MECS Technology Research Innovation for International Development (TRIID) Project Reviews – Delivery Models, Gender and Accessibility

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Modern Energy Cooking Services (MECS) Programme

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Executive Summary

This report sets out to review the learning from the first MECS Challenge Fund programme which looked at the wider picture of modern energy cooking services (mecs) across sub-Saharan Africa and Asia. It constitutes one of four reports which review the learnings from the TRIID themes.

These nine projects undertook a 6-month study into either Delivery models, Gender &/or Accessibility. They span five countries (Kenya, Tanzania, Malawi, Myanmar, and Nepal) and look at communities across both rural and urban geographies and all income bands, with a focus on middle- and low-income families.

This report draws on the main points of the research, considering the key findings and barriers to the uptake of clean cooking. This is predominantly from an awareness, supply aspect and includes one report focussed on the impact of gender on the uptake of clean cooking. Indeed, gender is mentioned almost anecdotally in all reports but is insufficient to draw any major conclusions at this stage.

This body of work highlights the impacts of supply chain, appliance availability and awareness along with the support mechanisms on sustainable uptake of clean cooking options. We consider the implications of finance and finance models in ensuring affordability and awareness to different income-levels along with the impact of culture, in particular fuel stacking, in understanding fuel choice. There is a review of the importance of insulation in reducing energy use (and thereby increasing affordability) and highlights on the barriers to uptake.

Clean cooking is high on many Governments agenda, it is a focus of the UN's Sustainable Development Goal 7 (SDG7) and is seen as an aspirational commodity by many consumers. The barriers to uptake are many but none are insurmountable.

This research indicates that a systematic approach with an eye on the whole system is the way forward. The key to mitigating barriers is not so much in the technology but in the business models – in supply chains, awareness raising, and finance models.

Challenge Fund Overview

MECS-TRIID Challenge Fund was run to support innovative cooking projects with a four-fold approach:

- Reduce barriers to innovation and advance technology in modern energy cooking.
- Enable a more sustainable, economical, and easily accessible cooking system in countries supported by FCDO.
- Develop smart ideas that have the potential to advance further.
- Fund early-stage innovations to take to the next stage of development.

The call focused on four themes that would address some of these issues:

Energy storage for cooking - To stimulate ideas generation and test initial concepts around how energy storage could be used in transitions towards the use of modern energy cooking services in one or more countries supported by FCDO.

Grid and infrastructure adaptability - Ideas for new solutions and approaches which help to improve the transition to MECS by improving grid (both national and localised grids) infrastructure was sought. This also include work to assess challenges of getting the grid to reach all households and enabling consumers to connect to the grid.

Alternative fuels - providing fund to research into developing new solutions and approaches that improve the implementation and adoption of modern energy cooking services based on fuels other than electricity and provide tangible benefits.

Delivery models, Gender, Accessibility (vulnerable groups such as people with disabilities) and inclusion in MECS – (the topic of this review) research into developing new services, solutions, and approaches which can demonstrate how modern energy cooking services can be made equitable for men and women, people of different social groups and people with different physical, sensory or cognitive impairments or mental health issues and which will provide tangible benefits and impact.

Applications were varied across the themes but generated a large number for delivery models and alternative fuels.

Delivery Models, Gender and Accessibility

The CF supported nine applications under this theme and provided work on a wide range of topics. Most of the projects covered sub-Saharan Africa with projects undertaken in Kenya, Tanzania, and Malawi but projects were also supported in Myanmar and Nepal. Most of the research was undertaken in rural communities where access to grid connection was low.

Comparing the research has been challenging as the projects took very different approaches to their research areas. Some chose to review the cooking market generally, including the potential for eCook, looking at employment factors (e.g. Power For All), delivery models (e.g. Tatedo) and drivers and barriers to uptake (e.g. GenDev and SCODE) whilst others looked at the impact of demonstrations both in person and online (e.g. Kisambara). Whilst the approaches were different, there were several topics that were raised by more than one

study and that will be reviewed in this paper. To understand the focus of these projects an outline of the project title and focus of the research are listed in table 1.

