Annex C2-1:
Socioeconomic Report

Subject	Project acronym / Ref. No.	Date
Deliverable under Action C.2	ETANOLIX 2.0 FOR LIFE+ / LIFE12 ENV/SE/000529	09/05/2017

Issued by	Company / Department
Carina Webjörn (Work Environment Engineer)	St1 Refinery AB / HSM dep.
Anna Ternell (Market Manager Economics and Planning	COWI AB / Sustainable Strategies and Resources

SOCIOECONOMIC REPORT

LIFE12ENV/SE/000529

Etanolix 2.0 – Demonstration of innovative method for converting industrial waste to ethanol in oil refinery for LIFE+

CONTENTS

1 Background

St1 has received funding from LIFE+ to produce ethanol from food industry waste. The concept is called Etanolix® 2.0 and has as main objective to demonstrate the sustainable production of food residues to ethanol integrated with the production process at the oil refinery. The production has extremely low carbon dioxide emissions partly because the plant enables integration with the existing oil refinery processes, and e.g. heat and cooling from the refinery and water systems can be used from already existing processes.

The project started in June 2013, operations started in mid-2015 and aims to be fully operational in December 2017. The objectives of the project are to re-use industrial food waste[1] to produce 5,000 m^3 ethanol per year. Of the by-product called stillage, 25,000 tons are expected to be produced. The stillage is mainly used to animal feed and production of biogas.

The project has a focus on 'closing the loop' (see Figure 1-1) and is in line with the circular economy package, adopted by the Commission on 2 December 2015, with the aim to support the transition towards a more circular economy in the EU. This package included legislative proposals on waste, with long-term targets to reduce landfilling, increase recycling, and reuse. It delivers important energy savings and environmental benefits. It further relates to key EU priorities on jobs and growth, investments, the social agenda and industrial innovation. The wider benefits of the circular economy also include lowering energy consumption and carbon dioxide emissions levels. Hence, the project has strong synergies with the EU's objectives on climate and energy and with the Commission's recently adopted package on 'Clean Energy for all Europeans'[2].

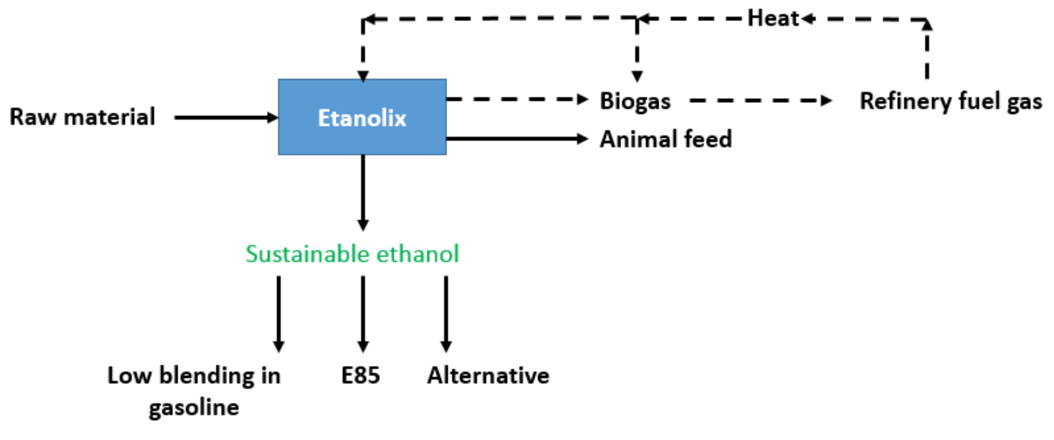


Figure 1-1 Closing the loop, Source St1

The project has developed an energy-integrated installation, which will be the first complete system for production of bioethanol using industrial residues as raw material and based on the

[1] Organic waste from industrial processes or retail chains or households

[2] https://ec.europa.eu/energy/en/news/commission-proposes-new-rules-consumer-centred-clean-energytransition

proximity principle with refineries. The ethanol plant is 80 % of a full-scale plant and will demonstrate an installation to enable energy integration with existing oil refinery processes. The ethanol is used as bio-component in commercial gasoline production to be used by cars. The main objective is to show that ethanol can be produced with extreme low carbon dioxide emissions with 0,01 kg CO_2/kgoe[3], which is the lowest among ethanol on the market[4] (compare to biodiesel RME with 1,6 kg CO_2/kgoe and fossil gasoline with 2,7 kg CO_2/kgoe)[5]. The plant produces ethanol fulfilling the specification to be used as a blend component in commercial gasoline production.

