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BIFRÖST UNIVERSITY

Master's Thesis- International Business

Atlantic Green Chemicals

Site location study in Iceland

Indriði Waage

Supervisor
Andri Ottesen

Executive Summary

About us

Atlantic Green Chemicals (AGC) is a company that is formed to execute green and environmental chemical manufacturing projects, using renewable raw material as a feed stock for its products and by using renewable energy source in the production of its products. This newly constructed firm is looking for a possible industry site to build a factory and has intended the location for its first plant to be in Western Europe. There are a few interesting sites identified as suitable for a factory of this caliber both in Iceland and other Western European countries. In Iceland's case four sites are considered most attractive in regarding satisfying energy source. Those are **Bjarnarflag** in Norðurþing municipal on the north-east coast, the industrial site at **Grundartangi** in Hvalfjöður, a new industrial site at **Helguvík** in Reykjanes peninsular and in **Djúpivogur** municipal on the east coast.

AGC is a spin-off company from the research and consulting firm **Efnaferli ehf (Icelandic Process Development, IPD)** with the purpose to develop implement and execute projects on the field of "green" chemical industries in Iceland and/or elsewhere. IPD was formed in 1997 to research various chemical processes that would be suitable for medium scale chemical plant productions. **Gunnlaugur Friðbjarnarson:** is the founder and key inventor of Icelandic Process Development Ltd. Since 2007 IPD has operated a sophisticated fully staffed pilot plant in Reykjavik for the proof of processes and the verification and characterization of utilities, energy, and specific consumption parameters. This pilot plant is well suited to develop and test various kinds of catalysts and process conditions, by using hydrogen and a variety of biomass feed stock. Rannis (Icelandic Research Council) granted IPD a 3 years support in 2008 for testing and catalyst's developments. One of the results from operating the pilot plant resulted in a newly achieved process patent, registered in Iceland in January 2011. This patent has already been filed and is pending internationally (PCT). The patent involves processes using glycerin and other sugars to produce renewable chemicals, such as glycerin, which delivers mainly and with high selectivity propylene glycol and ethylene glycol, valuable and in high demand commodities. This process is considered more efficient and environmentally friendly than prevailing glycols processes based on petrochemicals sources.

About the technology:

The technology implemented for this project will be the proprietary and newly patented process of IPD and licensed to AGC. Process based on this technology reduces the emission of greenhouse effect generating carbon dioxide compared to conventional production methods

that uses petrochemicals as feedstock. Not only is the project economical feasible, it also has environmental benefits that both have market value that can lead to cost effective funding from EU-green grant programs or green-tech. investment funds.

Base Case

The first steps in raising a factory capable of producing 30.000 tons per annum of products in an industrial scale plant in Iceland. Within two years' time plan is to double the size of that factory again to the production capabilities of 65.000 tons per annum, and after five years from initial first step was taken the final expansion would take place and the production capability will reach 125.000 tons per annum. The engineering, procurement and construction cost for the overall glycerin purification and conversion plant is estimated to be around EUR 15, 3 million. This total installed cost has an estimated accuracy of -10/+35 % according to IPD estimation.

The project is based on three phases:

Phase I:	***Small scale industrial plant***
Investment:	EUR 17.8 million
Total production at full capacity:	30.000 tons
Total sales value -:	EUR 33,1 million
Phase II:	***Operational in year 3***
Additional Investment:	EUR 15 million
Additional production at full capacity:	35.000 tons
Total sales value:	EUR 71,7 million
Phase III:	***Operational in year 5***
Additional Investment:	EUR 19,9 million
Additional production at full capacity:	60.000 tons
Total sales value:	EUR 137.9 million

The total investment for Phase I, Phase II and Phase III is EUR 52,7 million, expected to produce 125.000 MT of products with a total sales value of EUR 137.9 million.

Results and conclusion

AGC plant converts glycerin - a by-product from bio diesel production into propylene and ethylene glycols with chemical processes that rely on use of steam and hydrogen. This process in based on 9 years research and verified technology demonstration that has been patented and is one of a kind worldwide. This process is highly profitable due to two developments: Glycerin prices have dropped drastically due to EU tax policies that require use bio fuel for transport of 5,75% of total transportation fuels used in EU. This proportion will increase to 10% by 2020. Hence, there is a foreseeable supply of Glycerin as bi-product from bio diesel production at affordable prices over the next ten years or so. However, the products propylene and ethylene glycols have until now been derivatives from oil production, made in oil refineries and have to the large extent followed the world price of oil. Due to EU policies products that are made from renewable and waste recourse have priority over such products and can even be sold at premium over equivalent products, this should apply to AGC products.

Capex and Opex model was constructed for all the four cases. The dependent variables were assumed the same for all the four cases. These were labor cost, construction cost, raw material cost, income from products sold abroad, and foreign marketing, logistics and storage cost. The independent variables were case specific as they were different for each case. These were electricity cost for electrolyzing hydrogen or alternatively cost of purchasing hydrogen as a bi-product or cost of abstracting hydrogen from non-condensable gases at geothermal sites. Cost of steam and logistics and storage cost. Several cost assumption were made based on references from reputable sources and NPV and IRR were calculated for each site. The required WACC is set at 15% for these four cases. The result from these calculations are that Bjarnarflag/Helguvík that assumes abstraction of hydrogen from non-condensable gases and non-transmission tariffs of electricity scores the highest with 98,4% IRR and NPV EUR 96.921.861. The second highest score is at the Grundartangi site where it is assumed that hydrogen can be purchased from Proposed Sodium Chloride factory as a bi-product the IRR for that site is 93.2% and the NPV is EUR 95.347.804. The third site option is Helguvík where AGC is going to buy waste heat as steam from the Icelandic Silica Factory. This option yields IRR of 86, 2% and NPV of EUR 89.427.385. The forth option is Djúpivogur which were storage tanks and buildings could be donated. This option yields IRR of 74, 3% and NPV of EUR 68.844.894.

Even though all sites obviously yield acceptable outcomes which is 50% IRR (the higher end of accuracy limit in addition to 15% WAAC) , one shall keep in mind the accuracy of this study is -10% and + 35%. It is not unusual that total cost for erecting a new chemical plant can overrun up to 40% thus large contingency I need or more studies, bids and calculations are clearly needed to tighten the outcome accuracy figures. Confirmed bids and detailed estimates will have to be conducted and analyses. A special study has to be made what is the most economical method of abstracting hydrogen from non-condensable geothermal gases at Bjarnarflag. Kemira, the Sodium Chloride factory has not given confirmed answer if they will build their plant in Iceland or elsewhere. No formal price negotiations have been conducted and the purchasing price of hydrogen is at this stage only an educated guess and best estimate. Helguvík case is the one that is the best developed at this time and these costs there are most researched. MOU has already been signed with the Icelandic Silica Corporation with some steam price and quantity indications. Price of electricity is based on two contracts of equivalent quantity from HS Orka. A premise has already been secured at Helguvík Harbor and Environmental Impact Assessment is expected to pass in February 2012. Furthermore, option B was studied for Helguvík in case contracts with ISC would fall through, and that was to have the factory based next to Reykjanes Geothermal Power Plant where there is abundance of steam and because of co-locations with the power plant no transmission tariff would apply. However storage facility and sea logistics would still remain in Helguvík. This option yielded almost same outcome as option A, in spite of more transportation and somewhat more storage capacity.

The recommendations from this study are as follows.

a) Continue developing the case for Helguvík as the primary option. The outcome meets required cut off rate above of 50% IRR. The costs figures have the least inaccuracy out of these four cases. The company need to get a firm budget quotes and perform basic engineering to further tighten of cost estimates. The plant is next to largest urban area where access to skilled labor, mostly mechanics and tradesmen, is guaranteed. The plant is only 5 minutes from the International Airport which is very important as financing of the plant is planned to be largely from international sources. Furthermore, the company plans to sell its alcoholic products as a fuel blend additive, which is about 80% distributed out of Reykjavik. A lot of oxygen is a bi-product of the electrolysis process. The Reykjanes area is probably the best locations for selling such gases, especially the airport that might become a customer, but also local fish farmers.

b) Economical and technical feasibility study should be conducted at the earliest convince on the optimal methodology and technical verification on how to abstract hydrogen from non-condensable geothermal gases at proposed new Bjarnarflag power plant. AGC should apply for a grant for this study from National Power Company, Ministry of Industry or the Energy fund. AGC should furthermore follow closely development in H_2S cleaning systems for the non-condensable gases at the proposed Bjarnarflag geothermal power plant. It is possible that for cleaning of H_2S the National Power Company uses so called Klaus method would be used that hydrocracks the hydrogen out of the H_2S while solidifying the sulfur. This process could yield hydrogen that can be used for industrial processes.

c) AGC should follow closely developments if Kemira is going to build plant in Grundartangi and have hydrogen available as a bi-product. The company should engage in price negotiation and be ready to move their plant to Grundartangi if prices are too good to miss. AGC should furthermore work with Kemira in developing option to abstraction steam for their production, which could come through steam boiler from the Elkem Ferro-silica plant.

Team and partners

Dr. Andri Ottesen, Chief Executive Officer

Magnús Magnússon, Chief Engineer

Gunnlaugur Friðbjarnarson, founder and key inventor of Icelandic Process Development Ltd

About Project Preparation

The current owners of the project are seeking interested investors to participate. The next steps in the project are to form a project preparation group of specialists who further design, negotiate and form contractual basis about utilities, raw material supplies and site specifics and capital costs. Furthermore, to gather and collect information and data with the objective to enable the decision for project's Phase I initiation before end of 2012. An important task of the project preparation is to start working on the documentation delivery for the official permitting processing of the project. It is important to be able to start this soon as the authorization processing in Iceland normally takes 6-10 months. The cost to reach this objective is estimated at EUR 1.000.000. Simultaneously AGC would seek strategic partners for the operation of the project as well as potential investors for the second phase.

Abstract

Chemical industry has been a very important industry in the western hemisphere for the last century or so. Today the chemical industry in Iceland is a relatively new concept and has evolved very slowly in recent time mostly because the basic infrastructure for industry of that caliber is in many parts not progressing as fast it has the potential to do. In Iceland there is an opportunity to move the chemical industry into new highs with available low energy prices, feasible land, good harbor-and road connections, and with growingly educated work force. This research provides a financial valuation of raising a glycerin to glycol factory in four locations in Iceland. These locations are Helguvík, Grundartangi, Bjarnarflag and Djúpivogur. Each location has something unique to offer in comparison so valuation is bound to reflect different opportunities. A standard profitability assessment method with 10 year operational time period provides a very positive net present value and internal rate of return at each location.

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List of Abbreviations

NPV	Net Present Value
IRR	Internal Rate of Return
EUR	Euro
USD	US Dollar
GBP	British Pound
ISK	Icelandic Krona
NOR	Norwegian Krona
KW	Kilowatt
KWh	Kilowatt hour
MW	Megawatt
MT	Metric Ton

1. Introduction

The purpose of doing this analysis is to determine if a business opportunity is possible, in fact practical and viable. This study undertakes such approach as to make a realistic look at both positive and negative aspects of the business opportunity, but adds to it by looking at some aspects that might increase the value of the project and make it more profitable in the future.
One angle of this study is to examine the competitive environment of Iceland towards other suitable sites like Delfzijl in the Nederland and Nepic in the North England. Both those sites have in common is that they are a developed chemical parks and as such have both good excess to feedstock, skilled labor and world class facilities in the field. In addition they use on location industrial byproducts to decrease cost and enhance protection of the environment as a result. Invest Iceland Agency commissioned a report (Investum, 2009) in 2009 that demonstrates what elements successful chemical parks would comprise of. The result that such parks would be possess harbor facility that could facility large cargo ships, have large storage areas, sophisticated drainage and effluence system but most important access to affordable electricity, steam and hydrogen (either as a bi-product from other chemical plants or as derivative from natural gas). Last but not least the park will have to be connected to international market via train network or equivalent land transport system.

