Integrated Southern Africa Business Advisory (INSABA)

Assessment of Business ideas for the productive use of RE in Zambia

Report for Deliverable 3.2 and 3.3

Prepared by CEEEZ, Zambia

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1. Identifying Business ideas for productive use of RE in Zambia

1.1 Process of identifying project ideas:

CEEEZ as INSABA SC identified and trained IAs namely members of the National Technology Business Centre (NTBC), the International Development Enterprises (IDE), SNV Zambia, and Sylva Catering. These IAs together with CEEEZ selected Mkushi, Chibombo, Katuba and Mungwi as pilot regions and identified entrepreneurs in these regions based on consultations.

1.2 Development of business plans

CEEEZ, IAs and entrepreneurs in the pilot regions together undertook market assessment on

- solar drying;
- honey processing,
- PV pumping for irrigation,
- PV telecenters, and later on
- electricity generation using multi-function platforms from biomass (Jatropha) as source for combustion purposes.

Five business plans on irrigation, honey processing, telecentre, solar drying and biomass electricity generation for income generation were completed. IAs, SC and SMEs-SP together were able to design and select technologies for production of goods and services as summarised below.

1.3 Financing of business ideas

CEEEZ is an AREED-Member and has therefore access to funds to realize certain actions if the economical conditions fit into loan-conditions from AREED. However, it is difficult to meet these conditions. In this aspect the INSABA tools were very helpful.

However, there is need to devise other innovative financing mechanism for implementation of such businesses due to their apparent risks. “Normal” banks would not cover these programs in Zambia.

1.4 Implementation of business plans

While the solar drying and telecenter businesses are already running, as described below, the PV pumping for irrigation and bio-diesel project are in their early stage of implementation. Only the Honey processing has not put into practice yet.

The business plans which have been developed in this project are replicable. The first action will be to synergise them in the AREED 11 programme with financial support required for their implementation. AREED 11 with support from SIDA will focus on financial support for relatively high risk energy businesses in rural areas.

1.5 Lessons learned

- Potential for increased production and improved quality of good and services to include agro processing, farm produce,
- Communication/Telecommunication is evident, vital and possible in particular for rural areas
- The challenge lies on the need to ensure that the market for goods and services exists and suitable renewable technology is appropriately designed

2. Description of business ideas

2.1 Solar Drying

Title: **Sylva food solutions**

Objectives of the project: To dry indigenous vegetables

Justification for INSABA: Sylva catering has a good market base of sale of indigenous vegetables with renowned supermarkets, however prior to the implementation of the project, the vegetable were being sun dried thereby affecting quality and productivity, Because of this limitation, Sylva catering as part of the INSABA process requested for improved solar drying which is capable of improving the quality and production.

Technology and system design: The solar drier based on the design in figure 3.3 selected in this business plan has an input capacity of 10-15kg of fresh vegetables per batch and an output of 5-6kg of dried vegetables. The drying period is one and half hours per batch and three batches per day. With this capacity, the 50 solar driers installed are capable of producing over 150 tonnes per year of dried vegetables. For the purposes of this business plan 100 tonne per year of dried vegetables was budgeted for at a price of US$ 0.13 per unit (250 gram)

Given in table 3.10 are unit prices of various dried vegetables

Table 3.10 Unit prices of various dried vegetables

Description	Unit/ Quantity [g]	Selling Price US$
Pumpkin leaves	250	1.30
Cowpeas	250	1.30
Black Jack	250	0.70
Bean Leaves	250	1.30
Sweet Potatoes	250	1.20

Pre-Screening

Based on the investment cost, production cost and selling price of combined packs of 250 gram per pack dried vegetables, given in the table 3.1.1 a pre-selection assessment was done and results are shown on table 3.1.2

Table 3.1.1 Production cost of dried vegetables

Product	Production 250g units	Production cost US$	Selling price US$/kg
Combined packs	396000	0.8	1.32