The project is a way to meet the EU goal to reduce CO_2 emission to address the climate change concerns. The project will contribute to reduce the dependence of fossil fuels and to reduce the impact on global warming through the increase of GHG emissions from the transport sector. The use of Etanolix ethanol is expected to reduce CO_2 emissions by at least 90 % of the portion constituting the ethanol, compared to fossil fuel.

The other issue to be highlighted and which is of highly national and EU concern, is the large and increasing volumes of food waste. Proper waste management is a key element in ensuring resource efficiency and the aim is to achieve much higher levels of recycling and to minimize the extraction of additional natural resources. The project wants to demonstrate an innovative technology and production system integrated into the existing refinery to recycle and transform industrial food waste into renewable fuel in an environmentally friendly and energy efficient way. This is part of the strategy to meet the EU and national efforts to the transition to a more circular economy, where the value of products, materials and resources is maintained in the economy for as far as possible, and the generation of waste is minimised.

Hence, the project can contribute to existing refineries and fuel production plants across Europe by demonstrating sustainable production of bioethanol.

In summary, the increased socioeconomic benefits are expected to influence the environment, health, and the economy and are further expected to have beneficial influences for other industrial sectors (e.g. waste, food, agriculture and biofuel sectors).

---

[3] *kgoe = kilogram of oil equivalent*

[4] *WSP Report 2006*

[5] *Concawe, Shell, WTW 2004, BioScience 55/7 2005*

2 Objectives of the socioeconomic evaluation

The objective of Action C2 in the LIFE+ application is to monitor and evaluate the socioeconomic benefits of the project actions. This intends to clarify the financial effects of the project for the Municipality of Gothenburg and its socioeconomic impact that will partly form the basis for a decision for any further expansion in the region and as information material for external interests.

An evaluation of the socioeconomic impacts of the project is outsourced to an external consultant. The evaluation takes place between October and December 2016, thus about 6 months prior to project finalisation.

The benefits expected by the project are several:

- Lowering of CO_2 emissions by 4,500 tons by using Etanolix ethanol due to the fact that the refinery is located close to supplier of feedstock and therefore short distances for transport deliveries.
- Contributing to the reduction of the negative health effects of poor air quality on citizens, improving citizens' well-being and quality of life.
- Sustainable waste management
- Decreasing the environmental impact on food production from the full life-cycle process.
- The project expects to create approximately 5 new full time jobs at St1 and 50 jobs in the Gothenburg region during the project's duration.
- The project expects to improve the current market situation of several industrial sectors like the food waste management industry, the agricultural sector and the renewable fuel production industry both on a local, regional and European level.

The benefits evaluated are the same as identified in the application but further discussions have been made between St1 and the evaluator so that the benefits are further detailed as listed in Chapter 3. The benefits to be evaluated in this study are identified in the application and are included in the following benefits:

- Direct employment growth during construction of the Etanolix plant at St1
- Direct employment growth in operation (demonstration phase) of the Etanolix plant at St1
- Indirect employment growth during construction of the Etanolix plant at St1
- Indirect employment growth in operation (demonstration phase) of the Etanolix plant at St1
- Enhancement of other activities within the renewable fuel sector
- Enhancement of other activities within food waste management industry
- Sustainable production and consumption, promoting local ethanol production
- Production and sale of ethanol
- Fiscal effects to public authority and the Municipality of Gothenburg

3 Assumptions for the socioeconomic evaluation

The project started in June 2013 and the plant was ready for start-up (test running) in January 2015 but this was postponed until May 2015 due to a planned refinery shut down for maintenance and inspection. Later, since the start-up of the plant the throughput has incrementally increased with increased input of food waste. Negotiations for contracts with food companies are still ongoing and the project expects that sufficient contracts will be in place so that the plant can run at approximately 100 % capacity by end of 2017. The following assumptions have been done based on information from St1:

