Project Appraisal and Risk Analysis of Biodiesel Expressing and Refinery Plant in Africa

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Submitted to the
Institute of Graduate Studies and Research
In Partial Fulfillment of the Requirements for the Degree of

Master of Science
in
Banking and Finance

Eastern Mediterranean University
May 2012
Gazimağusa, North Cyprus

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ABSTRACT

Day by day environmentally clean and less harmful sources of diesel fuel for conventional engines are becoming more and more popular because of global warming problems, high level of pollution of the atmosphere created by devices and increased expansion of human diseases. There are various sources of such non harmful diesel fuels, like ethanol and biodiesel which can be obtained from diverse vegetable oils and animal fats. In this research I am going to investigate how beneficial the production of biodiesel from the sunflower seeds by using case study. The project's validity and profitability will be analyzed based on the Investment Appraisal and Risk Analysis tools. The major conclusions and recommendations regarding the project will be given by relying on the project appraisal results.

Keywords: Biofuel, biodiesel, biodiesel plant, project appraisal, risk analysis

ÖZ

Gün geçtikçe küresel ısınma problemi, motorlar tarafından oluşan yüksek düzeyde atmosfer kirliliği ve bunlara bağlı olarak artan hastalıklar yüzünden geleneksel motorlara uyumlu çevreye temiz ve sağlığa daha az zararlı dizel yakıt çeşitleri popüler olmuştur. Bu zararsız dizel yakıtların farklı çeşitleri vardır. Örneğin; çeşitli bitkisel ve hayvansal yağlardan elde edilen etanol ve biyodizel gibi. Bu çalışmada ayçiçeği tohumundan üretilen biyodizelin nasıl faydalı olabileceği incelenecektir. Bu projenin geçerlilik ve karlılığı yatırım değerlendirme ve risk analizi araçlarına dayanarak incelenecektir. Projeyle ilgili önemli sonuç ve öneriler proje değerlendirme sonuçlarına göre verilecektir.

Anahtar Kelimeler: biyoyakıt, biyodizel, biyodizel bitkisi, proje değerlendirmesi, risk analizi

To my mother

MRS. SARA GULIYEVA

And to my sister

MRS. SVETLANA BAYVERDIYEVA

ACKNOWLEDGMENTS

My very big gratitude and appreciation goes to my supervisor Prof. Dr. Glenn Paul Jenkins for his interminable assistance and motivation in writing this thesis.

Thanks to my department chair of Banking and Finance, Assoc. Prof. Dr. Salih Turan Katricioglu for his help and support anytime needed.

My special appreciation goes to my lectures: Assoc. Prof. Dr Cahit Adaoglu, Assoc. Prof. Dr Mustafa Besim, Assoc. Prof. Dr Nesrin Ozatac and to Assoc. Prof. Dr Hatice Jenkins. I was really happy to take courses from such wonderful lecturers like you.

Enormous thanks to my colleagues and friends: to Nigar Taspinar, Ceyda Ozkan, Awojobi Omotola, Bezhan Rustamov and to all other my friends who were supporting me a lot since the day I came to this university.

And of course my endless gratitude goes to my mother, father and my sister who supported, motivated and created all conditions for me in order to study at Eastern Mediterranean University and to finish my master.

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LIST OF ABBREVIATIONS

ISO	International Organization for Standardization
NOx	Nitrogen Oxides
CN	Cetane Number
IFPRI	International Food Policy Research Center
NBS	National Bank of Saravis
MIGA	Multilateral Investment Guarantee Agency
SBERP	Saravis Biodiesel Expressing and Refinery Plant
NPV	Net Present Value
IRR	Internal Rate of Return
ADSCR	Annual Debt Service Coverage Ratio
LLCR	Loan Life Coverage Ratio
CFS	Cash Flow Statement
RAF	Road Accident Fund
BFP	Basic Fuel Price
NCF	Net Cash Flow

Chapter 1

INTRODUCTION

1.1 Background

Due to the fact that majority of countries in the world are facing with the energy problems and petroleum is still considered as the main fuel source, the prices for the diesel and gasoline are currently soaring at high speed. The way to overcome this difficulty is to substitute petroleum with the source which is renewable and feasible from the economic point of view (Kamarudin *et al.*, 2011). According to Timilsina and Shrestha (2010) starting from the 1970s with the crisis of oil, biofuels came to agenda as a proper alternative for the petroleum. Kamarudin *et al.*, (2011) states that biofuel is not the only renewable like solar energy or wind it is also feasible economically.

Historically biofuel as an energy source took its beginning from 1895 by Dr. Rudolf Diesel. He constructed his own diesel engine which was functioning with the peanut oil (IFPRI, 2008). As biofuel is obtained from the animal fats and vegetable oils it is considered as ecologically clean and nontoxic (Krawczyk, 1996). As oil prices are staying at high level, Brazil launched production of ethanol from the sugarcane, at the same time the United States is deriving ethanol from the maize and biodiesel can be obtained from the various oils such as jatropha or palms. Thus, in 2006 the production of biodiesel from all over the world reached 6.5 billion liters and for the ethanol 40 billion liters (WB, 2008). Figure 1 can give the descriptive information regarding the production of biofuel from all over the world:

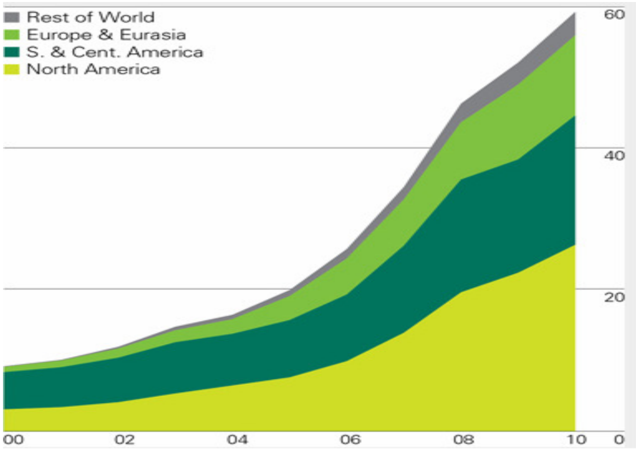

Figure 1: Worldwide Biofuel Production (in mln tones)

Source: www.bp.com

At it can be observed from the Figure 1 in 2010 the production of biofuel climbed a lot. The highest part goes to the South, Central America and North America. The reason behind this is high production of ethanol in Brazilia and ethanol and biodiesel in the USA. The next Figure 2 reflects the analysis for ethanol and biodiesel productions in 2000 and 2010 accordingly:

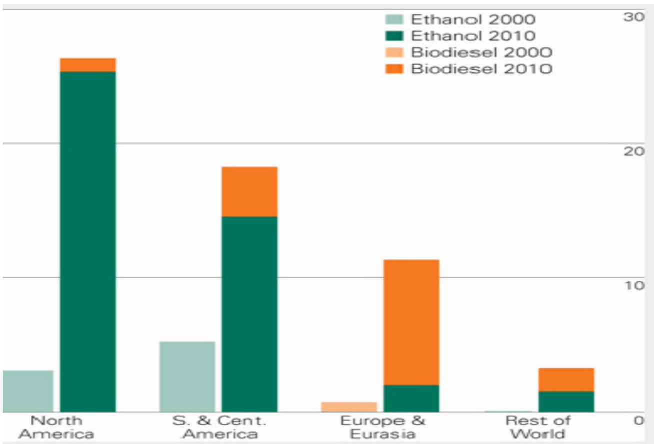

Figure 2: Worldwide Productions of Ethanol and Biodiesel in Year 2000 and 2010 Accordingly

Source: www.bp.com

From the Figure 2 biodiesel production substantially expanded in 2010. At the same time biodiesel production in Europe and Eurasia noticeably exceeded ethanol production. However, for the South, Central and North America the situation is reverse: ethanol is in excess of biodiesel. This is due to proper sources for ethanol production in those parts of the world rather than biodiesel manufacturing.

According to Shay (2003) the major reason for the increased CO2 emissions and global warming warnings are the usage of engines which are functioning on the petroleum and causing contamination of the environment. As an alternative energy source biodiesel is not only ecologically clean, at the same time it does not require the traditional diesel cars and machines to be modified as it has similar characteristics with the diesel fuel (Kamarudin *et al.*, 2011). Right now many countries are using biodiesel in a pure form or mixed with the conventional fuel. For instance, in the United States B5 (5% biodiesel and 95% diesel), B20 (20% of biodiesel and 80% diesel) , B100 (pure biodiesel) is used in diverse sectors, like transportation, hospitals, police stations, in national parks and in the various maintenance vehicles (IFPRI, 2008).

1.2 The Aim of the Study

The objective of this study is to show based on biodiesel project being under consideration for the potential implementation in one of African countries, Saravis[1], which is potentially attractive to Africa by large tracks of undeveloped lands and low labor costs compared to North America and EU countries. The target is to find out possible gains and losses from biodiesel production and realization; what can happen

[1] The name of the country is fictitious because of confidentiality reasons

to the project in case of getting tax exemptions from the government and how it can affect and modify the project's financial results.

The analysis of the project was done based on the project appraisal techniques and tools. Based on the major cost-benefit analysis criterias like the Net Present Value (NPV) and the Internal Rate of Return (IRR) the decision regarding the validity of the results was made. Risky variables from the project were identified by doing Sensitivity and Monte Carlo analysis by applying Crystal Ball software. In the light of derived results from the financial and the risk analysis the final decision and suggestions regarding the production of biodiesel was made.

1.3 The Structure

In this part the organizational structure of the research is described in short details:

The first Chapter introduced the main idea of the thesis and aspects which are going to be concentrated more.

Chapter II is the literature review and totally dedicated to biofuel characteristics, the process of getting the biodiesel – transesterification and the pros and the cons of it over the diesel fuel.

Chapter III outlines the methodology used in this thesis and the project description from African country, Saravis, which was applied as a case study.

Chapter IV reflects the financial and the risk analysis of the project – Saravis Biodiesel Expressing and Refinery Plant[2] (SBERP). The chapter includes not only the financial explanations of the project, at the same time it shows how they were derived by applying the proper methodology and formulas. The whole chapter is

[2] The name of the plant is fictitious

based on two scenarios: the base case and the optimistic case. The reasons behind giving two cases are also given in this chapter. In addition, the chapter explains whether the project is profitable or not with the application of the real price of biodiesel which does consider tax components or with the real price excluding tax compositions which are assumingly will be subsidized by Caspoland[3] government.

Chapter V is totally based on the Sensitivity and Monte Carlo analysis results for SBERP project. The most risky variables are unclosed and identified for the project.

And finally chapter VI gives conclusions and recommendations for SBERP project.

[3] Caspoland is neighbour country to Saravis. The parent company is situated in Caspoland while at the same time SBERP will be located in Saravis.

Chapter 2

LITERATURE REVIEW

2.1 What is Biofuel? Biodiesel as an Alternative Fuel Source

As it was indicated in the Introduction part biofuel became very popular nowadays. According to WB (2008), despite the fact that biofuel is considered as a perfect substitution for the conventional diesel fuel the usage of it can create such problems like increase in prices for the consumable crops due to the expanded demand for the vegetable oils; deforestation caused by the extended growth of the seeds; the rivalry for the lands and etc. Eisentraut (2010) mentions that biofuel which can be obtained from the sugar cane, diverse grains and vegetable oils can be a reason for the serious alterations in the food provisions, climate and environment. Brazil is getting biofuel (ethanol) from the sugarcane, in the United States maize is the major source for the ethanol and, moreover, various vegetable seeds can be used as an input for biodiesel production. Even though the substitution of the diesel fuel by biofuel can give huge economic benefits in the form of the subsided pollution of the environment, social advantages, decrease in climatic distortions, the usage of it should be analyzed and appraised cautiously (WB, 2008).

Engines which are functioning with the diesel fuels can be switched to machines working with ecologically clean biodiesel fuel (Biodiesel Handling and Use Guide, fourth edition, 2009). In 1992 in the United States, the National Soy diesel Development Board introduced the term biodiesel for the first time (Singh, 2010).

Biodiesel fuels can be obtained from the plant oils and animal fats and because of this fact they are renewable. For instance, the plants are getting oil from the natural sources like air and sun and the animals are receiving it while they are eating plants or consume other animals.

Thus, biodiesel is considered as a renewable and recyclable fuel source. (Biodiesel Handling and Use Guide, fourth edition, 2009). There can be numerous sources for the biodiesel like canola, palm, cotton seeds, olive, grape, sunflower seeds and etc. (IFPRI, 2008). In the table below you may see how many kg of oil can be given by diverse vegetable seeds per hectare of land:

Table 1: Amount of Given Oil per Hectare by Diverse Crops and Vegetable Seeds. Source: IFPRI, 2008

Oil Producing Crops

Plant	Latin name	Kg Oil/ Hectare	Plant	Latin Name	Kg Oil/ Hectare
corn	*Zea mays*	145	tung oil tree	*Aleurites fordii*	790
cashew nut	*Anacardium occidentale*	148	sunflower	*Helianthus annuus*	800
oat	*Avena sativa*	183	cocoa	*Theobroma cacao*	863
palm	*Erythea salvadorensis*	189	peanut	*Arachis hypogaea*	890
lupine	*Lupinus albus*	195	opium poppy	*Papaver somniferum*	978
rubber seed	*Hevea brasiliensis*	217	rapeseed	*Brassica napus*	1,000
kenaf	*Hibiscus cannabinus L.*	230	olive tree	*Olea europaea*	1,019
calendula	*Calendula officinalis*	256	paiassava	*Attalea funifera*	1,112
cotton	*Gossypium hirsutum*	273	gopher plant	*Euphorbia lathyris*	1,119
hemp	*Cannabis sativa*	305	castor bean	*Ricinus communis*	1,188
soybean	*Glycine max*	375	bacuri	*Platonia insignis*	1,197
coffee	*Coffea arabica*	386	pecan	*Carya illinoensis*	1,505
linseed	*Linum usitatissimum*	402	jojoba	*Simmondsia chinensis*	1,528
hazelnut	*Corylus avellana*	405	babassu palm	*Orbignya martiana*	1,541
euphorbia	*Euphorbia lagascae*	440	jatropha	*Jatropha curcas*	1,590
pumpkin seed	*Cucurbita pepo*	449	macadamia nut	*Macadamia terniflora*	1,887
coriander	*Coriandrum sativum*	450	brazil nut	*Bertholletia excelsa*	2,010
mustard	*Brassica alba*	481	avocado	*Persea americana*	2,217
camelina	*Camelina sativa*	490	coconut	*Cocos nucifera*	2,260
sesame	*Sesamum indicum*	585	oiticia	*Licania rigida*	2,520
crambe	*Crambe abyssinica*	589	buriti palm	*Mauritia flexuosa*	2,743
safflower	*Carthamus tinctorius*	655	pequi	*Caryocar brasiliense*	3,142
buffalo gourd	*Cucurbita foetidissima*	665	macauba palm	*Acrocomia aculeata*	3,775
rice	*Oriza sativa L.*	696	oil palm	*Elaeis guineensis*	5,000

Tickell, Joshua. 2000. From the Fryer to the Fuel Tank

Singh (2010) implies that chemically oils derived from various vegetables can consist from different fatty acids. Composition of vegetable oils and animal fats 90-98% consists of triglycerides - esters from the three fatty acids which have large oxygen inside of their construction; and the rest of the structure are the mono and the diglycerids. Wang *et al.*, (2006) state that biodiesel obtained from the refined oils can be considered as the most proper source in virtue of the time minimization while getting biodiesel; in addition, sublimate triglycerids can give fatty acid esters.

