Project Resource

Project resources are materials which have been produced during support from the Business Innovation Facility team to a specific inclusive business project. They include inputs provided as part of technical assistance and summaries of findings and outputs. They are adapted for wider use so that other practitioners can also make use of the material.

Business Innovation Facility

Sustainable Energy for Sustainable Industries: Renewable Energy Assessment Report for Global Tea Commodities Limited

What is this resource?

This document summarises the findings of a study which assessed the potential for the development of renewable energy resources at the three estates operated by Global Tea Commodities Ltd (GTC) in Malawi. It was created by teams from Practical Action (Clement Kalonga, Lasten Mika and Drew Corbyn) and Imani Development (Iain Gatward), as part of a Business Innovation Facility project.

Why is it interesting?

The study was undertaken as renewable energy options were seen to have the potential to provide GTC with affordable and sustainable energy. The aim is to meet their current and future energy needs while sustaining both productivity and the benefits to local communities around and within these estates. Renewable energy also offers a further benefit of reducing GTC's carbon footprint from their current operations. The Business Innovative Facility provided advisory support and facilitation, as well as information and insight on innovative ways of linking private sector investment to wider community benefits.

Who is it for?

This document is relevant to other businesses who are considering the introduction of renewable energy, as there is substantial potential for the replication of the GTC case described here.

Contents

1 Executive Summary

This report summarises the findings of a study which assessed the potential for three estates operated by Global Tea Commodities Ltd (GTC) in Malawi to switch from reliance on electric power and diesel to renewable energy.

Global Tea and Commodities (GTC) Ltd was established in 1992 in the UK, where its headquarters remains to date. The Company specialises in the production and trading of tea, coffee and macadamia nuts and employs over 12,000 people internationally with offices in the UK, India, Kenya and Malawi.

In Malawi, GTC employs a total of around 10,000 people and the estates support an estimated 25,000 family members. The Global Tea and Commodities (Malawi) Ltd consists of three plantation companies, namely, **Kawalazi** Estates Company Ltd (Northern Malawi), **Sable** Farming Company Ltd and **Makandi** Tea and Coffee Estates Ltd (Southern Malawi) – these are all wholly owned by the UK Company.

The Business Innovative Facility was engaged to assess the potential for the development of renewable energy resources at three GTC sites of Makandi in Thyolo District, Ngapani in Mangochi District and Kawalazi in Nkhata-Bay District. Imani Development and Practical Action worked on the assessment.

An assessment of the energy options for the three estates was undertaken. This included a review of literature in line with Government of Malawi renewable energy targets and policy framework as well as other relevant renewable energy documents. Field visits were undertaken in order to document the baseline energy situation at the GTC sites as well as making energy demand projections and assessing carbon financing potential from possible low carbon initiatives. A summary of the findings and recommendations is provided among the three main proposals shown below.

The energy options are calculated as "stand alone" proposals. If more than one proposal is identified per site then total energy saving will be less than a simple addition of the proposals.

Estate Name	Options Identified	Savings/Benefits
Makandi	• Improved heat efficiency • Wind energy option	• Firewood savings 560m3/yr • Carbon savings 789 tonnes/yr • Demand savings 2,400 kVA/yr • Total savings US$55,200 • Investment Cost US$200,00 • Payback 3 years
Kawalazi	• Improved heat efficiency • Installation of Mini Hydro Plant	• Demand savings 3,600 kVA/yr • Diesel savings 91,000 litres/yr • Carbon savings 244 tonnes/yr • Total cost of savings US$85,247/yr • Investment Cost US$500,000 • Payback period 6 years
Ngapani	• Grid extension	• Diesel savings 45,500 litres/year • Carbon savings 122 tonnes CO2 per year • Cost of grid extension US$250,000 • Cost demand per year due to grid US$110,400

Table 1 Energy saving possibilities at GTC.

The proposed energy measures are an estimate and should undergo specific detailed technical review and investment calculations based on tenders before final implementation. The assessment found reasonable energy intervention options in all but one estate Ngapani. It is thus recommended that detailed feasibility studies are carried out on Makandi and Kawalazi Estates.

