Impacts of Solar PV on Teacher Satisfaction
Dedicated Study

MREAP Strand: Community Energy Development Programme (CEDP)
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Abstract: Under MREAP’s Community Energy Development Projects (CEDP), a significant focus has been installation of solar lighting systems in the classroom blocks and teachers’ houses of rural schools. It is recognised that access to electricity offers many benefits to schools, benefiting students, teachers and the wider community. It is also known that rural areas can struggle to attract and retain appropriately qualified staff. Since CEDP has targeted the provision of electricity in rural schools and their teachers’ houses, we investigated further the potential links between access to modern energy services and teacher retention in Malawi.

This has included 10 focus groups and interviews in Chitipa district to examine the pre-solar situation for some of the schools that have received solar installations under CEDP, a survey of 80 teachers from CEDP schools across all 3 regions of Malawi, and a review of national education sector policies in Malawi and other relevant literature.
Impacts of Solar PV on Teacher Satisfaction

Final Report

Prepared for // University of Strathclyde
Date // January 2015
By// Gillian Davies, Catherine Currie, Enrique Wedgewood Young

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Acronyms

CBO  Community Based Organisation
CDSS  Community Development Secondary School
CEDP  Community Energy Development Projects
CEM  Community Energy Malawi
CES  Community Energy Scotland
CRIDC  Child Rights Information and Documentation Centre
DEM  District Education Manager
EFA  Education for All
EMC  Energy Management Committee
GMR  Global Monitoring Report
LDF  Local Development Fund
MGDS  Malawi Growth and Development Strategy
MK  Malawian Kwacha
MREAP  Malawi Renewable Energy Acceleration Programme
NESP  National Education Sector Plan
NGO  Non-Governmental Organisation
PEA  Primary Education Advisor
PTA  Parent-Teacher Association
RETs  Renewable Energy Technologies
SMC  School Management Committee
TDC  Teacher Development Centre
UNICEF  United Nations Children’s Fund

Acknowledgements

IOD PARC is indebted to CEM for their coordination of the Chitipa visit and the Teacher Retention Survey. Our sincere gratitude and thanks also go to the communities for spending time discussing the RET installations at the schools.
Introduction

The Malawi Renewable Energy Acceleration Programme (MREAP) has supported the Government of Malawi in improving the rate of access to electricity through renewable energy technologies (RETs) in off-grid community settings. Under MREAP’s Community Energy Development Projects (CEDP), a significant focus has been installation of solar lighting systems in the classroom blocks and teachers’ houses of rural schools. It is recognised that access to electricity offers many benefits to schools, benefitting students, teachers and the wider community. It is also known that rural areas can struggle to attract and retain appropriately qualified staff (Malawi Ministry of Education, Science and Technology, 2008). However, links between modern energy access and staff retention have only been given limited exploration (as identified in Practical Action’s Poor People’s Energy Outlook Survey, 2013).

Since CEDP has targeted the provision of electricity in rural schools and their teachers’ houses, it was decided to investigate further the potential links between access to modern energy services and teacher retention in Malawi. This has been done through:

- 10 focus groups and interviews in Chitipa district to examine the pre-solar situation for some of the schools that have received solar installations under CEDP
- Survey of 80 teachers from CEDP schools across all 3 regions of Malawi
- Review of national education sector policies in Malawi and other relevant literature

An initial overview of the education sector in Malawi is provided below, followed by descriptions of the methodologies for the primary research. The remainder of the report uses the data gathered to explore the multiple, complex and inter-connected challenges faced by rural schools (Section 1) and why attracting and retaining teachers is a key challenge that clearly demonstrates the interlinkage between different issues (Section 2). Section 3 then focuses in on electricity access for teachers: why it can increase teacher satisfaction and to what extent it might therefore help attract and retain teachers in the long term. Benefits for students and other indirect benefits and possible burdens for teachers are also discussed. Finally, the conclusions summarise the difficulties involved in making a direct link between the CEDP projects and teacher retention or educational improvements more broadly, but emphasizes the positive benefits offered in terms of teacher satisfaction.

Malawi Education Sector Context

UNICEF’s Annual Report (2013) for Malawi states that while primary school enrollment rate is high 99%, less than half (46%) of pupils are still at school when they reach Standard 8 and then the total number of pupils drops to less than a third (32%) during the transition to secondary education. The Education for All (EFA) Global Monitoring report (GMR) of 2010 takes this one step further and states that only 18% of children who enroll in school manage to complete their primary education in Malawi. The gender imbalance is then illustrated when the results between boys (22.3%) and girls (13.8%) completing their schooling is compared. There is a cycle of dropout and repetition in Malawi which is expensive and exacerbated by poor learning.

The Child Rights Information and Documentation Centre (CRIDC) rightly states that there are several cross-cutting issues which impact on the performance of the education sector in Malawi (CRIDC, 2014). These are explored to some extent in this report in order to highlight that challenges in attracting/retaining teachers are part of this broad array of inter-connected issues. There is a need to be realistic and proportionate about the difference that improved electricity services can have on attracting/retaining teachers, and that improved teacher retention can in turn make in solving the challenges of meeting Malawi’s targets for improved education services.
The National Education Sector Plan 2008-2017 (NESP) provides the overall policy framework and targets that it aims to achieve. It sets out the foundation of *equitable access, relevant quality and management and governance* in order to improve the Malawian education system. The major priorities for the education sector run by the Department for Education, Science and Technology are to:

- Expand equitable access to education to enable all people to benefit,
- Improve quality and relevance of education to reduce drop-out and repetition and promote effective learning, and
- Improve governance and management of the system to enable more effective and efficient delivery of services.

The NESP operationalizes the Malawi Growth and Development Strategy II (MGDS, 2012) broad educational development priorities, which recognizes education as a catalyst for socio-economic development, industrial growth and an instrument for empowering the poor, the weak and the voiceless.

The guiding principles of NESP which are relevant to this report and are critical for the envisaged positive change in primary education between 2008 and 2018 are:

i. Ratio of pupils to teachers progressing to a 1:60 ratio by 2013/14 and below 1:60 ratio by 2017/18;

ii. Percentage of teachers eligible for hardship fund increasing from 15% in 2008/09 to 30% by 2014/15 and staying at 30% thereafter; and,

iii. Teachers transferred from CDSSs to primary schools starts at 300 in 2008/09 and thereafter 200 teachers.