Plant oils and animal fats can be converted to fatty acid methyl esters which are considered as biodiesel chemicals by using the transesterification process:

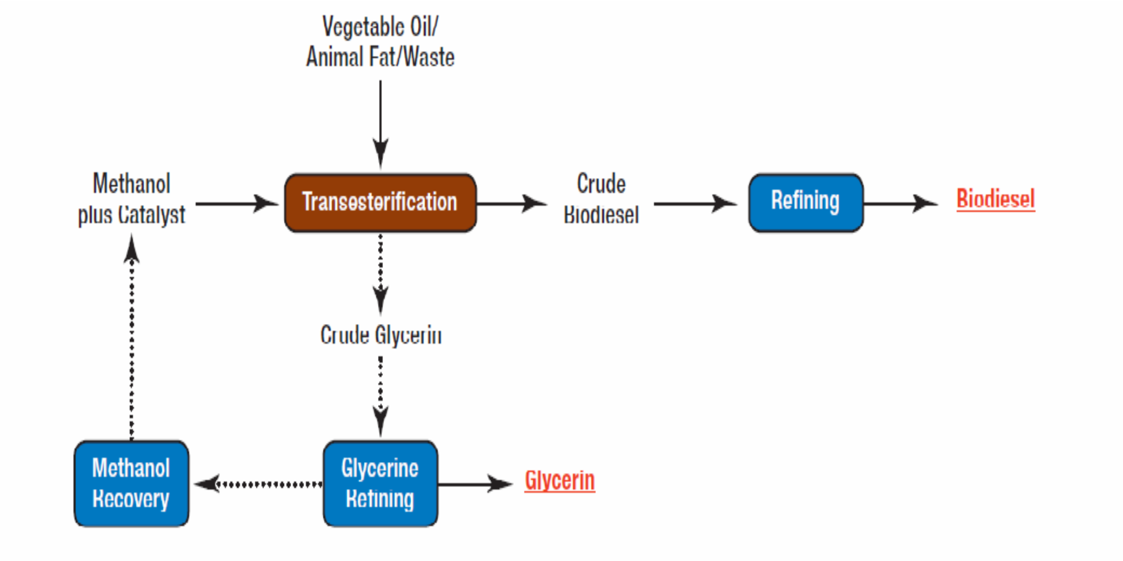

Figure 3: Basic Scheme for the Transesterification Process.

Source: Biodiesel Handling and Use Guide, fourth edition, 2009

In order to derive 100 pounds of biodiesel and 10 pounds of glycerin from 100 pounds of plant oil and animal fat, it should be reacted with 10 pounds of alcohol (methanol) with adding the catalyst to the process. As a by-product of the transesterification process glycerin (sugar) can be received in addition to biodiesel. So typically as a result of the transesterification process we have two products: biodiesel and glycerin (Biodiesel Handling and Use Guide, fourth edition, 2009). Wang *et al.*, (2006) note that the role of the catalyst can be given to enzyme, acid or alkali. According to Marchetti *et al.*, (2007) in the transesterification reaction the level of the temperature, the catalyst quantity, the amount of alcohol in relation to the plant oil, the intensity of the reaction, raw materials and the type of the catalyst to be involved in have very significant roles.

2.2 Advantages of Biodiesel

According to Bozbas (2008) ISO standards require definite characteristics for cetane number, flash point, viscosity, heating level, density, cloud and pour points, distillation and combustion. Although, biodiesel is very similar to the diesel fuel, it has some advantages and shortcomings over the diesel fuel. First of all, let's consider the main benefits created by biodiesel:

2.2.1 Reduces Emissions

Kamarudin *et al.,* (2011) remark the relevance of the reduction of CO2 emissions into the environment as it causes the main problem in the world – the global warming. In addition, hydrocarbon ejections from the tailpipes of the cars are the major reason for the formulation of the ozone and the smog (www.biodiesel.org) Therefore, the first benefit of the usage of biodiesel fuel is associated with the subsidence in the contamination of the atmosphere. IFPRI (2008) states that as a result of the study which was done in 1998 by the US Agriculture and Energy Department while using biodiesel in the conventional engines, CO2 emissions into the environment decreased by 78 %. The amount of CO2 from biodiesel gave significantly lower emissions of the carbon monoxide and dioxide, sulfates, unburned and aromatic hydrocarbons in comparison with the conventional diesel fuel (Carraretto *et al*., 2004). Based on the research which was done by the scientists in case of using biodiesel from the vegetable crops which are already in production the amount of emitted carbon dioxide, nitrogen oxide and methane can be reduced by 41%. However, if biodiesel is going to be obtained from the seeds which are going to be harvested exactly for the oil extraction, in this scenario the plant takes carbon dioxide from the air in order to grow up and get seeds, stems and roots; at the second step after the oil will be derived from the vegetable seeds it is going to be refined and used in the conventional engine. So when the biodiesel will burn it will emit CO2 into the atmosphere, as a result the carbon dioxide was obtained at the beginning of the process by the plant in order to grow up and was returned to the air – typically no change of CO2 amount in the air. In comparison with the diesel fuel biodiesel does not add any CO2 to the environment while it burns in the engine, but when diesel fuel is used 100% of carbon dioxide will be released. Due to the fact that biodiesel has 11% of oxygen in its weight, tailpipe emissions (hydrocardon and carbon monoxide) can be decreased in the diverse transportation engines because of possibility to burn more completely and not to keep big amount of unburned hydrocarbons. The Figure 4 below describes how emissions may change with biodiesel percentage in mixtures in the conventional engines (Biodiesel Handling and Use Guide, fourth edition, 2009).

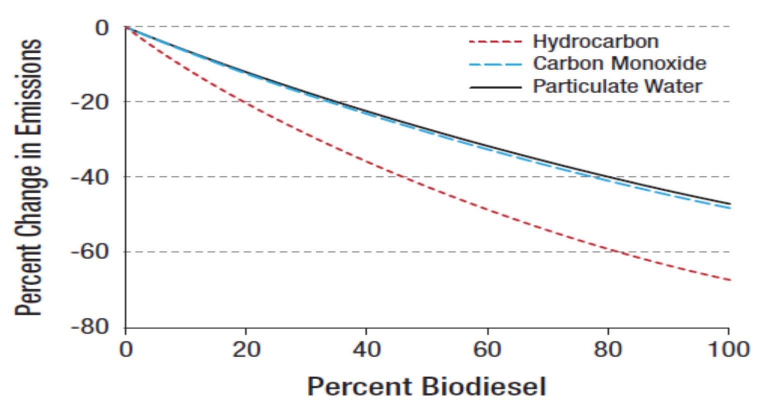

Figure 4. Change of Emissions with Biodiesel Blends.

Source: Biodiesel Handling and Use Guide, fourth edition, 2009

The higher the portion of biodiesel in the blend, the less is hydrocarbon and carbon monoxide ejections. As a conclusion to this type of advantage given by biodiesel here is the summary of comparison with the petrodiesel : (www.biodiesel.org)

- On the average the emissions from biodiesel of carbon monoxide is 48% lower;
- Even though, nitrogen oxides (NOx) can get higher or lower depending on the engine structure, biodiesel usage can assist to the regulation of NOx because of the small content of sulfur in biodiesel structure;
- with biodiesel utilization hydrocarbon ejections are 67% lower;
- 100% reduction of sulfur (IFPRI, 2008);

2.2.2 Biodiesel is Renewable and Biodegradable

Biodiesel is degrading four times faster than the conventional fuel, non-toxic and it is not harmful for the environment during the process of degradation in virtue of its oxygen content. For instance, vegetable oils' methyl esters, like rapeseed oil, degraded 98% in 21 days, however the conventional fuel decomposed only 60% in the same time period (Kamarudin *et al.,* 2011). In comparison with the diesel fuel which is decomposing 50% and with gasoline 56% in 28 days, the pure biodiesel (B100) is degrading 98%. In case of B5 the decomposition in amount of 50% was diminished from 28 to 22 days and in B20 it was reduced from 28 to 16 days. It means that the higher the content of biodiesel in the mixture, the more the biodegradability of the biofuel (Pasqualino *et al.,*2006).

2.2.3 Beneficial for Engines

Biodiesel can be a perfect substitution of the diesel depending on the amount of the blend, for instance, B20 does not require any modifications for the conventional engines which we are using in our everyday life (www. biodiesel.org). Biodiesel can increase the amount of cetanes (cetane number) in the blend and has higher lubrical capacity. With the high cetane number (CN) an engine is functioning more properly and without harm creation (Biodiesel Handling and Use Guide, fourth edition, 2009). Singh (2010) highlights the amount of CN between 40-55 for the diesel fuel and for biodiesel in the interval of 48-65 from diverse sources. For instance, for the grape the CN is 48 or for the palm 61 (Bala, 2005).

Demirbas (2008) implies that in comparison with the diesel fuel, 11% oxygen composition and no sulfur content of biodiesel can positively affect the burning mechanism and shrink the acidification of the combustion. However, according to facts given by IFPRI (2008) if biodiesel amount in the mixture will exceed diesel fuel, it can affect and change the engine's details, for example, dissolve rubber. Therefore, producers of cars need to take into consideration the compatibility of biodiesel with the engine structures.

2.2.4 Improves Human Heath

If instead of the diesel fuel biodiesel can be used, the particulate matter[4] in the air may decrease by 47%. It is well known that even lung cancer can be caused by the particulates which are emitted by the conventional diesel fuel engines. The usage of B100 can diminish the expansion of this disease because of substantial reduction in

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[4] Particulate Matter is chemical emissions in solid and liquid forms which are coming from the pollution of the atmosphere by plants and factories.

nitrified and aromatic polycyclic hydrocarbons. Except of the lung cancer numerous other diseases can also be eliminated, for instance, asthma due to diminution of particulate in the air. (www.biodiesel.org).

2.3 Disadvantages of Biodiesel

2.3.1 Higher Freezing Point and Viscosity

Bozbas (2008) noted that one of the most significant problems in usage of biodiesel is related to the higher freezing temperature of biodiesel in comparison with the diesel fuel. Insufficient and small ability of biodiesel for degrading temperatures which can be expressed in terms of pour and cloud points may create barriers in the exploitation of biodiesel for the aviation sector (Sarin *et al.,* 2007).

There is a need to keep storages and lines of fuels warm because B100 is launching to cloud at 2º to 15ºC. During winter the viscosity also boost up as biodiesel starts to mousse. As a result an additional burden arises for the transmission of oil by pumps (Biodiesel Handling and Use Guide, fourth edition, 2009). West (2008) implies that because of higher viscosity and smaller energy composition there is a possibility of corrosion creation for the engine's details. Moreover, poor ability of biodiesel to function in cold conditions can create an additional production costs in comparison with the diesel fuel.

2.3.2 Food Security Problem

Another significant disadvantage of biodiesel production may raise the food security problem. The author states that 95% of biodiesel can be obtained from the vegetable oils which are eatable. Therefore, instead of being used by the consumers the oils are involved into the production of biodiesel and this can create serious economic problem in form of insufficient supply of edible oil. In Brazilia, Indonesia and Malaysia more and more arable land is used for the growing up crops for biofuel production and this becomes a reason for the deforestation (Kamarudin *et al.,* 2011). Governments of most countries are trying to support biofuel production by providing tax exemptions and subsidies. However, because of this fact smallholders are becoming interested in harvesting crops with the purpose of selling the output later on to biodiesel expressing plants. This will establish reasons for the increase in prices for the food crops. According to the facts in order to provide 100 liters of ethanol as a source of fuel for the sport engine there is need in 240 kilograms of maize. So the major conclusion here is that some smallholders who are sellers will benefit from the price soaring, meanwhile the ordinary consumers will suffer as they will spend more amount of money in order to buy staple oil for the food preparation. Therefore, if in the future biofuel can be expressed and refined from the wastes other than vegetable sources, the heavy rely on the food sources can be minimized. However, for this purpose the second-generation machines and special technologies are required which can increase the production costs for biodiesel. This is still debatable topic which needs broader investigation, time and experiments (WB. 2008).

In addition, Mitchell (2008) notes how biodiesel plantation can affect non-biodiesel feedstock prices. Thus, in order to cultivate sunflower instead of growing up the staple products, like wheat, the farmers switch to the plants which are the feedstock for the biodiesel motivated by subsidization (tax credits) provided by the government. Meanwhile, the price for the wheat will soar up highly and, therefore, it can be substituted as well for another product, like rice. As a result, the rice price will also go up in virtue of the demand expansion for it. Ivanic and Martin (2008) support the fact that increase in biodiesel production may be a reason for the rise in non-biodiesel vegetable prices and cooking oil prices, and for poor population it can be a big burden as they spend 75% of their money in order to buy necessary products. According to information given by World Bank (2008) 100 million people are already faced with the food security problem.

2.3.3 Other Technical Problems Related to Usage of Biodiesel

The storage of biodiesel is another significant problem. In comparison with the conventional diesel fuel it is not possible to keep it for a long time period because of high biodegradability and possibility to contaminate. In case of long storage, filters, dispensers and storage tanks as a whole will get polluted and biodiesel will become no longer proper for the utilization. The author states that if the fuel is going to be kept for a long time special control, measurements and precaution measurements are required.

In addition, B100 has an ability to decompose some matters, rubbers and polishes. Moreover, it may not be proper for some types of engines and can require special modifications in order to be used. However, this is in case of the high content of biodiesel in the mixture (Biodiesel Handling and Use Guide, fourth edition, 2009).

Thus, the above discussions and literature review regarding the biodiesel advantages and disadvantages showed that the pros are in excess of the cons. However, depending on country, conditions, source of the crude oil and other possible reasons, the application of biodiesel can vary from positive to negative side or vice versa.

Chapter 3

METHODOLOGY APPLIED AND PROJECT BACKGROUND

3.1 Why does Saravis Need Biodiesel Plant?

As it was mentioned in Chapter II there are numerous reasons for the production of biodiesel worldwide. Africa is one of the continents where all conditions exist in order to build up and establish strong fuel sector sourced by biofuel. High oil prices requires the substitution of it for any other alternative in majority of counties and, thus, biofuel comes to agenda and becomes more and more attractive for African exporters. In addition, the reduction in number of respiratory diseases, environmental and health benefits can be achieved due to usage of biofuels instead of diesel fuel (Mitchell, 2008).

There is a large demand in Caspoland[5] for biodiesel. For instance, annually the consumption for the diesel is around 29 billion liters. Therefore, numerous problems are rising as Caspoland does not have enough diesel sources; it is importing part of fuel from abroad and by doing so the national reserves of foreign currency are getting exhausted. At the same time there are extended arable lands in Saravis, neighbor country of Caspoland, where Caspoland company is going to build a branch of the plant (other benefits of biodiesel production were described in Chapter II in

[5] The name of the country is fictitious

more details). Establishing biodiesel plant in Saravis can not only save the reserves of the country, at the same time it can create additional job places and, consequently, diminish the unemployment level in Saravis.

Despite the fact that the infrastructure in African counties is poor, there is an undeveloped business environment and advanced tariffs on importables, like the ones imposed on the equipment, there is a target to use in this plant the cost effective technologies and equipment which will be brought from abroad (Mitchell, 2008). Due to the project the local infrastructure can be improved as well (IFPRI, 2008).

Thus, by taking into consideration high demand for the diesel sources in Africa and proper conditions for the building up the plant in Saravis the owners of the company are thinking that the project is going to be effective and beneficial from the financial point of view for the stakeholders: the lender and the owner. Let's see below the description of the project which is planning to be implemented in Saravis and which has got the name – Saravis Biodiesel Expressing and Refinery Plant.[6]

3.2 Project Background

The reasons for running this project were introduced in the part before and now let's get familiar how it does look like. Saravis Biodiesel Expressing and Refinery Plant is going to be implemented in Saravis, Africa with the duration of twenty years. The aim of the project is to produce biodiesel, sell it to contractors and, thus, to improve the infrastructure in the country, to stop depleting the currency reserves, to create additional job places and to expand the manufacture process to the level at which the output can be sold not only domestically but internationally as well.

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[6] The plant's name is fictitious

After getting the independence Saravis started to grow up at rapid rates, however, it is still considered as one of the poorest counties in the world. It is well known that this country is famous for its huge fallow lands in order to grow up diverse crops. These lands are going to be used in the project proposed and the major source of the oil is going to be sunflower seeds. The question can arise why exactly the sunflower plant and not the palm or another vegetable plant which can be grown up in Saravis too?

The answer is that sunflower is easy to be taken care of, the time period of getting harvest is less than six months and it does not require any special knowledge or abilities in order to be grown up. SBERP is going to start with 30,000 hectares of arable land which can be increased to the amount of 220,000 hectares in the future.