Table 3.12 pre screening assessment

	Solar Drying	
Investment Capital	110,000	
Investment Lifespan	10	
Production	396,000	
Price/unit	1.32	
Revenue	522,720	
Variable cost/unit	0.80	
Cost of energy/unit		
Total fixed costs	131,000	
Amortization/unit:	0.03	11,000
Direct costs per unit:	0.83	327,800
Gross Margin/unit	0.49	
Fixed costs/unit	0.33	
Total costs	1.16	458,800
Net Margin	0.16	**63,920**
ROI	**58%**	
Payback period years	**1.47**	

Table 3.13 Financial

Item	Year 1	Year 2	Year 3
Revenue	528,000	528,000	528,000
Direct costs	316800	316,800	316,800
Over heads	131,000	131, 000	131,000
Net profit	35,528	46,513	62,000
Cash flow	291,377	175,926	248,967

2.2 Telecentre

Title: Telecentre.

Objectives of the project

Provision of telecentre business to include email, internet browsing and telephoning to rural communities.

Justification for INSABA

Market base for this business idea is based on the study undertaken by UNIDO and GEF on “Renewable energy promotion through ICT in off grid rural communities using the Ministry of education, zonal teacher resource centres as multipurpose telecentres”

The study undertook a comprehensive assessment and identified 47 potential centres through out the country. Introduction of telecentres is important as it will improve communication between rural area and cities. The telecentre will also provide for example information on how to grow different crops and added value to farmers. It will also provide among others information on prevailing prices of farm products on the market floors in Lusaka.

Technology and system design

The proposed telecenter design for Chibombo is based on the use of 5 computers. Because of the large load of the Telecenter it is recommended that the DC operational voltage is 24V. This voltage is converted to 220-240VAC using an inverter.

There was a permanent discussion however, whether a user in rural areas should pay high prices for energy for Telephone-and Internet services whilst the price for energy in cities receives a high subvention. With new technologies however, which came up recently in the information-and telecommunication sector energy consumption can be reduced considerably which would lower the energy-demand of internet[1]. As a consequence the ration between rural telephone and rural internet-access would change.

[1] http://www.linutop.com/linutop2/index.en.html

Given in table 3.1.4 are the system design and related cost

Table 3.1.4 The system design and related cost

System calculation [Table 4.1 : Power System Cost, highlighted data are variables]

Energy	number	hrs/day	usage	power (W)	total(W)	Wh
PC	5	10	50%	300	1500	7.500
Internet hub	1	10	100%	10	10	100
Telephone	2	10	60%	10	20	120
Printing	0	10	5%	300	0	-
Faxing	0	10	5%	30	0	-
Printer/fax standby	0	10	95%	30	0	-
Lights	2	10	20%	15	30	60
						7.780
					efficiency	90%
					Wh required	8.644

Investment Costs	#	Unit cost US$	Cost US$
Solar panels (Wp)	1729	7,1	12.275
Batteries (Ah)	2561	1,8	6218
Controller (30A)	3	175	525
Inverter (2400W)	1	1.550	1.550
Installation components	1	200	200
PC	5	1.260	6.300
Internet hub	1	30	30
Telephone	2	30	60
Printer/fax machine	0	400	-
Software	1	50	50
Chairs + tables	1	300	300
Cost for registering business	1	100	100
		Investment	27518

Rent	1	50				50
Insurance	1	30				30
Maintenance	1	10				10
Salaries	2	100				200
Broadband provider charges	1	100				100
Battery replacement	1	170				170
					Expenditure/year	6.723
Income	#	hrs/day	Use	min/year	US$/min	Income/day
PC for Internet	5	10	50%	450000	0,04	60
Telephone	2	10	60%	216000	0,5	360
					Income/day	420

Pre-Screening

Based on the investment cost, production cost and selling price of internet and telephone services, given in the table 3.1.5, a pre-selection assessment was done and results are shown on table 3.16

Table 3.15 Production, production cost and selling price

Product	Production (minutes)	Production cost US$	Selling price
Internet	22500	0.004	0.04
Telephone	108000	0.008	0.4