Education statistics are published by the Ministry of Education, Science and Technology in Malawi, generated from the Government’s Education Management Information System. The last publicly available report is from 2010 and indicates a teacher to pupil ratio of 1:80 in 2010, having increased steadily from a ratio of 1:71 in 2005. For fully trained teachers, the ratio is even higher, at 1:91 in 2010.

The NESP has set the following Basic Education indicators for Primary:

i. Reduced drop out from 14.3 percent to 5 percent,

ii. Reduced repetition from 18 percent to 5 percent. Only move towards automatic promotion upon developing mechanisms for remedial measures for failing pupils and improving teaching and learning which reflects successful continuous and summary assessment,

iii. Improved distribution of teachers in rural areas from 1 qualified teacher to 90 pupils to at least 1:70,

iv. Improve the survival rate of pupils to standard five from 53 percent to 75 percent, and increase the survival rate from 29.6 percent to 60 percent at standard 8. Overall Basic Education ranges between 54 percent and 60.2 of the total education expenditure during the plan period.

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1 The hardship fund provides an additional allowance for those teachers working in rural areas.
Chitipa Interviews/Focus Groups Methodology

Out of 76 solar systems installed in schools across the country, 45 are located in the northern region of Malawi (Table 1) and more specifically 22 are in the remote northern district of Chitipa. As the location of around 28% of CEDP’s school solar installations, Chitipa district was chosen as the site for this research.

Table 1: CEDP solar installations in schools and TDCs

<table>
<thead>
<tr>
<th>Region</th>
<th>District</th>
<th>Teachers’ homes</th>
<th>Primary schools</th>
<th>Secondary schools</th>
<th>Teacher Development Centres (TDCs)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>North</td>
<td></td>
<td>29</td>
<td>12</td>
<td>3</td>
<td>1</td>
<td>45</td>
</tr>
<tr>
<td>(of which Chitipa)</td>
<td></td>
<td>[14 or 46.7%]</td>
<td>[6 or 50%]</td>
<td>[1 or 33.3%]</td>
<td>[1 or 100%]</td>
<td>[22]</td>
</tr>
<tr>
<td>Centre</td>
<td></td>
<td>7</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>11</td>
</tr>
<tr>
<td>South</td>
<td></td>
<td>14</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>50</td>
<td>21</td>
<td>4</td>
<td>1</td>
<td>76</td>
</tr>
</tbody>
</table>

Chitipa is located in the far northwest of Malawi, adjacent to the Tanzanian and Zambian borders. The Chitipa CEDP projects are all located in and around the village of Mahowe, around 120km on unpaved roads from the district town of Chitipa (‘Chitipa Boma’). On 14th October 4 primary schools, 1 secondary school and 1 teacher development centre (TDC) were visited. A total of four focus groups and three individual interviews were conducted at these sites (Table 2).

Table 2: School/TDC focus group participants and interviewees

<table>
<thead>
<tr>
<th>Site</th>
<th>Focus group participants</th>
<th>Male</th>
<th>Female</th>
<th>Individual Interviewees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uledi primary</td>
<td>19</td>
<td>10</td>
<td>9</td>
<td>Headmaster</td>
</tr>
<tr>
<td>Mibanga primary</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Kalopa primary</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Male teacher</td>
</tr>
<tr>
<td>Mahowe primary</td>
<td>11</td>
<td>7</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>Chiungumile secondary (CDSS)</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Mahowe TDC</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Primary Education Advisor (PEA)</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>23 (61%)</td>
<td>15 (39%)</td>
<td>3 male</td>
</tr>
</tbody>
</table>
The 38 focus group participants included:

- Heads (3), Deputies (2) and other teachers (8)
- School Management Committee (SMC) members (12)
- Parent-Teacher Association (PTA) members (8)
- Energy Management Committee (EMC) members (3)
- Village chiefs (2).

The school visits were undertaken with Edgar Bayani, CEM National Coordinator, and Sithembile Nyirenda, CEM Development Officer for Northern Malawi, who kindly acted as translators when necessary.

Following the visits to the schools and TDC, a focus group was held with the Energy Management Committee (EMC) chairman and the Community Based Organisation (CBO) treasurer. The EMC is in charge of making sure that the Mahowe systems are functioning and used properly, and also manage the financial income from the school systems. The EMC has 15 members: 2 from each of the 6 schools and 3 from the CBO. The CBO has been responsible for overseeing implementation of all of the CEDP solar projects in the Mahowe area and controls the bank account for the maintenance fund, but ongoing responsibility for maintaining the systems and related decision making lies with the EMC.²

On 15th October an interview was undertaken in Chitipa Boma with the co-ordinating Primary Education Adviser (PEA) for the district of Chitipa, whose office is responsible for posting teachers to schools. A focus group was then held with 3 training teachers (2 male, 1 female) at Karonga Teachers’ College.

CEDP-wide Teacher Survey Methodology

A survey was carried out over the period August to October 2014, targeting the teachers that are based in schools across Malawi where CEDP has installed solar systems. The surveys were conducted by CEM staff in all three regions of Malawi. The selection of questions asked is provided in Annex 2. The

²This is the common model for the CEDP systems across Malawi: only one CBO is involved with CEDP in each district, and the projects are clustered in the area where that CBO operates.
questions focused on whether the installation of a solar panel had contributed to job satisfaction and/or improvement of living conditions for the respondent.

**Sample**

80 teachers completed the survey, of which 30 are based in the northern region, 30 in the central region and 20 in the southern region of Malawi. Out of the teachers surveyed, 52 had had a solar panel installed on their home. This represents 100% of all of the teachers who have had their houses electrified under CEDP. The remaining 28 had had solar installed at their school but not on their home. The additional 28 were selected based on a convenience sample i.e. who was available for the survey at the time of the school visit.

Nearly all (79 / 99%) characterised their school location as rural, with one exception characterising it as peri-urban. The majority (55 / 70%) were in their first teaching job, while 30% (24) were not. Of those who had previously had other teaching jobs, 5 had held two other teaching posts, while 12 had held more than 2 but no more than 5 other posts. Most respondents (76 / 95%) stated that they did not live alone; they mostly (median value) live with 5 family members, with the average (mean) being 4.8.