The exercise should help to collect further information to allow for detailed and specific investigations in the identified areas of intervention. At Makandi it is recommended to carry out energy efficiency interventions and analyse the potential of the wind. At Kawalazi, it is recommended to carry out detailed technical studies for the installation of the mini-hydro. At Ngapani, grid extension, while being the feasible option, the cost-benefit indicates that it will be negative unless other economic factors are considered such as improved production and welfare.

2 Introduction

The Global Tea and Commodities (Malawi) Ltd consists of three plantation companies, namely, Kawalazi Estates Company Ltd (Northern Malawi), Sable Farming Company Ltd and Makandi Tea and Coffee Estates Ltd (Southern Malawi) – these are all wholly owned by the UK Company. The three estates make up a total of around 17,000ha. All the GTC operations in Malawi have been very successful in increasing the production per unit area since acquisition. All policy and group-level management comes from the Group Office located at Makandi; otherwise, each plantation has a General Manager to run the day-to-day operations.

GTC produce 17% of the tea in Malawi with 60% sold at auction and 40% to private buyers, all the tea produced is Rainforest Alliance certified. 6.5% of this tea production comes from smallholder farmers to a total of around 364 tonnes per year. 33% of the tea is FAIRTRADE Certified. The tea is particularly attractive to buyers because of the low pesticide use in Malawi and distinctive red colour. GTC are the biggest producers of coffee in Malawi with 60% of the market and 800t of production each year. They are also the largest producers of macadamia nuts in the country with 700t of production and 40% of the market.

GTC are committed to sustainable development at all of its sites in Malawi and have worked towards socio-economic development through working with local communities on projects such as education, health care, crèches and clean drinking water. GTC also have a strong commitment to the environment and reducing environmental degradation at the sites through distribution of tree saplings and education and implementation of best practice methods for farming.

Both Makandi and Kawalazi are Rainforest Alliance certified and Sable is going through the application process, which means they adhere to strict economic and social criteria but with a particular focus on protection of the environment and ecosystem conservation. Kawalazi is also Fairtrade certified for both the factory and plantation tea. Although Fairtrade does consider the environment, their key focus is on social standards for workers.

Neither Rainforest Alliance nor Fairtrade have specific criteria relating to climate change or renewable energy, but both have released some statements. There is a climate change mechanism known as Reduced Emissions for Deforested and Degradation (REDD) whose objectives are very similar to those of Rainforest Alliance.

It is their interest in working towards environmental protection and mitigating the impacts of Climate Change that has lead GTC to discuss the potential for renewable energy systems in Malawi. GTC are also keen to see how reduced carbon emissions from their operations could contribute to Carbon Credits and Finance in Malawi.

3 Energy consumption

The current state of energy demand and supply at each of the three estates is provided. In this section an explanation of the state of affairs for each estate is provided.

Makandi Estate

Makandi Tea and Coffee Estates Ltd (hereafter referred to as 'Makandi') is in the Thyolo region of Malawi and comprises of the Chisunga and Mindale estates. The estates were purchased in 2004 and have a land area of around 4,500ha producing tea, coffee and macadamia nuts.

The tea processing factory as Makandi is one of the largest in the world under a single roof with the capacity for processing up to 250t green leaf per day. Having such high production capacity means that the factory also has an associated high power requirement of around 2.5MW. As well as power for the factory there are also 84 individual ESCOM connections, each requiring a separate meter reading and costing in the region of MWK10million (approx. US$70,000 per month). Due to unreliability of ESCOM supply and the sensitivity of the products, Makandi has installed standby diesel generators which are detailed in Table 3.

Table 2: Status of Standby generation at Makandi.

Generator type	Existing capacity (kVA)	Proposed capacity	Remarks
Catapillar	500	N/A	
Perkins	670	N/A	
Detroit	1050	-	To be decommissioned
2 x new generators		1300 (for the two)	To be commissioned
	2220	2370	Increase by 6.8%

The generators run for around 500 hours each year and consume on average 51,000 litres of diesel per annum. Malawi has been experiencing scarcity of diesel in the past few months despite a sharp increase in price. The issues relating to the lack of diesel in Malawi have been escalating in recent months and are largely attributed in the media to the lack of foreign exchange and therefore lack of funds to import the commodity.