The project is going to be implemented by the assistance of the advisor which is International Advisor Company[7] and Organization for Providing Aid to African Countries[8] (OPAAC). The OPAAC is trying to discuss with Saravis government the possible tax exemptions and subsidization. So typically the project is the branch of Caspoland Company which is controlled by International Advisor Company management and Organization for Providing Aid to African Countries. The final output (biodiesel) is going to be sold by Caspoland Company domestically.

The loan is going to be provided by the National Bank of Saravis (NBS). The financing will be provided in two stages: the first disbursement is going to be given in 2011 and the second in 2013. At the same time MIGA (Multilateral Investment Guarantee Agency) which is the branch of World Bank is going to insure the project.

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[7] The name of company is fictitious

[8] The name of organization is fictitious

The project includes purchasing of 23 expressing plants which are going to be provided by the manufacturer – Kallis, and the equipment for the two refineries which should be bought by SBERP from the USA. The refineries will be situated close to the market and suppliers' locations in order to minimize the delivery costs; the expressing plants in turn are mobile and can be moved anywhere near to the refineries' location.

The capacity of the one expressing plant is 6,600 tons of the sunflower seeds and the capacity of the one refinery is nine million gallons per year which is equal to 34 million liters. There is a plan to increase the amount of the raw materials (sunflower seeds) twice starting from the year three (2014) due to the fact that the project has two refineries.

3.2.1 Steps of Getting Biodiesel at SBERP

First of all sunflower seeds should be bought from the contractors which are going to be located in Saravis. The next stage will be sending those seeds to the expressing plants in order to deshell them. The shells of the seeds will be sold as by -product. After deshelling at the expressing plants the crude sunflower oil will be derived from the pure seeds. At the same time an oil cake which is the by-product from the sunflower oil will be separated and sold to the cattle farmers or animal feed companies. The obtained oil will be kept in the bunkers till the time when the tankers will come twice per week in order to deliver it to the refineries. For the purpose of the cost minimization the mobile storages can be used as well.

At the second stage, the collected oils from the storage bunkers will be brought to the refineries. The core point here is a transesterification process (it was discussed in broad details in the Chapter II) which was patented by US company.

In Figure 5 below the descriptive explanation of the refining process is given:

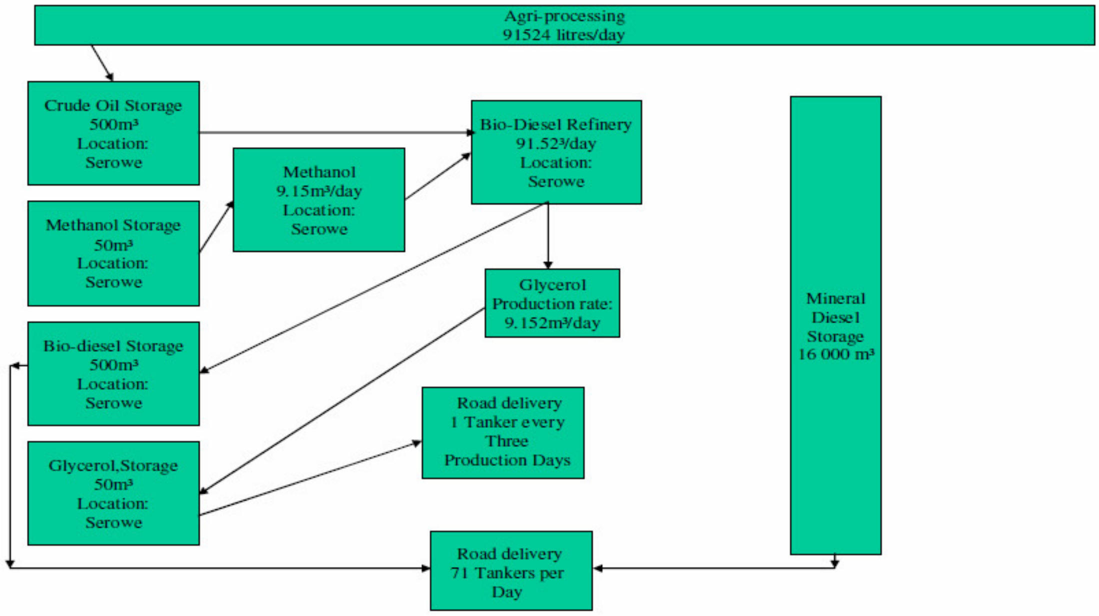

Figure 5: The Transesterification Process at the Refinery.

There is a daily production of sunflower oil in the amount of 91524 liters; from this by adding to the process methanol in amount of 9.15 cubic meters daily[9], 91.52 cubic meters of biodiesel can be obtained. In addition, as a result from the transesterification process by-product glycerin – 9,152 cubic meters can be extracted daily. After the transesterification the both products (the main and the by-product) will be send to the storage bunkers with the capacity of 500 cubic meters and 50 cubic meters accordingly. After getting the products and putting the prices at the factory gate they will be sold to the buyers of the project output.

[9] One cubic meter equals to 1000 liters

3.3 Applied Methodology

"It is very easy to define benefit cost analysis: simply add all the gains from a policy alternative, subtract all the losses, and choose the alternative that maximizes net benefits." (Gramlich, 1990).

The identification whether the project is beneficial or unprofitable will be based on the Investment Appraisal and Risk Analysis tools and the evaluation criterias. According to Jenkins *et al.,* (2011) the target of the project appraisal consists of not implementing bad projects and realizing good ones. Moreover, evaluation can assist the public and the private companies to make a right choice and not to create a burden for the country because of an incorrect decision regarding the project rankings. The Cost-Benefit Analysis contains Financial, Economic and Stakeholder Analysis where the point of views of all stakeholders can be considered.

Usually projects during their lifetime can provide the revenues which are not certain and risky and at the same time the capital costs can suffer from the cost overruns because of the several reasons. Therefore, doing an appraisal and the risk analysis of the project before its realization has a very significant role (Jenkins *et al.,* 2011).

Harberger (1976) mentions that during the project evaluation defining the demand for the project output, identifying the correct prices based on the market conditions, forecasting direct and indirect costs and considering the macroeconomic factors of the country are irreplaceable.

There are several important criterions for the project evaluation: the NPV (Net Present Value), the IRR (Internal Rate of Return), the Benefit - Cost Ratio and the Pay Out (pay back) Period criterions. All these criterions are useable and proper for the project appraisal; however, according to the authors due to the fact that all these criterions except of the NPV have significant shortcomings they are not reliable (Jenkins *et al.,* 2011).

The computation of the NPV which is a major evaluation criteria should be based on the real values, thus, after calculating in the nominal terms, all numbers should be converted into the real. Otherwise, the result can be biased and unreliable. In addition, in order to assist to the bankers to make a proper decision regarding giving the loan, several evaluation criterions exist. They are ADSCR (Annual Debt Service Coverage Ratio) and LLCR (Loan Life Coverage Ratio) ratios. At the end based on the results of the project, sensitivity analysis can be done to define the risky variables for the project (Jenkins *et al.,* 2011). Finally by applying Crystal Ball software the Monte Carlo analysis will be done in order to define probability distributions for the risky variables.

Chapter 4

FINANCIAL ANALYSIS

4.1 The Meaning of the Financial Analysis

In the cost-benefit analysis the first part which should be completed is the financial part and then based on it economic and stakeholder analysis can be done. In order to construct the spreadsheet for the project the first step should the preparation of the table of parameters. In here all given data, information regarding the project costs, prices and macroeconomic factors should be reflected. Only after completion of the parameters table it is possible to go forward and to get all the necessary tables for the cash flow statements (CFS). CFS has the most significant role in the project evaluation as based on its results the project owner and the lender can make their decisions about the profitability and the bankability of the project.

4.2 Construction of the Cash Flow Statements

As it was mentioned before the first step is preparation of the table of parameters. In our project SBREP, the following parameters are important to mention:

4.2.1 Investment Costs

In order to launch any project there is necessity in a series of investments. In our case the following investment costs are going to be incurred in year 0 prices in SRS[10]:

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[10] CPL is local currency of Caspoland.

Table 2: Investment Costs in CPL in Year 0 (2011) Prices

	2011	*2013*
Refinery 1 (9 MGPY)	63 665 522	
Refinery Infrastructure	18 427 654	
Refinery 2 (9 MGPY)		63 665 522
Refinery Infrastructure		15 335 329
Epressing plant 1-11	13 469 434	
Epressing plant 12-23		14 693 927
Total investment costs	95 562 610	93 694 779

The costs will be done in two stages, the first time in 2011 and after that in 2013. The investment costs are going to be in CPL as the promoting company is located in Caspoland. As the plant will be located in Saravis and the accounts and payments will be made in the national currency (SRS)[11] I will construct the cash flow statements in SRS. One very important detail should be mentioned: the data which was collected for all types of costs and revenues expressed in 2008 values. There is a necessity to inflate all numbers to 2011 values as we are proposing that the project will start in 2011 and hence we use this as the base year[12].

4.2.2 Structure of Financing

To construct the project the amount of total money spent will be equal to USD 26 522 899. From this amount 44% is going to be financed by equity and the rest 56% by term loans. Both, equity and loan will be disbursed to the project in two stages and in USD. Table 3 describes the financed structure for SBERP:

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[11] SRS is s national currency of Saravis

[12] In the spreadsheet all tables showed in the research will directly reflect 2011 values. All necessary modifications for adjusting values from 2008 to 2011 were already done. Inflation rates for conversion were obtained from www.global-rates.com

Table 3: SBERP Financing Structure in USD

	Phase 1	***Phase 2***
Equity	7 514 206	4 179 813
Loan	7 514 206	7 314 673
Real Interest rate including risk premium	7%	
Number of installments	15	
Repayment starts in year	2012	

4.2.3 Loan Treatment

The loan for the project will be provided by the National Bank of Saravis. Two stage disbursements are considered (in 2011 and 2013). The real interest rate including the risk premium (R) is 7% and by using the following formula for the calculation of the nominal interest rate identified by Jenkins *et al.,* (2011) it was possible to obtain the nominal interest rate for the loan:

$i = r + R + (l + r + R)* gPe., (1)$

where *i* states for the nominal interest rate; *r* is the real interest rate, *R* implies the risk premium and *gPe* reflects the inflation rate for the current year.

Thus, by inserting all the proper values into the above formula the nominal interest rate 10% was derived. The number of installments is going to be 15 and it will be repaid to the bank from 2012 to 2026 inclusively as soon as the project starts generating revenues.

4.2.4 Pricing

4.2.4.1 Price of Biodiesel

One of the most important parts of this investigation is related to the determination of biodiesel price. The price of biodiesel depends on the petroleum based fuel prices directly as they are going to be used in the blend. Diesel price directly affect the biodiesel price, but not vice versa. Let's see how biodiesel price for 2011 (starting year of our project) can be derived.

First of all, diesel prices for Caspoland are required. The Figure 6 below describes the components that come together and determine the price of diesel fuel in CPL:

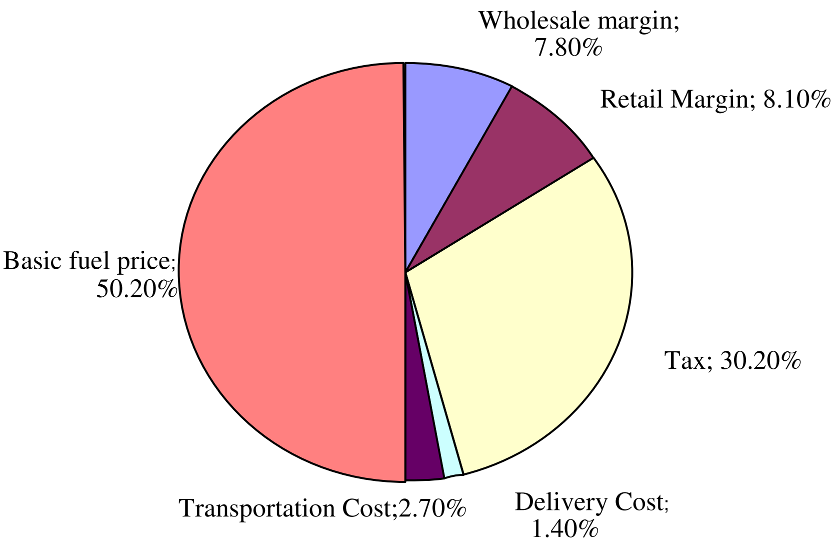


Figure 6: Composition of Retail Price for Diesel

It is obvious that taxation in Caspoland of diesel fuel is quite heavy. It includes customs and excise tax; RAF[13] (road accident fund) and the fuel tax – the latter is equal to 19 percentage points from the total taxation of 30, 20 percentage points. The

[13] RAF is type of tax levied on diesel fuel in Caspoland in order to compensate third parties in case of road accidents

next step will be to derive the average historical diesel prices for Caspoland and to calculate from them the basic fuel prices which are described in details in Table 4:

Table 4: CIF Prices for Diesel Fuel in Caspoland in SRS for Both Scenarios

	Scenario I	Scenario II
Caspoland Retail price of diesel fuel	925.7	925.7
Wholesale margin	72	72
Retail Margin	75	75
Tax Payments	280	0
Delivery Cost	13	13
Transportation Cost	25	25
CIF price of diesel to Caspoland in cents	461	741
CIF price of biodiesel in CPL	4.61	7.41
Exchange rate CPL/SRS	0.95	0.95
CIF price of biodiesel in SRS	4.36	7.00

The diesel prices for Caspoland are given in CPL cents (1 CPL =100 Caspoland cents). The CIF can be obtained by subtracting from the diesel price all costs like wholesale and retail margin, taxes and delivery and transportation costs. The basic price in cents then will be converted into CPL and the price for 2011 is going to be 4.61 CPL or equivalent to 4.36 SRS.

In the second Scenario when the price excludes tax payments and it is going to be equal to 7.41 CPL or 7.00 SRS. The differences between these two scenarios from tax points of view and reasons for including taxes and not considering them will be explained in this chapter later on.

Note: From now on two scenarios are going to be considered because of tax implications.

4.2.4.2 Price for the Sunflower Seeds

According to Food Price Monitor (2011) the price per ton of sunflower was identified at 4 088.21 CPL which makes per kg 3.87 SRS.

4.2.4.3 Prices for By–products and Glycerin

Glycerin is a by-product from the transesterification process and shells and oil cake are by-products from the expressing of sunflower seeds. The Table 6 below presents the prices for all by-products:

Table 5: Prices for Glycerin and By-products in SRS

Real price of glycerin per liter	0.685
Expressing plant and admin revenues per liter	0.103
Plant shells' price per kg	0.015
Oil cake price per liter	1.431

Expressing plant and administration revenues per liter is also a component of revenues associated with biodiesel production.

4.2.5 Costs

Another component of the cash flow statements are direct and indirect costs.

4.2.5.1 Direct Costs for Biodiesel Production

The direct costs for the given project are operating costs that are necessary for the production of biodiesel. Direct costs for biodiesel include all inputs and chemical components which are significant for the transesterification process. They are given in Table 6 below.

Table 6: Direct Costs for Biodiesel Production at the Refinery; All Values are in SRS, per Liter of Biodiesel

Alcohol less alcohol in dopant	0.5557
Dopant with alcohol	0.0202
TG dopant neutralizer	0.0098
Catalyst Contract	0.0226
Active Filtration Material	0.0945
Active Filtration Material Removal	0.0047

There are other direct costs which are irreplaceable for the production, like electricity or water costs. The detailed distribution of other direct costs is described below:

Table 7: Other Direct Costs per Liter of Biodiesel Production at the Refinery in SRS

Electricity	0.0144
Water	0.0125
Sewerage	0.0001
Maintenance	0.0313
Monthly payments to workers	128,216

Here are some points which should be paid attention on: the cost of electricity was calculated based on the fact that for the production of 100 liters of biodiesel there is need in 4kwh of electricity. One kwh in Saravis costs 36 SRS cents[14] meaning 0.36

[14] SRS is divided into 100 cents

SRS. So, it is going to be 0.36*4=1.44 for 100 liters of biodiesel. The cost of electricity inputs for one liter of biodiesel is 0.0144 SRS.