It is obvious that Iceland is in a disadvantage in this regards mainly as there is no tradition for clusters of chemical plants at this magnitude, there is a shortage of skilled labor for industries and specialization is clearly needed. Iceland is fair away from the world markets and there are no gas/hydrogen sources in place in Iceland. All logistics becomes difficult and costly along with storage facility and pricy inventory management system. The only means of transport to and from international markets are through large ocean vessels that require large inventory systems at each side.

What Iceland has to offer is renewable electricity to heavy industries at price that is only one third of the average cost in Europe, steam from geothermal sources at only one fifth of common European prices. Land is also much more affordable and thanks to the currency crises in 2008 even labor cost and professional services in Iceland has become affordable and competitive. The main purpose of this study is to gather information and calculate if the advantage of building energy intensive chemical plant, mainly Propylene Glycol Plant in Iceland in comparison to sites at chemical parks in England and Holland.

Four cases were constructed, studied and evaluated: Helguvík Harbor, Grundartangi, Djúpivogur and Husavik/Bjarnarflag. Each location has a harbor that can accommodate at least 10.000Ton transport vessel. Helguvík Harbor location is next to the proposed Icelandic Silica Factory that can provide steam at affordable rate. In Helguvík is also depot of tanks at the harbor that can be used to store raw materials and products. Grundartangi site is oldest established area for heavy industry in Iceland which aluminum smelter and ferrosilicon factory and proposed Sodium Chloride factory that has hydrogen as a side product. That company has expressed interest in selling that hydrogen to AGC at affordable rate. Húsavík/Bjarnarflag, is where Húsavík would be the harbor and the tank storage area and Bjarnarflag is next to a geothermal power plant where one third of volume and one tenth of weight of the non-condensable gases that are used for power production is natural occurring hydrogen that can be abstracted, cleaned and used for production, furthermore, as the AGC plant would be built next to a geothermal power plant and thus no transmission tariff of electricity would apply. Djúpivogur has tanks and buildings that the municipality is likely to donate partially or fully to such operations.

Research Question

The research question put forward is the following:

Where is the most suitable site location in Iceland for raising AGC Ltd. factory and does outcome of financial and risk analysis compete with building the factory in Holland or England?

Description of the research

My interest in this research was sparked during a summer course “International Trade and Emerging Markets” at Bifröst University, Iceland. In that course we the students were introduced to proposed raising a factory in three different locations: Delfzijl in Nederland, Bordeaux in France, and Fray Bentos in Uruguay. It emerged that a similar approach would take place in Iceland and a search for suitable building site was needed. The topic is interesting as it involves investment in Iceland and completely new industry that could add more volume to Icelandic industrialization.

The objective of the research

The object of this report is to obtain and to analyze more knowledge of suitable location site for AGC factory in Iceland if one could be identified. The study will attempt to use financially recognized methods to value each location and to find what will be the best solution for AGC in Iceland according to those valuations methods.

Research Method

The research study will be based up on two measurements tools; gathered quantitative secondary data from published internet web sites and qualitative data that will be gathered through e-mails and telephone calls during the fall period September to November. By twinning those two measurements methods together it will hopefully result in a clear conclusion whereas the idea is that the two will support each other and add value to the research.

Limitations

In a preliminary study like this assumption are made to further advance the project. Using assumption in such way will always cause inaccuracy in calculations and therefore the conclusions are not as reliable as attempted, but could still give a pretty fair value of the job that was at hand. This study is a concept screening for the proposed plant and very little is known other than what type it is and what capacity it will generate. Because of limited available information and amount of estimates in this study a wide accuracy should be expected and more advantaged research should be made if the conclusions are considered profitable.

2. AGC

About AGC

Atlantic Green Chemicals (AGC) is a company that is formed to execute green and environmental chemical manufacturing projects, using renewable raw material as a feed stock for its products and by using renewable energy source in the production of its products. This newly constructed firm is looking for a possible industry site to build a factory and has intended the location for its first plant to be in Western Europe. There are a few interesting sites identified as suitable for a factory of this caliber both in Iceland and other Western European countries. In Iceland's case four sites are considered most attractive in regarding satisfying energy source. Those are **Bjarnarflag** in Norðurþing municipal on the north-east coast, the industrial site at **Grundartangi** in Hvalfjöður, a new industrial site at **Helguvík** in Reykjanes peninsular and in **Djúpivogur** municipal on the east coast.

AGC is a spin-off company from the research and consulting firm **Efnaferli ehf (Icelandic Process Development, IPD)** with the purpose to develop implement and execute projects on the field of "green" chemical industries in Iceland and/or elsewhere. IPD was formed in 1997 to research various chemical processes that would be suitable for medium scale chemical plant productions. **Gunnlaugur Friðbjarnarson:** is the founder and key inventor of Icelandic Process Development Ltd. He graduated as a chemical engineer from the Karlsruhe University, Germany, in 1986 where he studied, among other fields, process design and separation technology, thermodynamics and Fisher-Tropsch catalysis.

Gunnlaugur is a specialist in green chemistry and heterogeneous catalysis process technology and has collected over 25 years' experience in chemical plant design, engineering, project management, manufacturing and product development. After graduation he spent two years as a branch manager of the Icelandic Fisheries Laboratories branch in East Iceland. Thereafter, he founded and managed a company, Kraftlýsi Ltd, which specialized in marine food supplements and marine oils.

After 9 years of running his own company he returned back to consulting engineering and was a member of a design team for some of the largest geothermal projects in Iceland working under the auspices of VGK Ltd, where he worked for almost 9 years. Gunnlaugur was the main process designer for a polyol plant that was built by Global Bio-Chem in China in 2005, using sorbitol as a feedstock. He managed and coordinated the design, supervised construction and was responsible for the start-up of the plant.

In 2006 to 2007 he became on-site engineer in El Salvador for the construction of an ORC-binary cycle power plant which was built by Enex Ltd, an Icelandic power plant technology provider. In Q3 of 2007 he became the project coordinator for the site preparation of a geothermal deep drilling project of Geysir Green Energy in Bavaria, Germany. At the end of 2008 Gunnlaugur decided to explore his interests within green chemistry full time and has since then dedicated his efforts on the chemical technology company Icelandic Process Development Ltd which he founded in 2006.

Since 2007 IPD has operated a sophisticated fully staffed pilot plant in Reykjavik for the proof of processes and the verification and characterization of utilities, energy, and specific consumption parameters. This pilot plant is well suited to develop and test various kinds of catalysts and process conditions, by using hydrogen and a variety of biomass feed stock. Rannis (Icelandic Research Council) granted IPD a 3 years support in 2008 for testing and catalyst's developments. One of the results from operating the pilot plant resulted in a newly achieved process patent, registered in Iceland in January 2011. This patent has already been filed and is pending internationally (PCT). The patent involves processes using glycerin and other sugars to produce renewable chemicals, such as glycerin, which delivers mainly and with high selectivity propylene glycol and ethylene glycol, valuable and in high demand commodities. This process is considered more efficient and environmentally friendly than prevailing glycols processes based on petrochemicals sources.

The Officers at AGC

Dr. Andri Ottesen, Chief Executive Officer

Mr. Ottesen graduated from the International School of Management, Paris, France in 2007 with Ph.D. in the field of International Business Management. He was also a Graduate Fellow from Stanford, USA, in 2002 and in Leipzig University, Germany, where he received a grant from the German Ministry of Educations (DAAD). He graduated in 1999 with MA in Commerce from Otaru University, Japan, with grant from the Japanese Ministry of Educations (Monbusho). In 1996 he graduated with MBA from California State University, Fullerton on a scholarship from the American Marketing Association. In 1995 he graduated from the same school with degree in International Business and Foreign Languages. Currently Mr. Ottesen is the director of business operations at Carbon Recycling International (CRI) in Iceland, the world first factory that converts industrially emitted CO2 to renewable methanol. Before joining CRI Mr. Ottesen was the Managing Director of Seed Forum Iceland and "Klak" which is the Center for Entrepreneurship, Reykjavík, Iceland. He was head of

division/budget analyst for the Icelandic Ministry of Finance for 6 years where his responsibilities where to approve the national budget towards ministries of employments and natural resources. Mr. Ottesen is a member of the Icelandic Crisis Respond Unit and has served as appointed Major in Kosovo in 2003 where he was an Economic Advisor to NATO.

Mr. Ottesen has taught regularly at the University of Iceland, University of Reykjavík, University of Bifröst and Icelandic Agricultural University, all located in Iceland. In 2010 he was qualified as Assistant Professor at University of Iceland. His teaching subjects are Marketing, Finance, Entrepreneurship, International and Macro Economics, Strategy and Leadership.

Magnús Magnússon, is Chief Engineer at AGC

Mr. Magnússon graduated with M.Sc. in Exploitation of Materials in 1979 and has BSc in Mechanical Engineering in 1978 from the University of Leeds, England. He has qualified various management courses which include quality management, reengineering and negotiating technique. He was certified from The US National Training Branch to audit Haccp systems. Process improvement leader series certificate form PMI, USA in 2006. He graduated with Mechanical Engineering degree from the Technical Collage of Iceland. He was the Director of Project at CRI where his responsibility was to build the world's first CO2 to Fuel factory at Grindavík Iceland. He was Chief Executive Officer of Almenna Consulting Engineers. Mr. Magnússon was a partner and a Senior Consultant at Deloitte & Touche Management Solutions Ltd. in Iceland. He was Managing Director of Reykjanes Geo-Chemicals Ltd, where he reconstructed the financing of the company and was involved in the startup in a new product from precipitated silica. Mr. Magnússon was heavily involved in the Icelandic fishing industry where his profile includes the Head of Production and Marketing at ÚA Plc. (one of Icelandic leading fishing process company), Production Manager at Síldarvinnslan Plc., Fjarðarbyggð.

Mr. Magnússon was a lecturer at University of Iceland, The Technical Collage of Iceland and to United Nations University in Iceland during 1980-2000 on Quality Management, Operational Research and Statistical Control.

International partners

Godavari Biorefineries Ltd. is owned by Somaiya Group and is the 2nd-3rd largest sugar mill operator in India. Its production is now 475 thousand Tons (2010) of sugar and sugar derived products. Godavari had an interest to build a glycol plant in India using sugar as feed stock (Somaiya, 2011). Those plans turned to be unprofitable due to drastic rise of sugar price in 2009-2010. Godavari has expressed interest in participating in a European project in an MOU after IPD suggested using glycerin instead of sugar in the manufacturing unit. Godavari Biorefineries has supported and cooperated with IPD for over 3 years on the field of sugar to glycol technology developing platform. Somaiya has strong operational ties to Helm and Vinmar and has expressed interest as bringing them in as minority co-investors.

Icelandic Process Development (IPD) has initiated and concluded a letter of interest for the potential of selling and distributing glycol products with Helm AG. The letter of interest states that Helm AG is obligated to sell all off AGC products at market value at the cost of 5% sales fee for Helm AG. Helm AG was founded in 1900 but since 1950 the company´s focus has been on chemical trading. Today Helm AG is an international chemicals distribution and marketing company, located in Hamburg, Germany, with operations in over 30 countries and a yearly turnover around EUR 8 billion (Helm AG, 2011).

