

**GOLDEN STAR**



**GSOPP Mill  
Feasibility Study**

# GSOPP and Growth

## Golden Star Oil Palm Plantation

The Golden Star Oil Palm Plantation (GSOPP) was established in April 2006 as a non-profit subsidiary of Golden Star.

GSOPP in partnership with the Traditional Authorities, and affected farmers, with the support of the agro-forestry industry, promotes the development of oil palm plantations amongst our catchment communities, using the smallholder concept.

Through GSOPP, we continue to advance the businesses objectives of reducing poverty through employment generation, and promoting wealth creation through sustainable agri-business.

Funded by Golden Star through US\$1 per ounce of gold produced, to date we have directed over \$6.6 million to this important initiative.

## Sustainability In Action

The GSOPP social enterprise initiative has the credentials of bringing a new high revenue livelihood into some of Ghana's most impoverished Districts. GSOPP is based in the 'Oil Palm Belt' of Ghana, an area where oil palm is indigenous and self-propagates. Having been established on low production farm land, or former mined lands the plantations have not resulted in forest or Forest Reserve exploitation. With GSOPP unique approach to land acquisition, land tenure issues have been minimal, there has been no displacement, and land owners remain strongly supportive of 'their' business. In over 10 years of operations GSOPP has experienced no labour or human rights related disruptions to its operations.

## Oil Palm Mill Concept and Business Plan

Having established a sustainable plantation business, following the 10<sup>th</sup> anniversary of GSOPP we are now focused on future organic growth and the evolution of GSOPP to incorporate down-stream processing through the establishment of a milling facility.

As these plans evolve we expect to see ongoing benefits flowing from this important social enterprise endeavor as we remain focused on our objectives for poverty reduction through employment generation, and promotion of wealth creation through sustainable agri-business.

Golden Star and the Board of GSOPP have evaluated and determined the benefits of expansion of the business into downstream processing. The construction and operation of a 10 tonne per hour oil palm mill will significantly enhance GSOPP revenues and associated returns to farmers and host communities.

This document outlines the business proposal prepared by GSOPP in a bid to attract financial support for the GSOPP mill project. It is our objective that GSOPP remain a not for profit entity, and we hope to gain the support of partners that share our desire to enhance the sustainability of GSOPP as a genuine legacy for host communities and their future generations.

## Local Processing to Add Value

GSOPP sells all fresh fruit bunches to the Wilmar BOPP organization, over 80km from the core GSOPP plantations. As a result, transport represents almost 20% of the farm-gate price for the fresh fruit bunches.

By developing a 10 tonne per hour oil palm mill, GSOPP will be able to process its fresh fruit bunches into crude palm oil which will be sold to Wilmar BOPP.

The expansion into local downstream processing will enhance the local value chain, increase revenues to farmers and communities, and reduce costs associated with transportation.

The project evaluation includes the processing of 6000 t of outside purchased fruits (non GSOPP FFB production). This volume is conservative and is based on field assessments of farms within a defined radius of the proposed mill site. The data has been validated by Wilmar BOPP and regional industry studies. These independent out-growers will also benefit directly from a reduction in transport costs.

## Multiple Product Streams

In addition to the crude palm oil (CPO), additional by-product streams will be generated:

- palm kernel oil (PKO) a saleable product;
- palm kernel cake (PKC) a saleable product used for supplementary feeding of livestock;
- palm kernel shells (PKS) a product that can be sold or used as fuel for the oil palm mill; and
- palm fibre which will be used as a compost for the palm plantations.

## Options Assessments

Options assessments were conducted to determine processing methodology and mill sizing. In view of the size of the GSOPP plantations and independent smallholder farmers in the area, a 10 tonne per hour mill (medium scale) was identified as the optimum solution.

Initial designs and costing of the mill and construction have been developed by Solidaridad and are estimated at US\$3.6 million plus \$0.1 million of working capital.



## Discussion on Cost Assumptions and Variables

### Oil Palm Supply and Demand

Of the major vegetable oils traded on the international market, palm oil is the most important and accounts for over half of the global import and export trade. The USDA estimated global production of palm oil at 50 million metric tonnes (t) in the 2011 crop year.

Palm oil accounts for over 20% of the global edible oil market, and is the second most consumed edible oil in the world. With its increasing use by food, health, cosmetics and biodiesel industries, global demand is projected to continue growing. In fact, 2011 studies projected edible oil demand to increase by 40% over the subsequent 10 year period, with palm oil expected to attract an increasing share of the demand.

Within Ghana, the production of CPO is insufficient to meet internal demand, and Ghana imports between 30 - 65,000t of CPO annually, at an estimated cost of some \$300M. Projections of demand indicate that the present CPO shortfall will continue and even increase in the future in Ghana (MASDAR 2011).