Another important other direct cost is water. In order to produce one liter of biodiesel one liter of water is necessary. In Saravis the water public company is selling 1 cubic meter of water for 12.45 SRS , thus, as one cubic meter consists of 1000 liters, the cost of water to be used as an input per one liter of biodiesel is going to be 0.01245 SRS.

4.2.5.2 Direct Costs at the Expressing Plant

For by-products which are incurred at the expressing plants the direct and other direct costs are described in the following table:

Table 8: Direct and other direct costs at the expressing plant in SRS

Direct costs for sunflower seeds per kg	3.87
Other Direct costs	
Operating expenses and maintenance costs per liter of sunflower oil	0.12
Wages, plant 11-23 (monthly)	216,061

The direct cost for sunflower seeds is the price which was already described in pricing section of this chapter.

Wages are showed in monthly terms and should be converted to annual terms.

4.2.5.3 Indirect Costs

As every project, SBERP has indirect costs as well:

Table 9: Indirect Costs for Biodiesel Production in USD

	2011	*2012*					
Accounting and Auditing		10735					
Bank Charges		6441					
Distribution		1520636					
External Service Contractors	93203	51848					
Licence Fees		268365					
		2012	*2013*	*2014*	*2015*	*2016*	*2017-2031*
Management Fees-Holding company		1639815	494649	1138724	494649	1042113	494649
Other Contingencies		55207					
Payroll - Management Salaries		368043					
Payroll - Extracting Plant		208555					
Pre-Operating Feasibility Expenses	1805434						
Promotional & Advertising		33738					
Staff Travel & Accommodation		26836					
Staff Training		53673					
Telecommunications		10735					

4.2.6 Important Technical Aspects

At the beginning of the project, once it starts generating revenues in 2012 till 2013 the quantity of purchased sunflower seeds are 33.000.000 kg. However, starting from 2014 till the end of the project the amount of seeds will be doubled. This is due to the fact that the project has two refineries and has enough capacity to express a higher quantity of seeds. It is also should be noted that sunflower seeds are going to be bought in 2011 (base year) even though the project starts generating revenues since 2012. So every year half of necessary seeds should be bought in advance and kept till the next year.

From one kg of seed 0.87 liters of suflower oil can be obtained. From one hectare of land 1.10 ton[15] or 1100 kg of seeds can be obtained; at the same time one hectare

[15] 1 ton =1000 kg

gives 800 kg of oil equivalent to 952 liters of sunflower oil. If 30,000 hectares will be used for growing seeds, accordingly 30,000*1100 (per hectare kg of seeds) =33,000,000 kg of seeds. At the same time where is information regarding daily production of biodiesel and glycerin which should be used properly in calculations (discussed earlier in part 3.2.1). An output reduction factor at the beginning of the project affects the quantity produced. If initially it is quite big reduction (20%), later on it is reduced. When project is starting it may have numerous difficulties, like insufficient resources for production, inexperienced utilization of equipment and etc. which causes the reduction factor to be high enough.

4.2.7 Economic and Tax Depreciation

Depreciation is spreading the costs of assets over the life of the project. Tax depreciation should not be included into the cash flow statements as it has an accounting meaning and it will be a reason for the double counting (the costs for the capital assets were already shown in CFS as an outflow). Thus, tax depreciation will appear only in Income Tax Statement Table. Another type of depreciation is the economic depreciation which is calculated for the purpose of showing the value of the asset at the end of the project. These final year values are called liquidation or residual values. In order to find the liquidation value which will be included into the inflow side of CFS there is need to subtract from the initial value of the asset the accumulated economic depreciation values over the years. In addition, the value should be adjusted to the price index for that particular year (Jenkins *et al.,* 2011).

For SBERP all capital assets are going to be depreciated over 20 years for the economic depreciation and over 15 years for the tax depreciation.

4.2.8 Working Capital

Working capital items are accounts receivable, accounts payable, cash balances, inventories, debt service reserve accounts and prepaid expenses. In this project only the first four items are exist. The table 11 below describes working capital in details.

Table 10: Working Capital Items

Accounts Receivable	12%
Accounts Payable	8%
Cash Balance	8%

Accounts Receivable is estimated to be 12% of the Gross Sales. Accounts Payable is 8% of the value of the total of direct and indirect costs with the subtraction of royalties. Cash balances are 8% of the Gross Sales as well. One item was not showed in the above Table 11; however it is also included into the CFS as an outflow item. This is the Debt Service Reserve Account. This account of cash holdings needed in order to give assurance to the banker of the project ability to meet its debt service payments. It equals each year to half of the annual debt repayments on the given loan to the project for the following year.

4.3 Different Points of View

Once all the necessary data and appropriate tables are obtained, it is possible to start the construction of the cash flow statements from different points of view.

There are numerous items in the CFS which should be or should not be included into those tables depending on considered point of view. Loans, loan proceeds, subsidies, land grants and etc., need to be examined in terms of whether this should be included into the CFS from the particular point of view (Jenkins et *al.,* 2011).

4.3.1 Banker's Point of View

According to Jenkins et *al.,* (2011) the owner's point of view is different from the banker. The banker want to see the project without loan disbursements and loan proceeds, thus, the CFS from his point of view should not include those parts. The bank is only interested in the financial capability of the project to repay back the acquired debt and the interest payments. In order to see this ability the ADSCR (Annual Debt Service Coverage Ratio) and LLCR (Loan Life Coverage Ratio) ratios should be calculated. The ADSCR is the ratio of the annual real net cash flows before financing over the annual debt service amount:

$ADSCR_t = ANCF_t / \text{Annual Debt Repayment}_t$

For different industries the required ratio can be various. The banker must to see a large enough ratio in the initial years. The probability of the ratio to be less than 1 becomes zero. To evaluate the ability of the project to generate cash the LLCR ratio is calculated. This ratio meanwhile is the relation of the discounted annual real net cash lows before financing over the discounted annual real debt repayments:

$LLCR_t = PV(ANCF_{\text{t to end year of debt}}) / PV(\text{Annual Debt Repayment}_{\text{t to end year of debt}})$

When the bank oversees that LLCR shows results that are significantly greater than 1 even though the ADSCR in that particular year is not sufficient the creditor will agree to give that loan to the debtor because of possibility to do bridge financing.[16]

[16] Bridge Financing is a tool which is using excess cash flows in other years in order to cover the gaps in the problematic years

Table 11: CFS for SBERP from Banker's Point of View, in mln SRS, Scenario I (price including tax)

Years	*Real Annual Net Cash Flows*	*Real Annual Debt Service*	*ADSCR*	*LLCR*
2011	-167.0			
2012	-30.0	5.0		
2013	-162.1	4.9		
2014	-64.4	15.5	-4.1	-4.2
2015	-38.3	14.5	-2.6	-4.2
2016	-42.7	13.5	-3.2	-4.5
2017	-39.3	12.5	-3.1	-4.7
2018	-39.8	11.6	-3.4	-5.0
2019	-40.8	10.7	-3.8	-5.4
2020	-37.9	9.9	-3.8	-5.7
2021	-38.9	9.1	-4.3	-6.2
2022	-40.0	8.3	-4.8	-6.7
2023	-41.2	7.6	-5.4	-7.2
2024	-42.4	6.9	-6.1	-7.8
2025	-43.7	6.3	-7.0	-8.4
2026	-45.1	5.7	-8.0	-9.1
2027	-46.5	5.1	-9.2	-9.9
2028	-48.1	4.5	-10.7	-5.5

As it can be seen SBERP is not efficient for the bank at all in Scenario I. Even though when ADSCRs are not sufficient there is a chance to have a look on LLCRs in order to do the bridge financing, in this scenario LLCR in turn is not high enough either. Therefore, the project from banker's point of view is not bankable.

The next Table 12 describes Scenario II excluding tax payments into the price: These prices may be relevant if Caspoland will be willing to forgo from all fuel taxes on biodiesel consumption that they will earn on diesel fuel from the petroleum product.

Table 12: CFS for SBERP from Banker's Point of View, in mln SRS, Scenario II (price excluding tax)

Years	*Real Annual Net Cash Flows*	*Real Annual Debt Service*	*ADSCR*	*LLCR*
2011	-167.0			
2012	14.8	5.0		
2013	-94.9	4.9		
2014	46.2	15.5	2.98	7.86
2015	87.5	14.5	6.05	8.74
2016	84.3	13.5	6.26	9.24
2017	86.8	12.5	6.95	9.82
2018	86.2	11.6	7.45	10.40
2019	85.3	10.7	7.97	11.03
2020	90.1	9.9	9.12	11.71
2021	89.1	9.1	9.81	12.33
2022	88.0	8.3	10.56	12.98
2023	86.8	7.6	11.41	13.67
2024	85.7	6.9	12.37	14.40
2025	84.4	6.3	13.45	15.16
2026	83.1	5.7	14.69	15.97
2027	81.3	5.1	16.03	16.80
2028	79.9	4.5	17.71	9.16

In the second scenario the situation is reverse. All the years ADSCR and LLCR ratios are very attractive and viable from the banker's point of view. So the creditor can easily give the loan to this project. However, the price of biodiesel which was considered in the Scenario II excluded tax payments; so it can be possible to use this price if the government will help the project with tax credits.

So according to the first scenario the project is not vital at all, however the second one is totally reverse project which is very profitable from the banker's point of view.This arises only if Caspoland is willing to subsidize biodiesel consumption by not applying the normal fuel taxes to biodiesel sales in Caspoland.

PV of NCF of Scenario II (242.9 million SRS) – PV of NCF of Scenario I (-581.6 million SRS) = 824.5 million SRS (129.62 million USD), this difference shows the amount of NCF which is generated by reduction in Caspoland taxes on biofuels; the project hopes to get this tax subsidy from Caspoland government.

4.3.2 CFS from Owner's Point of View

In comparison with the banker, the owner is interested in all type of inflows and outflows and considering all of them in construction of CFS. In this case loan disbursements are source of income for the owner, however loan proceeds are outflow. Only after taking into account all these details, CFS after financing can be obtained. Based on which the project's NCF (Net Cash Flows) are calculated and only after that the evaluation criterions can be applied. In this case two appraisal criterions will be used: the Net Present Value (NPV) and the Internal Rate of Return (IRR).

Jenkins *et al.,* (2011) state that NPV is a major evaluation criterion among all others. Since it has no drawbacks in comparison with other tools its results are more precise and reliable. What simply NPV does it summing up all the discounted values or in other words:

$$NPV^0 = \frac{B_0 - C_0}{(1+r)^0} + \frac{B_1 - C_1}{(1+r)^1} \ldots\ldots + \frac{B_n - C_n}{(1+r)^n}$$

$$= \sum_{t=0}^{n} \frac{(B_t - C_t)}{(1+r)^t}$$

So by subtracting from the benefits the project's costs, net cash flows can be obtained and then by dividing it by (1+discount rate) ^t the present values can be derived. Thereafter, the summation of those present values will give the NPV result for the project. NPV shows by how much money the project increases the net worth of the owners of the project.

The higher the discount rate, the lower is the net present value when evaluated at the initial year of the investment to be made. The discount rate reflects the opportunity cost of equity funds to the owner. For example, the funds made that can be invested somewhere else, for instance in another project. When the NPV is more than zero, in other words it is positive, the project worth to be undertaken by investors. In case of being less than zero the project is not able even to cover the opportunity cost of the funds. This type of project should be rejected. When NPV equals to zero the investor is in situation of indifference. In this case the owners of the project are requiring a 15 percentage of return on equity (after tax, for SBERP) on the funds they invest in the project. In SBERP project the following tables accordingly describe the owner's position in two different scenarios:

Table 13: CFS from Owner's Point of View, in mln SRS, Scenario I

Years	*Real Annual NCF Before Financing*	*Real Annual NCF After Financing*
2011	(167)	(115)
2012	(30)	(35)
2013	(162)	(112)
2014	(64)	(84)
2015	(38)	(59)
2016	(43)	(63)
2017	(39)	(60)
2018	(40)	(61)
2019	(41)	(62)
2020	(38)	(59)
2021	(39)	(60)
2022	(40)	(62)
2023	(41)	(63)
2024	(42)	(64)
2025	(44)	(65)
2026	(45)	(66)
2027	(47)	(67)
2028	(48)	(68)
2029	(48)	(48)
2030	(52)	(52)
2031	56	56

Owner is interested in all inflows and outflows for the project like land grants, subsidies, loan disbursements and etc. Therefore, unlike banker owner is considering all items in the CFS. So it is observed from the Table 14 with the price of 4.36 SRS the situation is not attractive to the owner. Till the end of the project negative cash flows are remaining and even after financing the situation has not improved. Although, the loan disbursements decreased the negativity of cash flows in 2011 and 2013, they still are not positive. The NPV which was calculated based on the CF after financing is equal to – 522 million SRS which is equivalent to –76 million USD. In other words, if the owners invest 11 million USD in equity they can expect to earn a negative 76 million USD. Without subsidy this project is immediately bankrupt.

Table 14: CFS from Owner's point of view, in mln SRS, Scenario II

Years	*Real Annual NCF Before Financing*	*Real Annual NCF After Financing*
2011	-167.0	-115.4
2012	4.3	-1.2
2013	-101.9	-51.5
2014	45.3	25.2
2015	82.4	61.9
2016	85.1	64.4
2017	83.7	62.7
2018	84.0	62.8
2019	83.9	62.6
2020	90.2	68.8
2021	89.3	67.8
2022	88.3	66.8
2023	87.2	65.8
2024	86.1	64.8
2025	84.9	63.9
2026	83.6	63.0
2027	82.2	62.1
2028	80.9	61.4
2029	81.5	81.5
2030	77.9	77.9
2031	171.3	171.3

When the biodiesel sales are not taxed the price they can charge will increase to 7.00 SRS which exclude the tax payments, thus, all financial results improve substantially. The Table 14 results show that only in the first three years the project is facing with negative CFs because of making investment in the plant and the initial start up. However, this is decreased significantly due to the loan disbursements made to the project. From 2014 the project becomes very profitable. The calculated NPV is equal to 144 million SRS or to 21 million USD. However, this profitability is totally artificial in the sense that the attractiveness only exists because of the assumed favorable tax treatment of biodiesel in Caspoland.

Now let's consider other important criterion which was applied in SBERP project as well which is the IRR. According to Jenkins *et al*., (2011) IRR is such criteria where the present value of costs is equal to the present value of benefits:

$$\sum_{t=0}^{n} \frac{B_t - C_t}{(1+K)^t} = 0$$

The discount rate which makes the NPV equal to zero is called IRR which has only mathematical meaning. That IRR is acceptable for the project only if it prevails the discount rate used in the discounting of NCFs; in case when the IRR is lower that the opportunity cost of capital that project should not be under consideration at all.

IRR has numerous drawbacks due to which it can not be reliable at times: does not considering irregularity of cash flows – sometimes there is necessity to invest more money even though the revenues already started to be obtained or there is need to restore or substitute equipment; projects can be with different start time and with various lifetime (in this case it is hard to pick among projects the proper one based on the IRR only), projects can be with diverse scales - they may have different investment costs and finally the IRR may not be unique meaning that the NPV can be equal to zero several times and the project is going to have in that case several IRRs and, therefore, which of IRRs to use and to choose will be under a big question.

In case of SBERP the following table shows IRRs for the Scenario I and for the Scenario II:

Table 15: IRR for Given Scenarios

	Scenario I	Scenario II
IRR	n/a	26%

Thus, IRR for Scenario I can not be calculated mathematically because in no year there is positive net cash flows. For Scenario II the IRR is very high 26% which is bigger than the project's discount rate 15%.

Conclusion regarding the evaluation criterions:

Table 16: Summary of Project Evaluation Criterions for the Owner, in mln SRS

	Scenario I	Scenario II
Price of biodiesel	4.36	7.00
NPV	- 522 (-76 mln USD)	144 (21 mln USD)
IRR	n/a	26%

Undoubtedly, the project should be chosen by relying on the NPV criteria, so with the Scenario I it is unacceptable project, and meanwhile with higher price 7.00 SRS SBERP is a profitable and very feasible project. The Difference between the prices for biodiesel is 2.65 SRS which is tax payment for one liter of biodiesel and affects the financial returns of our project a lot. Until the real price for biodiesel goes to 5.96 SRS results (NPV and IRR) are still acceptable and project can be implemented. However, once the price will fall from 5.96 SRS the project becomes unattractive.