Vinmar International Ltd. is an international distributing company of chemicals and polymers located in Huston, Texas in the United States. The company was founded in 1978 and operates as a subsidiary of Vinmar Group. Vinmar International

also offers market analysis and counseling in various fields such as logistics, marketing and sales and so forth. In 2006 the company shifted its focus to added fuels trading, specializing in ethanol and natural gas liquids. Vinmar International operations arena is worldwide. (Vinmar International ltd., 2011).

The Perstorp Group is a world leader in several sectors of the specialty chemicals market. Perstorp focuses on performance culture that creates resource-efficient and environmentally sustainable solutions for business clients within selected niches of organic and polymer chemistry. Perstorp offers many innovative chemical solutions. In their role for an application or product competitiveness, using specially formulated chemicals, they give their products elements of surprise in the marketplace. Perstorp is operating a medium sized biodiesel operation at their headquarter location in Stenungsund, Sweden (Perstorp Group, 2011) and can provide up to 30.000 tons per annum of 97% technical grade glycerin.

The project

The first steps in raising a factory capable of producing 30.000 tons per annum of products in an industrial scale plant in Iceland. Within two years' time plan is to double the size of that factory again to the production capabilities of 65.000 tons per annum, and after five years from initial first step was taken the final expansion would take place and the production capability will reach 125.000 tons per annum. The engineering, procurement and construction cost for the overall glycerin purification and conversion plant is estimated to be around EUR 17, 8 million. This total installed cost has an estimated accuracy of -10/+35 % according to IPD estimation. Further investments are needed in some of the locations and in others they will be reduced. But in every location there is need for connectors for energy as AGC factory can be regarded as an intensive user of energy, but do not fully reach the intensive users category which is required by law until for filling 10 MW criteria or 80 GWhours.

Table 1 Shows project timeline - capacity - investment:

	Production capacity in tpa							
Year/description:	**Phase 1**		**Phase 2**		**Phase 3**		**Total**	
(Feasibility study cost 1 M.euro)								
Investment - EURO:	17.851.423		15.000.000		19.900.000		52.751.423	
Capacity - tons(products):	30.000		35.000		60.000		125.000	
0								
1	30.000	100%					30.000	
2	30.000	100%					30.000	
3	30.000	100%	35.000	100%			65.000	
4	30.000	100%	35.000	100%			65.000	
5	30.000	100%	35.000	100%	60.000	100%	125.000	
6	30.000	100%	35.000	100%	60.000	100%	125.000	
7	30.000	100%	35.000	100%	60.000	100%	125.000	
8	30.000	100%	35.000	100%	60.000	100%	125.000	
9	30.000	100%	35.000	100%	60.000	100%	125.000	
10	30.000	100%	35.000	100%	60.000	100%	125.000	

Further benefits to mention are low costs for land rent, competitive construction market, and access to highly skilled, experienced and educated labor and management personnel. In general the efficiency of Icelandic workforces is considered high. The time schedule for designing and building the plant is estimated 13-15 months from the project's execution decision date.

The purpose of the small scale plant is to bridge, transform and verify technology concepts prior to the construction of a large scale industrial unit

Table 2 Shows Estimated project timeline by IDP

Year	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Permitting						
Phase 1						
Construction						
Operation						
Phase 2						
Construction						
Operation						
Phase 3						
Construction						
Operation						

Phase II:

G2G-Plant-II: Modular designed plant producing about 100 tons/day or 35.000 tons per annum of products.

Estimated cost is EUR 15 million with an accuracy of about -10/+35 %. Start-up and commissioning is possible in Q1 2016.

Cost and time figures have to be re-evaluated in a detailed feasibility study.

Phase III:

G2G-Plant-III: Modular designed plant producing ca. 370 t/day or approximately 120.000 tons per annum of products.

Estimated cost is EUR 19, 9 million and the accuracy estimate at this time is -10/+50 %.

The commissioning and the plant startup are possible 2017-2018. Cost and time figures have to be evaluated in a detailed feasibility study.

Further expansion plans in terms of multiple plants.

About the Cost and time

Preliminary estimate of the investment cost of the Phase I am EUR 17, 8 million which will yield 30.000 tons of products with a total sales value (at full capacity) of EUR 33, 1 million. The accuracy of those estimates is considered to be in the range -10%/+35%. Initially 1,0 million Euros is needed to finish necessary contracts, permitting, and to start the front engineering design (FEED) intended to be finished by mid of 2012. After the execution of FEED, that will include budget prices for several major equipment, the accuracy of the cost estimate will subsequently improve and can likely be -10%/+20%. If detail design and the ordering of key equipment with a long lead time can be realized in end of 2012, the physical construction is scheduled for mid of 2013 to enable production by end of 2013.

About the Risks

Locations Risk

One of the risk factors related to an Icelandic location is the current rater volatile political environment due to and after a bank meltdown in late 2008. Recent and rapid changes around governmental regulations have affected several projects and project preparation. For example, cooperative taxes have increased from 15% in 2005 to 20% in 2011. Also an Icelandic location is subject to changes in freight costs and the development in crude oil pricing which

affects both feedstock and cost of product delivery. On the other hand the product prices will develop in a relation to petrochemical raw material prices, so price increase in crude oil will also result in an increase in product prices. This will more than compensate for the variations in freight costs due to changes based on fuel cost variations.

Operational Risk

The main operational risk of this project is price fluctuation of crude glycerin and that crude glycerin will increase more proportionally than the glycols being manufactured. As crude glycerin is a by-product of biodiesel production a likely scenario is that supply will increase with EU target by 2020 of doubling the use of renewable fuels. Competing use of glycerin are methanol production by companies such as MCN in Netherlands, which converts glycerin to methanol and new processes of the chemical company Solvay making epichlorhydrin, which is intermediate chemical for plastics. Methanol is a relatively cheap chemical, so BioMCN will unlikely be able to follow rising price of glycerin unless up to a certain level, so this will dampen the raw material market.

Market prices for propylene glycol are expected to rise correlated to oil price as the main raw material for conventional propylene glycol is propylene a directly derived petrochemical product, thus hedging the price fluctuations of crude glycerin.

Permitting Risk

Permits need to be obtained by the local and national government. The most important permits are environmental impact assessment and operational permits. Most of the sites are already developed as industrial areas except for Djúpavogur, and no harmful emission will come from the factory. Obtaining these permits is standard procedure, but this must be adapted towards the specific site conditions and site requirements. However, these procedures that are depending on local authorities might take more than one year to obtain, therefore they might possess some scheduling risk. Necessary permits are however usually achievable well within a year when projects are related to renewable industries in Iceland.

Technological and Scale Up Risks

Technological risks are believed to be mainly related to performance and lifetime characteristics of the catalysts and catalysis systems, thus requesting decent and long time and fundamental testing of catalysts to be applied. Reflecting IPD experience in process scaling up projects using adherent reaction systems the scaling up risk has showed little deflection towards the proportioning of the equipment and systems, but more related to unexpected process fluid contamination, lack in material quality or due to poor operators skills.

In this project the catalyst candidate is commercially available, specially adapted for this particular process by IPD. It has been extensively tested both by the manufacturer and also by IPD. Testing runs for over 8000 hours or for one year have been realized. IPD has developed special process features with this catalyst and tested it for 2000 hours under strain conditions. The results obtained from those tests were outstanding and partially used to achieve process patent. As part of the patent process all results have scrutinized by the patent authorities and IP legal office.

Project Cost Risk

The presented Phase I project cost estimate, at the current stage of the project preparations, of MEUR 17, 8 has -10%/+ 35% inaccuracy. The next pre-engineering work will deliver more accurate numbers given the site specific information specifics. Even though in worst case analysis of the project cost, the project profitability still looks promising as the EBITA exceeds 35%, thus the project economy shows rather little dependency on variations in capital cost.

About the technology:

The technology implemented for this project will be the proprietary and newly patented process of IPD and licensed to AGC. Process based on this technology reduces the emission of greenhouse effect generating carbon dioxide compared to conventional production methods that uses petrochemicals as feedstock. Not only is the project economical feasible, it also has environmental benefits that both have market value that can lead to cost effective funding from EU-green grant programs or green-technology investment funds.

The history of the idea to produce glycols by hydro-treating of glycerol steams from IPD participations in two related projects. The former project was a pilot test executed in South Africa for almost three years in 2001 to 2003. The aim of that project was to use sugars from sugarcane mill to convert to glycols. The later project was executed in China over the period from 2003-2005, with the aim to process corn glucose to glycols. This project was rated for as 10.000 MT per year demonstration unit. The experience and know-how from the processes further lead to independent improvements and verification of new catalyst systems and subsequent process technologies. In 2008 IPD build its own pilot plant for catalyst testing and process development. Prove of process was achieved in 2009 that lead to a granted patent in January 2011.

In test systems of this kind catalyst performances, in particular; yield, product selectivity, hydrogen usage and catalyst lifetime characteristics are measured. This leads in general to an effective scale-up of chemical processes of various kinds.

The process

Production process involves the pre-handling of glycerol; it is mixed with water and brought into the reaction system as it comes into contact with specific solid catalyst along with hydrogen. Additionally the process also needs the help of a catalyst, in this case it is alkali-hydroxide but in small quantities to maintain the conditions and to ease the rapid reaction of the preferred way. The hydrogen is piped into the system as well as other feeding chemicals and the conditions thus created are to convert glycerin into glycol and some other alcohols. The remaining production process is primarily to isolate and strengthening of the products formed.

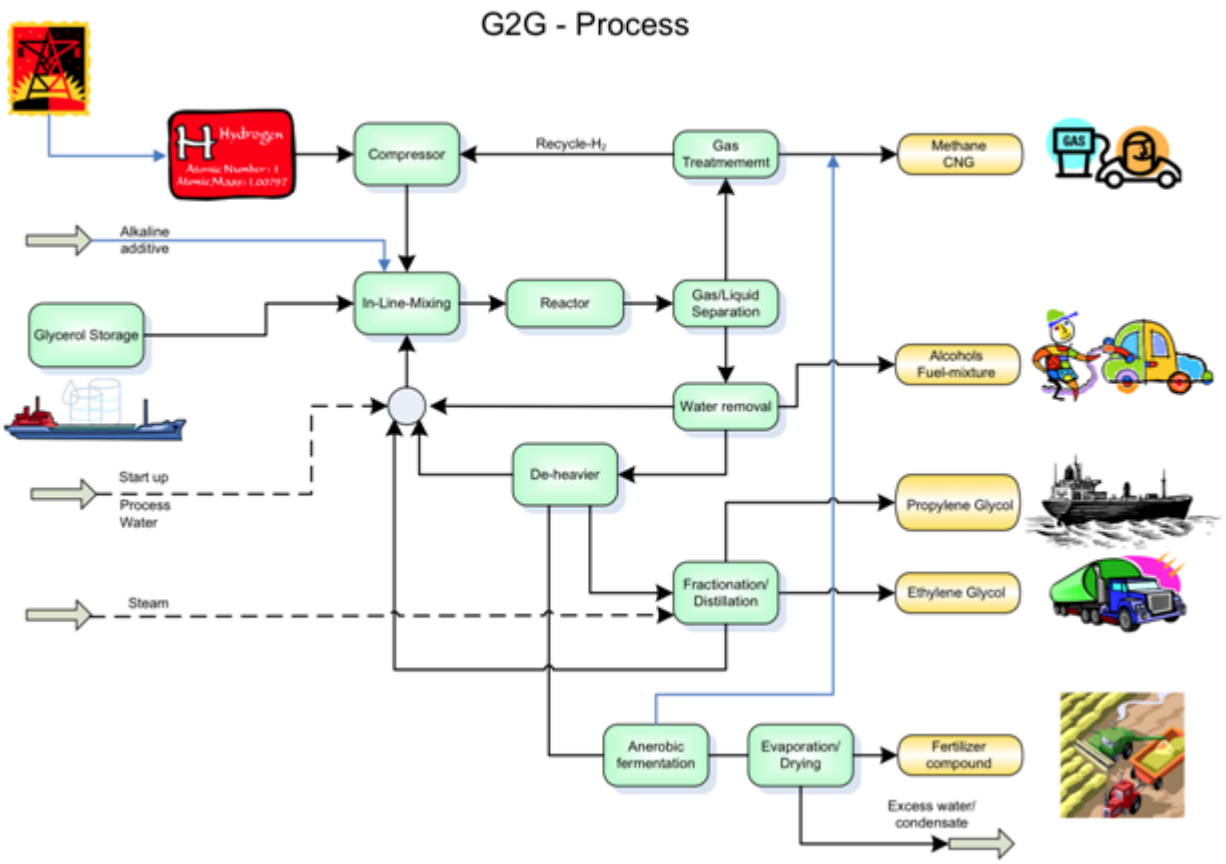


Figure 1 Simplified version of the process and production of the AGC plant in Iceland

The main elements of the process essentially constitute the bulk of the production which is based on evaporation, thickening and distillation. These are relatively large heat users. Hydrogen would be produced by conventional electrolysis or possibly lead to the processing from other manufacturer in the area that had a by-product hydrogen. All water and other

unreacted materials are circulated and the process is thereby to maximize yield and utilization of the materials.