Firewood is an important source of energy to meet the heating needs of the factory. It is approximated that 2,800m3 of firewood is burned every year with 1m3 of wood required for every 215kg of tea produced. Of this firewood 70% is grown and managed on estate land and 30% must be purchased from outside sources. Management reported a problem of illegal harvesting of timber/ firewood which has affected the yield of firewood from its own forests.

Firewood storage near boiler house

Electricity needs of households are met by the national grid supplied by ESCOM. Makandi has also already introduced improved stoves to its junior staff as well as kitchen facilities providing food to its staff. Despite the positive outlook, power outages due ESCOM load shedding have affected the factory operations forcing management to invest in standby generation capacity which is at 2220kVA.

Kawalazi

Kawalazi Estates Company Ltd (Hereafter referred to as 'Kawalazi') produce tea and Macadamia nuts and comprises the Kavuzi tea estate and Mzenga and Tihomane macadamia estates. The total land area is 8400 ha and this was the first operation in Malawi purchased by GTC in 2000.

In terms of energy supply and consumption, Kawalzi Estate is on ESCOM lines. In addition it has heat sources and apparatus for steam production. Steam from the boilers is used to produce electricity at Kawalazi. These are run from waste of the macadamia nuts. These pictures show some of the major energy generating devices at Kawalazi.

Thomson boiler at Kawalazi

Standby generator at Kawalazi

Steam turbine

Sable Farming Company Ltd

Sable Farming Company Ltd (Hereafter referred to as 'Sable') comprises the Mapanga division in the South and the Ngapani division in the East of Malawi). The company produces coffee and macadamia nuts on around 4,500ha of land and houses the only integrated milk and processing diary in the country. The farms were purchased in 2000 at the same time as Kawalazi. There is a macadamia factory, tea factory, the boiler house and junior staff houses as the main energy consuming centres.

The key issue that has been highlighted by Sable management is the lack of ESCOM power supply in the Ngapani region. Ngapani Estates is the only one out of the three GTC estates that is yet to be connected to the national electricity grid. They currently rely on diesel power generation.

On an annual basis, Ngapani currently require 90,000 litres of diesel each year to power the generators at the site. The energy consumption is an equivalent of 750 MWh per annum and it costs approximately (US$135,000) per year on diesel fuel alone. Due to current shortages of diesel and that it is available on the parallel market makes this figure even lower. As a result the estate is limited in the amount of processing they can do with the coffee and as a result it is transported to Blantyre for secondary processing. The plans for the estate are to invest in 110KW processing plant, which would employ as many as 200 workers. The power requirements are likely to increase in the coming years as the macadamia plantations mature and the load needed could go up to 280KW.

At Ngapani, junior members of staff reside in 'villages' that are completely without access to modern energy. There are 620 workers houses on the estate and these are without access to energy. According to the management they have ambitions to improve the living conditions of the workers by providing energy that is adequate for lighting and heating purposes. At least they require 0.1kW (according to management) for lighting purposes.

3.1 Prior energy alternative efforts

3.1.1 Past Energy Alternatives:

Kawalazi has high potential for hydro-electric power generation. This confirms earlier assessments done in 1979 when the estate was being run by Malawi Government through ADMARC. As regards household energy needs for its labourers, Makandi has already disseminated energy saving wood stoves for junior staff houses, replacing the traditional 3-stone cook place.

3.1.2 Energy management:

There is no energy management strategy that is put in place by the company. Although meter reading for energy and water is available, the fuel consumption is not metered. Currently the information gathered on energy and water is mainly for accounting purposes.

3.2 Heat consumption

Biomass is a major energy source for boilers that produce process heat for the factories at both Makandi and Kawalazi. Potentially this would be the case for Ngapani if it were to go into coffee processing soon. Biomass is also the principal source of energy at household and institutional levels at all the three sites. The main source of heat is biomass on all the three estates. The table below shows the estimated heat generated at the estates for the steam boilers. All heat is produced from biomass which was used in the steam boilers. Sable estate is the only one without steam production and use.