**Limitations**

Some limitations to the methodologies used for this study are described in Annex 3.
1. Challenges for rural schools

The NESP notes that the major relevant challenge which dictates what is possible within rural remote primary schools is the lack of coherent policies and clear strategies to address overwhelming demand. This has in turn put a strain on and/or compromised both the quantity and quality of primary and secondary school education. Incoherent policies have led to teachers being reluctant to work in areas of greatest need (remote and rural schools) and inadequate teaching time. This challenge has then been reinforced by an estimated 6 percent attrition rate of primary school teachers. The cycle of dropout, failure and repetition in Malawi is triggered by the difficulties in providing a high standard of education, but is in turn expensive and leads to a further drain on resources.

The Education for All (EFA) Global Monitoring report (GMR) of 2010 also notes that there is a lack of qualified teachers across the country – the teacher-pupil national average reached 1:74 in 2012 (World Bank, 2014). There continues to also be a shortage of school blocks since the introduction of free primary school education in 1994. However at the core of educational problems are much bigger problems of chronic poverty. The nutritional security of children remains a very real problem that threatens to get worse during lean seasons. 24 of 29 districts are deemed to be food insecure by the Malawi Vulnerability Assessment Committee report (2013). High rates of student malnutrition, in rural areas in particular, are known to affect concentration levels.

In terms of how this situation looks at local level, the Chitipa case study provided an opportunity to explore what the challenges are for rural schools on a day-to-day basis. Perhaps unsurprisingly (given that they were fully aware of the context of the research) electricity was mentioned at all of the schools as a challenge prior to solar systems being installed. Previously battery-powered torches and/or paraffin lamps were used for evening study sessions for children and for teachers to do work-related and other activities. These options were discussed as being expensive due to the large amounts required. Mahowe primary used about 48 batteries per month per class, for example. For those using paraffin, the PEA stated that MK60,000 was spent on paraffin from January to May (exam revision time) for only one class to study (Standard 8, last year of primary).

The high costs were prohibitive, so that for most schools only Standard 8 was allowed to have evening study sessions. In some cases it also led to inequality between students within a class, since parents were asked to contribute to the cost (MK1000/year at Mahowe primary) and if unable to then their children were denied participation in evening study. This specifically goes against the NESP goal of equitable access to education. Other difficulties mentioned were the occasional unavailability of paraffin, the poor quality of light, and health concerns for students inhaling smoke.

However, various other significant challenges were also mentioned that illustrated that the challenges for rural schools are wide ranging and inter-connected.

- **Water:** Water was raised as an issue in all school focus groups. Specific challenges include the distance to collect water due to either broken boreholes (Uledi - 1.5km distance to river) or the borehole running out in dry season (Mibanga and Mahowe primaries – up to 6km to river). Sometimes the students don’t come back after the break when they fetch water “We can start with 80 or 90 students in the morning, and afterwards there are maybe only 20. This is for

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3 Malawi Integrated Household Survey 2010/11 stated that 50.7% of households live below the national poverty line and 25% are ultra-poor households. These figures translate into more than 2 million children who live in extreme poverty.
Standard 1 and 2 students in particular” (the youngest 2 years, who are often assigned family water collection duties).

- **Shortage of teachers**: Shortage of teachers was a significant problem. At primary school level it is expected that each class has its own teacher (this was referred to by several Headmasters, the PEA and staff at the district education office, rather than the national targets based on teacher to pupil ratio). Uledi primary has 8 different classes but only 4 teachers. For secondary (CDSS) the Headmaster hoped to have one teacher per subject (8 in total) yet only had 3 teachers (including himself). Mahowe education zone overall had 45 primary teachers for 3,197 pupils in 9 schools, or a ratio of 71 students to every teacher; this falls short of the 1:60 target ratio set by the NESP. Reasons mentioned for teacher shortages included both attracting and retaining them, and being unable to host them physically (lack of teachers houses) or financially in the first place. This is explored further below.

- **Shortage of teachers’ houses**: Most schools do not have enough houses for teachers (e.g. Mibanga primary – 6 teachers but only 3 houses) and those available are often poor quality. Teachers who are not provided a house at the school must rent one in the village at their own expense. Houses are allocated based on seniority, so that most schools have a Headmaster and Deputy Headmaster house, but only one or two other houses at most.

- **Shortage of other school buildings**: Other school buildings were also an issue. The Headmaster of CDSS noted: “That is the biggest problem - shortage of buildings. It has brought down the development of the school.” One school block had collapsed at Mibanga primary the previous year due to heavy rains and had not been rebuilt yet due to shortage of funds (Photo 2).

  Photo 2: Mibanga primary – collapsed school block

- **Health care access**: For one community the nearest health centre is 50km away, for another it is 25km. In Uledi village 2 women had died just prior to the research visit due to labour complications and lack of nearby health care.

- **Shortage of desks**: This was raised as a concern at Uledi primary.

- **Sanitation**: Kalopa primary does not have enough toilets for students, but the PEA noted this was not an issue for other schools in the area.

The interconnectedness of many of the issues is clear, particularly between electricity access and provision of other services. This was highlighted by one Headmaster: “Why is it different here in rural areas, why the level of services – education, health, water and so on – is so different to that in urban areas? It is because we do not have electricity. Give the rural areas access to electricity with these solar systems and we will be the same.” Lack of energy was given as a reason for a newly constructed local health post not being functional, for example, because there was no energy for a fridge to store vaccinations making the facility redundant.
Accessibility is another inter-connected issue in rural areas. In Mahowe education zone only 3 primary schools had not been allocated solar installations under CEDP: one already has one solar system at the Headmaster's house and 1 is out of the catchment area of the CBO. However, Muzimelo primary can only be accessed by foot, not with a vehicle. This would have presented serious difficulties to bring the solar equipment to the school, and although the community offered to walk in with it on their heads, this impracticality left it out of the group of selected CEDP schools.

Despite extreme poverty in rural areas, the local communities do provide some input into rural schools, particularly at primary level. While not a specific policy, it was described as a legacy from all primary schools having been made free of charge in 1994. Since parents no longer have to contribute school fees, there is an unwritten expectation that the community contributes in other ways. In Mahowe, for example, they provide bricks for new school buildings. In some cases the local community also pays for a watchman. Furthermore, while there are clearly a wide range of difficult challenges for rural schools, the Mahowe PEA was also keen to note that rural areas do have some advantages, such as the cheap cost of living.