Table 3.1.6

	Telecentre	
Investment Capital	27,518	
Investment Lifespan	5	
Production	300	
Price/unit	174.00	
Revenue	52,200	
Variable cost/unit	0.06	
Cost of energy/unit		
Total fixed costs	7,000	
Amortization/unit:	18.35	5,504
Direct costs per unit:	18.41	5,522
Gross Margin/unit	155.59	
Fixed costs/unit	23.33	
Total costs	41.74	12,522
Net Margin	132.26	**39,678**
ROI	**144%**	
Payback period years	**0.61**	

Table 3.1.7 **Financial analysis**

Item	Year 1	Year 2	Year 3
Revenue	62,640	62,640	62,640
Direct costs	3132	3132	3132
Over heads	7,000	7,000	7,000
Net profit	34,156	14.205	14,205
14,Cash flow	49,777	47,618	56,362

2.3 Biodiesel Production for Use in Integrated Rural Energy Services Application

The business model developed is based on the concept for biodiesel production for use in integrated rural energy services application as illustrated in figure 3.4

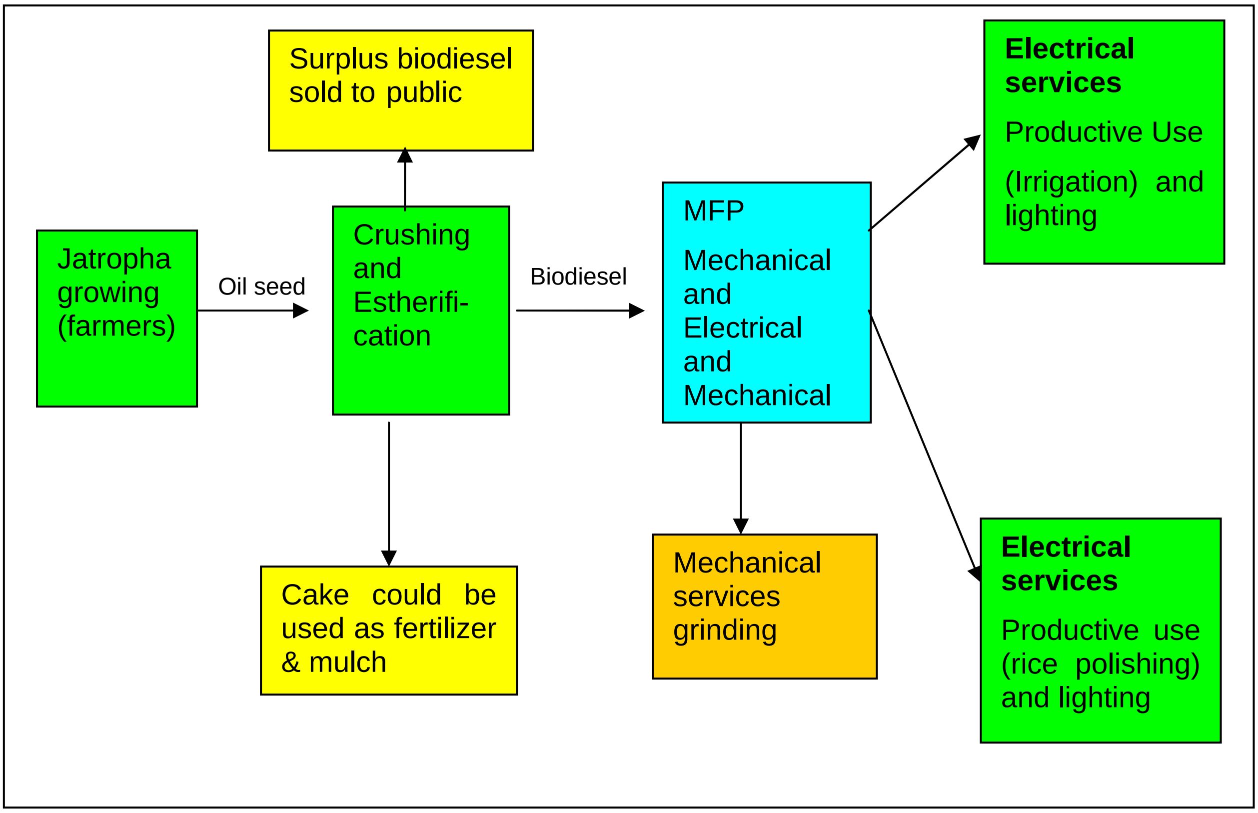

Figure 3.4 Integrated rural energy services application

2.3.1 Biodiesel Production

Title: Biodiesel Production

Objectives of the project: To produce biodiesel to be sold to multi function platform who will in turn sell electricity services to two satellite centres for irrigation, and rice polishing, respectively.