Heat Consumption at each estate	**Fuel Source**	**Fuel consumption (m3)**	**Fuel consumption [MWh]**
Mapanga Estate	Firewood	2,800	8,867
Sable Estate	None	0	0

Table 3.1 Fuel consumption at the three GTC Estates.

3.3 Power consumption and demand

The power sources include the ESCOM and diesel fired generators. The tables below show the demand and consumption by the utility and the on-site generation. There are no power meters besides the main power meter so the figures in the table below are calculated from experience.

	Annual Power consumption [MWh]	Average Demand per month (kVA)
Makandi Estates	Not given	2,500
Kawalazi Estates	Not given	880
Ngapani Estates	0	0

Table 3.2 Power consumption and demand by Estate from Utility.

Additional information is required for the energy consumption and demand at the two estates namely Makandi and Kawalazi Estates.

There is no grid available at Sable Estates and power is considered in table below.

	Generator Size (kVA)	Fuel Consumption (litres)	Annual Power generation [MWh]
Makandi Estates	2,200	51,000	496
Kawalazi Estates	Not given		
Ngapani Estates	218	90,000	875

Table 3.3 Power consumption from on-site generators (Assume 60% combustion efficiency, diesel 35 MJ/litre).

There is limited data for the standby generation on Kawalazi Estates for a complete analysis.

3.4 Energy and demand prices

The energy prices in Malawi for the purposes of this study are 0.016 US$/MWh$_{power}$ and 105US$/MWh$_{heat}$ (diesel). The cost of energy demand is 23 US$/kVA.

4 Energy Supply Options

In this section we analyse the energy options considered at each site. The table below uses a qualitative assessment of the potential options that could possibly be considered during the detailed study. The table is an indicator of the various options.

Table 4: RES options for GTC sites

	Energy source or technology	**Status/ Availability of the energy source/technology at the sites**		
		Makandi	**Kawalazi**	**Ngapani**
1.0	**Biomass Potential**			
1.1	Improved HH stoves	√	√	X
1.2	Improved institutional stoves	√	√	X
1.3	Process heating	√	√	X
1.3	Biogas	X	x	X
1.4	Briquettes	X	x	X
1.5	Steam turbine	X	√	X
2.0	Solar Energy Potential			
2.1	Solar PV	√	√	√
2.2	Solar thermal	√	√	√
2.3	Solar water pumping	X	x	X
3.0	Wind Potential			
3.1	Wind power generation	√	x	X
3.2	Wind water pumping	√	x	X
4.0	Mini/Micro hydro power	X	√	X
4.1	Electricity generation	X	x	X
4.2	Motive power	X	x	X

4.1 Makandi Estates

Two main areas for energy interventions are considered for Makandi. One of the areas is energy conservation it relates to improving efficiency of energy generation leading to potential carbon emission reduction and secondly we look at replacing the reliance on the diesel generators with a potential option of replacing it with renewable energy options. As indicated in the table above, at Makandi it was observed that there is potential for alternative energy sources that include biomass, solar and wind.

Energy Efficiency Options
There are energy efficiency opportunities at the boilers (although further analysis is needed on boiler efficiency). From experience potential savings of at least 10% can be made on boilers which can lead to reduced firewood consumption of approx. 280m^3/year. This will result in energy saving of approx. 887 $MWh_{heat.}$ The current equivalent carbon emission by the boilers is estimated at 3940 tonnes of CO_2. Thus the intervention will result in 394 tonnes of CO_2 being saved.

Renewable Energy Options
Wind power
Makandi shows very high potential for wind turbine to generate electricity. A picture of a tree taken on site at Makandi shows that high wind speeds are available at sometimes and this information has been corroborated by the people who live in the area. There is no wind data available on site and estimates provided by the RETScreen are available and have been used for estimation of power generation as an additional option to unreliable ESCOM and reducing the demand.

It is recommended to carry out detailed technical analysis of the wind speed and regime before investing into a wind power plant.

Solar Power
Potential for both solar thermal and photovoltaic is high at the sites. The table below shows satellite data from RETScreen and EU GIS Software showing the available solar radiation. The feasible use of the solar would be for the purposes of preheating boiler feed water to save on energy consumption and demand. 20% saving on biomass use for process heat is estimated. This is equivalent to 560m3 of firewood leading to carbon saving of 400 tonnes of CO_2.