### Oil Extraction Rates (OER)

A CPO extraction rate of 20% has been assumed. Estate plantations in Ghana achieve 21% even with lower yielding stock and aging equipment. World class performance is recorded as over 25%. GSOPP uses only high yielding variety stock, the mill design incorporates equipment to maximize oil extraction, and clean water supply is readily available (oil washing and processing), and as such, an extraction rate of 20% is reasonable.

For conservatism, this Feasibility Study assumes slightly lower extraction rates for PKO (2%), PKC (3%) and PKS (7%) than are typically achieved by estate operations in Ghana.

### Exchange Rate

Exchange rate has limited effect on the economics in that variables partially cancel each other out as the US \$:Ghc rate fluctuates. The largest cost input is FFB pricing which is limited in movement regardless of exchange rate. CPO price in a weakening dollar environment would probably rise in price in dollars and vice versa. The operating costs (plant and labour), which would be sensitive to exchange rate, are small inputs compared with the FFB cost.

### CPO Price

The CPO price follows a cyclical pattern, however over the last 50 years has followed an upward trend. Using a conservative CPO price of \$740/t the project has a positive NPV of \$2.8M. The 10-year mean CPO price is \$850/t.

### Cost of Production and FFB Price

The major contributor to cost of CPO production is the purchase of the fresh fruit bunches. Within Ghana the FFB price has not varied significantly in US Dollar terms over the last ten years, varying within the range of \$80-\$102/mt and closely reflecting the CPO price.

Processing and maintenance costs are a small contributor to the costs. The oil palm mill will utilize by-products of the plantation and mill as fuel and as such, minimal power consumption is needed.

2005 to 2009 Annual Report of Wilmar BOPP, a medium scale plantation company, report costs of production of CPO in the order of \$600/t. Industry studies report small scale palm oil mill cost of production in the range of US\$180 to \$359/t (MASDAR 2011).

### Other Product Streams

The additional product streams including palm kernel oil and cake, are by-products of the CPO production, and as such do not result in additional processing costs.

### CPO Market

GSOPP has a long relationship of support with, and presently sells its FFB to Willmar BOPP, who have agreed to purchase the GSOPP mill products. Within the market context in Ghana there are several alternative purchasers available.

## Key Feasibility Study Assumptions

The following assumptions have been applied in the mill feasibility study:

### Mill Capacity Analysis

Mill capacity	10 t/hour
Hours per day	1 shift of 12 hours operation
No. days per month	22
Total available capacity	31,680 tpa
Optimum utilization	26,928 tpa (85%)

### Cost of Fresh Fruit Bunches

Cost of FFB	US\$102.28/t
Operating cost per t CPO	US\$42.45/t

Product	Price Forecast	OER
Crude palm oil (CPO)	US\$740/t	20.0%
Palm kernel oil (PKO)	US\$1,000/t	1.8%
Palm kernel cake (PKC)	US\$35/t	2.0%
Palm kernel shell (PKS)	US\$23/t	6.0%

### Other

Exchange rate	4.335 Ghc to US\$
Corporation tax on profit	0%
Interest on loan	10.0%

### FFB Yield Analysis

Year 0-3	0 t/ha
Year 4	3.20 t/ha
Year 5	5.40 t/ha
Year 6	7.50 t/ha
Year 7	10.00 t/ha
Year 8	13.00 t/ha
Year 9	15.00 t/ha
Year 10-15	18.00 t/ha
Year 16-19	17.00 t/ha
Year 20-22	16.00 t/ha
Year 23-25	14.00 t/ha

# Assumptions

## Fresh Fruit Bunch Production Forecast

FFB PRODUCTION FORECAST		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
(tonnes)	Hectares	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
2006 Planting	275	4,950	4,950	4,950	4,950	4,950	4,675	4,675	4,675	4,675	4,400
2007 Planting	160	2,880	2,880	2,880	2,880	2,880	2,880	2,720	2,720	2,720	2,720
2008 Planting	257	3,855	4,626	4,626	4,626	4,626	4,626	4,626	4,369	4,369	4,369
2009 Planting	98	1,274	1,470	1,764	1,764	1,764	1,764	1,764	1,764	1,666	1,666
2010 Planting	100	1,000	1,300	1,500	1,800	1,800	1,800	1,800	1,800	1,800	1,700
2011 Planting	33	247.5	330	429	495	594	594	594	594	594	594
2015 Planting	50	-	-	160	270	375	500	650	750	900	900
2016 Planting	80	-	-	-	256	432	600	800	1,040	1,200	1,440
2017 Planting	80	-	-	-	-	256	432	600	800	1,040	1,200
2018 Planting (Proposed)	200	-	-	-	-	-	640	1,080	1,500	2,000	2,600
Independent outgrowers	600	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000
<b>TOTAL FFB AVAILABLE</b>	<b>1,933</b>	<b>20,207</b>	<b>21,556</b>	<b>22,309</b>	<b>23,041</b>	<b>23,677</b>	<b>24,511</b>	<b>25,309</b>	<b>26,012</b>	<b>26,964</b>	<b>27,589</b>
<b>Mill Capacity Utilisation</b>		<b>75%</b>	<b>80%</b>	<b>83%</b>	<b>86%</b>	<b>88%</b>	<b>91%</b>	<b>94%</b>	<b>97%</b>	<b>100%</b>	<b>102%</b>
CPO Production (t)		4,041	4,311	4,462	4,608	4,735	4,902	5,062	5,202	5,393	5,518
PKO Production (t)		364	388	402	415	426	441	456	468	485	497
PKC Production (t)		404	431	446	461	474	490	506	520	539	552
PKS Production (t)		1,212	1,293	1,339	1,382	1,421	1,471	1,519	1,561	1,618	1,655