Technology and system design

The project area which has been selected to test the business model is Mungwi sub district in Kasama district which is 800 km from Lusaka. Mungwi is currently actively involved in Jatropha through the Mungwi Jatropha Farmers Group and District Business Associations.

To date, there is an hectarage of 100 ha already planted with Jatropha and should be ready within the next two years. It is likely that the action will have a positive result because it is a fertile region and high rainfalls with around 1400 mm/year.

The business model being proposed involves creation of a small centralized processing plant at Mungwi with a capacity of 300 liters per day of biodiesel produced. The plant will use the Jatropha from the already planted and produce 90, 000 liters per annum of biodiesel to sell to 2 satellite centres with potential for income generating activities and surplus to the public

The investment cost is estimated at US $ 15, 000.

The total production of biodiesel from this plant is 90,000 litres/annum out of which 21, 900 liters will be sold the two multi-functional platform centres producing electricity to sell to a village set up and rice processing mill, situated 50km from the national grid. The surplus of 68,100 liters will be sold to the public for use in stationary engines and tractors etc. Based on the investment cost, O&M cost and selling price of biodiesel, financial analysis is summarized in table 3.1.8

Table 3.1.8 O&M cost and selling price of biodiesel

Material	Cost/ tonne US$/t	Quantity (tonne)	Final Cost US$
Feedstock	120	250	30,000
Methanol	400	20	8,000
Potassium hydroxide	1,200	1.5	1800
Additives	85	1.5	128
Labour cost			3000
Depreciation over tem year period			1500
Total Cost			44,428
Unit production cost of biodiesel per litre			0.50
Tax at 15%			0.575
Selling Price at 20% margin			0.69

To ascertain the viability of the biodiesel plant a pre-screening analysis was undertaken as shown in table 3.1.9:

Table 3.1.9 Pre Screening for biodiesel plant

	BIODIESEL	
Investment Capital	**15,000**	
Investment Lifespan	**10**	
Production	**90,000**	
Price/unit	**0.70**	
Revenue	**63,000**	
Variable cost/unit	**0.50**	
Cost of energy/unit	**0**	
Total fixed costs	**10,000**	
Amortization/unit:	**0.02**	**1,500**
Direct costs per unit:	**0.52**	**46,500**
Gross Margin/unit	**0.18**	
Fixed costs/unit	**0.11**	
Total costs	**0.63**	**56,500**
Net Margin	**0.07**	**6,500**
ROI	**43%**	
Payback period years	**1.88**	

Some of the bio diesel to be produced will be sold to two satellite centres with a good potential for income generating activities. The first centre will use biodiesel in a 10kW multifunctional engine for electricity generation for providing water required for irrigation in the area, light up 50 houses, 1 school and 1 rural health centre. To the platform will be connected a hammer-mill for maize grinding for selling in the locality. The second centre will also use biodiesel for making electricity to drive a rice polishing mill in an area currently growing rice. This additional investment will add value to the rice which is currently being sold and polished. Given in table 3.20 is the O&M Cost and electricity price from the multi functional platform.

Table 3.2.0 O&M and electricity Price from the multi functional platform

Material	Cost/ tonne US$/t	Quantity (tonne)	Final Cost US$
Biodiesel	0.7	10,950	7555.5
Labour cost			3000
Depreciation over tem year period			800
Total Cost			11355.5
Unit production cost of kWh			0.311
Tax at 15%			0.357
Selling Price at 55% margin			0.6

Based on the selling price of US$Cents0.6/kWh and annual sales of 36,500 kWh and O&M cost of US$7556 and overheads of US$8000/annum, pre-screening analysis was undertaken for three possible option namely biodiesel, diesel and hydro.