- The evaluation will cover the time period of mid 2013 - mid 2017, i.e. the project period and include calculation when running at full capacity (est. end 2017).
- Production of ethanol (European standard EN 15376) is 5,000 m^3/year
  - Full capacity of 5,000 m^3/year is aimed to be reached at the end of 2017. For the calculations, the below average estimation of the capacity is used (Table 3-1). The capacity depends on the access of raw material (food waste) as mentioned above and the plant's production is dependent on the frequencies of deliveries of the raw material. When capacity reaches 50 %, the plant can run continuously without stops.
- Production of stillage for animal feed: 25,000 tons/year will be produced at full capacity. The amount of stillage may be higher (see Table 3-1) but for the calculations, the targeted amount mentioned in the application is used.
- From a lifecycle perspective, the use of Etanolix fuel reduces CO_2 emissions by at least 90 % of the portion constituting the ethanol (the requirement to meet the sustainability criteria are 35 % for the bio-component). Therefore, GHG emissions can be reduced in a most substantial manner, i.e. more than 90% reduction in CO_2/year on the blended bio-component part compared to a fossil fuel Mogas RON95.
- Processing 15,000-21,000 tons/year of food waste at full capacity.

Table 3-1 Actual and estimated capacity utilisation of the ethanol plant, Source: St1

	Actual		Forecast	
Year	**2015**	**2016**	**2017**	**2017**
	(Start up of operation, May)		*(End of project, 1st July)*	*(31st Dec)*
Average Capacity/Utilization* (%)	2.3	16.5	80	100
Feed-stock (tons/year)	740	3,337	16,400	20,500
Ethanol (m^3/year)**	117	825	4,000	5,000
Stillage (tons/year)	1,985	9,075	40,000	50,000
RED-calculation (CO_2-reduktion) %	57.6	87.8	>90	>90

*The facility capacity/utilization is calculated in relation to design of 5,000 m^3/year.
**Etanolix ethanol produced according to specification and used as a blend component in commercial gasoline production.

- When calculating the financial benefits for the local market in the Municipality of Gothenburg, it is assumed that the yearly salary is on average 300,000 SEK based on the average salary presented in Swedish Bureau of Statistics (SBC) for Gothenburg Region[6].

4 Socioeconomic benefits

4.1 Evaluated benefits

The project expects to generate several socioeconomic benefits in the short and long run.

Each section of the benefits presents the assumptions for the final calculations in chapter 5 'Conclusion'.

4.2 Direct employment growth during construction of the Etanolix plant at St1

The project has not created direct new employments during the construction phase. Instead, many St1 employees have been added extra workload with the Etanolix project, as evidenced in previous LIFE+ reporting, but it is not included here.

4.3 Indirect employment growth during construction of the Etanolix plant at St1

Based on information from St1 on the employment effect during construction of the plant, 7.7 full-time employment was needed for 7 months in 2013, 20.4 full-time persons were required for 12 months in 2014, and 5.1 full-time persons were required for 5 months in 2015. In total, 325 person-months were required for the construction of the plant, equivalent of 33 full-time employment. This is outlined in Table 4-1.

Table 4-1 Indirect employment effects during the project construction period, Source: St1

	2013	**2014**	**2015**	**Total**
Person-month	54	245	26	325
Number of months	7	12	5	24
Full year employments	7.7	20.4	5.1	33

The type of jobs required for the construction of the plant were the following:

[6] http://www.scb.se/sv_/Hitta-statistik/Lonedatabasen/

- Design
- Construction and building
- Administration, education, and project management

4.4 Direct employment in operation (demonstration) phase of the Etanolix plant at St1

Based on information from St1 on new employment effect during operations, 3.5 full-time employments have been needed as listed below.