In addition to liquid products, methane formulates in the productions process. This is a new domestic source of methane, the energy medium suitable for cars. By using certain parcel of circulating gases in the thinking process for the methane, the methane rate is increased to > 90% v / v. This process would increase methane production in Iceland and would bring in a more stable stream of the product, as the other producer of methane in Iceland is using a landfill area in Álftanes (in Reykjavík) and is therefore limited by both time and space.

The products

The main products of AGC are shown in Table 3 below, but consist mainly of two kinds of glycols; Propylene glycol (86 % of production by weight) and Ethylene glycol (11 %). The remaining 3 % of the production are a mixture of second generation bio-ethanol and bio-methanol and in addition to that some methane will be generated as gaseous by-product. In this research it is assumed that those productions products would be the same in all locations.

Table 3 Shows G2G - Raw material usage/Product(s) distribution

Raw material / products		distribute weight	Phase 1 MT/year	Phase 2 MT/year	Phase 3 MT/year	Total MT/year
Production capacity			30.000	35.000	60.000	125.000
Crude Glycerin (crude 80%)			41.209	48.077	82.418	171.703
Net feedstock Glycerin (100 %)			32.967	38.462	65.934	137.363
Methane	1,5 % of feed Glycerin		495	577	989	2.060
Methanol		2,0%	600	700	1.200	2.500
Ethanol propanol		1,0%	300	350	600	1.250
Total Alcohols.		3,0%	900	1.050	1.800	3.750
Propylene glycol		86,0%	25.800	30.100	51.600	107.500
Ethylene glycol		11,0%	3.300	3.850	6.600	13.750
Total liquid Products.		100,0%	30.000	35.000	60.000	125.000
Total liquid products - excluding methane:			**30.000**	**35.000**	**60.000**	**125.000**

Propylene glycol is used as a base compound in poly-glycol ethers and in polyurethane- and polyester-resin formulations. Examples of products using propylene glycols are insulation foam compounds, furniture, automobile interiors, resin in reinforced fiber glass for boat hulls

and rubber compounds for shoes. Propylene glycol is also used as surface active ingredient in cosmetics, hygienic and pharmaceutical products.

Propylene glycol is a colorless, viscous liquid at room temperature. It doesn't have a true freezing point, but becomes glasslike at -50°C, and it can lower the freezing point of water to about -60°C. Propylene glycol is essentially nontoxic (generally accepted as a food product) in comparison to ethylene glycol with its acute toxicity to mammals. Hence, the share of propylene glycols of the U.S. and European aviation deicer market has grown significantly. Companies like Union Carbide, Lyondell, Kilfrost and Clariant are among the major players in the market. Shortages in supplies of propylene glycol lead to temporary closing of several national airports in Europe late 2010. Affected airports were among others Heathrow, Amsterdam, Frankfurt and Charles de Gaulle.

The market price in September 2011 was around EUR 1.250 pr MT free delivered in North-West Europe (Rangarajan, 2011).

Ethylene glycol is used as a base compound in polyester formulations such as PET–bottles and textile products, it is best known as radiator coolant liquid and antifreeze. Estimated world market size in 2010 is 19.9 million metric tons (SRI Consulting, 2011) and the market price in 2011 where around EUR 1230 pr MT free delivered North-West Europe.

Ethylene glycol has been the standard for antifreezes and deicers for decades because of its relative low cost. It is a colorless, slightly viscous liquid with a freezing point of -13°C, and it can lower the freezing point of water to about -50°C. Today the more environmental propylene glycol is preferred.

The market price in June 2011 was around EUR 1.230 pr MT free delivered in North-West Europe (ICIS (a), 2011).

Bio Methanol and Ethanol is currently blended into gasoline in Europe. European directives require increasing percent of renewable fuels to be blended into gasoline, currently around 6% of energy value, to be increased to 10% by 2020. Incentive programs such as tax discount and pay back policies have been put in place in most of the EU countries to reach these goals. Second and third generation of bio fuels from byproducts or emissions are given preference for tax incentives. According to European Directive 2009/28/EC (European Parliament, 2009) 46, 5 million m3 should be blended into either diesel or gasoline by 2020, that requirement is only met today by 24, 5 million m3 of biodiesel and 1, 9 million m3 of ethanol that is mostly imported from Brazil.

About product application

Propylene glycol can be the main component for de-icing for aircrafts. Chloride salts deicers are prohibited for use in aviation because of corrosive characteristic. Therefore historically mixtures of Ethylene glycol and Propylene glycol have usually been used. Glycols and other deicing chemicals are efficient freezing-point depressants. They act as an agent to lower the freezing point of the solvent. Today, Propylene glycol is the main component of aircraft deicers (about 80%), 10% is water and 10 % other chemicals. Typical application of deicing fluid is to spray on critical surfaces of an aircraft, such as the wings, flaps, and fuselage. It is heated to 65°C - 80°C and sprayed on aircraft surfaces at high pressure to melt or remove ice, snow, or sometimes just defrost.

Market prices of raw material and products

Table 4 Shows Estimated product price and raw material price

Chemicals:	Price	Phase 1	Phase 2	Phase 3	Total
		Total value in Euro			
Raw materials					
Crude Glycerin (80 %), ex factory	**280**[1]	11.538.462	13.461.538	23.076.923	48.076.923
Glycols					
Propylene glycol	**1.150**[2]	29.670.000	34.615.000	59.340.000	123.625.000
Ethylene glycol	**850**[3]	2.805.000	3.272.500	5.610.000	11.687.500
		32.475.000	37.887.500	64.950.000	135.312.500
Alcohols					
Ethanol	**700**[4]	210.000	245.000	420.000	875.000
Methanol	**700**[5]	420.000	490.000	840.000	1.750.000
	700	630.000	735.000	1.260.000	2.625.000
Gas					
Methane (0,714 kg/Nm3)	**400**[6]	197.802	230.769	395.604	824.176
Total - without methane:		**33.105.000**	**38.622.500**	**66.210.000**	**137.937.500**
Total - average price pr MT		*1.104*	*1.104*	*1.104*	*1.104*
Total revenume - with methane		**33.302.802**	**38.853.269**	**66.605.604**	**138.761.676**

1 Source: Rajiv Rangarajan, Director Somaiya Biorefinaries BV - Head trader for chemicals in Holland Office. Visit to Iceland 4. September 2011 (Rangarajan, 2011).
2 Source: Rajiv Rangarajan, Director Somaiya Biorefinaries BV - Head trader for chemicals in Holland Office. Visit to Iceland 4. September 2011 (Rangarajan, 2011).
3 Source: Rajiv Rangarajan, Director Somaiya Biorefinaries BV - Head trader for chemicals in Holland Office. Visit to Iceland 4. September 2011 (Rangarajan, 2011).
[4] Source: Andri Ottesen Director of Business Operations CRI. E-mail 11.desember.2011. Sold for domestic use.
[5] Source: Andri Ottesen Director of Business Operations CRI. E-mail 11.desember.2011. Sold for domestic use.
[6] Source: IPD estimates

Market prices of the raw material and AGC products are based on prices during the period May to September 2011 in the western European markets. The accuracy of those prices is limited due to little or no public listing of those prices. There is of course volatility present at the European markets, and those prices have the tendency to increase or decrease, but do not have effect on selection of location for AGC factory. Our international business partner HELM has guaranteed the sale of our main products the glycols and alcohols at the price of 5% of market value.

3. Literature view

This project is based more on the field of realistic approach than academic theories, and there for it will lack the depth of academic fulfillment that otherwise would be have given this report both structural and deeper validation. There is however a few theoretic approaches that will be examined in this report and used to build foundation for conclusion about each location and to give final assessment about the results.

There are both external and internal factors that all firms need take notice of and base their future strategy with those factors in mind. The external factors are related to forces in a firm's external environment, and such can lead to new growth opportunities or can form of threats. Example of a new opportunity is when a company can exploit the difference between countries or/and geographical regions to achieve economies of scale in broadening the size of the market they serve. Example of threat could be the entry of a new competitor on the market that can weaken the position of existing firms. Internal factors are conditions within the firm itself. Example of an opportunity from within could be a firm's desire to exploit and employ its resources and competences and the threat could be the threat of matching the firm's resources and competence to the marked. (Boddy, 2008, pp. 119-127) (Aubert & Frigstad, 2007, pp. 18-20).

PESTEL

The aim is to analyze the external environment of a firm by applying the PESTEL framework. The model is divided into six categories that represent the most influential factors in the firm's environment which are indicated as; political, economic, social-cultural, technological, environmental and legal factors. The model can be regarded as a checklist about how to evaluate the firm's environment and as the macro-environmental forces changes over time it is imperative to understand the key drivers of change and the impact they have on particular

industries. PESTEL analysis relies on past events and experiences, and from a prescriptive strategy view it can be used to forecast about the future, but should be focused on things that do have impact or are most likely to change and affect the firm (Lynch, 2009, bls. 82-83).

Political environment

The political system in a country has a major influence on how businesses and industries operate. Political factors are closely linked to economic factors especially in how they allocate resources and deal with property ownership. In many words political stability and type of government are political factors that can determine attractiveness of the market. As seen here in Iceland political and social events can have deep impact on profitability firms as the whole economy can be stained with political risk (Boddy, 2008, p. 121).

- Sovereign risk which could arise from policies and decisions of the government,
- Lack of consistent legislation and effective policies.
- Corruption within the government or/and local municipality
- International risk that are linked to developments to the international political arena
- Policies towards foreign companies acquiring local firms
- Patent and intellectual property policy

Figure 2 Shows the PESTEL framework (Aubert & Frigstad, 2007, p. 25).

Economic environment

Economic environment is both at local level and international level of a country. It includes economic development and has significant impact on firm's activities in the market place and the size of the market. Example of economic development is could be income per head of the population or measure of gross domestic production (GDP). To operate in the economic environment firms need to adapt to a veracity of many opportunities or/and obstacles, to name a few; currency rates, interest rate and inflation rate, that are likely to considerably affect a firm's revenues and future growth.