Company	Project Title	Project Area/Country	Main Focus
Bidhaa Sasa	Women-to-women distribution model to increase adoption of clean cooking methods by low income women in rural Kenya	Kenya	Rural women in Kenya are overwhelmingly in charge of most household chores and this includes cooking. They currently use wood and charcoal even though new and old technologies for cleaner cooking already exist in Kenya. These rarely reach the rural women who face many barriers to access these technologies. Bidhaa Sasa has been operating in Kenya since 2015 distributing and financing a range of household goods targeting rural women using a women-to-women distribution model. They are seeing an increasing demand for gas by rural women as word of mouth spreads and biomass fuels become expensive. However, there are many obstacles to accelerate the demand of LPG and modern cooking methods. This project would help accelerate the adoption of the use of gas and test the demand for induction hobs and other electric appliances that may be in stock in country.
GenDev	Drivers and barriers to sustained adoption of LPG as clean cooking energy: applying lessons from India's LPG programme to Nepal and Myanmar.	Nepal & Myanmar	India's very large programme of distributing subsidized LPG to poor women is reported to have increased access to 90 per cent of households in India. However, this access has not translated into sustained use or demand for LPG as the primary cooking fuel and studies show that poor are continuing to use solid biomass as the primary cooking fuel where it is available (ENERGIA, 2019 and CEEW, 2018). GenDev will identify the barriers and drivers in sustained use enabling the formulation of an innovation strategy to meet the challenge of turning access into sustained use. Their preliminary innovation concept is to incentivize last mile connectivity in remote areas, overcome delays in supplying refilled LPG cylinders and empower women to sustainably use LPG as their primary cooking fuel.
Kachione	Customizing Malawi-made solar electric cooking technology and business models to provide access to very low-income villagers	Malawi	Most families in rural Malawi receive less than $100/month of cash income so can afford only $5 to $10 per month for electricity. In addition, every year (shortly before harvest), most rural families experience a "hunger season" where they must choose between buying food or paying for household essentials like fertilizer or health care for their children. "Pay as you go" (PayGo) solar electricity for cooking simply is not practical or workable for them. Our alternative is what we call "pay as you grow" (PayGrow). Poor farmers do make money and make investments. But they make

			investments near harvest time and pay back by the next harvest season. In this project, we develop, distribute, and scientifically evaluate the PayGrow method for solar cooking access in Malawi. The key to our system is a Malawi-made solar home system with a low-cost cooker that provides electricity regulation and management. This allows for a system design where the customer can purchase increased solar electric cooking capacity piece by piece when as cash is available at harvest time.
Kisambara/Jikoni Magic	Smart Cooking Solutions	Kenya	Energy is important for every Kenyan household for the purposes of cooking, lighting, heating, and cooling, among others. Many households in urban and semi-urban areas in Kenya rely on unclean and wasteful methods of cooking such as charcoal stoves, kerosene stoves and firewood yet they are connected to the main grid. This is because these methods are perceived to be easily accessible and cheap whilst the use of electricity in cooking is perceived to be expensive. The objective of this project is to encourage use of electric pressure cookers that are cheap to run and cook quickly and the use of energy meters to keep track of the cost of making a meal. This will facilitate household planning that will lead to smarter cooking practices and more effective decision making on the best source of energy for cooking.
Power for All	Powering Jobs: The Employment Footprint of Clean Cooking Solutions in Kenya	Kenya	Power for All, together with Strathmore Energy Research Centre, will undertake the first jobs census for the MECS sector, together with a targeted campaign to communicate results to key stakeholders. A robust evidence base is vital to demonstrate to policymakers and donors the employment opportunity from delivering MECS. By showing the economic benefits from a shift to MECS, through employment opportunities throughout the value chain, the project team will seek to ensure greater investment by governments and donors in the hard and soft skills needed to fill the jobs (direct, indirect, productive and induced) being created in MECS. This will in turn lead to development of a skilled workforce, a thriving MECS sector and health benefits for households using modern cooking methods.
PowerGen RE	Accelerating uptake of electric cooking on AC microgrids through business and delivery model innovations	Tanzania	This project aims to test business and delivery model innovations to accelerate adoption of electric cooking in the context of a rural AC mini grid, where efficient Electric Pressure Cookers (EPCs) will be delivered with pay-as-you-go financing alongside reduced tariffs to improve competitiveness with relatively cheap and ubiquitous biomass.