Challenges such as extent and quality of school infrastructure are not isolated to rural schools. There are similar constraints in urban schools, particularly with expanding urban populations. However, issues such as access to electricity, clean water, health facilities and other services such as banks, are very much specific problems for rural areas. Similarly, higher income levels in urban areas lead to greater ability of communities and parents to support schools. Despite the clear differences, previously teachers in rural areas received no additional incentive to those working in urban areas (World Bank, 2008) but in 2008/09 a hardship fund for working in rural areas was made available to 15% of teachers. The NESP sets out a policy to increase the number of teachers eligible for this funding to 30% by 2014/15. However, Government statistics (Ministry of Education, Science and Technology, 2010) indicate that this does not come close to the real number of primary schools that are classified as rural. In 2010, 5,026 primary schools were classified as rural, while only 75 were classified as semi-urban and 291 as urban. Government funding for urban and rural schools is understood to be similar, with a decentralized funding system that provides a fixed amount as a School Improvement Grant to each school. In 2014 this amounted to MWK 600,000 per school.

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4 During the recent Presidential elections the ballot boxes had been airlifted out in a military helicopter.
5 The employment of a watchman was introduced as a sustainability measure and a requirement for having a CEDP solar installation.
2. Attracting/retaining qualified staff as a key challenge

The findings above already indicate that a shortage of teachers is a common key challenge both nationally and for rural schools in particular, and that there are various reasons for this. These are explored further below.

Teacher training and deployment

The National Education Sector Plan (NESP) attributes the national shortage partly to inadequate funding for teacher training. Infrastructure and other facilities have not been maintained and procurement of what can facilitate effective and efficient training for teachers has not been done. The poor learning environment in colleges impacts negatively on preparation of teachers and discourages potential teacher learners from enrolling, especially female teachers. In Mahowe education zone in Chitipa, out of 45 primary school teachers only 5 are female.

Teacher training in Malawi consists of 1 year at college or doing a distance learning course and then 2 years of practical on-the-job training at a school. The teachers are matched to a school by the government. It is expected that most newly qualified teachers spend 5 years working in rural areas. The 3 trainee teachers interviewed for this research described this as the ‘pay-back’ to the Government for the investment it has made in their training. After the 5 year period, teachers can request to be placed at a certain school.

Photo 3: Focus group with trainees at Karonga Teachers’ College

The problem of incoherent policies and poor co-ordination appears to extend to teacher management. Having been coordinated in their training by one government agency, newly qualified teachers are then posted to a school by another, managed by two others, and potentially disciplined by at least two others. Without clear roles and responsibilities for each organisation and a mechanism for coordinating them, recruitment and deployment of teachers has therefore become inefficient.

Qualified teachers rarely attend continuing professional development courses, and many primary school teachers are deployed in other duties through “administrative arrangements” such as School Management Committee, further adding to their low availability. Some are also assigned to secondary schools to tackle the shortage of secondary teachers: in 2008, it was estimated that 5,000 primary teachers were working in secondary schools (World Bank, 2008). The rate of teacher deaths have also increased in the past, having more than doubled in the period 1995–2004, which is thought to be
linked to the prevalence of HIV/AIDS in Malawi (World Bank, 2008). These factors lead to the 6 percent attrition rate of primary teachers nationally, an issue which disproportionately impacts on rural schools through worse pupil: teacher ratios in rural compared to urban areas. 2010 data shows a ratio of 1:80 in rural primary schools compared to 1:54 in urban primaries (Ministry of Education, Science and Technology, 2010).

At district level, the District Education Manager (DEM) is responsible for posting teachers to schools within the district. The process involves checking the size of the school and ideally providing 8 teachers minimum for a full primary school (8 classes in a school with 60 students in each class). In some instances enrolment of students is very low so there are fewer teachers, but for Chitipa district the district education staff feel that the main challenge to meeting staffing levels is the lack of teachers’ houses. If a school does not have adequate teacher accommodation, they find it very difficult to allocate additional teachers from an already insufficiently sized pool of qualified teachers.

Government policy is that all teachers should be provided with a house that is rent free. If there is not one available, the teacher must rent one nearby at their own expense. The trainee teachers spoken with found this unfair. Although the district education office in Chitipa stated that there is a rural allowance for teachers in remote areas (quoted as MK10,000 extra per month) this is not meant to cover rent. Rather, it should be the responsibility of the community to provide housing and other infrastructure, with parents contributing materials (e.g. bricks, stones, cement etc.) According to the co-ordinating PEA of Chitipa district, this has worked historically but in the recent past there have been increasing difficulties due to the high cost of materials.

To overcome this challenge the government has opened the Local Development Fund (LDF, previously the Government Social Action Fund) to construct teachers’ houses, classrooms and toilets. However, the fund is limited and teachers’ housing may not be a priority, particularly given that the LDF is not ring-fenced for education needs. For schools specifically, the government is again promoting local-level planning through an annual School Management Grant for every school. Allowing responsiveness to specific local needs, the school and its community must make a School Improvement Plan for how it should be spent, with a requirement to focus on 3 target areas: quality and relevance (50%); access and equity (40%); management (10%). Again, however, given the numerous challenges faced by rural schools the priorities will vary. NGOs such as ActionAid (which was in the process of building a new teacher’s house in Mahowe education zone at the time of research) are one other possible source for the improvement of infrastructure.

Teacher retention

The challenges for rural schools discussed above mean that teachers in rural areas have a very difficult environment to teach in, particularly for newly qualified teachers. The trainee teachers interviewed for this report were aware of the types of problems that teachers face in remote rural schools, such as lack of access to clean water, limited basic energy services, being at a distance from a trading centre, and shortage and poor quality of housing. They stated, however, that it would be very difficult to refuse their first school placement as it is government policy to be sent to a rural area first, and something they have effectively agreed to when enrolling at the college. However, after the first 5 years they could choose to avoid such rural areas if they have had a difficult experience.