The owners of the project are requesting that the tax payments will be subsidized by Saravis Government and only in this case it can be possible to use this price and, thus, to accept the project with very proper NPV and IRR. However, if the government is not going to give that tax credit to the project it is going to have the NPV and the IRR described in the scenario I which is totally unacceptable from all points of view.

Chapter 5

RISK ANALYSIS

5.1 Sensitivity Analysis

All projects are facing with some uncertainties which can be in form of project's own parameters or due to macroeconomic factors like inflation, exchange rate and etc. There are several types of risk analysis: Scenario, Sensitivity and Monte Carlo. Scenario analysis describes diverse scenarios for the projects: optimistic, pessimistic and base case by allowing changes in several variables at the same time. Although Sensitivity analysis is simple, it is very common in risk analysis and permits to see the impact of change in one variable on the project's output. Based on the obtained risky variables from the Sensitivity Analysis, Monte Carlo analysis can be applied. Monte Carlo analysis is relying on Crystal Ball Software which is assigning probabilities to risky variables and allows deriving all results for the project graphically. Doing risk analysis is very important for the project and creates terms for preventing diverse sources or risks which can affect the project significantly and can modify the output results (Savvides, 1994).

In SBERP only Sensitivity analysis is going to be applied. Among variables for the analysis the following are chosen: domestic and foreign inflation rates, investment cost overrun factor, % change in the real price of glycerin, % change in the real price of biodiesel and % change in the real exchange rate.

Table 17: Sensitivity Results for the Domestic Inflation Rate, Scenario I

	NPV	ADSCR-2014	ADSCR-2015	ADSCR-2016	ADSCR-2017	LLCR-2014	LLCR-2015	LLCR-2016	LLCR-2017
	- 522	-4.15	-2.65	-3.18	-3.15	-4.18	-4.19	-4.47	-4.73
0%	(432)	-3.81	-2.14	-2.43	-2.38	-3.10	-2.97	-3.12	-3.25
3%	(455)	-3.92	-2.31	-2.67	-2.62	-3.38	-3.28	-3.46	-3.61
5%	(474)	-4.00	-2.42	-2.83	-2.79	-3.60	-3.53	-3.74	-3.91
7%	(496)	-4.07	-2.53	-3.00	-2.96	-3.87	-3.83	-4.07	-4.28
9%	(522)	-4.15	-2.65	-3.18	-3.15	-4.18	-4.19	-4.47	-4.73
11%	(553)	-4.23	-2.77	-3.36	-3.34	-4.56	-4.62	-4.96	-5.27
13%	(590)	-4.31	-2.89	-3.55	-3.55	-5.00	-5.13	-5.55	-5.93
15%	(633)	-4.39	-3.01	-3.75	-3.77	-5.54	-5.75	-6.26	-6.75

Table 18: Sensitivity Results for the Domestic Inflation Rate, Scenario II

	NPV	ADSCR-2014	ADSCR-2015	ADSCR-2016	ADSCR-2017	LLCR-2014	LLCR-2015	LLCR-2016	LLCR-2017
	144	2.98	6.05	6.26	6.95	7.86	8.74	9.24	9.82
0%	239	3.37	6.71	7.15	7.89	9.00	10.02	10.63	11.31
3%	213	3.24	6.49	6.86	7.58	8.68	9.66	10.25	10.91
5%	193	3.15	6.34	6.66	7.38	8.44	9.39	9.96	10.60
7%	170	3.07	6.20	6.47	7.16	8.17	9.09	9.63	10.24
9%	144	2.98	6.05	6.26	6.95	7.86	8.74	9.24	9.82
11%	114	2.89	5.90	6.06	6.73	7.51	8.34	8.79	9.32
13%	79	2.81	5.76	5.85	6.50	7.09	7.86	8.25	8.72
15%	37	2.72	5.61	5.63	6.27	6.60	7.30	7.61	8.00

The above tables 18 and 19 show that domestic inflation rate is risky variable as it affects NPV, ADSCRs and LLCRs, however not at high level. In case I the higher the inflation rate NPV, ADSCR and LLCR are getting more negative. The affection of increased domestic inflation in Saravis has the same impact in case II: the more the inflation the lower are evaluation criterions.

Table 19: Sensitivity Results for the Foreign Inflation Rate, Scenario I

	NPV	ADSCR-2014	ADSCR-2015	ADSCR-2016	ADSCR-2017	LLCR-2014	LLCR-2015	LLCR-2016	LLCR-2017
	(522)	(4.1)	(2.6)	(3.2)	(3.1)	(4.2)	(4.2)	(4.5)	(4.7)
0%	(574)	(3.9)	(2.5)	(2.9)	(2.9)	(3.8)	(3.8)	(4.1)	(4.2)
1%	(555)	(4.0)	(2.5)	(3.0)	(2.9)	(3.9)	(3.9)	(4.2)	(4.4)
2%	(538)	(4.1)	(2.6)	(3.1)	(3.0)	(4.1)	(4.1)	(4.3)	(4.5)
3%	(522)	(4.1)	(2.6)	(3.2)	(3.1)	(4.2)	(4.2)	(4.5)	(4.7)
4%	(509)	(4.2)	(2.7)	(3.3)	(3.3)	(4.3)	(4.3)	(4.6)	(4.9)
5%	(497)	(4.3)	(2.8)	(3.3)	(3.4)	(4.5)	(4.5)	(4.8)	(5.1)
6%	(486)	(4.4)	(2.8)	(3.4)	(3.5)	(4.6)	(4.6)	(5.0)	(5.4)

Table 20: Sensitivity Results for the Foreign Inflation Rate, Scenario II

	NPV	ADSCR-2014	ADSCR-2015	ADSCR-2016	ADSCR-2017	LLCR-2014	LLCR-2015	LLCR-2016	LLCR-2017
	144	3.0	6.0	6.3	6.9	7.9	8.7	9.2	9.8
0%	98	2.6	5.3	5.2	5.6	5.9	6.4	6.5	6.7
1%	115	2.7	5.5	5.6	6.1	6.5	7.1	7.4	7.7
2%	131	2.9	5.8	5.9	6.5	7.2	7.9	8.3	8.7
3%	144	3.0	6.0	6.3	6.9	7.9	8.7	9.2	9.8
4%	157	3.1	6.3	6.6	7.4	8.6	9.6	10.3	11.0
5%	167	3.2	6.6	7.0	7.9	9.3	10.5	11.4	12.3
6%	177	3.4	6.9	7.4	8.5	10.1	11.5	12.5	13.6

Based on the sensitivity analysis results, foreign inflation rate is risky variable. This also can be due to the fact that the loan is given in USD and indirect costs are expressed in foreign currency. Therefore, it affects SBERP in a positive way: the higher is the inflation rate in the United States, the NPV is getting less negative, however, ADSCR and LLCR ratios are getting more negative for the case I and for the case II these criterions are improving. It is explained by the fact that when the foreign currency is depreciating it has a positive impact on the domestic situation, for instance loan proceeds will be decreased and SBERP will pay less money to the bank with the higher foreign inflation.

Table 21: Sensitivity Results for the % Change in the Real Exchange Rate, Scenario I

	NPV	*ADSCR-2014*	*ADSCR-2015*	*ADSCR-2016*	*ADSCR-2017*	*LLCR-2014*	*LLCR-2015*	*LLCR-2016*	*LLCR-2017*
	(522)	(4.1)	(2.6)	(3.2)	(3.1)	(4.2)	(4.2)	(4.5)	(4.7)
-20%	(495)	(4.8)	(3.1)	(3.6)	(3.6)	(4.8)	(4.7)	(5.1)	(5.3)
-10%	(509)	(4.4)	(2.8)	(3.4)	(3.4)	(4.4)	(4.4)	(4.7)	(5.0)
-5%	(515)	(4.3)	(2.7)	(3.3)	(3.2)	(4.3)	(4.3)	(4.6)	(4.9)
0%	(522)	(4.1)	(2.6)	(3.2)	(3.1)	(4.2)	(4.2)	(4.5)	(4.7)
5%	(529)	(4.0)	(2.6)	(3.1)	(3.1)	(4.1)	(4.1)	(4.4)	(4.6)
10%	(536)	(3.9)	(2.5)	(3.0)	(3.0)	(4.0)	(4.0)	(4.3)	(4.5)
20%	(550)	(3.7)	(2.4)	(2.9)	(2.8)	(3.8)	(3.8)	(4.1)	(4.3)

Table 22: Sensitivity Results for the % Change in the Real Exchange Rate, Scenario II

	NPV	*ADSCR-2014*	*ADSCR-2015*	*ADSCR-2016*	*ADSCR-2017*	*LLCR-2014*	*LLCR-2015*	*LLCR-2016*	*LLCR-2017*
	144	3.0	6.0	6.3	6.9	7.9	8.7	9.2	9.8
-20%	168	4.0	7.7	8.1	8.9	10.2	11.3	12.0	12.7
-10%	156	3.4	6.8	7.1	7.8	8.9	9.9	10.5	11.1
-5%	150	3.2	6.4	6.7	7.4	8.4	9.3	9.8	10.4
0%	144	3.0	6.0	6.3	6.9	7.9	8.7	9.2	9.8
5%	139	2.8	5.7	5.9	6.6	7.4	8.3	8.7	9.3
10%	133	2.6	5.4	5.6	6.2	7.0	7.8	8.2	8.8
20%	121	2.3	4.9	5.0	5.6	6.3	7.0	7.4	7.9

In both scenarios the % change in the real exchange rate has significant impacts on the evaluation criterions. The higher the positive % change in the real exchange rate, the less improved are NPV, ADSCR and LLCR ratios.

Table 23: Sensitivity Results for the Investment Cost Overrun Factor, Scenario I

	NPV	*ADSCR-2014*	*ADSCR-2015*	*ADSCR-2016*	*ADSCR-2017*	*LLCR-2014*	*LLCR-2015*	*LLCR-2016*	*LLCR-2017*
	(522)	(4.1)	(2.6)	(3.2)	(3.1)	(4.2)	(4.2)	(4.5)	(4.7)
-10%	(506)	(4.1)	(2.6)	(3.2)	(3.1)	(4.2)	(4.2)	(4.5)	(4.7)
-5%	(514)	(4.1)	(2.6)	(3.2)	(3.1)	(4.2)	(4.2)	(4.5)	(4.7)
0%	(522)	(4.1)	(2.6)	(3.2)	(3.1)	(4.2)	(4.2)	(4.5)	(4.7)
5%	(531)	(4.2)	(2.7)	(3.2)	(3.2)	(4.2)	(4.2)	(4.5)	(4.7)
10%	(539)	(4.2)	(2.7)	(3.2)	(3.2)	(4.2)	(4.2)	(4.5)	(4.7)

Table 24: Sensitivity Results for the Investment Cost Overrun Factor, Scenario II

	NPV	ADSCR-2014	ADSCR-2015	ADSCR-2016	ADSCR-2017	LLCR-2014	LLCR-2015	LLCR-2016	LLCR-2017
	144	3.0	6.0	6.3	6.9	7.9	8.7	9.2	9.8
-10%	160	3.0	6.0	6.3	6.9	7.9	8.7	9.2	9.8
-5%	152	3.0	6.0	6.3	6.9	7.9	8.7	9.2	9.8
0%	144	3.0	6.0	6.3	6.9	7.9	8.7	9.2	9.8
5%	136	3.0	6.1	6.3	6.9	7.9	8.7	9.2	9.8
10%	129	3.0	6.1	6.3	6.9	7.9	8.7	9.2	9.8

Another less risky variable is the investment cost overrun factor. For both cases it does have slight affection on ADSCR and LLCR ratios. However, the NPV is getting higher impact and changes more substantially in comparison with the ratios. With the increase in the investment cost overrun factor in case I the NPV is getting more negative and it is getting less positive in the second scenario. Thus, the more the cost overrun factor, the less is the NPV value.

Table 25: Sensitivity Results for % Change in the Real Price of Biodiesel, Scenario I

	NPV	ADSCR-2014	ADSCR-2015	ADSCR-2016	ADSCR-2017	LLCR-2014	LLCR-2015	LLCR-2016	LLCR-2017
	(522)	(4.1)	(2.6)	(3.2)	(3.1)	(4.2)	(4.2)	(4.5)	(4.7)
-2%	(547)	(4.4)	(3.0)	(3.5)	(3.5)	(4.6)	(4.7)	(5.0)	(5.3)
-1%	(535)	(4.3)	(2.8)	(3.4)	(3.3)	(4.4)	(4.4)	(4.7)	(5.0)
0%	(522)	(4.1)	(2.6)	(3.2)	(3.1)	(4.2)	(4.2)	(4.5)	(4.7)
1%	(510)	(4.0)	(2.5)	(3.0)	(3.0)	(4.0)	(3.9)	(4.2)	(4.4)
2%	(497)	(3.9)	(2.3)	(2.8)	(2.8)	(3.7)	(3.7)	(4.0)	(4.2)

Table 26: Sensitivity Results for % Change in the Real Price of Biodiesel, Scenario II

	NPV	ADSCR-2014	ADSCR-2015	ADSCR-2016	ADSCR-2017	LLCR-2014	LLCR-2015	LLCR-2016	LLCR-2017
	144	3.0	6.0	6.3	6.9	7.9	8.7	9.2	9.8
-2%	110	2.6	5.6	5.8	6.4	7.2	8.1	8.5	9.1
-1%	127	2.8	5.8	6.0	6.7	7.6	8.4	8.9	9.4
0%	144	3.0	6.0	6.3	6.9	7.9	8.7	9.2	9.8
1%	161	3.2	6.3	6.5	7.2	8.2	9.1	9.6	10.2
2%	178	3.3	6.5	6.7	7.5	8.5	9.4	10.0	10.6

The percentage change in the real price of biodiesel is very risky variable as it can be seen from the above tables for both cases. In case I the higher is the positive % change in the real price of biodiesel, the NPV and the ratios are getting less negative for case I and more positive for the case II, for instance in 2% increase in the real price for biodiesel the NPV has improved ; the same can be observed for ADSCR and LLCR ratios. The same can be observed for the case II, the higher is the positive % change the more is NPV and ratios. The real price of biodiesel and, consequently, its % change has a very big impact on this project.

Table 27: Sensitivity Results for % Change in the Real Price of Diesel, Scenario I

	NPV	*ADSCR-2014*	*ADSCR-2015*	*ADSCR-2016*	*ADSCR-2017*	*LLCR-2014*	*LLCR-2015*	*LLCR-2016*	*LLCR-2017*
	(522)	(4)	(3)	(3)	(3)	(4)	(4)	(4)	(5)
-4%	-572.40	-4.69	-3.31	-3.89	-3.91	-5.09	-5.17	-5.51	-5.83
-2%	-547.41	-4.42	-2.98	-3.53	-3.53	-4.64	-4.68	-4.99	-5.28
0%	-522.41	-4.15	-2.65	-3.18	-3.15	-4.18	-4.19	-4.47	-4.73
2%	-497.42	-3.88	-2.32	-2.82	-2.77	-3.73	-3.70	-3.95	-4.17
4%	-472.42	-3.61	-1.99	-2.47	-2.38	-3.27	-3.21	-3.44	-3.62

Table 28: Sensitivity Results for % Change in the Real Price of Diesel, Scenario II

	NPV	*ADSCR-2014*	*ADSCR-2015*	*ADSCR-2016*	*ADSCR-2017*	*LLCR-2014*	*LLCR-2015*	*LLCR-2016*	*LLCR-2017*
	144	3.0	6.0	6.3	6.9	7.9	8.7	9.2	9.8
-2%	110	2.6	5.6	5.8	6.4	7.2	8.1	8.5	9.1
-1%	127	2.8	5.8	6.0	6.7	7.6	8.4	8.9	9.4
0%	144	3.0	6.0	6.3	6.9	7.9	8.7	9.2	9.8
1%	161	3.2	6.3	6.5	7.2	8.2	9.1	9.6	10.2
2%	178	3.3	6.5	6.7	7.5	8.5	9.4	10.0	10.6

According to results from the sensitivity analysis for the % change in the real price of diesel, it is very risky variable for the project. This is due to the fact that biodiesel price is tied to diesel price and moves together with it. Table 27 shows that the more is the positive % change in the real price of biodiesel, the less negative are

NPV and ratios. For the Scenario II the same logic can be applied, The higher is the % change in the real price of diesel in a positive way, NPV and ratios are improving.