## Revenue Forecast

REVENUE (US\$)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Revenue from CPO	2,990,562	3,190,288	3,301,732	3,410,068	3,504,196	3,627,628	3,745,732	3,849,776	3,990,672	4,083,172
Revenue from PKO	363,717	388,008	401,562	414,738	426,186	441,198	455,562	468,216	485,352	496,602
Revenue from PKC	13,984	14,918	15,439	15,945	16,385	16,963	17,515	18,001	18,660	19,093
Revenue from PKS	27,967	29,835	30,878	31,891	32,771	33,925	35,030	36,003	37,320	38,185
<b>TOTAL REVENUE</b>	<b>3,396,230</b>	<b>3,623,049</b>	<b>3,749,610</b>	<b>3,872,642</b>	<b>3,979,538</b>	<b>4,119,714</b>	<b>4,253,839</b>	<b>4,371,996</b>	<b>4,532,005</b>	<b>4,637,052</b>

## Processing Costs

COSTS (US\$)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Cost of FFB	(2,066,796)	(2,204,828)	(2,281,848)	(2,356,720)	(2,421,772)	(2,507,077)	(2,588,699)	(2,660,605)	(2,757,979)	(2,821,906)
Operating cost	(422,994)	(434,450)	(440,842)	(447,056)	(452,455)	(459,535)	(466,309)	(472,277)	(480,359)	(485,664)
<b>TOTAL COST</b>	<b>(2,489,790)</b>	<b>(2,639,278)</b>	<b>(2,722,690)</b>	<b>(2,803,776)</b>	<b>(2,874,227)</b>	<b>(2,966,612)</b>	<b>(3,055,008)</b>	<b>(3,132,882)</b>	<b>(3,238,337)</b>	<b>(3,307,570)</b>

## Mill Investments/Repayments

REPAYMENTS (US\$)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	total
Processing plant cost	3,700,000										
Principal outstanding	3,700,000	3,330,000	2,960,000	2,590,000	2,220,000	1,850,000	1,480,000	1,110,000	740,000	370,000	
Interest payment	370,000	333,000	296,000	259,000	222,000	185,000	148,000	111,000	74,000	37,000	2,035,000
Principal payment	370,000	370,000	370,000	370,000	370,000	370,000	370,000	370,000	370,000	370,000	3,700,000
Total payment due	740,000	703,000	666,000	629,000	592,000	555,000	518,000	481,000	444,000	407,000	5,735,000

## Mill Project Evaluation

### Free Cash Flow

Mill project evaluation demonstrates positive operating and net cash flows, with all coverage ratios satisfied.

### Net Present Value (NPV)

The NPV of post tax cash flows at a 10% discount rate is US\$2.8 million.

### Project Internal Rate of Return (IRR)

The Project internal rate of return after tax is 26%.

### Payback

The payback period after tax is 3.7 years.

### Evaluation Summary

**The post tax NPV, IRR and payback demonstrate the project's positive feasibility.**

Under an interest free loan scenario, the project financials are even more positive, with significant and direct benefits to flow to farmers and host communities. With a zero interest loan the NPV increases to \$4.1 million.

Scenario	NPV (US\$M)	Project IRR (%)
Base case (10% interest loan)	2.8	25.6
Zero interest loan case	4.1	25.6

Discount rate	Project NPV
0%	\$ 7,705,506
5%	\$ 4,714,948
10%	\$ 2,789,893
15%	\$ 1,515,930

Project IRR	25.6%
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**GSOPP not for profit business model ensures benefits flow to host communities.**