The DEM’s office in Chitipa was also reticent to acknowledge that teachers can refuse to go to an allocated school or easily leave once there, but did suggest that this can happen when no or inadequate accommodation is provided: “Most teachers when accommodated have to stay as it is their job, but if they have high quality homes there is less excuse,” said the co-ordinating PEA for the district.
One question within the CEDP-wide teacher survey asked “Have you requested a transfer from a teaching post before?” Out of the 80 respondents, just less than a quarter (19) said “yes”. Table 3 shows that the main reason given was to be closer to a town or trading centre, in order to benefit from improved access to health services, electricity and better infrastructure. 4 respondents wanted to move to a better school, without a specific location mentioned but for improved facilities, accommodation and a better teaching environment, and a further 3 cited proximity to health services as the key reason.

Table 3: Reasons for requesting transfer from school

<table>
<thead>
<tr>
<th>No. of respondents</th>
<th>Reason for requesting transfer</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>To be in/closer to a town/trading centre (with electricity, health services and modern infrastructure)</td>
</tr>
<tr>
<td>4</td>
<td>To go to a better school (in terms of teaching environment, facilities and accommodation)</td>
</tr>
<tr>
<td>3</td>
<td>To be closer to health facilities (2 specifically for taking sick relatives)</td>
</tr>
<tr>
<td>2</td>
<td>To be closer to home village/family</td>
</tr>
<tr>
<td>2</td>
<td>Had been there for a long time and wanted a change</td>
</tr>
<tr>
<td>1</td>
<td>Due to bad relations with the community</td>
</tr>
<tr>
<td>1</td>
<td>Due to lack of maize mill and clean water</td>
</tr>
<tr>
<td><strong>Total - 19</strong></td>
<td></td>
</tr>
</tbody>
</table>

The survey also asked the respondents to rank the priorities for them in terms of living standards, out of a list of 8 factors. The results are shown in Figure 1. It shows that key priorities include housing, modern energy services, supplies for teaching and safe water and sanitation.

Figure 1: Importance of factors related to living standards for teachers
3. Electricity access and teacher satisfaction

Like the challenges faced by rural schools, the issue of attracting and retaining teachers is clearly multi-faceted and will not be solved simply by providing lighting in classrooms and their homes. However, access to modern energy services does appear to be one of a number of priorities for teachers.

The role of electricity in attracting/retaining teachers

A key finding from the Mahowe education zone was the interconnectedness of challenges faced, and this was again the case for energy services: that the role of electricity in attracting/retaining teachers is closely bound with the issue of teacher housing availability and quality. The PEA stated that: “It was very difficult to attract teachers before. Some newly trained teachers were saying I won’t go to Mahowe. A grass-thatched house with no electricity is not appealing. Several teachers have left. […] With construction of good houses with solar systems it is much more appealing for teachers.” The chair of one School Management Committee which was failing to get sufficient teachers stated: “It is partly because of energy. But also we do not have enough houses.”

In a zone that currently hosts 45 teachers, 5 instances of teachers leaving in recent years were anecdotally mentioned, though these could not be verified. Although many focus group participants felt that electricity was a contributing factor, it is not clear to what extent, if any, access to electricity in their homes may have helped reduce this number or made it easier to attract other teachers. The PEA did note, however, that when the Government’s LDF had first been used to build some new higher quality teachers houses in some schools, some teachers had still refused to move there until solar systems had been installed. Similarly one Headmaster stated that one teacher who had resigned had gone to another remote rural school but where they had solar.

It was felt that younger teachers in particular were more reliant on energy access and thus susceptible to it being a strong influence on where they would like to teach. The trainee teachers interviewed, for example, had all grown up in houses with grid connections and had had no experience of being without access to energy or of new technologies like solar. In the anecdotes of teachers leaving they were referred to as young or new teachers, and one Headmaster stated: “I have been here since 1991 and it is the first time I’m in a house with electricity. For those who started a long time ago they can do it. But for new teachers they are used to electricity.”

Due to the shortage of teachers’ houses, in most cases those that are available are allocated to the Head and Deputy Headmaster who tend to be older teachers. This has had the knock-on impact of most CEDP systems being installed on these houses rather than those of more junior teachers. In Mahowe education zone, for all except one school6 it is the Head and Deputy Headmaster who have systems. However, the research suggests that the solar installations have even made the older, more senior staff more positive about staying at their current school. One Head said: “This technology develops the desire for going to those schools with electricity. Even for me, if I had to transfer somewhere with no electricity, I would cause a problem and demand to stay!” Similarly the PEA stated: “My friends at other places don’t have energy. Even my friends are admiring this place. When I came here they told me they [the district education management] were throwing me away. Now I am not even thinking of moving away.”

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6 The exception is where the Deputy Headmaster chooses to live in the village rather than at the school, so one other male teacher has a house at the school which has been installed with a solar system under CEDP.
Prior to the solar installations, the survey found that teachers at CEDP schools had predominantly used battery powered torches (54%) or paraffin lamps (27%), as shown in Figure 2.

**Figure 2: Responses to the question “Which did you use for light at night time?”**

![Pie chart showing the distribution of light sources used by teachers before solar installations.](Image)

While teachers therefore had some source of lighting, Figure 3 shows that the majority did not find that it met their expectations.

**Figure 3: Responses to the question “How satisfied were you with the lighting at home and at the school? (Prior to installation)”**

![Bar chart showing levels of satisfaction with lighting before solar installations.](Image)

By comparison, the majority were satisfied or very satisfied with the lighting in the schools, and to a lesser extent homes, subsequent to solar being installed. Figure 4 shows that the levels of satisfaction are much higher for those teachers (65% of survey respondents) who have had solar panels installed on their houses, particularly with regards to lighting at home. The majority of teachers without a solar panel in their home remained not satisfied at all or only somewhat satisfied with lighting at home.
The survey respondents were asked to what level they agreed with the assumption that improved living standards through providing modern energy services could improve staff retention. The results, shown in Figure 5, indicate that 98% agreed or strongly agreed with this.
Electricity use

The trainee teachers interviewed noted that they need access to lighting in the evenings for lesson preparation and planning. Furthermore, in the first year of practical experience as probationers they will remain under assessment and therefore they expect lighting in the evening to aid their study. Mobile phones also play an important role in communicating with family and friends and trainees were conscious of needing to charge their phones.