- Unemployment rate
- Labor cost
- Stock market values
- Currency exchange controls

Social-cultural environment

Social-cultural factors have most effect on firms and industries when there is a change in form of increase or decrease in population of the country. Another similar factor could be if the population is aging which could indicate more demand for healthcare or the average age could be lowering which would indicate more demand on daycare and education. Cultural barrier can be an obstacle for firms moving between countries or country sites, as the difference can be in form of religion, old traditions and languages (Hollensen, 2011, bls. 242). Other important factors are (Boddy, 2008, p. 120):

- Lifestyle in changes
- Levels of education
- Levels of healthcare
- Gender equality

Technical environment

For a firm it is of most importance how well the basic infrastructure in the country is made. Infrastructure is basically the physical facilities that support all economic activities (Boddy, 2008, p. 124). So what we call basic infrastructure in each country we are referring to example:

- Road system
- Telecommunications system

- Volume and stability of power system
- Ports
- Airports

Natural environment

For the business context the natural environment has increasingly become a factor that represents an opportunity or threat. One of the key issues is the consideration of natural resources on what is renewable and what is not. Example of this could be oil which is not a renewable resource but geothermal power is renewable. More and more firms adapt to this new environmental friendly practices as a result of the demand from the market which is a part of the changed lifestyle in the western hemisphere. There has been increased demand of more environmental friendly products from the public and government. A special interest has been shown from international agencies over the recent years in issues evolving the protection of the environment (Boddy, 2008, p. 125).

- Environmental laws
- Waste disposal
- Environmental governance

Legal environment

Every country has its own laws and regulations that the government creates for the firms and industries so they can operate in the economy without collision. A change in regulation can affect operation of a firm in the market both for the better or worse for the firm. Example of this could be if the government would put a tariff on import on beef, it could benefit some producer within the industry, but could damage the sales on imported beef for importers and the distributers. Example of legal factors that could affect the market is (Boddy, 2008, p. 97):

- Tax laws
- Labor laws
- Competitive laws
- Consumers protection laws

NPV

The Net Present Value (NPV) method is used for measuring the profitability assessment of investment over period of time. In the most general terms, the NPV criterion method can be divided into four subtopics or time analysis periods: present worth method, future worth

method, annual worth method, and capitalized worth method (Remer & Nieto, 1995, p. 82). The present worth method that is used in this report is in most fundamental way, can be descript as the present value of all cash inflows is compared to the present value of all cash outflows associated with the investment project. What is called the NPV rule indicates that investment is should be accepted if the NPV is greater than zero and subsequently to reject project that if the NPV is lower than zero (Ross, Westerfield, Jaffe, & Bradford, 2008, p. 162). In calculating the NPV the user must determine the interest rate used in discounting the cash flow, and in most cases the rate is at where the investors can alternatively invest their money, i.e. the return of the most preferable alternative investment. Another important factor is the planned horizon of the project which has to be determined as well, and subsequently the cash flows for each period of the planning horizon projected (Remer & Nieto, 1995).

Equation 1 Shows the formula for NPV (Ross, Westerfield, Jaffe, & Bradford, 2008, p. 101).

$$NPV\,(I) = -C_0 + \frac{C_0}{(1+i)^0} + \frac{C_1}{(1+i)^1} + \frac{C_2}{(1+i)^2} + \cdots + \frac{C_T}{(1+i)^T}$$

Where

C_I = Net cash flow at the end of period T.

i = interest rate of the project

T= Service life of the project

When comparing mutually exclusive alternatives the investors need to select the one that has the greatest positive NPV. But when comparing alternatives it is of most important to use the same interest rate and equal time periods for all alternatives investments. (Remer & Nieto, 1995, p. 85).

IRR

The Internal Rate of Return is most important alternative to NPV method. The IRR is calculated both on project and equity.

$$IRR = 0 = \; -C_0 + \sum_{t=1}^{T} \frac{Ci}{(1+r)i}$$

Equation 2 Shows Internal Rate of Return (Ross, Westerfield, Jaffe, & Bradford, 2008, p. 170)

One of basic rationale behind the IRR method is that is provides a single number which summarizes the merits of a project and does not depend on anything except the cash flow of the project. Note that the single number does not depend on the interest rate prevailing in the capital market, but much rather that the number is internal or intrinsic to the project and does

not depend on anything other than the cash flow of the project. The general rule of IRR is to accept projects if IRR is greater than the discount rate and reject the project if the IRR is less than the discount rate. (Ross, Westerfield, Jaffe, & Bradford, 2008, pp. 169-171).

4. Framework of this analysis

In this analysis there is used the same excel model in all different locations. In our search for finding profitable location for AGC factory, the focus is mainly on the big cost drivers and other cost is mostly fixed. The following chapter is therefore in two fields of exploring this excel model, the first field is about big and expensive cost drivers that vary from location to location. And the other is about the smaller field that does not affect the big picture as much or is important but is similar to all locations.

Similar cost between locations

Currency

In forming this analysis it was crucial to synchronize currency to a fixed level. There are few currencies that are used trough out this report and that can be problematic do to volatility at the financial markets. To asses that problem the decision was taken to use fixed numbers as shown here below.

Table 5 Shows currency rates (ISK to :) use in this report (SI, 2011).

USD	116,0
EUR	159,0
GBP	183,0
NKR	21,00

Those currencies are chosen and fixed in this analysis to ease calculations and neutralize fluxions in currencies. Those numbers were chosen as a result of taking the average position each currency had against the Icelandic krona (buy) during the time period 1st of September 2011 and 11th of November 2011.

Employees

The staffing of the company and what requirement each job holds is based on estimates by Icelandic Process Development. As seen in the tables below the staffing requirements are based on three phases. The first phase requires 22 people, the second requires 30 people and the third requires 39 people.

Table 6 Employment - phase 1 + additional workers for expanding to Phase 2 and 3:

	Unit cost	Phase 1		Phase 2		Phase 3	
Description	**pr year**	**Number**	**Euro**	**Number**	**Euro**	**Number**	**Euro**
Managing Director	58.125[7]	1	58.125				
Production Dir.	55.350[8]	1	55.350				
Laboratory Dir.	49.050[9]	1	49.050				
Line staff	24.900[10]	12	298.800	4	99.600	4	99.600
Maintenance	41.250[11]	2	82.500	1	41.250	2	82.500
Quality assurance	40.950[12]	2	81.900	1	40.950	1	40.950
Office workers	41.550[13]	1	41.550	1	41.550		0
Various	27.750[14]	2	55.500	2	55.500	1	27.750
Total:		**22**	**722.775**	9	278.850	8	250.800
	Phase 2 - total staff and cost:			**31**	**1.001.625**		
	Phase 3 - total staff and cost:					**39**	**1.252.425**

The table shows the additional employee cost each phase ads and in what field of expertise the increasing numbers are. The wages are based upon surveys from selective workers unions within this year, but are mostly from the first months of the year 2011. In all cases the medium salary in same or similar field was used except in the case of managing director and production director the highest amount was used as in those two cases the higher wages are more likely to give better example of current market structure on wages due to the difficulty of the new industry. In all location the need will be the same for staff and the decision was made that the same amount of wages will be used in all locations. There are of course differences in wage structure in Iceland and it is very probable that ground staff in Bjarnarflag or Djúpavogur would be willing to work for lower wages than in Helguvík or Grundartanga, but at the same time that would be the opposite problem regarding very skilled or highly educated employees in management and supervision. It is there for a likely scenario that wages structure would be on level terms regarding location in Iceland.

[7] Framkvæmdast/önnur stjórnunarstörf (VR, 2011, p. 6).
[8] Sviðsstjórar (VR, 2011, p. 6).
[9] Vöruþróun og hugbúnaður** (VFI, 2011, p. 19).
[10] Framleiðsla eða pökkun (VR, 2011, p. 7). Note: without extra % because of sifts
[11] Eftirlit (TFÍ, 2011, p. 18).

[12] Eftirlit (VFI, 2011, p. 19)..
[13] Hag- og viðskiptafræðingar (VR, 2011, p. 6).
[14] Gæslu-, lager- og framleiðslustörf (VR, 2011, p. 7).

Marketing cost, license fee and cost of catalyst

Marketing cost, license fee and cost of catalyst as shown below are based on recommendation from IPD and representative of Somaiya Biorefineries in Holland. Included in the marketing cost is storage for AGC products in Rotterdam and unloading cost propylene and ethylene glycols. As indicated earlier our international partner Helm has guaranteed the sales of AGC products in the international market but at the cost of 5% of the sales price.

Table 7 Shows AGC marketing cost, license fee and cost of catalyst

Desription			Phase 1	Phase 2	Phase 3	Total
Marketing cost:	4,0%	of sales:	1.332.112	1.554.131	2.664.224	5.412.500
Royalty: 1% of sales	1%	Euro per t product.:	331.050	386.225	662.100	1.379.375
Catalyst cost	40	Euro per t product.:	1.200.000	1.400.000	2.400.000	5.000.000

The royalty cost is the exclusive fee for the design and process license that belongs to IPD owner Mr. Friðbjarnarson.

Various fixed cost

In the table below there is a list of some various cost that will be very similar between locations, the only variable that do behave differently are maintenance and insurance because they are calculated here as a percentage of the total investment and therefore will change between locations, however that fact will not have significance to the choice of location and therefore it is of less concern than other factors.

Table 8 Shows AGC various fixed cost

			Phase 1	Phase 2	Phase 3	Total
Maintenance:	4,0%	of investment:	606.747	600.000	860.000	2.066.747
Insurance:	0,75%	of investment:	113.765	112.500	161.250	387.515
Travels - staff:	7000	Euro per person	28.000	7.000	7.000	42.000
Telephone:	400	Euro per person	8.800	3.600	3.200	15.600
IT system:	1700	Euro per person	37.400	15.300	13.600	66.300
Security:		estimate	60.000	15.000	15.000	90.000
Auditing and consulting:		estimate	70.000	17.500	35.000	122.500
Various cost:		estimate	184.942	154.180	219.010	558.132
Total - various fixed cost:			1.109.654	925.080	1.314.060	3.348.794
Percentage of total sales:			*3,0%*	*2,1%*	*1,8%*	*2,2%*

Other important aspects of the business plan are as follows:

- Energy usage is based on an estimate made by Icelandic Process Development.
- Other cost factors are based on experience from industrial projects in Iceland, Europe and America or is an estimate made by Icelandic Process Development.

Different between locations

In this category are the most costly factors to the new factory. The following cost drivers affect the investment or/and operations depending on location. In many locations there is not much difference individually between investments but the cost can change the financial structure significantly.

Investment cost

The following table shows what IPD assessments of probable investment cost for the 1 phase. Those buildings mentions below are what IPD identifies for required need in building the G2G factory of 30.000 tons capacity. The need for investment cost for phases 2 and 3 are identified as well but not in details, but additional hydrogen electrolyser and storage tanks are need for expanded operations..

Table 9 Shows Investment estimate - phase 1, 2 and 3

Phase 1 - 30.000 tons capacity:	**Euro**		**Depreciation**	
Design, engineering, construction management:	1.500.000	9%	10,0%	
Land, building and premises:	1.200.000	7%	3,0%	
Storage tanks:	1.400.000	8%	10,0%	
Hydrogen electrolyser:	3.000.000	18%	12,5%	
Evaporators and distillation:	3.800.000	23%	10,0%	
Other fixtures and fittings:	3.200.000	19%	10,0%	
Contingency:	2.500.000	15%	10,0%	
Total: -10 % /+35% accuracy	**16.600.000**	**100%**	**1.651.000**	annually
Year 0-2				
Phase 2 - 35.000 tons capacity:				
Total investment: -10 % /+35% accuracy	**15.000.000**		**9,9%**	
Year 3-4				
Phase 3 - 60.000 tons capacity:				
Total investment: -15/+-50 % accuracy	**20.700.000**		**9,9%**	
Year 5-6				

At some sites there will be change from this table either added or withdrawn investments that will be suited to each location. Initial investment is one of the key areas of our research as we look at each location, with the purpose of valuating the total investment needed and assess them toward operations.