Table 4-2 Direct employment effects due to operations of the plant, Source: St1

	2014	2015	2016	2017
Person-month	42	42	42	42
Number of months	12	12	12	12
Full year employments	3.5	3.5	3.5	3.5

The type of jobs required are the following:

- 1 Supply and distribution engineer (100 %)
- 1 Laboratory engineer (50 %)
- 2 Field operators (100 %)

4.5 Indirect employment growth in operation (demonstration) phase of the Etanolix plant at St1

Based on information from St1, approximately 7 full-time jobs are generated by the ethanol plant outside the company.

Table 4-3 Indirect employment effects in operation phase, Source: St1

	2015	2016	2017
Full time employment	2	5	7

The type of jobs required are the following:

- Handling and packaging of raw material

- Transport and logistics of raw materials, stillage and biogas
- Agricultural sector (animal feed)
- Biogas sector (Borås energy)

4.6 Enhancement of other activities within the renewable fuel sector

The project could improve the market situation of bioethanol by producing 5,000 m^3 ethanol. In the long run, and if installing 5 units producing 5,000 m^3 each, would lead to a 20 % increase of sustainable ethanol production in Sweden. This would contribute to a decrease in imports from other parts of the world. If successful, the project estimates that the potential and a wider implementation of the technology in other EU countries would, for example after 5 years after the Etanolix project is finished, enable bioethanol produced from bio-waste increase with more than 15% compared with the estimated 5.4 billion liters of bioethanol produced in the EU in the EU27[7] in 2011.

Further, the innovative aspects of the demonstrated Etanolix 2.0 production process contributes to strengthening the European knowledge base regarding ethanol production and moreover, takes an important step in converting traditional fossil-run refinery to a refinery that processes renewable fuels.

It is believed that the main impact the project has on the renewable fuel sector is spreading and trigging the market by giving evidence that it is possible to develop renewable ethanol using waste in an environmentally friendly and sustainable way. The project has demonstrated a technology and integrated production process in a successful way that is pioneering on the market.

The national goal of CO_2 emissions are to reach zero CO_2 emissions from cars in 2030. The EU, in turn, considers that global emissions of greenhouse gases must be reduced by at least 50 percent by 2050 compared to 1990 and close to zero in 2100. In the shorter time, EU has as goal to reduce greenhouse gases by 20 % in 2020 compared to 1990[8]. Producing ethanol according to the Etanolix concept is one way to contribute to these goals and the project is thus highly relevant for the climate and environmental goals.

4.7 Enhancement of other activities within food waste management industry

Food waste is rapidly increasing and Sweden had approximately 1/2 million tons of food waste in 2013 (SCB 2014). The gross economic benefit of reducing the total national waste with 20 percent

---

[7] EU27 were the member states in the European Union in 2013.

[8] https://ec.europa.eu/clima/citizens/eu_en

would mean an economic profit of 10-16 billion SEK per year and therefore the Swedish environment goals address this as a national priority[9].

During the project duration, 15,000-21,000 tons of industrial food waste per year is aimed to be processed for ethanol. This is approximately 4 % of the total food waste in 2013 based on above figure. Based on above figures, it would mean an economic profit of more than 40 million SEK per year.

The project can stimulate sustainable development in communities/regions by taking advantage of industrial waste and using it as a resource and feedstock for ethanol production with environmental benefits as a result.

Food waste is also an important part of the EU's flagship initiative on resource efficiency, which states that the amount of edible food is thrown away should be halved by 2020 in the EU[10].

The project is hence addressing the national and European targets and can be seen as an important precursor of waste reduction and renewable fuel sector. The energy in the form of ethanol and biogas can be used as a substitute for fossil fuel in the transport sector.

The food waste from the bakeries and shops is generally given to the municipalities who in turn discard it or give it to biogas plants. A very small portion is sold to farmers. The farmers are, however, hesitant to buy the waste as it is difficult to meet the strict requirements before it can be used for animal feed. It is further assumed the 2,000 tons (about 10 %) of the industrial food waste collected by St1 would have been discarded. It is further assumed that the price to discard the waste is 1,000 SEK/ton. The benefit is hence monetary savings for retail companies by delivering it to St1 who takes care of it and use it for production of sustainable ethanol.

4.8 Sustainable production and consumption, promoting local ethanol production

This section will concentrate on the environmental benefits as raised in the application. The project has two environmental effects.