At a primary school in Chitipa, one male teacher summarised the importance of lighting for good quality teaching: “Our profession is about writing and preparing. But sometimes we run out of money so we cannot afford to buy batteries or kerosene. So the result is we cannot plan and we get to the classroom without being prepared.” Since the lack of teachers in rural areas increases the pressure on those that are there, it makes any extra time they can find (through lighting in the evenings) for teaching, marking or preparation even more valuable. One Deputy Headmaster in a CEDP school noted that the teachers would now sometimes take catch-up classes in the evening, if they missed a class during the day.

Over a quarter (23 out of 80 / 29%) survey respondents had found that since having solar installed, they had increased time to do their work and a better teaching/learning environment. Figure 6 shows that the majority of teachers who responded to the survey had increased the hours they worked per day in a typical week. However, this increase was less significant for those without a solar panel at their home. Since an increase in working hours might be seen as a negative impact due to it increasing
teachers’ burdens, particularly if having to work beyond 8 hours per day, this was explored further in the Mahowe focus groups. No teachers claimed it to have become a burden, however.

Figure 6: Response to question “How many hours did/do you work before/after solar?”

As well as using the solar for lighting for both teaching-related activities and personal or social purposes, the teachers use it for phone charging, radio and watching TV. Photo 3 shows the satellite TV, radio and lighting systems in the house of one deputy Headmaster.
For the younger teachers at the schools which have solar PV systems who either do not have a house at the school at all, or have a house but not their own solar home system, there do still seem to be some peripheral benefits. From the Chitipa research it was clear that they used the classroom block solar system for phone charging during the day and teaching-related work in the evening. The latter was harder for those that were renting houses far from the school, however. One teacher said: “Other teachers do benefit but it is minimum. We can prepare or work to supervise the students in the evening for revision and charge the phone.” Another stated that despite having no solar in his home he was happy to stay at the school now, when he might not have been before. He uses the school block system for phone charging and preparing lessons.

Benefits for students

Since the teachers have used the school block lighting to supervise evening revision or teaching sessions for students, it provides the learners with more opportunities to study in evening for longer, with better quality light. It also removes the need for parent contributions towards batteries or paraffin, so that poorer students are not marginalised and helping move further towards the NESP goal of equitable access to education. In Mahowe, parents have become noticeably more engaged in making sure children attend the evening study sessions, even being joined by some that are not at the school or other community members. One teacher suggested that out of 90 or 95 students enrolled at the school, 50 students were staying at or coming back to the school each night. Because the teachers are able to prepare better for lessons the students were also thought to be benefitting from higher quality teaching in the daytime. To a lesser extent, the ability for teachers to remain well informed about current affairs through radio and television was also perceived to have a potential impact on improving teaching quality, although this link is clearly more tenuous.

This combination of factors led to anecdotal reports that the solar installations might have already had some impact on student performance in Chitipa, with the pass rate into secondary school being presented as an indicator. One Head (Mibanga primary) commented: “20 students have been selected this year for secondary school and we attribute this to solar. Before it was usually 2 or 5 students who went to secondary school.” The pass rate increase was confirmed by records on display in the PEA office (Photo 7). The PEA similarly stated: “Mibanga school has performed miracles after this solar. 1 student went to the best school in the country.” However, these assertions were not backed by any other evidence and given that the solar systems had only been operational for 1 or 2 months prior to the secondary entrance exams, the link remains speculative. Comparison of pass rates at the next annual secondary entrance exams with the baseline (pass rates over the past 5 years in all CEDP schools) will help to ascertain its credibility.
The Mahowe PEA was also hopeful that in the longer term, some of the income generation activities that the schools were undertaking using the solar systems (phone charging, TV viewings, barber shops, weddings etc.) combined with the savings from reduced expenditure on batteries/paraffin would allow expenditure on other school improvements. These would again improve the learning environment for the students. However, the long term income generation will depend entirely on the standard of financial\(^7\) and technical\(^8\) management of both the schools and the CBOs which manage the maintenance funds.

Other benefits and burdens for teachers

An interesting area of future research is the potential for a feedback loop whereby better student performance affects the motivation of teachers. As one teacher in Mahowe described, the students using the solar to study at night was making them better students and improving his job satisfaction. Should this feedback loop exist, unpicking the contributors to student performance would be required to understand the effect. For example, as long as other issues such as malnutrition persist in rural areas, the challenges discussed earlier in this report such as poor student concentration will still remain.

Another possible indirect teacher benefit is that if there is sufficient savings/income generation to improve school facilities in the longer term, it might again improve the environment for teachers – particularly if it can help address the issue of teacher housing. Further exploration of this potential knock-on impact may be possible if a longitudinal study is made of the CEDP projects, to investigate what happens in the long term once income beyond what is needed for the maintenance fund has been generated.

While the extent to which the above benefits arise will only be known after several years of monitoring the CEDP projects, there are some other indirect teacher benefits which are already being delivered. It is required that any school with a solar system employs a night watchman. It varies by school how this is paid for but it offers teachers more security, both for those that are living there and those staying late to work. One female teacher in particular stated: “It is now more secure. It makes it better to be here”. Another benefit for those teachers with solar systems in their houses is that their families can

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\(^7\) One Mahowe school was running a barber shop and reportedly making enough money (over MK12, 000 per month) to pay the monthly Energy Management Committee fee (MK2, 000 per month) after a couple of days. In other schools, the income generation was significantly lower but the systems had not been operational long and there were plans to increase income generation activities. Some schools seemed to have already identified barriers, however, such as a need for more extension cords for phone charging but not yet finding a solution to where the investment would come from. It therefore seems likely that income generation will vary considerably between the schools in the CEDP portfolio. Similarly if a CBO does not effectively manage the maintenance fund and ensure that systems are appropriately maintained, it will jeopardise the long-term operation of the systems.

\(^8\) In the Chitipa research there were calls for someone in the community to be trained as a solar technician.
also utilise the lighting and electricity. Those teachers that responded to the survey on average lived with 5 family members.