4.2 Kawalazi Estates

Historically Kawalazi Estates has been identified with a potential for hydro power generation. These assessments date back to 1979 when a feasibility study was undertaken to quantify the potential for a hydro-electric development on the Lichelemu River. The report, which was kindly provided by estate management, includes some basic information on hydrology, geology and topography, but is quite basic owing to the equipment available at the time of writing and it is likely that conditions have changed to some extent in the 32 years since the survey was undertaken. The report does conclude that there is water available to generate up to 750kw, 1MW and 2.5MW from the river, so this is at least a preliminary indication that hydro power is feasible at Lichelemu. Options for Kawalazi are basically energy efficiency and harnessing the power of water to generate on site power for the estate and these are considered.

Energy Efficiency Options
There are energy efficiency opportunities at the boilers (although further analysis is needed on boiler efficiency). Due to lack of technical information no further analysis is done although it is recommended for next phase.

Kawalazi has also potential to disseminate improved firewood stoves for households. It is proposed that a technology transfer arrangements where women within the estates could be trained as entrepreneurs to produce the stoves by a women trainer group based in the same district, at Chintheche. This is in line with enhancement of BIF goals of empowering the local communities

Renewable Energy Options
There is high potential for hydro-electric power generation. Two sites were proposed by management but on the ground it was observed that only Lichelemu water system showed potential in terms of head and flow rates, and hence generation capacity. There are reports that allude to potential mini hydro plant of 2MW to 3 MW capacity. The site at Kavuzi Weir has low head and flow rates, and hence very low generation capacity. Thus, the Lichelemu water system

was taken further for a detailed feasibility study. The generation site could either be at the break tank, which would demand additional transmission costs.

Our own assessment given the technical parameters at the site showed that with the current infrastructure it is possible to generate 300 kW of hydro power at the site. The investment would be about US$500,000 again we estimated this since most of the infrastructure exists. The Power generation will be 600 MWh per year translating into a Carbon saving of approximately 200 tonnes per year. At a cost of US$10 per unit this would translate to US$2,000 per annum of GHG equivalent. The saving of demand per year will be approx. US$100,000 per year giving a payback period of roughly 5 years. But proper calculations will be required to make a good estimation. Again if we can increase the power to 1 MEGA then we can potentially gain much more and reduce the payback time.

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4.3 Ngapani Estates

At Ngapani the main energy source for the operations is a diesel generator set. The general workers currently have no access to modern energy and rely on traditional energy sources. The lack of grid power at the estate and the unreliability of diesel in the country has constrained expansion plans at the Estate.

The diesel generator consumes 90,000 litres diesel per year. Thus the energy generation is 750MWh per year. Translating this to a cost of US$135,000 per year of fuel. The emission is 3 MWh per tonne of carbon.

Solar Photovoltaic for Households

Communities at Ngapani particularly the junior members of staff in 'villages' are without access to modern energy sources for cooking and also for lighting, power for radio and TV. Sable Farming is considering constructing a communal hall and using solar PV with entertainment facilities at each of the village sites, as well as providing solar PV street lights. A simple solar home systems and lanterns could be provided to households for use as lighting sources. For cooking look into introduced fuelwood efficient stoves to address the cooking needs of the communities.

	Description of product	Cost (MK)	Approximate cost (US dollars)
1	Low cost kit : LED lamp, connectors for radio and phone ("Tough Stuff")	7,349.00	42.00
2	5 lights + radio (50W panel)	175,750.00	1,005.00
3	5 lights +TV+radio (2x80W panels)	331,250.00	1,893.00
4	9 lights +TV+radio (2 x 80W panels)	371,450.00	2,123.00
5	12 lights +TV+radio (2 x 80W panels)	401,600.00	2,295.00
6	Street lights (per 5 lights)**	175,750.00	1005.00

