

Thermal Solar Energy Project Quotation

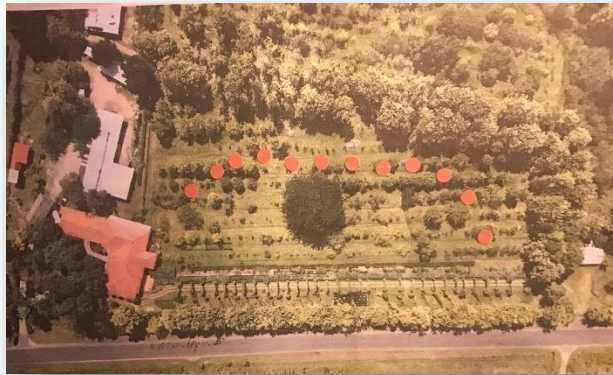
Project Name: **The farm**

Somewhere,
Belize

March 2023

Version A

cabins



1. General

Installation of Chromagen Solar water heating systems at the farm in Sometown, on the proposed cabins being constructed. The scope of the installation will include two (2) x 300L (80-gal) Thermosiphon systems installed centrally, each unit providing hot water to six (6) cabins. The systems will supply as high a percentage of the hot water demand as

economically viable. During the low season or during shut down periods, one, or both systems can be drained using the quick drain valve to prevent overheating.

This proposal also includes a 'Sunvalue SV-50' (from Magen eco-energy) panel array for heating of the swimming pool.

2. Project Description & requirements

The farm is in the Some district.

Chromagen system

The project will include 12 cabins, twenty ft (20) apart from each other. Each proposed solar water heater will supply hot water to six (6) units, aided by a fast hot water circulation pump and bridge valve, to ensure minimal waiting time for hot water and preventing water loss. The distribution pipes will be insulated and buried.

The units will have an electric backup element to ensure supply of hot water. The backup is controlled by a timer and thermostat for automatic operation.

Demand is based on an average of 10gal hot water / guest / daily, at 70% annual occupancy rate.

The system design is modular, so more units can be added if needed.

Magen Eco-energy system

The Sunvalue SV-50 model panels help to increase pool water temperature by up to 10°F. The pool size is 30ft x 50ft x 4.5ft and will be covered at night to prevent heat loss. We recommend an initial setup of 1:0.5 pool surface area / panel surface area, or a total of 15 panels, controlled by the Hayward GL-235 differential controller for automated operation.

The system design is modular, so more panels can be added if needed.

3. Climate Data

The climatic data used in our calculation is specifically taken from the project location geographic region. Due to advanced calculation instruments, we have the possibility to use the exact climate conditions of every place in the world. The average climatic data for Belize city is shown below:

Name of site	The farm, Somewhere
Latitude [°]	17 N
Longitude [°]	87 W
Altitude [<i>m</i>]	180
Collector direction	South
Collector Inclination [°]	17

	<u>Month</u>	<u>Irradiation of global rad. of 30degree tilted plane South direction</u>	<u>Ambient temperature</u>	
	Jan	149	24.4	
	Feb	160	25.7	
	Mar	198	26.8	
	Apr	195	27.9	
	May	184	29	
27.4	Jun	159	29	
	Jul	174	29.1	
	Aug	174	29.1	
	Sep	170	28.9	
	Oct	158	27.6	
	Nov	144	26	
	Dec	145	25	
The				solar

**Year
2008**

**4. Solar
Water
Heating
System**

The system will consistently provide 160-gallons of hot water at **60** degrees Celsius (140F) during radiation hours. Calculations of the optimal number of collectors for the project are shown below:

Using 4 QR-D size collectors we can produce an average of ~21kWh daily of heat (~17kwh lowest production, in December, and up to 25Kwh in March-April). These average covers ~90% of yearly energy demand.

