre and Network, and other Incubator systems that have evolved on the continent during the past decade could benefit significantly from the regional and national institutions and agencies in advancing their work.

A good policy environment that enables the African private sector to compete favourably with international counterparts, government agencies and bilateral partners, in the development, provision, and dissemination of renewable energy technologies will promote the development, deployment, uptake and adoption of the technologies. A successful renewable energy market depends on well-defined Government incentives that de-risk investments in the sector.

The 'Constructing Pathways to Sustainability' network will focus on interdisciplinary integration, inclusive design, co-production and joint dissemination as core aspects of its work. We aim to engage knowledge partners and relevant actors (described above) at every stage in the project. The partners in the Africa Sustainability Hub have experience in engaging different stakeholders especially those in the low carbon sector. In addition, they have established working relationships with several Sub-Saharan African based institutions ranging from universities, research organizations, and regional bodies among others.

During the development phase of this proposal, ACTS engaged different actors and stakeholders through a regional workshop held in Nairobi. The workshop had twenty nine participants from Kenya, Tanzania, Uganda and the UK. Following some preliminary presentations, a round table discussion was facilitated to explore ideas and priorities around the issue of low carbon energy transitions for the poor. Preliminary ideas were also discussed on how the participants would engage with wider stakeholders within their respective countries using their existing networks and platforms of engagement.

The workshop demonstrated a high degree of buy-in from regional stakeholders to the idea and value of an Africa Sustainability Hub as part of a wider Transformative Knowledge

Network. High value was perceived in both a networked Africa hub and the links that a global Knowledge Network would provide for south-south and south-north-south knowledge sharing and capacity building. The event and ambitions around an Africa Sustainability Hub were subsequently covered in a piece by SciDev.net (see <http://www.scidev.net/sub-saharan-africa/networks/news/research-network-to-boost-development.html>).

Looking forward, research within the network will engage a range of participatory methods to ensure the co-production of knowledge with knowledge users. This includes more mainstream approaches such as policy dialogue meetings, group discussion, workshops etc. But it will also include the use of more innovative methods within research pursued through the network, such as the adaptation of the Innovation Histories method that ATPS developed in their research with STEPS at Sussex (see http://steps-centre.org/wp-content/uploads/Innovation-Histories-briefing_S.pdf). It will also draw on the suite of methods available via the STEPS Centre's methods portfolio (see <http://steps-centre.org/methods/pathways-methods/>).

Proposed Research Activities and Potential Insights

Future research within the Africa Sustainability Hub will seek to engage in critical research on existing dominant business models and their underlying assumptions in relation to the design, implementation and required 'enabling environment' for facilitating poor people's access to low carbon energy technologies. It will unpack these 'black boxes' through grounded empirical analysis.

Building on the workshop and collaborative work that led to the development of the current concept note, a range of different research questions have been articulated to aid the development of a programme of research. Interaction with other regional hubs in the broader potential Transformative Knowledge Network, particularly interactions with research interests arising in China, has also led to prioritisation of a number of foci for initial empirical research within the context of the broader network. We articulate these research questions and proposed areas for initial research below.

Research questions to frame a programme of research under the Africa Sustainability Hub:

1. What are the cultural, social and political pathways that dominate innovation histories of low carbon energy technologies popular in Africa?
2. What impact do these have on the relative success of business models – both dominant and less dominant – used to market and finance low carbon energy technologies?
3. How can existing structures, such as the Energy Centres in Kenya and other innovation enabling structures, better incorporate understandings of the socio, cultural and political pathways to more effectively meet the needs of those at the bottom of the pyramid?
4. How can the enabling environment at a policy level incorporate these alternative understandings of sustainable pathways and the methodologies to examine these pathways to provide more effective policy?

Proposed area for initial empirical research

Bearing in mind interesting interactions between the manufacture of solar home systems in China and the burgeoning market for Chinese imported solar home systems in Africa, we propose focussing on solar home systems in the first instance as an empirical focus for enquiry. Furthermore, the potentially transformative nature of mobile enabled payments for

solar home systems which better fit with existing cultural practices of payment for energy services amongst poor people in Africa, adds an additional aspect of interest. It presents an emerging business model that both has potential to better attend to socio-cultural aspects of energy access and has seen relatively little empirical analysis to date.

Initial empirical research will therefore focus on mobile payments for solar home systems. This will be pursued via the following activities:

1. Inception meeting between network partners – this will take place in Buenos Aires in November 2015. It will enable partners to share insights generated through the co-design (seed-funding) phase of the network, and explore themes to adopt as a focus going forward. In addition, one afternoon will be set aside for a participatory impact pathways analysis (PIPA) workshop, to be facilitated by Adrian Ely (see Proposed Communications Activities).
2. Transformation hub – the establishment of a hub, building on the co-design workshop and the networks with whom ACTS have been working previously (see history above). The hub will consist of networks of actors that interact in various ways (both physically and online) throughout the duration of the project and exchange information produced by each group (researchers, policymakers, practitioners). It will be supported by 2-3 workshops held in Nairobi and convened by ACTS, that bring together local actors in the 'solar home systems' innovation system to map out alternative pathways to low carbon energy that serve the needs of the poor.
3. Research studies - these will analyse solar home systems in Kenya, in particular the 'bridging innovation' of M-PESA-based mobile payment mechanisms, which has arisen from Kenya's dynamic sector and links to the innovation in hardware that is taking place in China.
4. Trainings of actors (at different levels), depending on budget - this may be associated with the workshops, or alternatively link to Africalics/ Globelics capacity-building already undertaken by ACTS and the STEPS Centre Summer Schools at Sussex.

Proposed Communications Activities

During the regional workshop members of the consortium agreed to have an effective communication strategy once the project commences. The overall objective of the communication strategy will be to meet the project's overall goal of influencing alternative pathways towards low carbon energy for the poor. The communication strategy will also be an effective tool in disseminating the projects research outputs to target audiences. This strategy will identify mechanisms, processes and materials to reach identified target audiences. The strategy will also build the capacity of both the consortium partners as well as various actors within the low carbon energy sector.

During the implementation phase of the project, the consortium partners will form a communication working group, the group will be responsible for the development of and implementation of the strategy. This will include the following activities:

1. A review and agreement of activities relating to communications with project stakeholders who are direct beneficiaries being involved in project activities
2. A review and agreement of activities relating to communications with project stakeholders who are indirect beneficiaries of the project activities
3. A review and agreement of activities relating to other stakeholders especially the media.

This working group will be responsible for engaging the media and they will also work closely with the STEPS centre communication team. Note that significant media engagement has already been achieved as demonstrated by the piece in SciDev.net covering the initial meeting (see <http://www.scidev.net/sub-saharan-africa/networks/news/research-network-to-boost-development.html>).

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