Grid Extension

Currently, the Electricity Supply and Corporation of Malawi (ESCOM) is extending the grid to Bakhresa Wheat Estates located about 15 km from Ngapani. Thus for medium term planning, Sable Farming should gear consider to be linked to the electricity grid from Bakhresa since the previous efforts to get connected through an alternative site that is about 12 km from the estate passing through the Mizimu Forest was not accepted due to environmental reasons. The cost of extending grid by ESCOM is in the range of US$12,000 per kilometre. This would translate to around US$180,000 excluding contribution to the cost of transformers which is about US$10,000 per transformer. Thus the total investment is estimated at US$250,000. However the tariffs would have to be factored in at approx. US$70,000 per year. The saving on diesel will be approximately 50%. This is equivalent to US$67,500 per annum. The emission savings would be from diesel generator limited use that would translate to 122 tonnes of carbon savings per year.

5 Energy Proposals

Estate: Makandi	Energy proposal measure No.:1	Date: 07-05-2013
Energy proposal measure: Improving efficiency of energy generation and use leading to potential carbon emission reduction and secondly we look at replacing the reliance on the diesel generators with a potential option of replacing it with renewable energy options.		Page: 1 of 1

Present situation:
Biomass is a major energy source for boilers that produce process heat for the factory at both Makandi. Unreliable power available from ESCOM affecting production at the Estate.

Energy proposal:
Improved boiler efficiency by introducing solar heating of boiler feed-water and other energy saving measures that lead to reduced firewood consumption.
Look into the medium term plan to investigate the viability of the wind option as a compliment to the power supply at the Estate.

Heat saving: The introduction of boiler heat efficiency will result in estimated saving of 20% of firewood.
*Wood savings = Annual Wood Cons (2800m^3/year) * 20% saving = 560 m^3/yr

Carbon emission savings 1 tonne of wood equivalent to 1 tonne of CO_2 (wood density is 0.71 tonnes/m^3) Annual CO_2 savings = 560m^3/yr/(0.71tonnes/m^3) = 789 tonnes CO_2

Cost of Savings
Annual Carbon Savings (789 tonnes/yr)* Cost per Unit of CO2 (US$10/tonne) = US$7,890

Power saving:
Introduction of alternative renewable energy system using wind power to reduce demand and energy consumption. It is estimated that savings of 200kVA per month will be attained.

Demand saving:
200 kVA/month*12 months = 2,400 kVA/year

Saving:
Demand component
2,4000 kVA/year * US$23/kVA = 55,200 US$/year

Investment:
The estimated investment is in solar water heating system and wind installation of 200kVA and that will be app. 200,000 US$.

Payback period:
(200,000 US$)/(55,200+7,890 US$)/year = 3 years

Remarks:
- Investigate further potential on wind
- Carry out detailed analysis of boiler efficiency and process heat utilization with a view to saving firewood consumption.

Estate: Kawalazi	Energy proposal measure No: 2	Date: 07-05-2013
Energy proposal measure: Energy efficiency opportunities at the boilers (although further analysis is needed on boiler efficiency). Installation of mini-hydro system (300kW)		Page: 1 of 1

Present situation:
There are energy efficiency opportunities at the boilers (although further analysis is needed on boiler efficiency). Factory using a diesel backup generator and need to look into alternative clean energy and also averting the serious diesel challenges which disrupt production.

Saving proposal:
Enenrgy efficicncy measures are recommended for the boiler system to save on biomass. The current levels of biomass utilisation are not yet established.
Introduce a mini-hydro power plant to provide own on-site power generation that is clean and renewable.

Heat saving: To be further investigated

Power saving:
Utilise the existing irrigation infrastructure to build a mini-hydro power plant. Assessments done on site indicate that with current infrastructure the power generation is limited to 300 kVA although potential for more can be investigated. On site power generation will result in reduction of plat demand and also energy consumption overally.

Demand saving:
The annual demand savings = 300 kVA/month * 12months/yr = 3,600 kVA/year
Cost of demand savings = 3,600 kVA/year * US$23/kVA = 82,800 US$/year

Carbon saving:
The diesel generator at Ngapani has similar capacity to the proposed mini-hydro generator. Based on the data from diesel consumption at Ngapani we assume that it will be the equivalent diesel emission savings achieved by replacing that generator. The consumption per year is 91,000 litres and the CO2 equivalent is 2.689 kg/l of diesel.