			Key performance indicators include the uptake of EPCs during the study period, projected biomass displaced, customer satisfaction with EPCs, ability to repay appliance loans, and effects on the load profile of the minigrid.
SCODE	Developing and testing innovative user-friendly LPG financing models to accelerate uptake among rural poor through mobile pay.	Kenya	The aim of this R&D project is to develop financial model to accelerate uptake of LPG as complementary fuel to the electric cooking (e-cooking), being developed by SCODE in the proposed project area in Nakuru county, Kenya. SCODE is engaged in an aggressive drive to transition rural communities from solid biomass fuels for cooking and heating to cleaner fuels and through this proposed project, SCODE will develop suitable financial model via a mobile App for accelerating uptake of LPG as complementary fuel to complement e-cooking for households already purchasing biomass fuels and kerosene for cooking and heating.
SOWTech	Delivering eCook at ground level	Malawi	Ecook technology is currently only accessible, in African communities, to middle income families and above. SOWTech is looking to design and develop this technology for those communities whose current cooking arrangements are 3 stone fires and similar. By working with local communities, the aim of the project is to produce a PV-eCook stove that will be acceptable to and meet the requirements of the local community. The stoves will be able to be built in the communities where they will be used and will therefore provide local employ as well as a cleaner, more sustainable way of cooking.
Tatedo	Approach to designing delivery models of modern energy cooking services in Tanzania	Tanzania	The research project will assess the entire modern cooking energy and technologies value chain to understand barriers, enablers, and drivers to improve the delivery of modern energy cooking services in Tanzania. The project will be implemented in urban, peri-urban, and rural areas of the three regions of Dar es Salaam region, three clusters of people will be selected to include low, medium, and high-income segments. The proposed research project aims to assess and understand the entire modern cooking energy and related technologies value chain to propose effective delivery models of modern energy cooking services in Tanzania.

Table 1. The TRIID projects focussing on Business Models and Delivery

Supply Chain & Reliability

Supply chain and reliability is highlighted as a major factor in the uptake of clean cooking, noted by 7 of the 9 projects as a major limiting factor. In fact, across the 22 projects supported by TRIID, supply chain is highlighted as one of the main barriers to uptake of mecs (CalPoly, SOWTech, iDE, Tatedo, Scode, PayGo, GenDev etc). Bidhaa Sasa who provide a number of products to women's groups via female sellers felt this was more of an issue than behaviour change with the '*…main bottleneck being the lack of robust supply chain, from the Chinese manufacturer to the end users'.*

It should be noted that these innovation projects were inevitably going to operate in a supply limited environment. They were pioneering new approaches, with devices that were not necessarily familiar to the participants and there were no established supply chains and therefore a lack of maintenance, repair, or technical support. Obviously for electric pressure cookers, these are imported items and the majority come from China.

The Made in China mark was an issue with most purchasers who saw this as an indication of a lack of reliability and therefore a waste of money. For Bidhaa, this lack of quality assurance and after-sales support has a detrimental impact on building purchaser confidence. The availability of spare or replacement parts, which were not obtainable from the supplier, wee also highlighted as a drawback. For Bidhaa, this failure represented a lack of service from the supplier and impacted on the good customer relationships that they had built over time.

Both Bidhaa and Kisambara spent considerable effort sourcing supplies of EPC's but the inability to 'build a long-term relationship' (for Bidhaa) was an issue resulting in the limitation of sales. Kisambara found this was less of an issue as they had the support of Kenyan Power to promote uptake and so were assured of greater sales. Since the challenge fund concluded Kenya Power has taken planned actions to support the scaling of EPCs through a Results Based Financing programme, to stimulate a stronger supply chain and O&M system of support. Clearly, they see a future for EPC's and a way of utilising any excess power from the grid.