1) The first effect is reduced CO_2 emissions. The refinery site where the Etanolix plant is located is close to the centre of Gothenburg city. The proximity to the feedstock (i.e. the industrial food waste) means lowering CO_2-emissions by using Etanolix ethanol instead of fossils in the fuel.

2) The second effect is reduced pollution of the air. The project contributes to enabling environmental benefits in term of improved air quality. The amount of reduced air pollution is though negligible why it is not presented in this report.

---

[9] http://www.livsmedelsverket.se/sv/grupp1/Mat-och-miljo/Miljosmarta-matval/

[10] Roadmap to a resource-efficient Europe - flagship initiative under the Europe 2020 strategy, the Commission Communication 2011.

Reduced CO_2-emissions and the equivalent costs

The project aims to reduce CO_2 with 90 % of the portion constituting the ethanol, as reported in Table 3-1.

Assuming that the annual production of Etanolix ethanol at St1 is 5,000 m³ this is equivalent of 5 million litres of ethanol. It is assumed that a gasoline-using car is driving an average of 14.2 km per litre gasoline (i.e. 0.7 l/10 km)[11]. It is further assumed that 5,000 m³ ethanol production will replace 3,300 m³ gasoline consumption[12] and this will correspond to 46.9 million km per year driving in a standard car. Different types of cars and lorries could have been assumed, but here we assume that the ethanol is used by standard gasoline cars.

Given that the "mass" density of gasoline is 0.77g/cm³, 3.3 million litres gasoline weigh 2,541 tons. Emissions factor measured in kilo per kilo gasoline is 3.16 kilo CO_2 are emitted per kilo gasoline[13] used in a standard car. This implies that 3,300,000 litres of gasoline save 8,030 tons CO_2 per year.

The emissions costs in EUR per tons CO_2 are 11.02[14] which gives a saved emission costs of 89,931 EUR per year. This is for production at full capacity. In Table 3-1 we have the actual capacity utilisation of the plant for the years 2015 and 2016 and forecasted calculations for 2017. The saved emission costs are thus adjusted with the actual capacity utilisation of the plant (see Table 4-4).

Table 4-4 Emissions per year and saved emission costs, Source: St1

	2015	2016	2017 (1st July)	2017 (31st Dec)
Emissions per year (tons CO_2)	188	1,325	6,424	8,030
Saved emission costs per year (SEK)	20,413	143,935	697,865	872,331
Saved emission costs per year (EUR)	2,104	14,839	71,945	89,931

[11] It is assumed as an average.

[12] St1

[13] http://www.folkecenter.dk/mediafiles/folkecenter/energibesparelse/Energiindhold-i-braendsler.pdf

[14] http://www.modelcenter.transport.dtu.dk/Noegletal/Transportoekonomiske-Enhedspriser. See sheet" Eksterne omk – enhedspriser" where the CO_2 unit costs are 0.0821 kr./kg CO_2.

Reduced air pollution and the equivalent costs

Reduced air pollution and the equivalent costs are not included in this study as they are negligible.

Emissions from production

Emission of production is not included in this study.

4.9 Production and sale of ethanol

In this LIFE+ project, the sustainability focus has been rather on proofing and visualizing the potential and possibility of producing bioethanol, by integrating a chemical process into a conventional refinery using waste material as resource, rather than fulfilling the sustainability aspects regarding the economics. This means that the profitability of the project has been a secondary aspect in the LIFE+ project. The most important has been to ensure a good example and show the potential of continuing the journey towards fossil independence.

In the cost evaluation of this project, there have been two different assumptions for pricing the bioethanol:

1. One case is based on the calculated cost scenario on the actual European open market ethanol price.
2. The other scenario is referring to an ethanol quality, which is qualified for so-called double counting regarding sustainability criteria and greenhouse gas reduction (GHG). In this business case calculation meaning that the ethanol price has been defined as an advanced biofuel. This "expensive" bioethanol can be very valuable in a marketplace and countries that have implemented the Renewable Energy Directive (RED) based upon bio quota (obligation) and so called "double counting" allowed for the volumes of biofuels blended in the fuel.