In terms of burdens for teachers after installation of a solar home system at their house, there may be a direct financial burden depending on how the CBO has set up the system for maintenance fund payments. In Mahowe, teachers with solar systems are expected to pay a set amount per month (MK1500) to the Energy Management Committee for this purpose. No teacher interviewed in the research felt that the amount was unreasonable, and acknowledged that alternatively they would be paying for paraffin, batteries or candles so in fact there might be some financial gain overall. For some other CEDP projects (e.g. Likoma, Nkhotakota) the EMC also charge teachers a monthly fee for the solar installation, but it is not common across all projects and the amount charged varies.

Due to the frequent mention of community members using the school and teacher house systems for phone charging, it was asked if this had become a distraction for teachers. One did state that: “It is very common that we get disturbed in our homes when trying to work because people want to charge their phones.” Others did not find it distracting, however, but a useful way to provide income for paying the monthly EMC fee.

One other issue identified was the potential for increased friction with other teachers or community members with lower levels of energy access. The survey showed that prior to solar most teachers felt they had a similar level of access to lighting as their community, but that subsequently it was much greater for those teachers with solar at their home, and a little greater for most of those without a home system (Figure 7).

**Figure 7: Responses to the question: “Do you now have more or less access to lighting compared to other members in your community?”**

<table>
<thead>
<tr>
<th></th>
<th>Much Less</th>
<th>A little less</th>
<th>About the Same</th>
<th>A little more</th>
<th>Much More</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers with solar panels at home</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>48</td>
</tr>
<tr>
<td>Teachers without solar panels at home</td>
<td>1</td>
<td>6</td>
<td>5</td>
<td>11</td>
<td>5</td>
</tr>
</tbody>
</table>

Even within the schools, some teachers’ houses remain without and those teachers not provided with a house have to both pay rent and mostly remain without electricity. As one of the trainee teachers stated: “If I was at a school and the Headmaster was living in a house with solar, but I didn’t have it, then I would look him in the face and say if he wants me to stay he needs to give me that house!”

Equally many non-teachers in the villages do not have the same level of lighting or electricity. One village chief in Chitipa commented that “It is difficult to see friends with solar and not have it.”
However, it was also acknowledged that it is important for schools in particular, if anywhere in the village is going to have power. One survey respondent (out of 80) said that resentment from colleagues/neighbours who did not have solar had been a significant issue for them, but this was not mentioned by any other respondents.
Conclusions

In Chitipa, the Mahowe education zone currently has 45 teachers (40 male, 5 female). CEDP has installed solar in the homes of 13 teachers and the Primary Education Advisor (PEA). This accounts for just under 30% of the teachers in the zone. The PEA is already optimistic that solar has had an impact on drawing in more teachers and improving the student to teacher ratio, but this was stated only a few months after installation of the systems and cannot be taken as evidence. Where teachers had left in the previous years, focus group participants also felt that lack of energy access had had some influence on the decisions to leave. Those teachers still at the schools claimed that they were more willing to remain due to solar. The teacher survey results also indicated that teachers themselves see a direct link between energy access and teacher retention.

However, much of this evidence remains anecdotal or based on supposition, and the relatively recent arrival of the CEDP installations further urges caution. The challenges for rural schools, and indeed the Malawian education system overall, remain complex, wide-ranging and inter-connected. Without more concrete evidence gathered over a much longer period of system operation and a counter-factual, claims cannot be made that the installation of solar systems on classroom blocks and teachers’ houses will tackle the issue of attracting and retaining teachers. Furthermore, if the research findings that energy access is more important to younger teachers, the prioritisation of Head and Deputy Headmaster houses for receiving solar systems and in fact the overall lack and inadequacy of teacher housing at all are likely to be limiting factors.

What does seem to be clear, though, is that providing electricity access through solar systems is immediately able to improve the living standards and working capacity of teachers, and can in turn help improve the quality of teaching that students receive. This adds to the benefits already experienced by students of evening study opportunities. Figure 7 shows a significant increase in job motivation for the majority of teachers surveyed since having solar installed. These results may be influenced by the respondent awareness of the survey context, but they clearly indicate a positive response to the CEDP systems. Again, however, the increase is markedly less significant for those teachers without a panel on their home, some of whom remain demotivated.
One additional important theme arising from the Chitipa research is the challenge of living in remote inaccessible locations. While stated in the Process Learning Review conducted in 2014 that there were various factors that led CEDP to choose the Districts it did, and then District Development Committees to then choose CBOs to work with. Until this research in Chitipa the challenges caused by being in remote locations were not truly understood or communicated. The particular remoteness of Mahowe was mentioned by various interviewees who suggested that it is a place where few donors come, or come but do not stay. Access is particularly difficult in the rainy season, when the drive from Chitipa Boma alone has taken 9 hours for CEM staff. This also increases the challenge for solar
contractors to make maintenance visits so may impact negatively in this regard\(^9\) but it allows for the systems to have greater impact than might be the case in less remote areas where rural challenges are less strongly felt. It was reported that other CEDP areas in other regions of Malawi were also similarly remote and that this had been a consideration at the targeting stage.

\textbf{Photo 7: Photos during 120km journey to Mahowe from nearest town (Chitipa)}

In conclusion, installation of off-grid solar systems has been found to offer an immediate benefit to teachers, schools, pupils and communities. However, these benefits must endure in the longer-term in order to create any sustainable impact on educational outcomes, and further research will be required in future to ascertain the extent to which this is delivered.

\(^9\) Although no evidence of this was found, and in fact contractor performance since system installation was reported as satisfactory. There had been some delays for smaller issues because the contractor would wait to make one trip to solve a number of technical problems, but overall it was felt that their response to problems was suitably prompt.
Annex 1: Bibliography


Annex 2: Teacher survey questions

Respondent's school

Name
Region (N/C/S)
District
Nearest city/village
Traditional authority
Density (Rural/peri-urban/urban)

Job history
1. How long have you been teaching at the school for?
2. Is this your first teaching job?
   a. If no, how many other posts have you been employed in as a teacher?
3. Have you requested a transfer from a teaching post before?
   a. If yes, what was the main reason for requesting a transfer?

System information
4. Do you live alone?
   a. If no, how many family members live with you?
5. Has a solar panel been installed at your home?
   a. If your answer was ‘yes’, what month and year was it installed?
6. Has a solar panel been installed at the school where you teach?
7. Did you have light in the evenings at home or at school before the solar panel(s) was/were installed?