As well as Kisambara, Tatedo, and Powergen have built on the TRIID project to work towards creating a longer-term supply chain at scale. For Powergen, *'the ability to offer EPCs to a wider variety of microgrid customers' would enable them to 'confirm product-market fit'*. Tatedo offer a comprehensive list of interventions to promote EPC use. For the supply chain these include:

- '*Encouraging supplier to import quality and efficient electric cooking appliances*
- *Incentivise local manufacture, once the market has developed, and*
- *Support the establishment of service networks'.*

While most projects and therefore comments focus on the EPC supply chain, the supply chain for LPG was also noted by SCODE and further supported by the work of Gen Dev. Both felt that capacity building, for both manufacturers and suppliers, would have a positive impact on uptake of modern energy cooking services (mecs) and ensuring replacement canisters were within short walking distances from households was a key factor for sustaining LPG use. SCODE suggest that a workable system relies on a close hub for pick up and drop off, with the optimal distance of 4.5km recommended.

As an alternative to the long-distance supply chain of imported equipment, Kachione chose to make local produced stoves. While this mitigates some issues of the supply chain it created additional challenges in terms of reliability and also safety. For instance, Kachione notes that the failure rate for their cookers was high '….at 10-20%. The two main reasons being corrosion from seeping water between pots and burning diodes in the heating element'. They felt both issues could be easily rectified thereby ensuring confidence of equipment and longevity of the system.

Lesson: - The projects confirm that a supply chain complemented by visible support mechanisms for operation, maintenance and repair must be in place for consumers to have confidence in the devices.

Insulation

The impact of insulation in reducing heat loss from the systems and the impact on costs was highlighted by the majority of projects. One of the key differences between electricity and other fuels is that it does not need air flow (even LPG needs air flow to work). This lack of a need for air flow opens the possibility of insulating the cooking pot. It is temperature that cooks food, and so if the food is raised to cooking temperature any energy over and above that depends on the losses of the system.

So, for instance, Kachione noted that their Highly Insulated Solar Electric Cooker (HISEC) system should have an extra 10cm of insulation added to them. They note that *'on average, 50% of input energy was lost to the environment*'. Higher levels of insulation could reduce this thereby offering a more efficient system that they suggest '*1/3 of rural customers appear to be disposed to*' using.

SOWTech found that 'insulation was the key to maintaining enough heat' in their hotplates (a subject that is raised by UIU in their Grid Integration project). As their project focus was on a locally produced system, they looked at a range of materials that could be used for insulation. These included rice husks and maize wastes which they suggested should be placed between the phase change material (PCM) and the hotplate. The impact on heat losses were significant and could help encourage greater uptake.

Commercial EPCs have insulation built in and use less energy for both open air cooking (in contrast to a poorly fitting electrical hotplate) and for their pressure phase. The insulation is an air gap, and the weakness of many systems is that they would benefit from insulation in the lid. The commentary on insulation generally supports the work undertaken by MECS and the decision to promote EPC's as a preferred mode of cooking.

Lesson: - The projects confirm that the use of electricity to cook opens many possibilities for a strategic use of insulation to reduce the energy required and to make the overall cooking system more energy efficient. This work is supported by research in other themes, such as CalPoly, UIU, Smart Villages and Kachione.

Finance and Finance Models

Finance and finance models were important for the uptake of all of the projects and for the uptake of cleaner cooking. This was reported using several different approaches, from income, upfront expenditure, sustainable use, and general affordability. Power for All used a different approach with their project that looked at the impact of different fuels and the job market. They highlighted the potential 'financial compensation' for staff within the growing eCook sector. Staff pay was found to be highest in the LPG and eCooking sector, where they also report that women make up a larger proportion of the workforce. The development of cleaner cooking can have a significant impact on the agency of women – a fact highlighted clearly by GenDev.

Finance, in terms of seasonality of incomes (e.g. those associated with a harvest) and fuel purchase, upfront expenditure and overall affordability are an issue for many projects. Whilst the levels of desire and 'aspiration' were clear factors (GenDev and Kisambara), encouraging the uptake of clean cooking and having a suitable finance system that takes into account the seasonality of income is important (particularly associated with rural farming roles (Kachione and SCODE). There is a need to mitigate the upfront expenditure on equipment and appliances (Kisambara and Bidhaa) and the overall affordability was suggested as key elements to uptake and sustainability (PowerGen RE and Kachione).