It is possible to decrease the estimated investment cost in Phase I: Firstly, if AGC could build the Phase I of the project where it would have access to hydrogen from external source. By

that the investment would be decreased by about EUR 2, 4 million or to EUR 14, 1 million. Secondly, it could be an option, depending on location, to hire tank space. Our estimated investment in tanks is EUR 2, 4 million. This figure could be decreased by about EUR 1 million lowering the possible total investment cost to approximately EUR 13, 1 million. Thirdly if AGC could build its distillation unit close to a geothermal site or build Phase 1 of the project where it would have access to steam from external source. Those cost lowering options are however site dependent on locations as following analysis in later chapter will show.

- Investment estimate are estimated by Icelandic Process Development.
- Depreciation is in line with Icelandic laws.

Finance and funding

Financing the three phases will be divided between loan capital and equity. In the phase 1 the aim is to get finance from investors up to 75% of the total amount needed for that phase. We assume that loan capital would be 25% of the needed capital and preferably from Godavari as a bridge loan as we have indication about that from their representatives. As the expansion of the factory in phase 2 and 3 occurs AGC factory will be generating profit and revenues and the need for equity capital grows less and loan capital grows cheaper.

Table 10 Shows AGC expected funding

	Investment		Equity		Loan capital
	Euro	%	Euro	%	Euro
Phase 1	16.600.000	100%	12.450.000	25%	4.150.000
Phase 2	15.000.000	100%	3.000.000	80%	12.000.000
Phase 3	20.700.000	100%	4.140.000	80%	16.560.000

- Loan capital is expected to be 8 year loans with an interest rate that is 600 points + libor.

Transport

In the field of transport it is assumed that the sea freight and land transport that AGC would receive the same price in all locations. We have confirmation from Nesskip that their prices are based on the ton in the cargo but not the distance. We have some conformation from Olíudreifing that those prices we received are valid but in the case of Djúpavogur we only assume that Olíudreifing can offer us the service needed at that location.

Sea transport:

Nesskip hf. is an Icelandic company founded in 1974 in Seltjarnarnes and is a leading company in Iceland in ship broking, agency services and consultancy. From the early start the company has been heavily involved in transporting pumice, salt, and fishmeal and fish oil. Today Nesskip hf. is a subsidiary of Wilson ASA in Bergen, Norway (Nesskip hf., 2011). Wilsons ASA focuses on short sea segment within Europe and operates around 112 vessels ranging from 1.500 – 10.000 deadweight tonnage (dwt) (Wilson ASA, 2011). Shipping between Iceland and Europe is vital for our operation and we have had discussions with Neskip who are one of the leading companies in Iceland in leasing bulk ships. We have made an inquiry about what price we could expect for importing glycerin in to Iceland and exporting glycols out of Rotterdam. The price would be 25 Euro's if we import 3500mts Rotterdam-Akranes in combination with 2500mts export Akranes-Rotterdam.

Land transport:

Olíudreifing ehf. (ODR) was founded in 1994 by Olíuverslun Íslands hf and Olíufélagið hf. to reduce operational cost of distribution. ODR´s main role is to store and distribute petroleum products for the owners and specialized maintenance for service stations and own equipment (ODR, 2011). ODR leases oil tanks in two locations where AGC is currently looking into, in Helguvík and in Húsavík. In discussions between AGC and ODR about possibility of AGC leasing the tanks form ODR for its glycol production, ODR has established price for leasing two 16 ton tanks and one 4 ton tank would cost 36.000 euros per month. AGC needs transportation inland for its liquid products and ODR is ideal candidate as it operations include the whole Iceland. ODR indicates that the average cost per liter would be 0, 0077 euro (1, 18 ikr) in transport and the company would allocate two trucks with trailers to the service.

Table 11 Shows freight cost - logistics:

Description	Euro/MT
NW-Europe-Iceland, liquid cargo	25[15]
Trucking - factory to harbor - liquid cargo	7,42[16]
Trucking & Storage factory to depot - alcohols	16,5[17]
Piping- factory to depot - methane	40[18]

Sea freight is very sensitive to load size. Freight cost for 1.250 tons cargo lots is 50 Euro/MT where's freight cost for 25.000 tons lots is 15 Euro/MT.

Energy

The power usage of the G2G process can be split into three in the initial phase:

a) Electrical usage (H_2 production 2/3 of the total): *About 35 million kWh or* ***35 GWh/a***

The main advantage of an Icelandic location is the access to energy at favorable prices: The electrical energy is 2 euro cents per kWh (Investum, 2009), but additional price for connection to the electricity grid is due and depends on which transmission company is distributing the electricity to the user's location. It is possible to make a special arrangement with the Icelandic power companies to buy what is referred to as non-priority electricity. There is a possibility of an occasional cut-off but in our case that is not an issue as the G2G process is not sensitive to electrical cut-offs.

The G2G process is not a large user of electrical power except for the production of hydrogen which is a major utility material in the process. If the hydrogen is produced on site by electrolysis, the electrical power consumption is significant.

The Icelandic electric market is divided into two separate entities by law. The production of electricity is in competitive environment and users can purchase the electricity from many sources. The distribution network is how ever subjected to patent licensing and every user has to connect to local distribution.

b) Thermal power usage – equivalent to: *About 70 million kWh or* ***70 GWh/a***

By locating the factory close to a source of geothermal heat the thermal energy cost will be lowered considerably compared to what it costs if we use electricity, oil or gas or other combustible materials.

[15] Source: Már Gunnarson transport manager at Nesskip -email dated 30.09.2011
[16] Source: ODR email to Andri Ottesen
[17] Source: ODR email to Andri Ottesen
[18] Source: IPD estimates

c) Hydrogen power usage:

There is no available source of hydrogen in Iceland in enough quantity to sustain the process of AGC factory for all the three phases, but there have been signs that the well-known international industrial company Kemira is keen on raising a bleaching factory in either Bakki or Grundartangi. One of Kemira by-products is hydrogen in enough quantity for AGC to buy their by-product at a fair price, and therefore lower the cost of electricity.

The table below shows how IPD estimates the energy needs of the AGC factory and gives the reader a clearer view of those three factors that are so important for the operations. The table here is not accurate and does not relate to all the locations, but only to give the reader a notion of how it works.

Table 12 Shows the three main power consumption factors to AGC factory

	Phase 1	**Phase 2**	**Phase 3**	**Total**
Transmission cost	149.186	285.850	559.180	994.216
Electrical consumption - full capacity: kW	1.180	2.360	4.720	8.260
Number of hours:	8.300	8.300	8.300	
Gigawatthours:	9,794	19,588	39,176	68,6
Electrical cost -Euro/kWh	0,023	0,023	0,023	
Total cost at full capacity: Euro	**374.448**	**736.374**	**1.460.228**	**2.571.050**
Thermal power consumption: kW	8.500	17.000	34.000	59.500
Converted to steam equiv. (t/h, 12 bar): t/h	14	28	56	97
Operating hours per year:	8.300	8.300	8.300	
Cost of steam equivalent: Euro pr ton	15	6	6	
Total thermal power cost at full capacity: Euro	**1.731.682**	**1.385.345**	**2.770.691**	**5.887.718**
Hydrogen power consumption: Nm3/hour	900	1.800	3.600	6.300
Converted to t/h	0,08	0,16	0,32	0,567
Number of hours	8.300	8.300	8.300	
Cost of hydrogen: Euro pr. Ton	700	700	700	
Total hydrogen power cost at full capacity: Euro	**470.610**	**941.220**	**1.882.440**	**3.294.270**
Tank storage rental (Euro Per Year)	**200.000**	**300.000**	**600.000**	**1.100.000**
Thermal power generated with electricity: Gigawatthours - efficiency 1,1	77,6	155,2	310,4	543,2

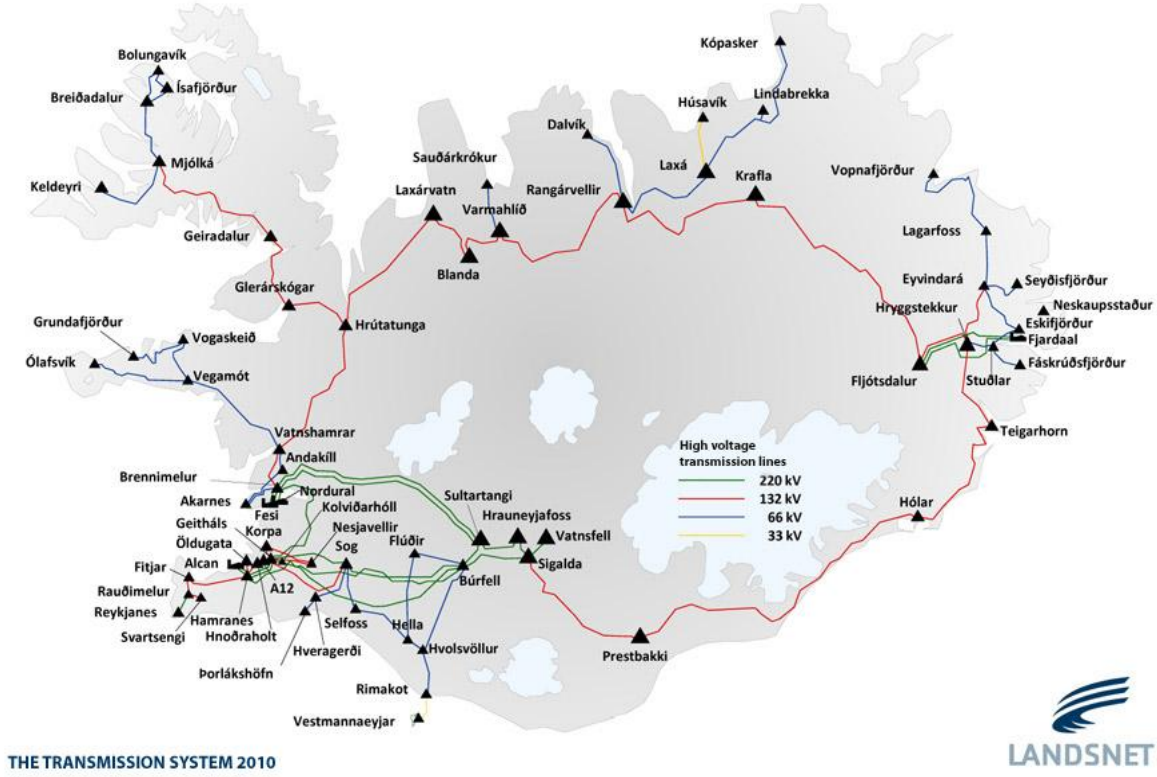
Key companies in energy production sector

Landsvirkjun (LV): Is a private company founded in 1965 and is in full ownership of the Icelandic government and as such operates under specific law dated from the year 1983 (Alþingi, 2009). LV is by far biggest producer of sustainable energy in Iceland with about 75% share of total electric production and with production sites spaced all around the country (Landsvirkjun, 2011). Produced close to 12, 6 terawatt hours of in the year 2010 and is one of 10 largest energy production companies of sustainable energy in Europe (Landsvirkjun (b), 2011, p. 14).

Orkuveita Reykjavíkur (OR): Is a private company in the majority ownership of some the biggest municipal in the south-west peninsular including Reykjavík municipal. The operating area is the Southwest-coast and Western part of Iceland. OR operates four main power plants in Iceland: two geothermal power plants Hellisheiðarvirkjun (213 MW) and Nesjavallavirkjun (120 MW), and two hydropower plants Elliðaárvirkjun (3,2 MW) and Andakilsárvirkjun (11,4 MW) (Orkuveita Reykjavíkur, 2011).