The Etanolix 2.0 economics are based on the investment cost of the process unit including the integration to the refinery. The operational costs are defined as energy, utilities e.g. steam, water, nitrogen, chemicals etc. Operational costs also cover maintenance repairs, laboratory analysis for quality control and personnel etc. Another cost in the project is the feedstock / raw material (waste) which also has to be transported to the refinery. Waste from the unit e.g. plastics, stickers, carbon board etc. from the commodity also has to be paid for being handled and treated according to legislation and waste hierarchy.

On the income side, main revenues are from the ethanol and the produced stillage. The profit of the stillage depends on the usage, but has been estimated as net positive in the project to be sustainable. The bioethanol has an energy value as upgraded to transport fuel with a very high GHG reduction.

The potential for a high ethanol production rate, measured in cubic per year, is dependent of the Etanolix 2.0 process unit availability and efficiency of the feedstock (yield) mix. In general, a high throughput of industrial residue through the unit is proportional to a high ethanol production. This is valid only when all the process steps work as designed, with no interruptions in the operation.

The design case of the Etanolix 2.0 unit is based on a production of 5,000 m^3 bioethanol per annum.

As of today, the production unit is not yet 100% loaded due to bottlenecks in the receiving station of the feedstock and the production is therefore not in continuous operation but rather batch wise producing products and byproducts. The ethanol quality is fit for purpose, fulfilling all the quality specification aspects and the GHG sustainability criteria is excellent allowing the ethanol to be counted as a highly valued advanced bioethanol.

With the knowledge of today’s actual operational cost and the investment costs covered in the project, the production volumes of ethanol have to be maximized all the time to get near the breakeven scenario with an ethanol price assumed for the spot price in the European market (1). To get a sustainable economic scenario for the LIFE+ project, also looking at the profitability aspects, it will be required to calculate with the second scenario (2). Even in the second scenario it requires a production rate of minimum 3,000 m^3 bioethanol per annum e.g. a unit throughput of at least 60 % to reach break-even and get the costs covered. This is not at all impossible, but modifications of the receiving station will have to be adjusted to ensure higher capacity when receiving feedstock to thus allow for continuously operation of the distillation column and thereby improved production volumes.

In the nearby timeframe, and within the time limit for the LIFE+ project, it is not foreseen that the required changes in the receiving station will be completed. Thus, at this stage, the conclusion will be that regarding the sustainability aspects, only the environmental aspects are fulfilled while the economics are still to come.

4.10 Fiscal effects to public authorities and Gothenburg Municipality

Due to the establishment of the St1 plant, new employees have been needed at St1. These new employees, as well as the increased employment during the construction phase and indirect employment generated by the project (as outlined above), have created new employments in the municipal and therefore also created increased municipal and state tax revenues. It has also entailed savings for the authorities due to fewer payments to unemployment fund and/or social fund.

It is assumed that a new employee will earn an average income of 300,000 SEK per year. It is further assumed that the new generated employee is coming partly from being unemployed and receiving a cash contribution from the government (Social assistance of 120,000 SEK per year) and unemployment benefits (Unemployment insurance rate of 240,000 SEK per year).

It is assumed that the municipal tax rate is 32 % while for these relatively low wages that the state tax rate is 0 %. Each taxpayer is assumed to be able to deduct 40,000 SEK before the tax rate is applied. Since the new employed wage earner will move from unemployed, the state as well as the municipality will increase their revenue.

The public authorities save costs to pay for unemployment insurance as well as the social contributions. However, the public authorities also receive taxes on the income received by the unemployed. The net effects are a saving on the public budgets that are accounted for in the financial calculations.

The Municipality further earns revenues from tax income from the newly employed persons. Table 4-5 shows the assumptions made on extra tax income for the Municipality due to new employment as an effect of the project.