These issues are not unknown in the sector and support our current understanding.

Capex (Capital Expenditure) The upfront expenditure on equipment that uses modern energy is a common challenge. This has been true for grid extension (connection fees for households), Solar Home Systems for lighting (pay as you go models) and LPG use (payment for the cylinder).

(Comparative) Affordability. The affordability of the system depends a lot on the mechanism for mitigating the upfront capital – if interest rates on loans are set too high, or the capital repayment is set over too low a period this affects affordability. This is also strongly influenced by the alternatives – cheap or free wood is a barrier to the uptake of modern energy (which involves monetary payments)

Income of household and seasonality. Assuming the overall system is 'affordable', the projects drew attention to the challenges of seasonality and income fluctuation. Particularly in rural communities the income, and therefore the availability of cash to pay for modern energy, may fluctuate with the growing season.

Several mitigation strategies were suggested: -

1. 'A 4-year subsidy would ensure LPG is sustainable' (GenDev) and allow this aspirational commodity to become a reality for more people.
2. Modular systems that enable the development of supply over time (Kachione)
3. Earn & Grow scheme to attain economies of scale (Kachione)
4. Loan and mobile pay programmes to spread the cost (SCODE, PowerGen RE & Bidhaa)
5. Local credit mechanisms (Tatedo)

Clearly, no one option fits all and each suggestion addresses one or more of the three key issues. The need for flexibility for payment needs to be linked to the income stream (rural or urban) and the regularity. Many projects discussed the impact of economies of scale and, wherever possible, local production for stoves and appliances were a key factor in affordability.

The work SCODE did on LPG highlighted the benefit of a 12-month loan which allowed fuel refills over a 6-month period (they suggest 5 refills) as well as the Capex mitigation.

Bidhaa were very clear that goods that cost USD50 or more were inaccessible as cash purchases to women, so affordability plans are key to enabling access and uptake. The importance of a relevant finance facility to the community and users are key to encouraging the uptake of clean cooking; '*a finance facility …. are key'* (Bidhaa). For Kisambara the best model was the option of a loan and payback finance programme. They were also able to negotiate a reduced cost with suppliers for the EPCs 'which were passed onto the buyer'.

Sharing liability in a group is the model Bidhaa use but they note '*there are few companies, other than Solar Home Systems (SHS) that are willing to do this'*.

Lesson:- The projects confirm that modern energy cooking systems need to be made accessible to consumers, by mitigating the need to find the capital to install the system (mitigate by loans or running it as a service), reduction of monthly expenditure (by cross subsidy or low loan interest) and flexibility (ensuring flexible payments that take account of households cash flow).

Health & Time Saving

Whilst all the projects understood the health implications of clean cooking, this was not a factor that was directly assessed during their work. Evidence from purchasers show that there is a real benefit to clean cooking noting the positive impact of '*..time and money savings and convenience' of EPC use* (Bidhaa), and *'..customers love that the EPCs save them time while adding minimal amounts to their electricity*' (PowerGen RE).

PowerGen customers note the impact of more time:

'The best thing about this [EPC] is having more time……It is especially helpful during the harvest season when we have so much to do. Now I can come home, and the food is ready' (p.14, PowerGen RE report)

The reduced costs of using the EPC to pre-cook beans and the health impacts of EPC use:

The [EPC] is so easy to use, I even let my children cook in it. Now that they can cook, I have more time and know they are safe. Coal and fire can be dangerous, but the [EPC] is easy and safe' (p15, PowerGen RE report)

Anecdotal evidence from GenDev suggest that the whole house 'appreciates a non-smoke-filled kitchen and that women enjoy the extra time it gives them'. Even though this benefit was also enjoyed by men it did not appear to be a factor in deciding where fuel money was spent.

Lesson: - The projects give qualitative evidence (consumers opinions) that modern energy cooking systems save women time, and for that they are greatly appreciated. This work is supported by evidence from Pesitho and iDE, amongst others.