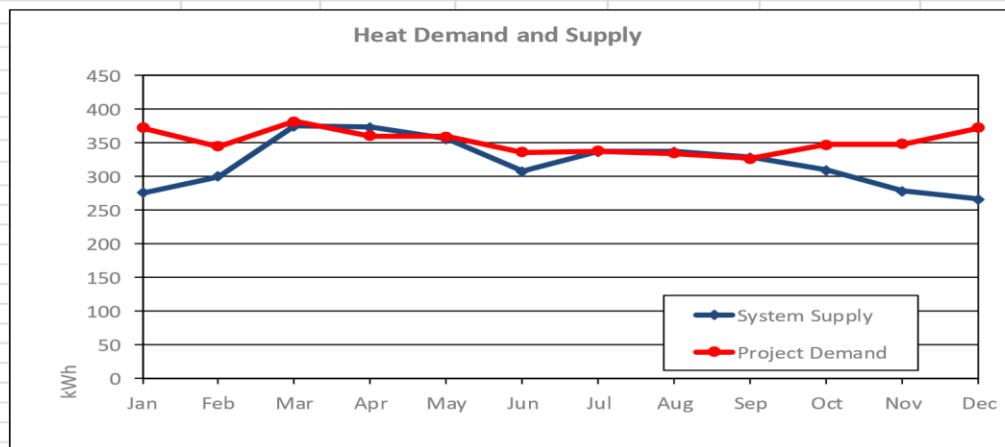
Project:	Belize							
Date:	17/08/2016							
Month	Rad. tilted plane KWh/Month/m ²	T Ambient °C	Supply water temp °C	System Supply KWh	Net Supply KWh	Project Demand KWh	Usage %	Solar Fraction
Jan	149	24.4	25.6	275	275	372	100	74%
Feb	160	25.7	24.7	299	299	345	100	87%
Mar	198	26.8	24.7	375	375	382	100	98%
Apr	195	27.9	25.6	373	360	360	100	100%
May	184	29	26.8	356	356	360	100	99%
Jun	159	29	27.9	307	307	336	100	92%
Jul	174	29.1	28.8	337	337	338	100	100%
Aug	174	29.1	29.1	337	334	334	100	100%
Sep	170	28.9	28.8	328	327	327	100	100%
Oct	158	27.6	27.9	309	309	347	100	89%
Nov	144	26	26.8	278	278	348	100	80%
Dec	145	25	25.6	266	266	372	100	71%
SUM				3,841	3,824	4,219		
Average	2008	27	27	320				91%

Energy Output base data

Collector model	QR-D
Collector efficiency curve ao	0.693
Collector efficiency curve a1	4.39
Collector efficiency curve a2	0.018
Average Capacity [kCal/day]	5323
Collector aperture area [m ²]	1.87
Number of collectors	2 units

Energy needs base data

Required amount of water (estimated)	300	liter
Required water temperature	60	°C



Collector's energy capacity will be different according to the position and shade. Optimal angle is 17 deg. to the South direction. 2 x (QRD) collectors are required to heat 300 litres of water each day up to 60°C.

The Solar collector field will provide 7648 kWh of Net Energy per year which is 90% of the project demand.