- Average yearly income
- Municipal tax rate
- Deduction

Table 4-5 Extra municipal taxes due to extra employment

Extra municipal and state tax due to new employment by the project	
Average annual salary	300,000[15]
Municipal tax (Gothenburg region)	32[16]%
State tax	0[17]%
Tax reduction	40,000
Personal taxable income in Gothenburg per extra person employed	260,000
Increase in average municipal income per extra person employed	38,450

Note: A newly employed person will generate a municipal tax payment of 83,200 SEK. It has been assumed that the newly employed person previously received public cash benefits or unemployment benefits. The cash benefits are assumed approximately 120,000 SEK of which the person is paying 25,500 SEK in municipal taxes. The unemployment benefit is assumed to be 240,000 SEK of which is paid 64,000 SEK. Assuming that on average the newly employed is partly on public cash benefits and partly on unemployment benefits, the average increase in municipal taxes is ((83,200-25,500) + (83,200-64,000))/2) = 38,450 SEK.

With an average yearly income of 300,000 SEK, a Municipal tax (32 %) as well as a deduction (40,000 SEK), the personal income for a newly employed in Gothenburg will be 260,000 SEK per extra person employed. With a municipal tax rate of 32 %, one extra person employed generates 38,450 SEK per year in extra municipal tax income.

Given that the state of Sweden is taxing the gasoline used by cars for transport the existing tax rate of gasoline can be applied, which is 5.58 SEK/liter. The ethanol is also assumed to be taxed with 1 SEK/liter. The difference of 4.48 SEK per liter is a lost income to the state of Sweden and is proportional with the consumption of gasoline used. The missing revenues to the State of Sweden

[15] Middle income 2014 for men in Gothenburg, Regionfakta 2016, http://www.regionfakta.com/Vastra-Gotalands-lan/Befolkning-och-hushall/Medelinkomst/ 2016

[16] SBC 2016: http://www.scb.se/hitta-statistik/statistik-efter-amne/offentlig-ekonomi/finanser-for-den-kommunala-sektorn/kommunalskatterna/kommunalskatterna-2016/

[17] No state tax on salaries at 300.000 SEK/year.

can be calculated and is presented in Table 5-1. This is to some extent reduced by the increased tax revenue at the municipal level as well as the state level. Hence, these missing revenues have to be collected by the state from other sources and will thus imply an additional tax distortion loss, which normally are calculated as 20 % of the missing tax revenue.

5 Summary and conclusion

Based on the outlined assumptions in the previous chapter the following socioeconomic results appears following the implementation of the Etanolix® 2.0 at St1 Refinery in Gothenburg.

There are also a number of costs as the state of Sweden loose revenues due to a shift from gasoline to ethanol. These are presented as NPV[18] of costs in the table below and at a real discount rate of 1 %. The figures are through the discounting presented as 2017 prices.

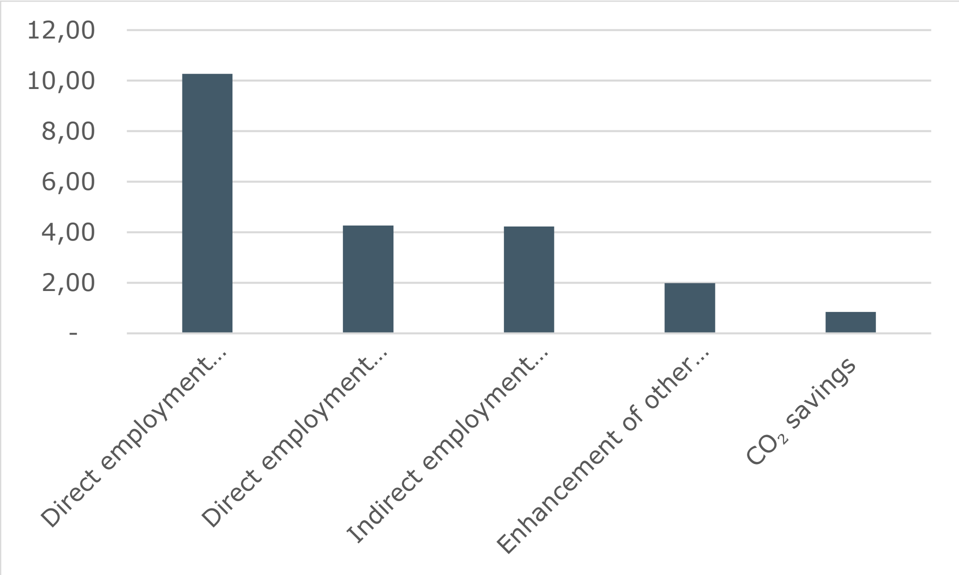
Table 5-1 Socioeconomic effect of the Bioethanol project at St1 (2013-2017)