Results of this analysis are shown in table 3.21

Table 3.21 pre-screening assessment for different alternative supply from bio-diesel, diesel and hydro supply options

	BIODIESEL		DIESEL		HYDRO	
Investment Capital	20,000		5,000		1,000,000	
Investment Lifespan	10		10		10	
Production	36,500		36,500		36,500	
Price/unit	0.60		0.60		0.60	
Revenue	21,900		21,900		21,900	
Variable cost/unit	0.20		0.50		0.70	
Cost of energy/unit	0		0		0.00	
Total fixed costs	608		608		608	
Amortization/unit:	0.05	2,000	0.01	500	2.74	100,000
Direct costs per unit:	0.25	9,300	0.51	18,750	3.44	125,550
Gross Margin/unit	0.35		0.09		-2.84	
Fixed costs/unit	0.02		0.02		0.02	
Total costs	0.27	9,908	0.53	19,358	3.46	126,158
Net Margin	0.33	11,992	0.07	2,542	-2.86	**-104,258**
ROI	60%		51%		-10%	
Payback period years	1.43		1.64		-234.85	

Financial

Item	Year 1	Year 2	Year 3
Revenue	21,900	21,900	21,900
Direct costs	7,446	7,446	7,446
Over heads	8098	8,451	8,826
Net profit	1,852	1,710	1,466
Cash flow	3,118	2,683	2,082

2.3.2 Electrical Services for Productive use: Irrigation

Objectives:

The objective of this business plan is use of electrical services from the multifunction platform for irrigation, telecentre and lighting for houses one school and a health centre.

Justification:

Currently, the baseline situation in the project area is use of water from Perennial River for irrigation purposes. Provision of electricity services will increase production of irrigated agricultural produce such as tomatoes and other vegetables.

Technology

The technology being used to produce electricity is multi function platform described in 5 (A).

Pre-screening

Based on investment cost of US$ 5000 for irrigation facilities and storage tank to cover one hectare for irrigation and production, production cost and selling price of tomatoes to be grown in three seasons of the year as shown on table 3.2.2 pre-screening assessment was undertaken in table 3.2.3

Table 3.2.2 Production, Production cost and selling price

Product	Production (Boxes)	Production cost US$	Selling price US$
Tomatoes	250	1.8	7.5

Table 3.2.3 Pre-screening

Investment Capital	5,000	
Investment Lifespan	10	
Production	2,500	
Price/unit	7.50	
Revenue	18,750	
Variable cost/unit	0.72	
Cost of energy/unit	1	
Total fixed costs	1,000	
Amortization/unit:	0.20	500
Direct costs per unit:	1.89	4,725
Gross Margin/unit	5.61	
Fixed costs/unit	0.40	
Total costs	2.29	5,725
Net Margin	5.21	**13,025**
ROI	**261%**	
Payback period years	**0.37**	

Financials

Item	Year 1	Year 2	Year 3
Revenue	27000	27000	27000
Direct costs	7560	7560	7560
Over heads	960	960	960
Net profit	7978	12,012	12012
Cash flow	6003	8738	9567

2.3.3 Electrical Services for rice polishing

Objectives

The objective of this business plan is use of electrical services from the multifunction platform for rice polishing.

Justification

The main aim of rice polishing is to add value and improve income for the various rice farmers in the project area who previously used to sell unpolished rice at give away prices.

Technology

The technology being used to produce electricity is multi function platform described in 5 (A).

Pre-screening

Based on investment cost of US$ 5000 for irrigation facilities and storage tank to cover one hectare for irrigation, and production, production cost and selling price of tomatoes to be grown in three seasons of the year as shown on table 3.2.2, pre-screening assessment was undertaken in table 3.2.3

Product	Production (buckets)	Production cost (US$)	Selling price (US$)
Polished Rice	202800	4500	0.1