Saving:
91,000 litres/year * 2.689 kg/litre = 244,699 kg CO_2/year
Cost of CO_2 per annum
244,699 kg/year * US$10/tonne *0.001 tonnes/kg = US$2,447 CO_2

Investment:
The investment will be in a mini hydro power plant mainly the power house, transmission cables, generator, turbine and control equipment. The total investment is approx. 500,000 US$.

Payback period:
500,000 US$ / (2,447 + 82,800) US$/year = 6 years

Remarks:
- The data for boilers was not given and neither was the energy bill.
- Further detailed investigations recommended for the mini hydro and the efficiency measures

Estate: Ngapani	Energy saving measure No.:3	Date: 07-05-2013
Energy proposal measure: Seek alternative reliable power supply source for the estate to reduce the diesel consumption. Improve access to modern energy for the 620 households at the estate.		Page: 1 of 1

Present situation:
The estate is not connected to the national grid and currently uses a diesel generator for the operations. Diesel is in short supply affecting the operations at the estate and limiting the scope of activities. The workers are without modern forms of energy and have to rely on traditional energy sources such as firewood. Approximately 620 households are on the estate and affected.

Energy proposal:
An option considered is to connect the estate to the national grid to a place 15km away. This is a medium term plan as the grid to that place is still under construction. The other proposal would be to provide the 620 households with improved firewood stoves and solar home systems.

Heat saving:

Power saving:
Installation of grid to Ngapani estate which is 15 km. Due to power cuts we anticipate 50% savings from the diesel generator.

Diesel saving: 50% of 91,000 litres/year = 45,500 litres/year

Cost of saving: 45,500 litres/year * 1.50US$/litre = 68,250 US$/year

Carbon saving: 45,500 litres/year * 2.689 kg CO2/litre = 122 tonnes CO2/year

Cost of carbon saving: 122 tonnes/year * 10 US$/tone = US$1,220/year

Investment:
The investment in power line 15 km is set to be app. US$250,000 (made up of cost of US$12,000/km, transformers and labour).
Estimated cost of energy bill from ESCOM:

Cost of energy demand:
400 kVA * US$23/kVA * 12 = US$110,400/year

Payback period:
There are negative savings.

Remarks:
- The savings in diesel will be less than the increased cost in electricity bill. Thus alternative options need to be considered for Ngapani Estates.
- Other economic benefits will have to be factored in for the option to be considered.

6 Recommendations

The assessment found reasonable energy intervention options in all of the estates. At Makandi it is recommended to carry out energy efficiency interventions and analyse the potential of the wind. At Kawalazi, it is recommended to carry out detailed technical studies for the installation of the mini-hydro. At Ngapani, grid extension is recommended.

A final word from the authors.....

"There are feasible renewable energy options at Makandi and Kawalazi Estates. Potential energy efficiency options are also identified for the process heat at the two factories. At Ngapani, the most feasible option was grid extension to the estate. We conclude therefore that detailed studies with a view to implementing the proposed measures be undertaken at Makandi and Kawalazi Estates.

Energy access is an increasingly prominent issue for development stakeholders in Malawi. Some effort has been made towards localised renewable energy initiatives, but most of these have been limited to small-scale pilots with limited coordination. Since the potential for renewable energy is substantial in Malawi, the case described here for Global Tea & Commodities Limited (GTC) has great potential for replication with other businesses and sites."

8 Further Information

This report summarises the detailed assessments of technology options, viability, constraints and associated costs. A detailed report was submitted to GTC to assist in energy supply decision making.

More material on this topic can be found in the **Know–how** section of the Practitioner Hub – Climate-smart solutions

This includes a **Checklist:** Developing a climate change strategy for business – how can I adapt my business to meet the challenges of climate change?

To view other **Project Resources**, go to: Practitioner Hub on Inclusive Business: www.businessinnovationfacility.org

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Practical Action works alongside communities to find practical solutions to the poverty they face. We see technology as a vital contributor to people's livelihoods. Our definition of technology includes physical infrastructure, machinery and equipment, knowledge and skills and the capacity to organise and use all of these.

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