Table 29: Sensitivity Results for % Change in the Real Price of Glycerin, Scenario I

	NPV	***ADSCR-2014***	***ADSCR-2015***	***ADSCR-2016***	***ADSCR-2017***	***LLCR-2014***	***LLCR-2015***	***LLCR-2016***	***LLCR-2017***
	(522)	(4.1)	(2.6)	(3.2)	(3.1)	(4.2)	(4.2)	(4.5)	(4.7)
-2%	(523)	(4.2)	(2.7)	(3.2)	(3.2)	(4.2)	(4.2)	(4.5)	(4.7)
-1%	(523)	(4.2)	(2.7)	(3.2)	(3.2)	(4.2)	(4.2)	(4.5)	(4.7)
0%	(522)	(4.1)	(2.6)	(3.2)	(3.1)	(4.2)	(4.2)	(4.5)	(4.7)
1%	(522)	(4.1)	(2.6)	(3.2)	(3.1)	(4.2)	(4.2)	(4.5)	(4.7)
2%	(522)	(4.1)	(2.6)	(3.2)	(3.1)	(4.2)	(4.2)	(4.5)	(4.7)

Table 30: Sensitivity Results for % Change in the Real Price of Glycerin, Scenario II

	NPV	***ADSCR-2014***	***ADSCR-2015***	***ADSCR-2016***	***ADSCR-2017***	***LLCR-2014***	***LLCR-2015***	***LLCR-2016***	***LLCR-2017***
	144	3.0	6.0	6.3	6.9	7.9	8.7	9.2	9.8
-2%	144	3.0	6.0	6.3	6.9	7.9	8.7	9.2	9.8
-1%	144	3.0	6.0	6.3	6.9	7.9	8.7	9.2	9.8
0%	144	3.0	6.0	6.3	6.9	7.9	8.7	9.2	9.8
1%	145	3.0	6.1	6.3	7.0	7.9	8.7	9.2	9.8
2%	145	3.0	6.1	6.3	7.0	7.9	8.7	9.3	9.8

The % change in the real price of glycerin is not a risky factor because it has no impact on ADSCR and LLCR ratios in the both cases, and has a very slight or no affection at all on the NPVs as well. This is by-product from the production and, therefore, it can not be considered as risky variable as its fraction in total revenues is not so huge.

As a conclusion for the risk analysis part it should be notified that the most risky variable is the % change in the real price of biodiesel as it is the main output from SBERP. Other risky variables are domestic inflation rate, foreign inflation rate, the % change in the real exchange rate and the investment cost overrun factor which is risky only for the NPV criteria.

5.2 Monte-Carlo Analysis

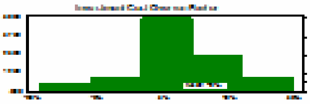
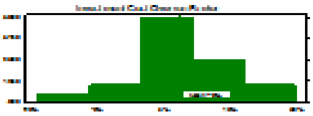
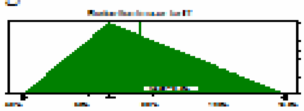
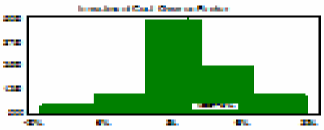
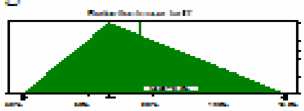
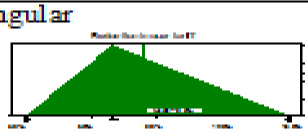
As soon as Sensitivity analysis is done and the risk variables are defined it is possible to start doing Monte Carlo analysis. According to Jenkins *et al.,*(2011) after assigning the probabilities to every risky variable which can be derived from experts or from historical data, the probability distributions for the project outcomes can be obtained. These probability distributions may help the project owners in making the correct decisions. Thus, by applying Crystal Ball software it is possible to run Monte Carlo simulation and get the project outcomes' statistical results. So let's see below the results for the project outcomes of the Monte Carlo simulation.

Note: Monte Carlo simulation will be applied only to Scenario II as the first case has negative financial outcomes and running Monte Carlo simulation for it is not proper as this project is not going to be implemented.

In Monte Carlo simulation the following risky variables were analyzed: domestic inflation rate, foreign inflation rate, investment cost overrun factor, % change in the real price of biodiesel and % change in the real exchange rate, sales of biodiesel.

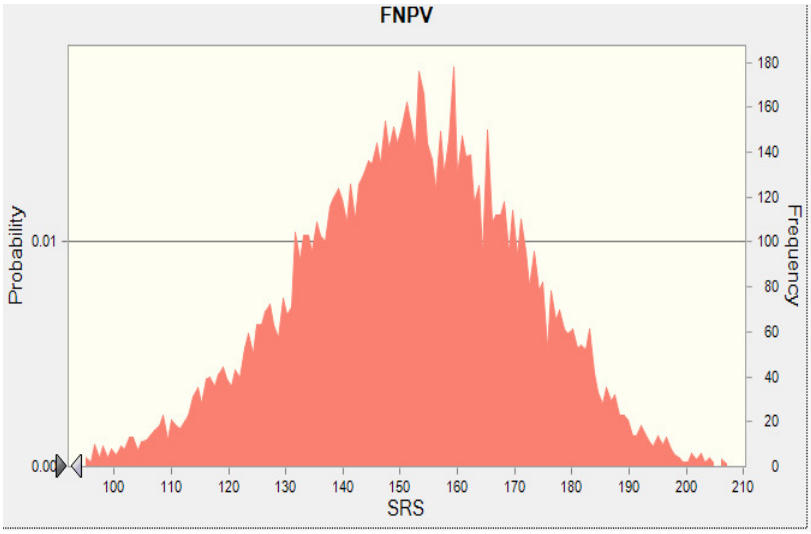
Here are the probabilities distributions for every risky variable:

Table 31: Probability Distributions for the Risky Variables

Variable	Distribution	Range
Domestic Rate of Inflation	Custom 	min / max / probability 5.26% / 8.65% / 46.67% 8.65% / 12.05% / 30.00% 12.05% / 15.44% / 16.67% 15.44% / 18.83% / 3.33% 18.83% / 22.22% / 3.33%
Foreign Rate of Inflation	Custom 	min / Max / Probability -0.36% / 1.78% / 13.33% 1.78% / 3.92% / 63.33% 3.92% / 6.06% / 16.67% 6.06% / 8.19% / 3.33% 8.19% / 10.33% / 3.33%
% Change in the Real Exchange Rate	Triangular 	Min -10% Likeliest 0% Max 10%
Investment Cost Overrun Factor	Triangular 	min / Max / probability -10% / -5% / 0.05 -5% / 0% / 0.15 0% / 5% / 0.55 5% / 10% / 0.25
% Change in the Real Price of Diesel	Triangular 	min -4% likeliest 0% max 4%
% Change in the Real Price of Biodiesel	Triangular 	min -2% likeliest 0% max 2%

Based on given probability distributions and the range the Monte- Carlo simulation was runned and the forecast charts were derived. The forecast charts were obtained for NPV, IRR, ADSCR from year 2014-2016 and LLCR for the same period as well.

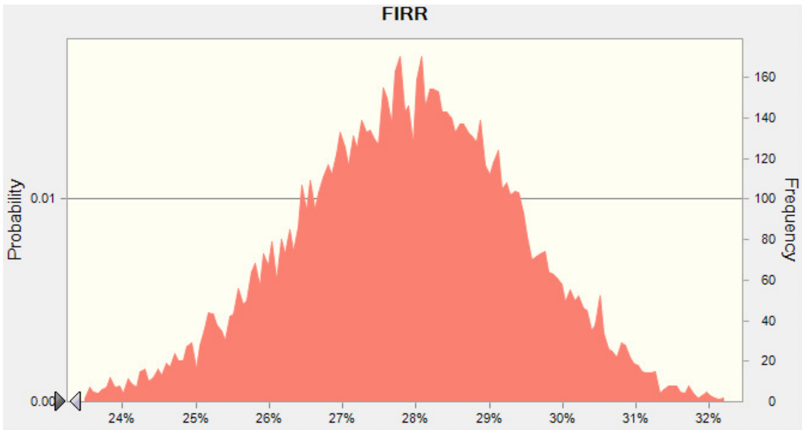
5.2.1 Forecast Results for Net Present Value and Internal Rate of Return



Statistic	Forecast values
Trials	10,000
Base Case	144
Mean	151
Median	152
Mode	---
Standard Deviation	20
Variance	404
Skewness	-0.2731
Kurtosis	3.16
Coeff. of Variability	0.1331
Minimum	50
Maximum	213
Mean Std. Error	0

Figure 7: Forecast Chart and Statistic Results for Net Present Value

As it can be observed from Figure 7, NPV has no risk at all in case of implementation the project. At the same its deviation from the mean (standard deviation) is very low. Even the minimum value is positive (50 mln.SRS) which is very good sign that the project's NPV is not risky at all. The certainty of being under the zero is 0%. This means that there is 100% probability that the project will generate positive NPV.

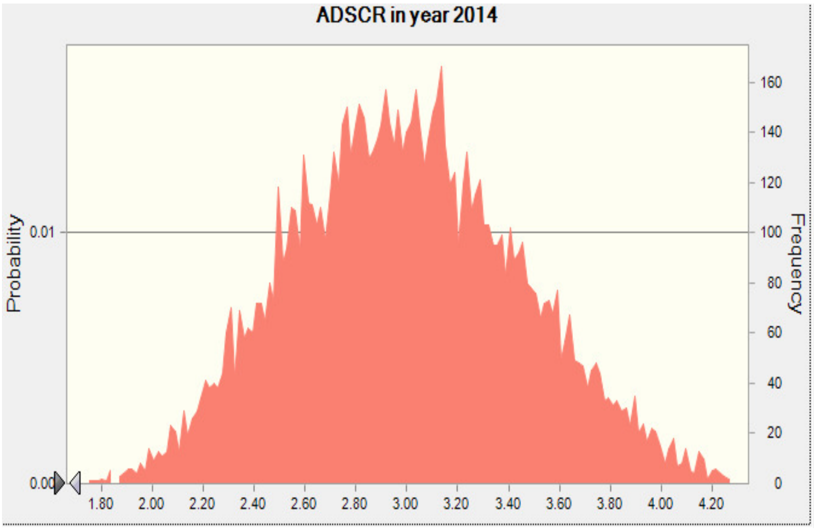


Statistic	Forecast values
Trials	10,000
Base Case	26%
Mean	28%
Median	28%
Mode	---
Standard Deviation	2%
Variance	0%
Skewness	-0.2326
Kurtosis	3.17
Coeff. of Variability	0.0562
Minimum	20%
Maximum	33%
Mean Std. Error	0%

Figure 8: Forecast Chart and Statistic Results for Internal Rate of Return

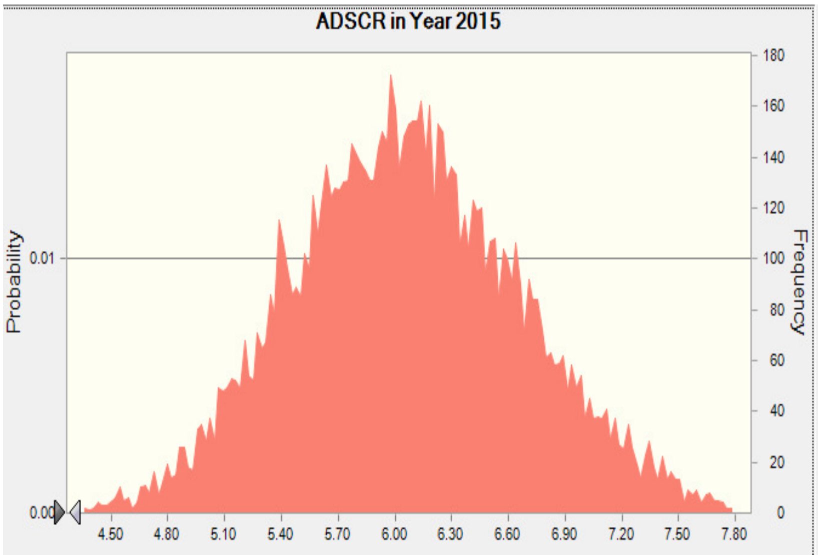
Figure 8 reflects the forecast chart and statistic results for IRR, which show that there is 100% certainty that the project's IRR is going to be higher than the project's discount rate which is 15%. At the same time the standard deviation from the mean 28% is 2% which is very low and not risky at all. The minimum value for this project can be 20% which is again in excess of the discount rate.

5.2.2 Forecast Results for ADSCR and LLCR Ratios



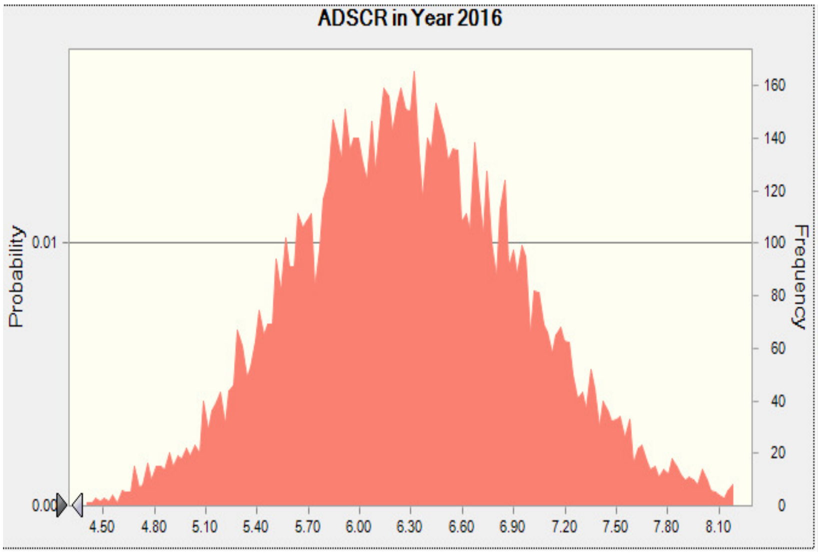
Statistic	Forecast values
Trials	10,000
Base Case	2.98
Mean	3.00
Median	2.99
Mode	---
Standard Deviation	0.45
Variance	0.21
Skewness	0.1868
Kurtosis	2.79
Coeff. of Variability	0.1516
Minimum	1.49
Maximum	4.79
Mean Std. Error	0.00

Figure 9: Forecast Chart and Statistic Results for ADSCR in Year 2014



Statistic	Forecast values
Trials	10,000
Base Case	6.05
Mean	6.07
Median	6.05
Mode	---
Standard Deviation	0.61
Variance	0.38
Skewness	0.1904
Kurtosis	2.98
Coeff. of Variability	0.1011
Minimum	4.09
Maximum	8.63
Mean Std. Error	0.01

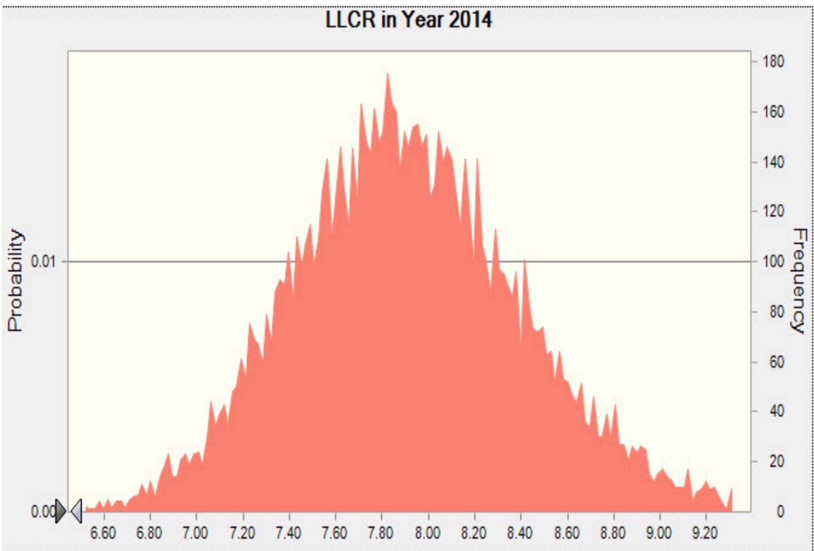
Figure 10: Forecast Chart and Statistic Results for ADSCR in Year 2015



Statistic	Forecast values
Trials	10,000
Base Case	6.26
Mean	6.29
Median	6.27
Mode	---
Standard Deviation	0.68
Variance	0.46
Skewness	0.1881
Kurtosis	2.96
Coeff. of Variability	0.1077
Minimum	4.29
Maximum	9.24
Mean Std. Error	0.01

Figure 11: Forecast Chart and Statistic Results for ADSCR in Year 2016

The above three figures (9,10 and 11) show that the project's ability to cover its debt obligations is very high and not risky at all. Thus, for all three years (2014-2016) the ADSCR is high enough and in excess of 1. Moreover, low standard deviations from the mean values for all the years reflect small level of riskiness for these ratios. Even the minimum values are in excess of the benchmark which is 1. Therefore, the banker can give the debt to this project as it has high ability to cover its debt service obligations.