Culture and Gender Review

Culture and gender were referred to in many projects, often only anecdotally. GenDev was the only study that specifically looked at the impact of gender on cooking and expenditure in the home. This was done within the context of policy support in India and the lesson learned for roll-out to different countries. (1)

From a cultural perspective, men were largely noted to be the key decision maker on expenditure (GenDev and PowerGen). However, this was contradicted by SCODE who felt the decision was made by both men and women and supported by work done in Cambodia with iDE. The use of domestic help in many homes to specifically undertake cooking duties was highlighted as being a negative factor when it comes to decisions about what system to use or buy. As the user and purchaser were different people, they placed different focuses on the purchase. Very often the purchaser did not consider the needs of the user and often the emphasis was placed on ease of use as the most important factor. The impact of cooking for more than one household would further restrict choice as whatever system was used had to be large enough to allow this practice to continue (Tatedo).

Many projects reported on the impact of fuel collection and cooking for women, particularly from a time perspective. Power for All state that women '*…spend 58 hours a week collecting fuel and cooking*' but did not reflect on the amount of money that is saved or spend by collecting fuel. They did, however, focus on the fact that 100% of the users of eCook are women and that women account for a higher participation in employment in both the LPG and eCooking sector. Both sectors come with the 'highest compensation' in salary. They suggest the development of a clean cooking sector offers 'a unique opportunity to close the skills and gender gap for women'. Equally, this may also impact on the available money for appliances and empower women to make the decisions to cook with electricity.

GenDev noted the importance of 'keeping up with Jones' to explain the continued uptake trend for LPG. A fact that is supported by iDE's work in Cambodia and the need to maintain status with cleaner appliances and home. The agency of women is noted as a key driver in the uptake of clean cooking (GenDev).

The impact of gender dynamics was noted by Kisambara with 'men enjoying the technological aspect of EPC's and the ability to save money whilst women like the faster cooking and recipes. This faster cooking time reduces the need for larger pots and batch cooking but highlights the fact that some men consider that 'the EPC will make women lazy as it is too easy to cook (with)'. Clearly there is a disconnect between how each gender

perceives the benefits of EPCs. Highlighting the health and time savings from the other projects (e.g. PowerGen) should be a key learning point from the gender work.

An understanding of how home life determines cooking was hinted at by several projects. Kachione noted that rural Malawians were using their power predominantly to heat water for bathing but Tatedo reflected that cooking may also provide space heating as well as for drying crops or for lighting (SCODE) in rural homes. SCODE also mentioned that '*the majority of households cooked outside the home'* but did not indicate why this was the case. A greater understanding of these cultural aspects of cooking would benefit the clean cooking sector.

Few studies, if any, noted the cultural importance of cooking, however SOWTech did stating that '*stirring is a cultural requirement and a two-ring hob is preferable*'.

Lesson: - The projects are clear that modern energy cooking systems are mainly used by women, and yet the decision to use them rests with both men and women. Overall, the projects advocate a greater agency for women either by solidarity in loan systems, women to women selling and training, and a release of time to do other things.

Fuel Stacking

We know that fuel stacking is a common occurrence but the impact of this was not a focus for any of our projects. Under this theme only three projects noted fuel stacking is still the way most people cook but adds to the increasing body of evidence across other themes (in particular work highlighted by PEEDA, PayGo, Climate and development Centre, Pesitho etc):

'*All customers were found to stack, usually with biomass…*'(PowerGen) and Kisambara notes that the focus was on reducing household costs and '*…adding the EPC to the fuel stack'*.

Kachione wanted to understand how users stack different types of electricity/energy relative to each other. They consider this is '*a key tool in incrementally improving solar electric cooking access'*. They see the perceived benefits of solar electric will have a bearing on how well solar electric is incorporated into the household. Understanding the behaviours, and time constraints, of households will help to change behaviours.

A better understanding of the local issues and policies will also inform our understanding of stacking which in turn will enable us to put policies and support in place to encourage greater uptake of clean cooking approaches. As Policy interventions and costs associated with fuel use increase, and the availability of free fuel diminishes, fuel stacking will shift and should focus users on the benefits of energy efficient (and therefore, cost effective) cooking options.

Power for All focus' on the impact of fuel switching to employment and is discussed in more detail below.