In retrospect
8. Please tick which of the options you used for light at night time.
9. What did you use the lighting for?
10. In general, how satisfied were you with the lighting at home and at the school?
11. In your opinion, did you, prior to installation, have more or less access to lighting compared to other members in your community?
12. Did you ever go anywhere else to access more light at night? What were (if any) the challenges you experienced due to this lighting source at night?

Current use of lighting
13. What do you use the lighting for now?
14. Does the lighting meet your expectations at home and at the school?
15. In your opinion, do you have now more or less access to lighting compared to other members in your community?
16. Do you ever go anywhere else to access more light at night? What are (if any) the challenges you experience due to this lighting source at night?

Job satisfaction
17. How would you rate your level of motivation for your job at the school?
18. For the 12 months prior to the installation, how many absences did you have from this and/or your last teaching post?
19. In a typical working week (5 days), how many hours did you work and do preparation (for teaching) before and after installation of the solar?
20. Overall, do you think your number of working hours has increased?
21. Is this because of the availability of light at night?
   a. Please explain your answer.

Living standards
22. Please rate these factors from least to most important: Support staff / Supplies for teaching / Infrastructure (e.g. road to school) / Social services (e.g. health visitor) / Housing / Communication (e.g. mobile phone network) / Modern energy services (e.g. lighting, clean and fast cooking, entertainment) / Safe water and sanitation.
23. The assumption is that an increased level of living standards, due to increased energy enables amenities (such as modern energy services), improves retention of staff. To what extent do you agree with this assumption?
24. Please rate from 1 to 4, where 4 is the highest, your current level of satisfaction with your living standards against each of the modern energy services.

Energy expectations
25. To what extent is access to modern energy services an important factor in job satisfaction?
26. Is the current level of service provision acceptable to you?
27. If no, why not?
28. Have there been any unexpected positive or negative results of the solar panel installation?
29. Is there anything else you would like to add that is relevant to us?
Annex 3: Limitations

Chitipa Interviews/Focus Groups

Time constraints
The fieldwork had to be reduced in time for several reasons. The drive from Chitipa Boma to Mahowe was 4 hours each way which reduced the time available for interviews and focus groups once arriving at the schools. On arrival it was also discovered that the funeral of a senior community member was to be held the following day, meaning that many people would not be available even if we were able to return for a second day. Reaching the target sample of project sites (3 primaries, 1 secondary, TDC and CBO) was prioritised and met, with at least one focus group at each and sometimes an additional interview.

A public holiday (Mother’s Day, 15th October) also reduced the availability of people at district level and at the teacher training college. The intended sample of one district level person was met and a mini focus group (3 participants) was held with the training teachers. This will have restricted the breadth of views.

Gender
All focus groups included some women. However, men were always in the majority and participation of women in the discussions was notably lower, perhaps partly because they had less positions of responsibility and in some cases due to language issues (see below). Often the Headmaster or Deputy (all male) dominated the discussions. Unfortunately due to time constraints it was not possible to hold more than one focus group at each school, so the inclusion of women in the main focus group was prioritised.

Language
The primary language used varied. In most cases it was Chitomboka and questions and answers were translated into/from English by CEM colleagues. In some cases, however, the Headmasters and other teachers preferred to respond in English before the question had been translated into Chitomboka. This may have excluded some participants from following all of the discussion and participating fully. On these occasions, it was specifically asked that the question be repeated in Chitomboka. In most cases, this resulted in nodding in agreement with the translated English response that had already been given, rather than generating new responses. Quotations have only been included where they were made in English rather than translated.

Focus group format
In most cases, the focus group participants had already been selected and were waiting on arrival at the school. The number and type (position, gender) was therefore already determined by the school’s interpretation of the request. In most cases there was diverse representation of different positions of responsibility as had been requested, including teachers, SMC members, EMC members, PTA members. Total participant numbers were very varied: 2 (CDSS), 6 (Mibanga), 11 (Mahowe), 19 (Uledi). For CDSS a focus group had not been formed in advance, resulting in a mini-focus group with only the Headmaster and one male teacher.

The focus groups were all held in classrooms. Due to timing constraints, the number of participants and reluctance to move large desks around, the two largest focus groups were carried out in a
classroom style format. A more informal circular format would have been preferred and may have promoted broader contribution from different participants.

CEDP-wide Teacher Survey

Sampling
The teacher retention survey provided several valuable insights into the impact of the CEDP programme. Its credibility was underscored by the fact that it captured the complete set of one type of beneficiary (teachers living in houses at the schools which have had solar systems installed). It also targeted a sample of other teachers from the same schools but who have not had solar installed on their houses. This second group was based on convenience sampling however, rather than purposive or random sampling, so it is not necessarily a representative group. Furthermore, since the total number of teachers across all CEDP schools is unknown the sample size as a percentage cannot be calculated.

Survey Design
The survey was designed in a way that was intended to minimise respondent bias. However, certain questions put to respondents may have had the unintended consequence of soliciting 'convenient' responses. In particular, questions which were designed to assess levels of satisfaction with the services delivered under the programme may have triggered respondents to provide 'polite' answers due to the perception that this would help ensure the continued delivery of services. The following responses to question 28 are illustrative of this general trend:

“We thank the Scottish Government who provided us with the gift; we are now able to do a number of things.”

“Please plead with the Scottish Government to extend electricity to the remaining five houses.”

Without concealing the true context of a survey, which would introduce ethical concerns, this respondent bias is an inevitable challenge.

Secondly, many of the questions in the survey were open ended and thus required categorisation. This entailed a degree of interpretation in the process of analysing responses and presenting the survey's findings.

Survey Administration
Survey administrators were given basic training in order to support consistency of approach and help them to gain relevant and honest responses from the interviewees. However, several of the responses suggest that some inconsistencies did arise in terms of how the questions were interpreted. In some
cases this is indicated by a response that contradicts the response given to an earlier question. These inconsistencies may have been due to a combination of factors such as unclear wording of questions, insufficient surveyor training and surveyor misinterpretation.

The ‘decentralised’ nature of the survey administration added to the challenge of ensuring consistency. Due to resourcing constraints, while the survey was designed in Scotland, it was administered in Malawi without in-country oversight from the designers, and survey data was returned to Scotland for interpretation/analysis. This made initial refinement of the survey, monitoring of survey administration and verification of results more challenging.