Socioeconomic effect	Value (millions SEK)	Share of benefit
Indirect employment growth at St1 (during construction of the Etanolix plant) - Investments	10.3	47.6%
Direct employment growth at St1 (in operation (Demonstration) phase of the Etanolix plant)	4.3	19.7%
Indirect employment growth at St1 (in operation (Demonstration) phase of the Etanolix plant)	4.2	19.6%
Enhancement of other activities within the renewable fuel sector	2.0	9.2%
CO_2 savings	0.9	3.9%
Total benefits	21.6	
NPV of costs - (loss of tax revenue from gasoline tax and tax distortion of 20%)	-12.3	

The majority of the socioeconomic benefits are due to the direct and indirect employment benefits, which constitutes around 85 % of the total estimated benefits. One crucial assumption is the cost of CO_2. The evaluation uses emissions costs in EUR per tons CO_2 and it has been assumed to attain a value of 11.02 EUR/ton. However, there is a long dispute on the correct value of the cost of emission of CO_2. Figure 5-1 shows the estimated socioeconomic benefits in net present value terms.

[18] NPV = Net Present Value

Figure 5-1 Socioeconomic benefits of the St1 project (millions SEK)



In Figure 5-2 and Figure 5-3, the socioeconomic benefits and costs are presented. The costs are based on the lost tax revenue from gasoline tax. The socioeconomic benefits are higher than the costs. However not all costs are included in the socioeconomic costs of the project, e.g. the investment costs and the operational and maintenance cost of operating the plant. The socioeconomic cost constitutes in the evaluation the reduced revenues to the government less the increased tax revenue following the increased employment. Since the government has to collect the missing revenues from other sources, it will produce a tax distortion cost of 20 %.

Figure 5-2 Socioeconomic cost and benefits of the St1 project (millions SEK)

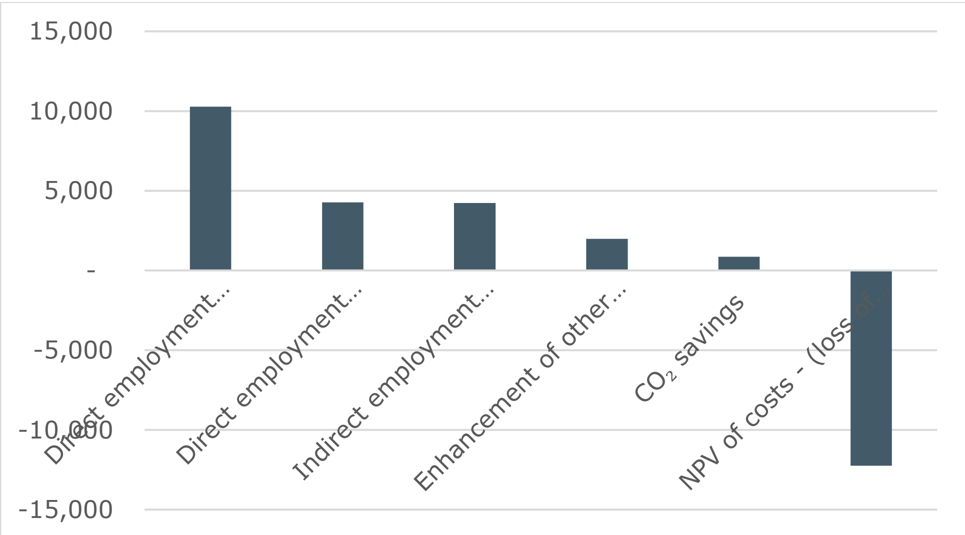


Figure 5-3 illustrates the total socioeconomic cost and benefits of the project. It shows that the total benefits are substantial higher than the costs.

Figure 5-3 Socioeconomic cost and benefits of the St1 project (millions SEK)