Lesson: - The projects suggest that fuel and appliance stacking will be the norm. This has both negative implications for health but also positive implications in that modern energy systems do not need to enter the market fulfilling every need, but can rather be gradually introduced and consumers can learn what the mecs is good for.

Policy

Tatedo's work looked closely at the implications of policy in Tanzania to the uptake of EPCs. They highlight the need for a range of measures to increase both awareness and encourage business models. These include '*adding mecs to the education system*' and '*government willingness to use subsidies or reform taxes on EPC's to stimulate*

uptake'. These would address the issues associated with understanding and inform users as to the benefits of EPCs.

Kachione focussed on the development of a 'Climate Mitigation Earnings Account' to offset the full cost of additional items for their own customers. The establishment of a wider scheme to offset costs would have a real impact on the uptake of energy efficient appliances. Equally, the withdrawal of tax on renewable energy products (as has been done in Malawi) would also benefit the off-grid clean cooking sector (SOWTech).

Power for All focussed on the impact of employment due to a shift to cleaner cooking practices. Whilst they note '*uptake of cleaner cooking will result in a decrease in jobs*' they also note that '*the level of compensation [to those employees] is set to improve*'. With an estimated 7 million African employees currently in the sub-Saharan Africa charcoal industry any shift in energy use could have major ramifications on employment. Power for All acknowledge there is currently a '*major limitation to understanding net employment*' with this shift in energy use. Clearly any Government policy or intervention need to take this employment change into account.

Finally, GenDev reviews the impact of the MGNERGA [1] programme in India to promote the uptake of LPG and suggests the lessons learned here could be transferred to Myanmar and Nepal.

Lesson: - The projects suggest that there are some strong possibilities for changing policies that would support the roll out of mecs, but the job displacement caused by an energy shift need to be better understood.

Promoting Uptake & the Importance of Technology

The importance of promoting uptake and raising awareness was a factor highlighted in many of the research projects. They ranged from incentivizing the last mile efficiency both of electricity and LPG (GenDev), to promoting sustainable use, education of the true cost of efficient EPCs, improving women's agency (GenDev), government subsidies (Tatedo), and a focus on fuel savings. The projects highlighted the needs in urban areas; a systematic review of literature to date has shown urbanisation as an associated issue in the clean cooking sector has been neglected, and that there are few studies about urban responses to clean cooking.

Technology and the use of social media were a key focus on promoting uptake. For Bidhaa's sales leaders they were surprised at interest that was generated in their products via WhatsApp and Facebook. The increased uptake of mobile phones means this 'business will adopt social media as a complimentary medium (*for marketing* -'Bidhaa). This is a business model that is supported by Kisambara who show 10,000 FB followers, 5000 Instagram followers and 51,000 YouTube subscribers. Whilst not all of these are following the EPC recipes, many will now be aware of the possibilities and the ease of cooking with electricity.

In addition to being a channel for social media, the mobile phone is seen as key to the greater uptake of clean cooking. The development of mobile money and online payment programmes allow clean cooking to be more accessible to more people. This is supported by the research by Kachione and SCODE who felt that the '*pay and grow model should enable the earning of rewards for cooker utilization*' (Kachione) and that a '*PayGo finance model was considered the most appropriate payment tool*' with the design of an' easy to use mobile application platform significantly contributing to the ease of ordering, payment and delivery of LPG kits and refills' (SCODE). The use of mobile apps to assess usage of gas were considered key to the uptake of LPG. SCODE and PayGo highlight a system like this would enable the end user, project team and hub manager to track the use and alert when gas levels are low.

In addition to technology, the importance of the personal approach was highlighted by both Bidhaa and Kisambara when it came to demonstrating the ease and versatility of cooking with EPCs. While social media can

stimulate a general interest, there is a need for a cooking demonstration to 'seal the deal'. This personal approach is also highlighted by iDE who note people are more willing to buy in person than online.

Lesson: The use of mobile technology as a tool for dissemination, to enable greater monitoring and therefore payment systems will play a key role in encouraging the greater uptake of mecs.