For ROI calculation – see below

5. General system operation concept (schematic):

Chromagen

80-Gal (300 litre) – twin collector (QRD) setup



Double system 160-gal Thermosiphon



Double system 160-gal Thermosiphon

Sunvalue sv-50



Sunvalue SV-50



6. cost estimate

ITEM	DESCRIPTION	COST (\$BZ)	QTY	TOTAL (\$BZ)
TS3000LPRO	Chromagen300L (80-gal) Thermosiphon open loop unit w. electric backup	0000.00	2	00,000.00
GEMBT	Heavy-Duty Mechanical Box Timer Switch, Metal, Tamper Resistant, Voltage, 120, 240, 277	318.00	2	636.00
1/25 HP Comfort Series Recirculator Pump	Hot water distribution pump with bridge valve	1392.00	2	2,784.00
IMASNE0075	in-line sediment and scale filter Amiad	416.00	2	832.00
SV-50	Sunvlaue SV-50 panels 12'x4', CPVC adaptors, end caps, top and bottom mounting units, vaccum relief valve	000.00	15	0,000.00
Hayward GLC-2PA	Hayward GLC-2P-A Solar Pool Heating Control System with 3-Way Valve, Actuator and 2 PC Sensors	3050.00	1	3,050.00
Jandy 7305	Jandy 180-Degree, 2-Inch to 2-1/2-Inch Check Valve for pool	337.00	1	337.00
INS	Installation at site			to be determined
TOTAL				00,000.00
GST				0,000.38

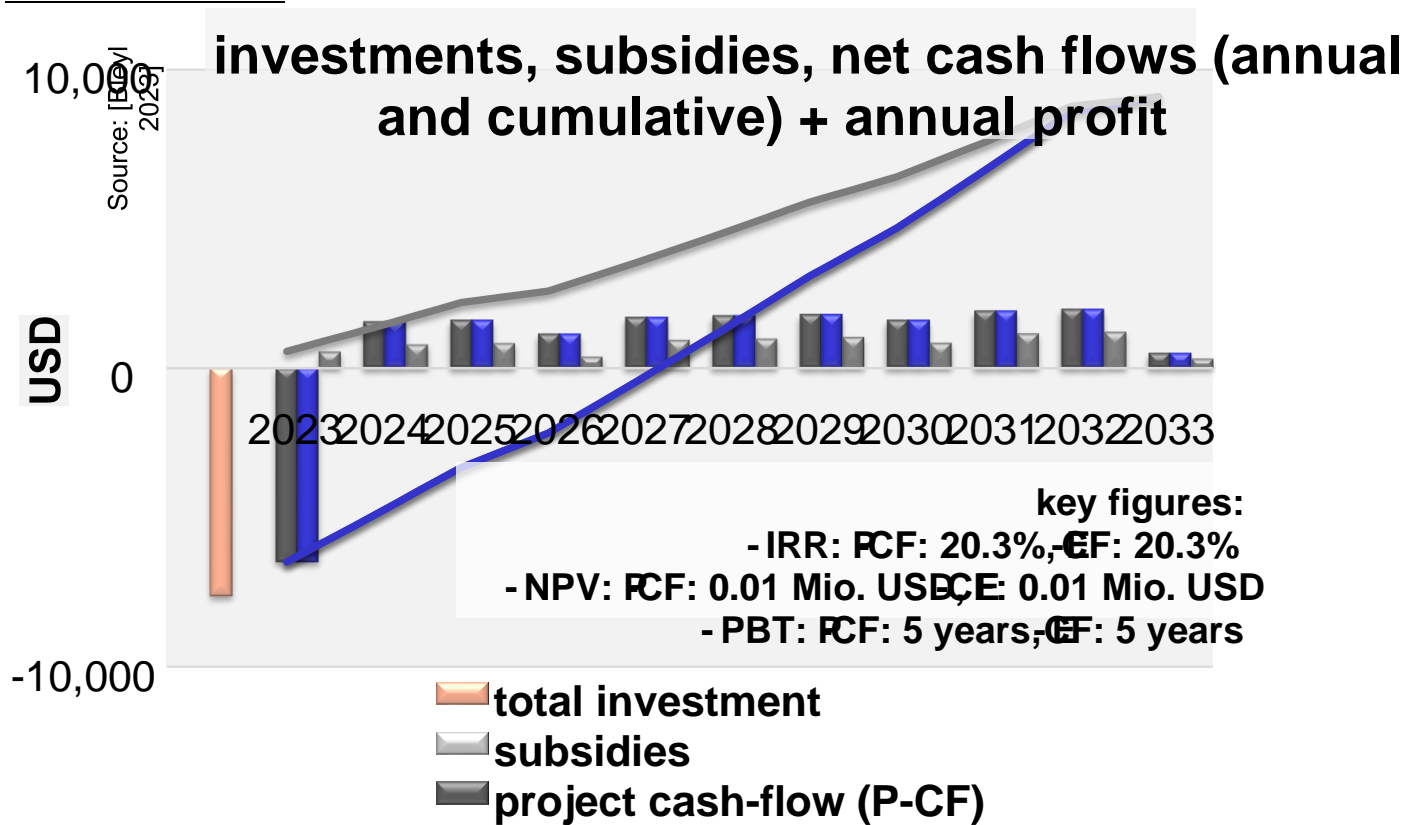
TOTAL INCL. GST				00,000.38
-----------------	--	--	--	-----------