Pre-Screening

Investment Capital	15,000	
Investment Lifespan	10	
Production	202,800	
Price/unit	0.13	
Revenue	26,364	
Variable cost/unit	0.01	
Cost of energy/unit	0	
Total fixed costs	1,000	
Amortization/unit:	0.01	1,500
Direct costs per unit:	0.03	5,759
Gross Margin/unit	0.10	
Fixed costs/unit	0.00	
Total costs	0.03	6,759
Net Margin	0.10	**19,605**
ROI	**131%**	
Payback period years	**0.71**	

Financials

Item	Year 1	Year 2	Year 3
Revenue	26,364	26,364	26,364
Direct costs	7,382	7,382	7,382
Over heads	1,000	1,000	1,000
Net profit	11,701	11,701	11,701
Cash flow	15,863	24,069	32,282

2.4 Irrigation

Title: PV Pumping for Irrigation at Katuba pilot region[2][3]

Objectives of the project

Using of PV to irrigate one hectare of potatoes and tomatoes and provide water for washing and feeding of pigs.

Justification for INSABA

The baseline situation in the project area is that water from rainfall is available only during the rainy season starting from November to March. This situation means that the farmer is unable to do increased agriculture production during the winter and summer periods which range from April to October. However, at the project site at Katuba, the Government of the Republic of Zambia has assisted the community with a perennial water reservoir. Currently, the farmers are using water from this reservoir through use of buckets and one of the farmers has a small gasoline engine which assist in the irrigation of this farm. However, due to a high cost of gasoline, it is not profitable to use this facility for providing water. Besides, the pumping capacity of this gasoline pump engine is limited.

Because of this limitation, Mr Phiri of Katuba was identified as one of the SME-SP and requested that he be assisted to produce a business plan for use of PV system to generate at least 50 m^3/day of water required for the irrigation of tomatoes and potatoes on one hand, and water for washing and feeding of pigs on the other. The PV irrigation system will actively be used in the winter and summer seasons from April to November. Additionally, water will still be required for washing of the pigs throughout the year and during the droughts days in the rainy season.

The project once implemented will meet the INSABA criteria in two ways. The first involves increased production of tomatoes from current levels of 200 boxes to 800 boxes per annum of tomatoes after irrigation. The production of potatoes will increase to 20 tonnes per annum. One the other hand, production of pigs will increase from 78 pigs to 300 pigs per annum. To maintain this high production requires reasonable amount of clean water. Use of clean water is essential so as to avoid diseases which will in turn affect the quality of the pigs when being sold on the market. Inquiry by veterinarian sorted out that pigs which grow under good sanitarian conditions gain in a shorter time more weight and losses of farrows can be decreased considerably.

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[2] Namibia-Solar-PV water pumping-Study, Final report_Single_Side.pdf

[3] Namibia Solat and Diesel Water Pump Costing Tool 2006 Vers1.xls

Technology and system design

Figure 3.1 PV irrigation system

To irrigate 0.5 hectare of tomatoes and 0.5 hectare of potatoes during the winter and summer period i.e. April to November and provide water for cleaning and washing of pigs, and additional water during drought days in the rainy season, requires water requirements of 50 m^3 / day. Based on this water requirement, solar radiation of 4.76kWh/ m^2/day, and the pressure head of 10 meters from the reservoir to the storage tank, a PV-generator of 1.3.5 KWp were selected. According to this dimensioning, a suitable water pump was selected which was able to pump 1.4 litres per second.

The selection of the capacity of the pump is based on the use of furrow irrigation which has a relatively low utilisation efficiency of between 50 to 60%, as compared to drip irrigation with an efficiency of between 75-95%. As farmers gain more experience, drip irrigation will gradually be introduced. Introduction of drip irrigation will lead to a reduction of investment cost through reduction of the size of the water pump, and corresponding PV generator.

It is being proposed that the power required to run the pump will be by the hybrid, solar power cogeneration module.

Pre-assessment

Based on the investment cost, production cost and selling price of tomatoes, potatoes and pigs, given in the table 3.1, a pre-selection assessment was done and results are shown on Table 3.2

Table 3.1 Production, production cost and selling price

Product	Production	Production cost (US$)	Selling price (US$)
Tomatoes	800 boxes	1215	7.5
Potatoes	20 tonnes	2125	1050
Pigs	300 units	13500	112.0

Table 3.2 Pre-screening assessment.