Barriers

As discussed above the lack of a supply chain is a potential barrier: a lack of local suppliers leads to a reduction in exposure and therefore a lack of knowledge and interest. Where there is exposure to technology, interest is generated – '*there was considerable interest by a small number of clients who …got exposed to it* (EPC)' (Bidhaa Sasa).

The lack of product choice, reliability & (for EPCS) button systems that do not fit cultural food (like the Von from Hotpoint) as noted by Kisambara, the lack of after sales support and a second pot (Kisambara & Bidhaa) all impacted on uptake. Providing the right added value services with a solid supply chain would ensure demand is maintained and '*should include credit, education and post sales service'* (Tatedo).

Bidhaa reiterate the belief that supply bottlenecks are more of an issue than either '*demand or potential behaviour change*'. This idea is developed by Kisambara who note that the lack of a local supplier for a local market means that systems are not tailor-made *'[EPC] pre-set buttons do not fit cultural food and the instructions are not provided in local language, but largely in English which must be translated*' (Kisambara).

Affordability was presented as a barrier for some (Kachione, SOWTech) with the sustainability of offering a low-margin service to disbursed rural populations being key to a business option (Kachione), however they do not present detailed data to support their supposition. The other projects suggest that affordability is not a significant barrier, but rather the upfront equipment cost is a stronger concern.

Awareness raising and education to dispel the perception that electricity is expensive was stated as a real barrier (SCODE and iDE) to eCook and is one of the key points discussed during demonstrations of EPCs. Bidhaa, Kisambara, & PowerGen all noted the positive feedback following demonstrations regarding energy use when using an energy monitor. This highlights a need for awareness raising, something that can also be delivered via local cooks and cookbooks.

Finance models are seen by many as a key element in uptake. Whilst this is echoed by Tatedo, Kachione, Bidhaa, Kisambara and others, the importance of a delivery method that is adapted to the local market is the key for wider uptake.

We see the same issues for LPG which centre around affordability and accessibility but with greater focus on distribution and the size of the canisters. GenDev's approach to women's agency and LPG notes the impact of patriarchy and men's control over finances as a factor in the uptake of LPG (GenDev).

Finally, the employment impact of clean cooking, whilst widely reported, anecdotally, in the literature should be subject to a more systematic review to enable a more informed approach to policy and the support mechanism required for this new sector (Power For All).

Lesson: - The projects suggest that there are many barriers. None are insurmountable, but they do need to be tackled in a systematic way with an eye on the whole system. The key to mitigating barriers is not so much in the technology but in the business models – supply chains, awareness, finance models.

Conclusions

This theme of the TRIID projects has given much food for thought. With such a diverse range of approaches to this theme, it is encouraging to note that many of the same opportunities and barriers to enable the increased uptake of mecs are highlighted across them.

Whilst we accept that regional influences will be a factor in uptake, the outcome and learning here show that a large body of work will be able to be replicated across geographical areas with minor amendments to allow for local customs and modes of operation.

The impact of technology to enable understanding and generate desirability for products is not to be underestimated. As more people have access to mobile phones, and as more developers of systems include the addition of a phone charger into their products, this should enable greater uptake of cleaner systems and methods of cooking. It offers flexibility in payments and access to platforms for recipes as well as information on use. This information will go some way to dispelling myths by explaining – SCODE notes '. *perceptions of use, cost cutting ability and safety increased by 50% after use*'. This cultural shift will highlight both the financial and health benefits associated with eCooking.

With the focus on SDG7 and the increasing availability of appliances, the opportunities for a shift to mecs are considerable. The growing jobs markets for clean technology has a double impact for women offering '*a unique opportunity to close the skills and gender gap*' (Power for All). It also provides the means by which they can purchase their own EPC and allows them to be ambassadors for the growing sector of electric cooking. Whilst consideration needs to be paid to the impact of fuel switching to employment, and the needs for greater skills to support eCook, the range of innovation currently displayed highlight that this offers a great opportunity, in the long term.

[1] Mahatma Gandhi National Rural Employment Guarantee Act was established in 2005 and aimed to enhance livelihood security in rural areas by providing at least 100 days of wage employment in a financial year to every household whose adult members volunteer to do unskilled manual work.