HS-Orka hf: Is the third largest company in the Icelandic electric production market. The company was founded in 1974 by local municipalities in Reykjanes peninsular. Today HS-Orka is in majority ownership of Magma Energy Sweden AB (75% of shares) and Jarðvarmi (25% of shares). HS-Orka produces electricity from two geothermal sites Svartsengi (75 MW) and Reykjanesvirkjun (100 MW), and produces electricity (4 MW) and steam (12 bar) in Kalka. Kalka is a sustainable incineration that burns waste in special high-temperature furnaces which operates in accordance with EU directives (HS-Orka, 2010).

Key companies in energy distribution sector



Picture 1 Shows Landsnets distribution network in Iceland 2010 (Landsnet, 2011).

In all the locations in this report there is a need for investment in connectors that runs between the AGC factory and the energy distribution companies. These investments may vary between locations but in this report the same assumption will be used for all locations. According to Landsnet information we will use the following evaluation to estimate the cost for connector for the distance of 1 kilometer (Ásmundsson, 2011).

Table 13 Shows the cost of connection with the transmission grid

Connectors to the transmission grid	
Underground cable 66 kV - 35 MVA	226.415 €
primary station 66 kV	522.013 €
Total cost	**748.428 €**

Landsnet: Is a private company in the majority ownership of LV (64, 73% shares) and RARIK (22, 51% shares). The company operates under a concession arrangement and is subject to regulation by the National Energy Authority (Orkustofnun), which determines the revenue framework which the company tariffs are based on. The company was established on the basis of the 2003 Electricity Act. The company owns and operates all of the Icelandic major electricity transmission system and administers its system operations. All power stations with the capacity to produce 7 MW or more are legally obligated to be connected to Landsnet power grid. Landsnet focuses on customers that are large intensive users and small distributers (Landsnet, 2011).

Table 14 Shows Landsnet Transmission charges for intensive users

			Phase 1 Tariff	Phase 2 Tariff	Phase 3 Tariff
Delivery Charge	39.029 €	€/year	39.029 €	39.029 €	39.029 €
Capacity charge	20.650 €	€/MW	127.618 €	255.236 €	510.473 €
Energy charge	1,045 €	€/MWh	53.588 €	107.177 €	214.353 €
Ancillary services	0,162 €	€/MWh	8.297 €	16.595 €	33.189 €
Transmission losses	0,368 €	€/MWh	*18.872 €*	37.745 €	75.489 €
		Total	**247.405 €**	**455.781 €**	**872.533 €**

The table above shows the traditional tariff for companies that are intensive users.

Rafmagnsveitur ríkisins (RARIK): Is a private company in the ownership of the Icelandic government. The company was established in 1946 with the purpose of developing various power projects throughout Iceland. In 2006 the company was changed to RARIK ltd. and now focuses on distributing electricity to smaller customers. RARIK distribution network has close to 90% share of reach in rural areas in Iceland (RARIK ltd., 2011).

HS-Veitur: Is a private company in the majority ownership of Reykjanesbær (66, 7% of shares), OR (16, 5% of shares) and Hafnarfjarðarbær (15, 4% of shares). The company is the largest distributer in the Reykjanes peninsula, in Árnessýslu and in Vestmannaeyjar. The company was founded in 1974 by local municipalities in Reykjanes peninsular and was part of HS Orka until the new energy laws in 2005 separated them into two companies (HS Veitur, 2011).

As AGC G2G factory fails to reach the requirements of Landsnet of using over10 MW or at least 80 GWh per year in phase 1 in all locations, the factory needs to use small distributers like HS Veitur and RARIK and has to pay additional fees for their service. There is a possibility to connect to Landsnet from the start, but to do so AGC has to reach approximately the capacity of over 10 MW or 80 GWh within 3 years. .

Figure 3 Shows additional cost using small distributors (Landsnet (b), 2011).

$$\text{Surcharge} = \frac{\text{Initial cost} * \text{Annual percentage} * \text{Share in stepped-down cost}}{\text{Energy amount} * \text{Energy charge} + \text{Power} * \text{Power charges}}$$

Initial cost	Signifies the starting cost on account of voltage step-down, here in Euro
Annual percentage	Refers to the percentage of the initial cost (to be collected each year) and other financial cost associated
Share in stepped-down voltage cost	Amounts to 80% of the stepping-down expense
Energy amount	Is the customer's annual amount of energy, in MWh
Energy charges	The charges for energy to power intensive users, according the Landsnet tariff
Power	Stands for the customer's agreed peak power
Power charges	Charges for power to power intensive users, according to Landsnet tariff

By putting in the numbers in the equation we find the Surcharge:

$$46{,}12\% = \frac{1.273.835^{19} * 0{,}082^{20} * 0{,}8}{51.294^{21} * 1{,}045^{22} + 6.180^{23} * 20.650^{24}}$$

By identifying the surcharge it is possible to finalize the model to find the total cost of transmission for the AGC factory. By using the model in table 16 we can establish by some accuracy the final cost.

Table 15 Shows how strain affects transmission cost

Usages		
Load capacity	6,18	MW
Energy	51.294	MWh
Utilization	8.300	hrs.
ISK/EUR	159,00	ISK kr.

Tariff for intensive users		
Delivery Charge	39.029	EUR per year
Capacity charge	20.650	EUR per MW per year
Energy charge	1,04	EUR per MWh
Ancillary services	0,1618	EUR per MWh
Transmission losses	0,3679	EUR per MWh
Intensive users strain		
Delivery Charge	0	EUR per year
Capacity charge	9.523	EUR per MW per year
Energy charge	0,48	EUR per MWh
Ancillary services	0,0000	EUR per MWh
Transmission losses	0,0000	EUR per MWh

Additional fee		
Delivery charge	0	EUR
Capacity charge	58.851	EUR
Energy charge	24.712	EUR
Total for transmission	83.564	EUR

[19] Source: Guðmundur Ingi Ásmundsson Deputy CEO at Landsnet ,email dated 08.11.2011. Landsnet estimated cost*
[20] Source: Guðmundur Ingi Ásmundsson Deputy CEO at Landsnet ,email dated 08.11.2011.
[21] Source: IPD estimates
[22] Source: Landsnet tariff (Landsnet (b), 2011).
[23] Source: IPD estimates
[24] Source: Landsnet tariff (Landsnet (b), 2011).

Up dated tariff		
Delivery Charge	39.029	EUR per year
Capacity charge	30.173	EUR per MW per year
Energy charge	1,53	EUR per MWh
Ancillary services	0,1618	EUR per MWh
Transmission losses	0,3679	EUR per MWh

Total tariff		
Delivery charge	39.029	EUR
Capacity charge	186.469	EUR
Energy charge	78.301	EUR
Ancillary services	8.297	EUR
Transmission losses	18.872	EUR
Total for transmission	330.968	EUR

If we compare total cost in phase 1 in table 5 and the total cost in table 6 we can conclude that the strain is increasing the cost by 25, 25%.

Table 16 below shows the basic estimate of the electrical usage in a small scale industrial production unit producing 30.000 tons of glycols and alcohols per annum.

Table 16 Shows Power consumption by electrolyser

Power Consumer/Equipment/device	Power Consumption kW	Installed Power kW
Hydrogen electrolyser for a 2 x 480 Nm^3/h, 30 tones production capacity	5.000	6.000
Main hydrogen compressor	250	300
Auxiliary compressor	80	100
Vapor compressor(MVR)	300	400
Circulation pump, water removal unit	15	20
Main feed pump	50	30
Cooling water circulation pump	45	60
Distillation tower-1	5	7
Distillation tower-2	20	25
Distillation tower-3	10	15
Distillation tower-4	10	10
Thin film evaporator	40	50
Lights, ventilation etc.	30	40
Various systems	300	400
Office, controls etc.	25	30
Intermediate sum	1.180	1.487
Contingency 10%	618	748,7
Total	6.180	7.487
Total without electrolyser	1.180	1.487

The hydrogen production alone consumes about 70% of the total electrical usage in such a plant. In view of this it could be feasible to investigate the possibility of "over the fence" availability of hydrogen in conjunction with the utilization of waste energy.

After the hydro-cracking process we need to separate the different chemical compounds made during the process. Separation is almost exclusively realized by evaporation, distillation, stripping and other methods, using steam or hot fluid stream as energy carrier.

In view of this it would be very beneficial, cost-wise, to have access to cost effective thermal energy. Geothermal steam could be one of those options and as the distillation tasks can make use of tempered energy stream of below 180°C. Most geothermal fields of Iceland would be suitable for this purpose. There is however a tradeoff, there are not many geothermal fields in Iceland that are situated close to major harbors unless in the Reykjanes/Keflavik area. Due to this the raw material and the finished product have to be trucked between the harbor and the factory. Other sites like Þeistareykir/Norðurþing and Bjarnarflag/Norðurþing, Hellisheiði can also be considered for potential sites.

Other energy streams could also well be utilized like steam from steam boilers or low tempered waste energy from combustion power plants if a location outside Iceland were to come into consideration. Also if a cost effective biomass is available, its combustion energy could be used for steam production. Steam is the preferred energy transforming carrier.

Further energy considerations are left to a specific site feasibility study.

The following table shows an overview of the estimated usage of thermal energy in the G2G process plant.

Table 17 Shows thermal energy usage estimate for a production capacity of 30.000 ton per year.

Steam or thermal power consumer	Steady State Consumption kW	Installed Capacity kW
Feed-pre heater	350	455
Alcohol column	300	390
Water removal – glycol concentrator	1.200	1560
Glycol evaporator	600	780
Water stripper	200	260
Main product splitter	3.500	4550
Ethylene glycol concentrator	300	390
Glycerin evaporator	100	130
Diverse heaters	840	1092
Intermediate sum	7.390	9.607

Contingency 15%	1.109	1.441
Total	8.499	11.048
Total steam equivalent[t/h, 12 bar]	13,9	18,1

The energy cost for a comparable factory in Europe is likely to be EUR 2-4 million higher than in the Icelandic case. The location cost for Iceland in terms of transport from/back to Europe is estimated EUR 1, 5 million in comparison.

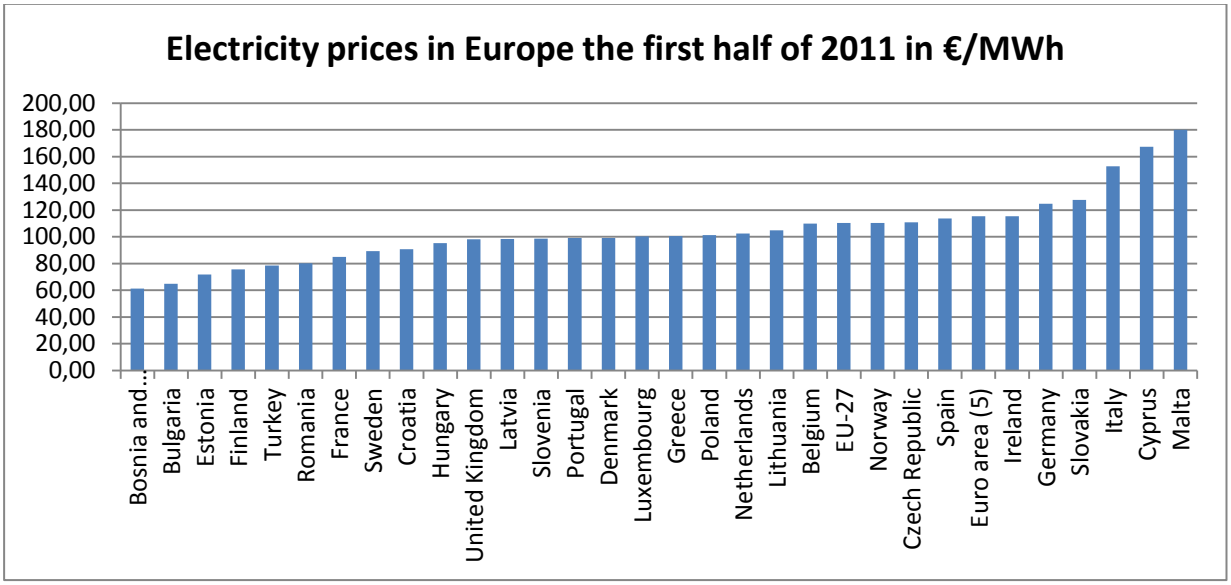


Figure 4 Shows annual consumption in Europe: 500 MWh < consumption < 2 000 MWh; excluding VAT (Eurostat, 2011).