Statistic	Forecast values
Trials	10,000
Base Case	7.86
Mean	7.92
Median	7.89
Mode	---
Standard Deviation	0.50
Variance	0.25
Skewness	0.2802
Kurtosis	3.18
Coeff. of Variability	0.0632
Minimum	6.28
Maximum	10.28
Mean Std. Error	0.01

Figure 12: Forecast Chart and Statistic Results for LLCR in Year 2014

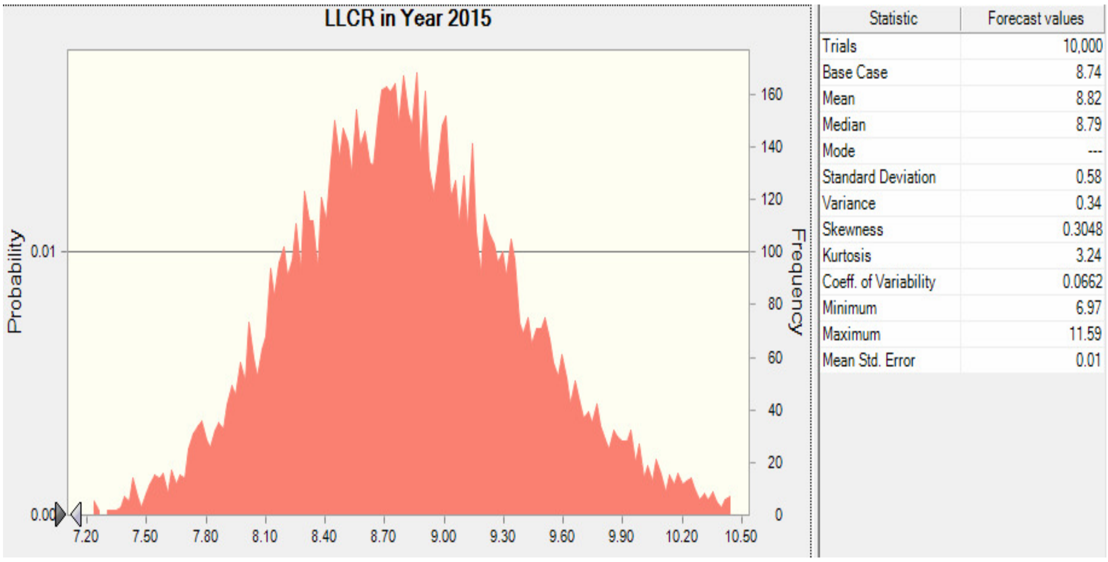


Figure 13: Forecast Chart and Statistic Results for LLCR in Year 2015

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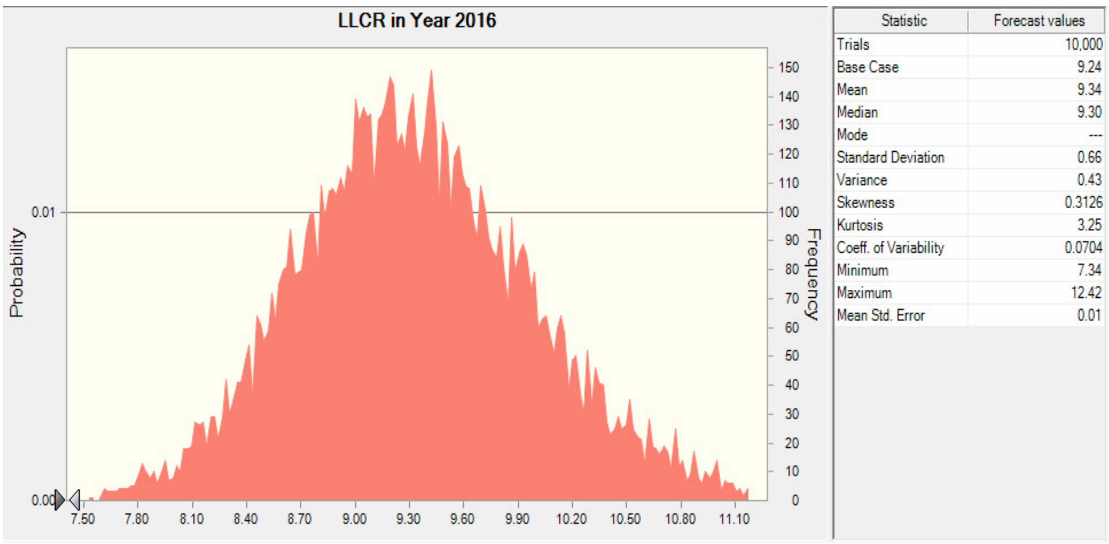

Figure 14: Forecast Chart and Statistic Results for LLCR in Year 2016

According to results for the LLCR ratios from 2014 to 2016 the project ability to do bridge financing is high. This is due to the fact that LLCRs in all three years are in excess of 1.7 and have low standard deviations from the mean values. Therefore, the project can cover its problematic years with the cash flows which are in excess in following years.

Monte-Carlo analysis showed that the simulated forecast results for the ratios and criterions are not risky at all. So the project has no or has almost zero level of riskiness from the banker and the project owner point of views.

Chapter 6

CONCLUSION

6.1 SBERP's Financial and Risk Results

This investigation has done the financial and the risk appraisal of Saravis Biodiesel Expressing and Refinery Plant. According to the obtained results from the project evaluation which was done in two scenarios the stakeholders should pay attention to some significant details. For instance, if the real price of biodiesel will be tax exclusive and those tax payments will be subsidized by Government of Saravis, in this scenario the project is feasible and can be implemented. However, if the price is going to be tax inclusive the project's results are unattractive to all stakeholders: creditor- National Bank of Saravis and to project owner as well.

Another significant detail which should be paid attention on is riskiness of the project. In the scenario I SBERP is very risky project and should be rejected at once. In the second scenario the situation is reverse and has low level of riskiness. Among risky variables the most attention should be based on the real price of biodiesel as it can cause huge profits and enormous losses at the same time, depending on percentage changes in the price. The rest risky variables are macroeconomic factors, like domestic and foreign inflation rates, real exchange rate which cannot be controlled by the project as they are external factors; however it is possible to regulate them by signing contractual arrangements. And it is investment cost overrun factor which affects NPV of the project.

6.2 Recommendations

The current situation in Saravis shows that the government is not interested in subsidizing biodiesel production. Therefore, before implementation SBERP there should be a strong guarantee that Saravis government will take care of tax payments and subsidize them for the project. If the tax credits will not be given to this project it doest not worth to be implemented at all from banker and owner points of views. Therefore, my suggestion is that this project may bring huge money only in case of getting tax subsidization from the government; otherwise there is no way to implement it as its investment costs are in excess of its revenues from the output.

Although, nowadays, biodiesel is highly developing and can be solution for getting rid from numerous environmental problems and this project may assist in fighting with these problems in Saravis, it is necessary to pay attention to its financial aspects as many stakeholders may suffer from its implementation if some conditions will not be met**.** If government in such developing countries helps the sector and provides subsidies to the producers of such projects, then these investments can be profitable for all interest groups involved in them, while at the same time they are disaster for the economy.

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International Monetary Fund, http://www.imf.org

World Bank Group, http://www.worldbank.org

APPENDICES

INCOME STATEMENT	Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2 020	2 021	2 022	2 023	2 024	2 025	2 026	2 027	2 028	2 029	2 030	2 031
Sales of biodiesel			115	141	317	353	385	420	457	499	543	592	646	704	767	836	911	993	1 083	1 180	1 286	1 402
Sales of glycerin			2	2	5	5	6	6	7	7	8	9	10	10	11	12	14	15	16	18	19	21
Sales of by -products from expressing			19	30	46	50	55	60	65	71	77	84	92	100	109	119	130	141	154	168	183	117
Total sales			135	173	368	409	445	485	529	577	629	685	747	814	887	967	1 054	1 149	1 253	1 365	1 488	1 540
Direct Costs																						
Operating raw materials for refinery per year			20	25	57	63	69	75	82	89	97	106	115	126	137	149	163	177	193	211	230	250
Operating raw materials for expressing per year		64	111	205	307	342	373	407	443	483	527	574	626	682	743	810	883	963	1 049	1 144	1 247	679
Operating expenses for refinery		0	3	4	7	7	8	9	9	10	11	12	13	14	16	17	19	20	22	24	26	29
Operating expenses for expressing plant			3	5	11	12	14	15	16	17	19	21	23	25	27	29	32	35	38	41	45	32
Total direct costs		64	138	239	382	425	463	505	550	600	654	713	777	847	923	1 006	1 096	1 195	1 303	1 420	1 548	990
GROSS PROFIT		(64)	(2)	(66)	(14)	(16)	(18)	(19)	(21)	(23)	(25)	(27)	(30)	(32)	(35)	(39)	(42)	(46)	(50)	(54)	(59)	550
OTHER COSTS																						
Accounting and Auditing			0.08	0.10	0.11	0.13	0.15	0.17	0.20	0.23	0.27	0.31	0.35	0.41	0.47	0.54	0.63	0.72	0.83	0.96	1.11	1.28
Bank Charges			0.05	0.06	0.07	0.08	0.09	0.10	0.12	0.14	0.16	0.18	0.21	0.25	0.28	0.33	0.38	0.43	0.50	0.58	0.67	0.77
Depreciation		13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	-	-	-	-	-
External service contractors			0	0	1	1	1	1	1	1	1	1	2	2	2	3	3	3	4	5	5	6
Insurance			2	2	2	2	2	2	3	3	3	3	4	4	4	5	5	6	6	7	8	8
Licence Fees			2	2	3	3	4	4	5	6	7	8	9	10	12	14	16	18	21	24	28	32
Management fees-holding company			13	5	12	6	15	8	9	11	12	14	16	19	22	25	29	33	38	44	51	59
Maintenance			0	0	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	4	4
Other Contingencies			0	1	1	1	1	1	1	1	1	2	2	2	2	3	3	4	4	5	6	7
Payroll - Management Salaries			3	3	4	4	5	6	7	8	9	11	12	14	16	19	21	25	29	33	38	44
Payroll - Extracting Plant			2	2	2	3	3	3	4	4	5	6	7	8	9	11	12	14	16	19	22	25
Pre Operating Feasibility Expenses		12																				
Promotional & Advertising			0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.8	1.0	1.1	1.3	1.5	1.7	2.0	2.3	2.6	3.0	3.5	4.0
Royalties			3	4	9	10	11	12	13	14	16	17	19	20	22	24	26	29	31	34	37	39
Staff Travel & Accommodation			0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.4	1.6	1.8	2.1	2.4	2.8	3.2
Staff Training			0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.3	1.5	1.8	2.0	2.4	2.7	3.1	3.6	4.2	4.8	5.6	6.4
Telecommunications			0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.8	1.0	1.1	1.3
Net Vat liabilties			(13)	(23)	(37)	(41)	(45)	(49)	(53)	(58)	(63)	(69)	(75)	(82)	(90)	(98)	(106)	(116)	(126)	(138)	(150)	(96)
Total Expenses		25	27	11	12	4	13	6	6	8	9	12	14	18	22	27	34	28	38	49	63	144
EBIT		(90)	(29)	(77)	(25)	(21)	(30)	(25)	(28)	(31)	(35)	(39)	(44)	(50)	(58)	(66)	(76)	(74)	(88)	(104)	(122)	406
Interest Expenses			5	6	12	12	12	11	11	11	10	10	9	8	7	6	5	3	2	-	-	-
EBT		(90)	(34)	(83)	(37)	(33)	(42)	(36)	(39)	(41)	(45)	(49)	(53)	(58)	(65)	(72)	(81)	(78)	(90)	(104)	(122)	406
Cumulative losses			(34)	(117)	(154)	(187)	(229)	(265)	(304)	(345)	(390)	(439)	(492)	(550)	(615)	(687)	(767)	(845)	(934)	(1 038)	(1 160)	(754)
Taxable income			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tax payments			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Profit		(90)	(34)	(83)	(37)	(33)	(42)	(36)	(39)	(41)	(45)	(49)	(53)	(58)	(65)	(72)	(81)	(78)	(90)	(104)	(122)	406

INCOME STATEMENT	Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2 020	2 021	2 022	2 023	2 024	2 025	2 026	2 027	2 028	2 029	2 030	2 031
Sales of biodiesel			184	226	510	567	618	674	735	801	873	951	1 037	1 130	1 232	1 343	1 464	1 596	1 739	1 896	2 067	2 253
Sales of glycerin			2	2	5	5	6	6	7	7	8	9	10	10	11	12	14	15	16	18	19	21
Sales of by -products from expressing			19	30	46	50	55	60	65	71	77	84	92	100	109	119	130	141	154	168	183	117
Total sales			205	258	560	623	679	740	807	879	958	1 044	1 138	1 241	1 353	1 474	1 607	1 752	1 909	2 081	2 269	2 390
Direct Costs																						
Operating raw materials for refinery per year			20	25	57	63	69	75	82	89	97	106	115	126	137	149	163	177	193	211	230	250
Operating raw materials for expressing per year		64	111	205	307	342	373	407	443	483	527	574	626	682	743	810	883	963	1 049	1 144	1 247	679
Operating expenses for refinery		0	3	4	7	7	8	9	9	10	11	12	13	14	16	17	19	20	22	24	26	29
Operating expenses for expressing plant			3	5	11	12	14	15	16	17	19	21	23	25	27	29	32	35	38	41	45	32
Total direct costs		64	138	239	382	425	463	505	550	600	654	713	777	847	923	1 006	1 096	1 195	1 303	1 420	1 548	990
GROSS PROFIT		(64)	67	19	179	198	216	235	256	279	304	332	362	394	430	468	511	557	607	661	721	1 400
OTHER COSTS																						
Accounting and Auditing			0.08	0.10	0.11	0.13	0.15	0.17	0.20	0.23	0.27	0.31	0.35	0.41	0.47	0.54	0.63	0.72	0.83	0.96	1.11	1.28
Bank Charges			0.05	0.06	0.07	0.08	0.09	0.10	0.12	0.14	0.16	0.18	0.21	0.25	0.28	0.33	0.38	0.43	0.50	0.58	0.67	0.77
Depreciation		13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	-	-	-	-	-
External service contractors			0	0	1	1	1	1	1	1	1	1	2	2	2	3	3	3	4	5	5	6
Insurance			2	2	2	2	2	2	3	3	3	3	4	4	4	5	5	6	6	7	8	8
Licence Fees			2	2	3	3	4	4	5	6	7	8	9	10	12	14	16	18	21	24	28	32
Management fees-holding company			13	5	12	6	15	8	9	11	12	14	16	19	22	25	29	33	38	44	51	59
Maintenance			1	1	1	2	2	2	2	2	2	3	3	3	3	4	4	4	5	5	6	6
Other Contingencies			0	1	1	1	1	1	1	1	1	2	2	2	2	3	3	4	4	5	6	7
Payroll - Management Salaries			3	3	4	4	5	6	7	8	9	11	12	14	16	19	21	25	29	33	38	44
Payroll - Extracting Plant			2	2	2	3	3	3	4	4	5	6	7	8	9	11	12	14	16	19	22	25
Pre Operating Feasibility Expenses		12																				
Promotional & Advertising			0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.8	1.0	1.1	1.3	1.5	1.7	2.0	2.3	2.6	3.0	3.5	4.0
Royalties			5	6	14	16	17	18	20	22	24	26	28	31	34	37	40	44	48	52	57	60
Staff Travel & Accommodation			0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.4	1.6	1.8	2.1	2.4	2.8	3.2
Staff Training			0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.3	1.5	1.8	2.0	2.4	2.7	3.1	3.6	4.2	4.8	5.6	6.4
Telecommunications			0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.8	1.0	1.1	1.3
Net Vat liabilties			(13)	(23)	(37)	(41)	(45)	(49)	(53)	(58)	(63)	(69)	(75)	(82)	(90)	(98)	(106)	(116)	(126)	(138)	(150)	(96)
Total Expenses		25	28	13	17	10	19	13	14	16	19	22	25	30	35	41	49	45	56	69	84	168
EBIT		(90)	39	6	162	188	197	223	242	263	286	310	337	365	395	427	462	512	551	592	637	1 233
Interest Expenses			5	6	12	12	12	11	11	11	10	10	9	8	7	6	5	3	2	-	-	-
EBT		(90)	33	0	150	176	185	211	231	253	276	301	328	357	388	421	457	508	549	592	637	1 233
Cumulative losses			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxable income			33	0	150	176	185	211	231	253	276	301	328	357	388	421	457	508	549	592	637	1 233
Tax payments			5	0	22	26	28	32	35	38	41	45	49	54	58	63	69	76	82	89	96	185
Net Profit		(90)	28	0	127	149	157	179	196	215	234	256	279	303	330	358	388	432	467	504	541	1 048