	Irrigation	
Investment Capital	25,000	
Investment Lifespan	15	
Production	1	
Price/unit	60,750.00	
Revenue	60,750	
Variable cost/unit	17,000.00	
Cost of energy/unit		
Total fixed costs	2,000	
Amortization/unit:	1666.67	1,667
Direct costs per unit:	18666.67	18,667
Gross Margin/unit	42083.33	
Fixed costs/unit	2000.00	
Total costs	20666.67	20,667
Net Margin	40083.33	**40,083**
ROI	**160%**	
Payback period years	**0.60**	

The business is attractive based on three products namely; tomatoes, potatoes and pigs. The question of including pigs in the business was questioned since it was claimed it did not meet the INSABA criteria. Although the view of CEEEZ is that pigs require clean water for washing and feeding so as to avoid diseases and affect the quality. To satisfy that even the sell of tomatoes and potatoes on their own is a profitable business, a second pre-screening assessment was undertaken to take account of the latter only (table 3.3)

Table 3.3 is pre-screening assessment for tomatoes and potatoes only

	Irrigation	
Investment Capital	25,000	
Investment Lifespan	15	
Production	1	
Price/unit	33,750.00	
Revenue	33,750	
Variable cost/unit	3,304.00	
Cost of energy/unit		
Total fixed costs	1,000	
Amortization/unit:	1666.67	1,667
Direct costs per unit:	4970.67	4,971
Gross Margin/unit	28779.33	
Fixed costs/unit	1000.00	
Total costs	5970.67	5,971
Net Margin	27779.33	**27,779**
ROI	**111%**	
Payback period years	**0.85**	

Table 3.4 Financial analysis-1st Scenario

Item	Year 1	Year 2	Year 3
Revenue	60,750	60,750	60,750
Direct costs	17000	17000	17000
Over heads	1920	1920	1920
Net profit	28400	28977	28977
Cash flow	31400	51123	68917

Table 3.5 Financial analysis-2st Scenario

Item	Year 1	Year 2	Year 3
Revenue	27000	27000	27000
Direct costs	7560	7560	7560
Over heads	960	960	960
Net profit	12012	12012	12012
Cash flow	11,448	12,777	13,106

2.5 Honey processing

Title Miombo honey processing and marketing enterprises (MHPME)...

Objectives of the project: The objective is to produce honey of high quality for sale on the local and international markets

Justification for INSABA

Currently, honey being produced in great parts of Zambia is not centrifuged to separate the honey from wax. However, market demands that good honey which does not contain wax is made available. It was for this reason that the centrifuge was proposed to improve the quality and production of honey. Since there is no electricity in the project area, it was recommended that a PV system be designed to propel 2.5KW electric motor on the centrifuge

Technology and system design

The honey centrifuge proposed by CEEEZ is a separator manufactured by Cook & Beals (info@cooknbeals.com). This machine separates the honey from wax, pollen and other foreign distracting particles. The heart of the spin-float honey-wax separator is the centrifuge. In operation, the honey and cappings are pumped or dropped into the top of the centrifuge. This mixture is thrown to the outside wall where the separation takes place. Then through a system of baffles and ports, the clear honey is drained off into the outer tank where it is pumped to the storage tanks. The wax is cut out by a rotary cutter and drops out of the centre of the centrifuge.

The entire process is continuous. The capacity is above 1350 kg/hr according to the manufacturer data. For best operation, the honey-wax mixture should enter at a temperature of around 85 degrees Celsius. If cooler than this, the separation is slower. CEEEZ has suggested using a fuel efficient stove for this operation. The design of the PV system is based on the power consumption of 2500 W of the centrifuge as provided by CEEEZ and a 90% usage during 8 hours per day.

The honey is produced in a decentralized manner. There are some 20 village around the central one. Every village has a different amount of beehives with different total yearly production. The honeycombs are transported in sealed small containers and transported generally by bicycle. The containers are provided by the central unit to grantee a proper product and to avoid attacks from bees. Bees are very sensitive to the smell of honey and might get aggressive.