Notes

- Final estimates for the installation at the site will be determined after discussion.
- Final system cost may be subject to fluxes in shipping cost at order time.
- System electric backup is 2500W / 220V, 11 amp.
- All systems carry a 5-year warranty for tanks and collectors and a 1-year warranty for installation.
- The quote *includes and electric backup controller and an in-line water treatment unit against hard water issues.*
- Regular maintenance can be done by The farm staff. Every 24 months a thorough inspection by a aaaaaa technician is recommended (not required for warranty)

ANNEX:

ROI calculation index



As seen in the graph, the ROI breakeven point is approx. 5 years at the current electricity rate of 0.41\$BZ per kWh.

summary and key figures of economic prognosis calculation

		project cash-flow	equity cash-flow
project duration	years	10	
total investment	USD	0,000	
invested equity	USD	-	0,000
invested debt capital	USD	-	0
cumulative cash-flow	USD	0,000	0,000
interest rate for discounting	%	0% (WACC)	0% (equity interest rate)
net present value	USD	0,000	0,000
internal rate of return (IRR)	%	20.3%	20.3%
payback period (dynamic)	years	5.0	5.0
Loan Life Cover Ratio	-	-	0.0

		total over project duration	annual averages
cumulative project cash-flow	USD	0,000	909
cumulative equity cash-flow	USD	0,000	909
total investment	USD	0,000	-
revenues	USD	00,000	0,000
expenditure	USD	8,124	812
earnings (EBT) (before taxes, accounting)	USD	0,000	909

Summary:

- *ROI period for the systems is roughly 5 years for the cabin heating.*
- *System 10-year NPV is over \$9,000US*
- *System IRR is an attractive 20.3%*
- *All our systems carry a 5-year warranty for the tank and collectors, and a 1-year warranty for installation.*
- *Chromagen tanks have an average life span of 15+ years. Chromagen collectors have an average life span of +20 years. Certain inexpensive components we recommend replacing after 3 years, such as the pressure relief valve and electric heating element flange. The longevity of a Chromagen system is mostly dependent on the environment, the water quality and maintenance procedures taken by maintenance staff.*
- *This quote considers that the resort has responsibility for the installation infrastructure, and it is not included in the cost estimation. Infrastructure includes available cold and hot water pipes to system location, hot water pipe to the room inlets, etc.*
- OPEX - This 10-year financial analysis considers replacement of the protective anode & pressure release valve every 3 years.
- All our systems come standard with an electric backup heating element, a sacrificial magnesium anode and minimal maintenance procedures.
- Our materials are top of the line in quality and durability, and exceed all European and North American standards <http://chromagen.com/209291>

- Xxxxx offers full support and service backed by Chromagen engineers
- More information at our website:

THANK YOU FOR CONSIDERING OUR BUSINESS!

The information in this document is propriety, legally privileged, and protected by law. Access is limited to the intended addressee only. The content is legally privileged information and the confidential use of this information is not waived by inadvertent receipt. Copyright in this document and the attachments created belong to aaaa, If you are not the intended recipient, please ignore the content, destroy any copies and delete it from any memory files. Your cooperation is appreciated.