CASH FLOW STATEMENT FROM BANKER POINT OF VIEW (real, in mln SRS)																						
		Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
	Domestic Price Ind		1.0	1.1	1.2	1.3	1.4	1.5	1.7	1.8	2.0	2.2	2.4	2.6	2.8	3.1	3.3	3.6	4.0	4.3	4.7	5.1	5.6
RECEIPTS																							
Sales of biodiesel				105	119	245	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
Sales of glycerin				2	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Sales of by -products from exoressing				17	25	35	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	21
Changes in Accounts Receivable				(15)	(4)	(18)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(1)
Liquidation Values																							-
Land																							-
Refinery 1 (9 MGPY)																							3
Refinery Infrastructure																							1
Refinery 2 (9 MGPY)																							3
Refinery Infrastructure																							1
Epressing plant 1-11																							1
Epressing plant 12-23																							1
TOTAL CASH INFLOW (+)				109	141	266	286	287	287	287	287	287	287	287	287	287	287	287	287	287	287	287	283
EXPENDITURES																							
Refinery 1 (9 MGPY)			60		0																		
Refinery Infrastructure			17		0																		
Refinery 2 (9 MGPY)			0		60																		
Refinery Infrastructure			0		15																		
Epressing plant 1-11			13		0																		
Epressing plant 12-23			0		13.9																		
Direct Costs																							
Operating raw materials for refinery per year				19	21	44	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
Operating raw materials for expressing per year			64	102	172	237	242	242	242	242	242	242	242	242	242	242	242	242	242	242	242	242	121
Operating expenses for refinery			0.4	3	3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Operating expenses for expressing plant				3	4	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	6
Indirect Costs																							
Accounting and Auditing				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bank Charges				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
External service contractors				0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Insurance				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Licence Fees				2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	5	5	5	5	6
Management fees-holding comp				12	4	9	4	9	5	5	5	6	6	6	7	7	7	8	8	9	9	10	11
Maintenance				0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Other Contingencies				0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Payroll - Management Salaries				3	3	3	3	3	4	4	4	4	4	5	5	5	6	6	6	7	7	7	8
Payroll - Extracting Plant				2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	4
Pre-Operating Feasibility Expenses			12.3845	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Promotional & Advertising				0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
Royalties				3	4	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Staff Travel & Accommodation				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
Staff Training				0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Telecommunications				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Changes in AP				(12)	(6)	(9)	(2)	(3)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	8
Changes in Cash Balance				10	3	12	2	2	2	2	2	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(1)
Changes in DSRA				3	0	6	0	0	0	0	0	0	0	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(2)	-	-
Net VAT Liability				(12)	(20)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(17)
TOTAL CASH OUTFLOW (-)			167	139	304	330	324	329	326	326	327	325	326	327	328	329	330	332	333	335	334	338	226
NET CASH FLOW BEFORE TAXES			(167)	(30)	(162)	(64)	(38)	(43)	(39)	(40)	(41)	(38)	(39)	(40)	(41)	(42)	(44)	(45)	(47)	(48)	(48)	(52)	56
INCOME TAX			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NET CASH FLOW			**(167)**	**(30)**	**(162)**	**(64)**	**(38)**	**(43)**	**(39)**	**(40)**	**(41)**	**(38)**	**(39)**	**(40)**	**(41)**	**(42)**	**(44)**	**(45)**	**(47)**	**(48)**	**(48)**	**(52)**	**56**

CASH FLOW STATEMENT FROM BANKER POINT OF VIEW (real, in mln SRS)

	Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
	Domestic Price Index	1.0	1.1	1.2	1.3	1.4	1.5	1.7	1.8	2.0	2.2	2.4	2.6	2.8	3.1	3.3	3.6	4.0	4.3	4.7	5.1	5.6
RECEIPTS																						
Sales of biodiesel			169	190	393	402	402	402	402	402	402	402	402	402	402	402	402	402	402	402	402	402
Sales of glycerin			2	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Sales of by -products from exoressing			17	25	35	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	21
Changes in Accounts Receivable			(23)	(5)	(28)	(5)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(3)
Liquidation Values																						-
Land																						-
Refinery 1 (9 MGPY)																						3
Refinery Infrastructure																						1
Refinery 2 (9 MGPY)																						3
Refinery Infrastructure																						1
Epressing plant 1-11																						1
Epressing plant 12-23																						1
TOTAL CASH INFLOW (+)			166	212	405	436	437	437	437	437	437	437	437	437	437	437	437	437	437	437	437	433
EXPENDITURES																						
Refinery 1 (9 MGPY)		60		0																		
Refinery Infrastructure		17		0																		
Refinery 2 (9 MGPY)		0		60																		
Refinery Infrastructure		0		15																		
Epressing plant 1-11		13		0																		
Epressing plant 12-23		0		13.9																		
Direct Costs																						
Operating raw materials for refinery per year			19	21	44	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
Operating raw materials for expressing per year		64	102	172	237	242	242	242	242	242	242	242	242	242	242	242	242	242	242	242	242	121
Operating expenses for refinery		0.4	3	3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Operating expenses for expressing plant			3	4	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	6
Indirect Costs																						
Accounting and Auditing			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bank Charges			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
External service contractors			0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Insurance			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Licence Fees			2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	5	5	5	5	6
Management fees-holding comp			12	4	9	4	9	5	5	5	6	6	6	7	7	7	8	8	9	9	10	11
Maintenance			0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Other Contingencies			0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Payroll - Management Salaries			3	3	3	3	3	4	4	4	4	4	5	5	5	6	6	6	7	7	7	8
Payroll - Extracting Plant			2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	4
Pre-Operating Feasibility Expenses		12.3845	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Promotional & Advertising			0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
Royalties			5	5	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Staff Travel & Accommodation			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
Staff Training			0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Telecommunications			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Changes in AP			(12)	(6)	(9)	(2)	(3)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	8
Changes in Cash Balance			15	4	19	4	3	3	3	3	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(2)
Changes in DSRA			3	0	6	0	0	0	0	0	0	0	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(2)	-	-
Net VAT Liability			(12)	(20)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(17)
TOTAL CASH OUTFLOW (-)		167	146	307	341	330	335	331	332	333	328	329	330	331	332	333	335	336	338	338	341	230
NET CASH FLOW BEFORE TAXES		(167)	19	(95)	64	106	102	106	105	104	109	108	107	106	105	103	102	101	99	99	96	203
INCOME TAX		-	5	0	17	19	18	19	19	19	19	19	19	19	19	19	19	19	19	19	19	33
NET CASH FLOW		**(167)**	**15**	**(95)**	**46**	**87**	**84**	**87**	**86**	**85**	**90**	**89**	**88**	**87**	**86**	**84**	**83**	**81**	**80**	**80**	**77**	**170**

CASH FLOW STATEMENT FROM OWNER'S POINT OF VIEW (REAL, SRS)

		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
	Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
	Domestic Price Ind	1.0	1.1	1.2	1.3	1.4	1.5	1.7	1.8	2.0	2.2	2.4	2.6	2.8	3.1	3.3	3.6	4.0	4.3	4.7	5.1	5.6
RECEIPTS																						
Sales of biodiesel			105	119	245	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
Sales of glycerin			2	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Sales of by -products from exoressing			17	25	35	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	21
Changes in Accounts Receivable			(15)	(4)	(18)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(1)
Liquidation Values																						
Refinery 1 (9 MGPY)																						3
Refinery Infrastructure																						1
Refinery 2 (9 MGPY)																						3
Refinery Infrastructure																						1
Epressing plant 1-11																						1
Epressing plant 12-23																						1
TOTAL CASH INFLOW (+)			109	141	266	286	287	287	287	287	287	287	287	287	287	287	287	287	287	287	287	283
EXPENDITURES																						
Refinery 1 (9 MGPY)		60		0																		
Refinery Infrastructure		17		0																		
Refinery 2 (9 MGPY)		0		60																		
Refinery Infrastructure		0		15																		
Epressing plant 1-11		13		0																		
Epressing plant 12-23		0		13.9																		
Direct Costs																						
Operating raw materials for refinery per year			19	21	44	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
Operating raw materials for expressing per year		64	102	172	237	242	242	242	242	242	242	242	242	242	242	242	242	242	242	242	242	121
Operating expenses for refinery		0	3	3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Operating expenses for expressing plant			3	4	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	6
Indirect Costs																						
Accounting and Auditing			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bank Charges			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
External service contractors			0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Insurance			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Licence Fees			2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	5	5	5	5	6
Management fees-holding comp			12	4	9	4	9	5	5	5	6	6	6	7	7	7	8	8	9	9	10	11
Maintenance			0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Other Contingencies			0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Payroll - Management Salaries			3	3	3	3	3	4	4	4	4	4	5	5	5	6	6	6	7	7	7	8
Payroll - Extracting Plant			2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	4
Pre Operating Feasibility Expenses		12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Promotional & Advertising			0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
Royalties			3	4	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Staff Travel & Accommodation			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
Staff Training			0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Telecommunications			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Changes in AP			(12)	(6)	(9)	(2)	(3)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	8
Changes in Cash Balance			10	3	12	2	2	2	2	2	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(1)
Changes in DSRA			3	0	6	0	0	0	0	0	0	0	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(2)	-	-
Net VAT Liability			(12)	(20)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(17)
TOTAL CASH OUTFLOW (-)		167	139	304	330	324	329	326	326	327	325	326	327	328	329	330	332	333	335	334	338	226
NET CASH FLOW BEFORE TAXES		-167	-30	-162	-64	-38	-43	-39	-40	-41	-38	-39	-40	-41	-42	-44	-45	-47	-48	-48	-52	56
INCOME TAX			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NET CASH FLOW BEFORE FINANCING		(167)	(30)	(162)	(64)	(38)	(43)	(39)	(40)	(41)	(38)	(39)	(40)	(41)	(42)	(44)	(45)	(47)	(48)	(48)	(52)	56
		(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	0
Loan Disbursements		52	-	56																		
Loan Repayments			5	6	20	20	21	21	21	21	21	22	21	21	21	21	21	20	20	-	-	-
NET CASH FLOW AFTER FINANCING		(115)	(35)	(112)	(84)	(59)	(63)	(60)	(61)	(62)	(59)	(60)	(62)	(63)	(64)	(65)	(66)	(67)	(68)	(48)	(52)	56
NCF after Financing in USD		(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	0
NPV (SRS)		- 522																				
NPV (USD)		- 76																				
IRR		#DIV/0!																				

CASH FLOW STATEMENT FROM OWNER'S POINT OF VIEW (REAL, SRS)	Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
	Domestic Price Ind	1.0	1.1	1.2	1.3	1.4	1.5	1.7	1.8	2.0	2.2	2.4	2.6	2.8	3.1	3.3	3.6	4.0	4.3	4.7	5.1	5.6
RECEIPTS																						
Sales of biodiesel			169	190	393	402	402	402	402	402	402	402	402	402	402	402	402	402	402	402	402	402
Sales of glycerin			2	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Sales of by -products from exoressing			17	25	35	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	21
Changes in Accounts Receivable			(23)	(5)	(28)	(5)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(3)
Liquidation Values																						
Refinery 1 (9 MGPY)																						3
Refinery Infrastructure																						1
Refinery 2 (9 MGPY)																						3
Refinery Infrastructure																						1
Epressing plant 1-11																						1
Epressing plant 12-23																						1
TOTAL CASH INFLOW (+)			166	212	405	436	437	437	437	437	437	437	437	437	437	437	437	437	437	437	437	433
EXPENDITURES																						
Refinery 1 (9 MGPY)		60		0																		
Refinery Infrastructure		17		0																		
Refinery 2 (9 MGPY)		0		60																		
Refinery Infrastructure		0		15																		
Epressing plant 1-11		13		0																		
Epressing plant 12-23		0		13.9																		
Direct Costs																						
Operating raw materials for refinery per year			19	21	44	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
Operating raw materials for expressing per year		64	102	172	237	242	242	242	242	242	242	242	242	242	242	242	242	242	242	242	242	121
Operating expenses for refinery		0	3	3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Operating expenses for expressing plant			3	4	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	6
Indirect Costs																						
Accounting and Auditing			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bank Charges			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
External service contractors			0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Insurance			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Licence Fees			2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	5	5	5	5	6
Management fees-holding comp			12	4	9	4	9	5	5	5	6	6	6	7	7	7	8	8	9	9	10	11
Maintenance			0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Other Contingencies			0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Payroll - Management Salaries			3	3	3	3	3	4	4	4	4	4	5	5	5	6	6	6	7	7	7	8
Payroll - Extracting Plant			2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	4
Pre Operating Feasibility Expenses		12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Promotional & Advertising			0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
Royalties			5	5	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Staff Travel & Accommodation			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
Staff Training			0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Telecommunications			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Changes in AP			(12)	(6)	(9)	(2)	(3)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	8
Changes in Cash Balance			15	4	19	4	3	3	3	3	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(2)
Changes in DSRA			3	0	6	0	0	0	0	0	0	0	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(2)	-	-
Net VAT Liability			(12)	(20)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(17)
TOTAL CASH OUTFLOW (-)		167	146	307	341	330	335	331	332	333	328	329	330	331	332	333	335	336	338	338	341	230
NET CASH FLOW BEFORE TAXES		-167	19	-95	64	106	102	106	105	104	109	108	107	106	105	103	102	101	99	99	96	203
INCOME TAX			5	0	17	19	18	19	19	19	19	19	19	19	19	19	19	19	19	19	19	33
NET CASH FLOW BEFORE FINANCING		(167)	15	(95)	46	87	84	87	86	85	90	89	88	87	86	84	83	81	80	80	77	170
		(0)	0	(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Loan Disbursements		52	-	56																		
Loan Repayments			5	6	20	20	21	21	21	21	21	22	21	21	21	21	21	20	20	-	-	-
NET CASH FLOW AFTER FINANCING		(115)	9	(45)	26	67	64	66	65	64	69	68	66	65	64	63	63	61	60	80	77	170
NCF after Financing in USD		(0)	0	(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NPV (SRS)		144																				
NPV (USD)		21																				
IRR		26%																				