The system design component of the centrifuge and PV systems are provided in table 3.3

Table 3.6. Technology and system design

Energy	number	hrs/day	usage	power (W)	total(W)	Wh
Centrifuge	1	8	90%	2500	2500	18,000
Lights	10	4	100%	10	100	400
					efficiency	80%
					Wh required	23,000
Solar System Costs						
	#	Unit cost US$				Cost US$
Solar Panels (Wp)	4600	7.1				32,660
Batteries (Ah)	9200	4				36,800
Outback Controller (60A)	2	1,100				2,200
Outback Inverter (3kW)	3	4,000				12,000
System Controller	1	500				500
Temperature Sensor	1	50				50
Ten Port Com. Manager	1	650				650
Soft start unit	1	1,000				1,000
Installation components	1	2,000				2,000
Panel Frames	1	1,500				1,500
					Total	89,360

Colour Coding		Verify all data in YELLOW	
		Data in BLUE from CEEEZ	
Processing Plant Costs	#	Unit cost US$	Cost US$
Centrifuge	1	15,000	15,000
Other	1	55,640	55,640
Land and buildings	1	6,000	6,000
Vehicles	1	15,000	15,000
Total, **Processing Plant Costs**			91,640
Total Investment Costs US$			181,000
Recurrent Costs, Fixed		US$/month	US$/month
Insurance	1	50	50
Telephone, fax, cell	1	30	30
Salaries and wages	1	1,000	1,000
Transport & travel	1	200	200
Maintenance	1	1,000	
Legal fees	1	10	10
Battery replacement	1	613	613
Recurrent Costs, Variable			1,903
Average honey processed (kg/month)		76160	
Cost per kg		1.5	
Monthly cost of honey			114,240
Income			
Average honey processed (kg/month)		76160	
Cost per kg		3	
Monthly income from honey			228,480

Pre-Assessment

Based on the investment cost, production cost and selling price of honey, given in the table 3.7, a pre-selection assessment was done and results are shown on table 3.8.

Table 3.7

Product	Production kg	Production cost US$	Selling price US$/kg
Honey	200000	1.5	3.0

Table 3.8 Pre-screening

	Honey processing	
Investment Capital	181,000	
Investment Lifespan	10	
Production	200,000	
Price/unit	3.00	
Revenue	600,000	
Variable cost/unit	1.50	
Cost of energy/unit		
Total fixed costs	22,840	
Amortization/unit:	0.09	18,100
Direct costs per unit:	1.59	318,100
Gross Margin/unit	1.41	
Fixed costs/unit	0.11	
Total costs	1.70	340,940
Net Margin	1.30	**259,060**
ROI	**143%**	
Payback period years	**0.65**	

Table 3.9 Financial analysis

Item	Year 1	Year 2	Year 3
Revenue	600,000	600,000	600,000
Direct costs	300,00	300,000	300,000
Over heads	22000	22000	22000
Net profit	265,000	265,000	265,000
Cash flow	139,400	139,400	308,576

The success of the business above has to minimise risks since the system is based on centrifuge and project proponents have to grow the market. Before this investment can be made, it is advisable that initially a small centrifuge type 1300 is purchased and experience build on it. The investment costs for this type of centrifuge is US2,000. Based on this investment cost, production costs and selling price of honey, given in table 3.7a, a pre-selection assessment was done and results are shown on table 3.8a.

Table 3.7a Production, production cost and selling price

Product	Production kg	Production cost US$	Selling price US$/kg
Honey	6,615	1.5	3.0

Table 3.8 a pre-screening small honey processing

	Honey processing	
Investment Capital	2,000	
Investment Lifespan	10	
Production	6615	
Price/unit	3.00	
Revenue	19,845	
Variable cost/unit	1.50	
Cost of energy/unit	0	
Total fixed costs	2400	
Amortization/unit:	0.03	
Direct costs per unit:	1.53	
Gross Margin/unit	1.47	
Fixed costs/unit	0.36	
Total costs	1.89	340,940
Net Margin	7323	**259,060**
ROI	**366%**	
Payback period years	**0.27**	

The results show that even with a small honey processing system, the business is still viable.