**NPV \$2.8M at 10% discount rate, Project IRR is 26%, project payback in 3.7 yr.**



# Evaluation

Details (\$)	Start	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Revenue		3,396,230	3,623,049	3,749,610	3,872,642	3,979,538	4,119,714	4,253,839	4,371,996	4,532,005	4,637,052
Cost of FFB		(2,066,796)	(2,204,828)	(2,281,848)	(2,356,720)	(2,421,772)	(2,507,077)	(2,588,699)	(2,660,605)	(2,757,979)	(2,821,906)
Operating Cash Flows		1,329,434	1,418,221	1,467,762	1,515,922	1,557,766	1,612,637	1,665,140	1,711,392	1,774,026	1,815,146
Factory Opex		(171,534)	(182,990)	(189,382)	(195,596)	(200,995)	(208,075)	(214,849)	(220,817)	(228,899)	(234,204)
General & admin		(251,460)	(251,460)	(251,460)	(251,460)	(251,460)	(251,460)	(251,460)	(251,460)	(251,460)	(251,460)
Project Capex	(3,700,000)										100,000
Mill EBITDA		906,440	983,771	1,026,920	1,068,866	1,105,311	1,153,102	1,198,830	1,239,115	1,293,667	1,429,482
Project Cash flow	(3,700,000)	906,440	983,771	1,026,920	1,068,866	1,105,311	1,153,102	1,198,830	1,239,115	1,293,667	1,429,482
<b>Tax Calculation</b>											
Capital Allowance		-	-	-	-	-	-	-	-	-	-
Interest		(370,000)	(333,000)	(296,000)	(259,000)	(222,000)	(185,000)	(148,000)	(111,000)	(74,000)	(37,000)
Pretax Cashflow		536,440	650,771	730,920	809,866	883,311	968,102	1,050,830	1,128,115	1,219,667	1,392,482
Tax		-	-	-	-	-	-	-	-	-	-
<b>Debt Repayment Schedule</b>											
Posttax Cashflow		906,440	983,771	1,026,920	1,068,866	1,105,311	1,153,102	1,198,830	1,239,115	1,293,667	1,429,482
Principal repayment		(370,000)	(370,000)	(370,000)	(370,000)	(370,000)	(370,000)	(370,000)	(370,000)	(370,000)	(370,000)
Interest		(370,000)	(333,000)	(296,000)	(259,000)	(222,000)	(185,000)	(148,000)	(111,000)	(74,000)	(37,000)
Loan Input	3,700,000										
Mill Plant Capex	(3,600,000)										
Working Capital	(100,000)										
<b>Net Cash Flow</b>		<b>166,440</b>	<b>280,771</b>	<b>360,920</b>	<b>439,866</b>	<b>513,311</b>	<b>598,102</b>	<b>680,830</b>	<b>758,115</b>	<b>849,667</b>	<b>1,022,482</b>
ICR (2.0)		2.45	2.95	3.47	4.13	4.98	6.23	8.10	11.16	17.48	38.63
DSCR (1.2)		1.22	1.40	1.54	1.70	1.87	2.08	2.31	2.58	2.91	3.51



## Sensitivity Analysis

Sensitivity analysis shows that the project is most sensitive to extraction rates, fresh fruit bunch price, and product prices.

### Oil Extraction Rates (OER)

For conservatism, lower extraction rates have been assumed for all product streams than are typically achieved by estate operations in Ghana: 92% of typically achieved CPO, 90% of PKO, 67% of PKC and 85% of PKS.

Despite this, and even when modelled with a further 10% reduction in OER, the NPV of the project remains positive.

### Fresh Fruit Bunch (FFB) Price

Within Ghana the FFB price has not varied significantly in US Dollar terms over the last ten years, varying within the range of \$80-\$102/t and closely reflecting the CPO price.

When modelled as high as \$110/t the NPV of the project remains positive.

### Product Prices

The crude palm oil (CPO) price follows a cyclical pattern but over the last 50 years has followed an upward trend despite the swings.

Using a conservative CPO price of \$740 the project has a positive NPV of \$2.8M. The 10-year mean CPO price is \$850/t.

There is more upside potential than downside risk for this variable.

## Upside and Growth

The GSOPP mill evaluation has been conducted on a conservative base case model excluding potential upside. There remains significant potential for this project in the terms of the following:

- Assumed crude palm oil prices are lower than the long-term average achieved price.
- There remains the potential to attract outside purchased fruits (OPF) to the mill business for additional profitability. Fruits grown within a 50km radius could be viably transported to the GSOPP mill.
- Organic growth of the GSOPP plantations is not included beyond 2018 despite land commitments by host communities.
- Oil palm plantation is the agreed next land use in a number of current and active mining areas. Further plantation organic growth will be achieved as these sites are reclaimed.
- All market projections are for growth in demand in crude palm oil as the product is increasingly used in food, health, cosmetics and biofuel industries. Presently Ghana is unable to meet even its internal demand for crude palm oil.
- The base case model has the mill operating for a single shift of operations, with potential to expand into double shift.
- The GSOPP proposed mill is modular and can be scaled up to 20 tonne per hour for further expansion.







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