The location advantage for Iceland is therefore Euro 1, 0- 2, 0 million taken into consideration lower construction, labor and other site benefits. Common electrical power prices for industrial units in Europe are in the range from € 61-180 MW per hour. Furthermore steam costs if produced on site in a steam boiler, using natural gas as a feedstock, are estimated to be € 25-30/ton steam (12 bar).

As has been explained the energy cost is probably one of the most important factors in deciding to invest. There are also other factors worth looking into including:

- Devaluation of the ISK following the banking crisis in 2008 has improved the environment of all export oriented industries in Iceland.
- Wages and salaries are much lower in Iceland than elsewhere in W-Europe.
- A stable and well educated workforce.
- Corporate tax is currently 20 % (2011).
- No restrictions on currency movements on new investments.
- Located between the US and the European market.

5. Helguvík

Helguvík is a part of Reykjanesbæ municipal on the south-west peninsular of Iceland. The municipal was formed in 1994 when Keflavík, Njarðvík and Hafnir amalgamated into one municipal. Helguvík is on the outskirt of Keflavík from the north site. In Reykjanesbær there are currently 13 thousand inhabitants where the main occupation is in the fishing industry and in the services sector mainly around Keflavik airport (Reykjanesbær, 2011).

Helguvíkurhöfn: Length of pier is 150 meters and maximum length of overall allowed ship is 200 meters. Depth is 10 meters. Distance from center of Reykjanesbær is 4 kilometers (Reykjaneshöfn, 2011).

About the project in Helguvík

Picture 2 Shows a possible location[X] for a glycol producing plant in Helguvík

Among the advantages of locating a glycol plant in Helguvík is an access to a favorable industrial site close to one of the deepest harbor in Iceland. There are many advantages to raising AGC factory in Helguvík, excellent roads and within 5 kilometers to International Airport in Keflavík. Furthermore, due to the recent announce of the execution of a silicon project in Helguvík of "The Icelandic Silicon Corporation" there will be a potential for a synergy through a thermal source. The Silicon operation will start by middle of year 2013 and will deliver excess energy in the form of hot water and economical supply of steam from their waste energy recovery system.

One of the main utility parameter is steam and will therefore be more easily available as "steam-over the fence". This particular site gives a possibility for cheap construction lot for the erecting of plant systems and product storages within several hundreds of meters from harbor dock, which enables the pumping of both feedstock and products via pipes. Raw material storage can be rented from an existing tank terminal, which enables economical sea

transportation in larger lots. The distance from Icelandic Silicon Corporation site is about 400 meters which is considered to be the length of a steam pipeline connecting those two with thermal energy service also has the potential of offering and the sharing of some other utilities (AGC ehf, 2011). Helguvík has the potential to develop further and in future the municipal hopes that sustainable industry will be part of the economy and possible future music will be advanced Chemical Park in Helguvík. At this moment the process has already begun in Helguvík, as the process of assessment of environmental effects has already begun and evaluation is expected soon.

Investment in Helguvík

In addition to all needed buildings and machines that were identified in the initial IPD estimated valuation. There is a shortage of tanks for the processed products and by IPD estimate there is need for one tank at the size of 4000m^3, another tank at the size of 2500m^3 and finally one tank the size of 1000m^3. The increases the investments are needed in the beginning of the project.

Table 18 Shows AGC Investment estimate at Helguvík- phase 1, 2 and 3

Phase 1 - 30.000 tons capacity:	**Euro**		**Depreciation**	
Connector to Landsnet	748.428	4%	10,0%	
Design, engineering, construction management:	1.500.000	8%	10,0%	
Land, building and premises:	1.200.000	7%	3,0%	
Storage tanks:	1.902.995	11%	10,0%	
Hydrogen electrolyser:	3.000.000	17%	12,5%	
Evaporators and distillation:	3.800.000	21%	10,0%	
Other fixtures and fittings:	3.200.000	18%	10,0%	
Contingency:	2.500.000	14%	10,0%	
Total: -10 % /+35% accuracy	**17.851.423**	**100%**	**1.701.300**	annually
Year 0-2				
Phase 2 - 35.000 tons capacity:				
Total investment: -10 % /+35% accuracy	**15.000.000**		**9,5%**	
Year 3-4				
Phase 3 - 60.000 tons capacity:				
Total investment: -15/+-50 % accuracy	**19.900.000**		**9,5%**	
Year 5-6				

The additional change of extra tanks does raise the volume of capital needed. The initial expected investment had been calculated by IPD as EUR 16. 6 million and there of equity need expected to be EUR 12.450 million, and loan capital EUR 4.150 million. The new estimates show however that investment needed is EUR 17.851 million. With this new

information the equity needed is EUR 13.388 million and to increase the loan capital to EUR 4.462 million.

Table 19 Shows IPD estimated investment, equity and loan capital structure at Helguvík

	Investment		Equity		Loan capital
	Euro	%	Euro	%	Euro
Phase 1	17.851.423	100%	13.388.567	25%	4.462.856
Phase 2	15.000.000	100%	3.000.000	80%	12.000.000
Phase 3	19.900.000	100%	3.980.000	80%	15.920.000

Pro forma financials

In the table below are major assumptions that are made for this profitability analysis, as we gather all possible information to show feasibility. We assume that we can connect to Landsnet grid right at the beginning of phase 1 and will build phase 2 within those 3 years that are required by law of every client that Landsnet has. By that AGC factory will only have to pay surcharge for the first three years and after that only the tariffs that are obligated, so transmission cost will decrease sufficiently over the projected period.

Table 20 Shows financial assumptions in the Helguvík project

Parameter	Units	Phase 1	Phase 2	Phase 3
Electrical cost	Euro/KWh	0,02	0,02	0,02
Cost of steam equivalent	Euro/ton	4,00	4,00	4,00
Crude Glycerin	Euro/ton	280,00	280,00	280,00
Propylene glycol	Euro/ton	1.150,00	1.150,00	1.150,00
Ethylene glycol	Euro/ton	850,00	850,00	850,00
Ethanol	Euro/ton	700,00	700,00	700,00
Methanol	Euro/ton	700,00	700,00	700,00

As previously mentioned above there is a possibility to buy steam from Icelandic Silicone Corporation from 2013. But to get enough steam earlier for the first phase planed AGC would have to buy steam from two companies, Kalka and Síldarvinnslan hf. From Kalka we assume that AGC would have to buy the steam at the cost of EUR 4 per ton and from Síldarvinnslan hf. the cost would be EUR 15 per ton. In our estimate the average price would be around EUR 10 when considering timing and the availability of steam from those two companies. In phase 2 and 3 AGC expects the price form Icelandic Silicone Corporation to be around EUR 4 per ton. As the project has been delayed from the originals plans the assumptions here is that all steam is bought from ISC at 4 EUR per ton.

Table 21 Shows power consumption at Helguvík project

	Phase 1	Phase 2	Phase 3	Total
Transmission cost	330.968	455.781	872.533	1.659.283
Electrical consumption(w.electrolyzer) - full capacity: kW	6.180	12.360	24.720	43.260
Number of hours:	8.300	8.300	8.300	
Gigawatthours:	51,3	102,6	205,2	359,1
Electrical cost -Euro/kWh	0,023	0,023	0,023	
Total cost at full capacity: Euro	**1.510.730**	**2.815.305**	**5.591.581**	**9.917.617**
Thermal power consumption: kW	8.500	17.000	34.000	59.500
Converted to steam equiv. (t/h, 12 bar): t/h	14	28	56	97
Operating hours per year:	8.300	8.300	8.300	
Cost of steam equivalent: Euro pr ton	4	4	4	
Total thermal power cost at full capacity: Euro	**461.782**	**923.564**	**1.847.127**	**3.232.473**
Tank storage rental (Euro Per Year)	**120.000**	**240.000**	**480.000**	**840.000**
Thermal power generated with electricity:				
Gigawatthours - efficiency 1,1	77,6	155,2	310,4	543,2

Summary of projected financial return

By calculating the assumptions from the pro forma figure and intertwining them with IPD other estimations, we have opportunity to estimate the profit and loss for the first 6 years or until AGC factory has the capabilities to reach full productions capacity.

Table 22 Shows estimated profit and loss from Helguvík project

EUR	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Total sales - CIF:	**33.105.000**	**33.105.000**	**71.727.500**	**71.727.500**	**137.937.500**	**137.937.500**
Marketing cost:	1.324.200	1.324.200	2.869.100	2.869.100	5.517.500	5.517.500
Total sales, net	**31.780.800**	**31.780.800**	**68.858.400**	**68.858.400**	**132.420.000**	**132.420.000**
Variable cost:						
Cost of raw material:	11.538.462	11.538.462	25.000.000	25.000.000	48.076.923	48.076.923
Sea freight cost:	1.653.301	1.653.301	2.865.722	2.865.722	4.822.128	4.392.870
Product trucking cost:	199.781	199.781	432.858	432.858	832.419	832.419
Electrical cost:	1.510.730	1.510.730	4.326.035	4.326.035	9.917.617	9.917.617
Thermal energy cost:	461.782	461.782	1.385.345	1.385.345	3.232.473	3.232.473
Catalyst cost	1.648.352	1.648.352	3.571.429	3.571.429	6.868.132	6.868.132
Royalty:	317.808	317.808	688.584	688.584	1.324.200	1.324.200
	17.330.215	17.330.215	38.269.973	38.269.973	75.073.892	74.644.633
	52%	52%	53%	53%	54%	54%
Fixed cost:						

Salaries and wages		722.775	722.775	1.001.625	1.001.625	1.252.425	1.252.425
Maintenance		714.057	714.057	1.314.057	1.314.057	2.110.057	2.110.057
Insurance		133.886	133.886	246.386	246.386	395.636	395.636
Storage Tank Rental		120.000	120.000	240.000	240.000	480.000	480.000
Other fixed cost		414.629	414.629	627.209	627.209	904.819	904.819
		2.105.346	2.105.346	3.429.276	3.429.276	5.142.936	5.142.936
Total costs		19.435.561	19.435.561	41.699.249	41.699.249	80.216.828	79.787.569
		6%	6%	5%	5%	4%	4%
EBITDA:		**12.345.239**	**12.345.239**	**27.159.151**	**27.159.151**	**52.203.172**	**52.632.431**
		37%	*37%*	*38%*	*38%*	*38%*	*38%*
Depreciation		1.701.300	1.701.300	3.130.849	3.130.849	5.027.385	5.027.385
		5%	*5%*	*4%*	*4%*	*4%*	*4%*
Financial items:		-210.551	22.695	-414.778	158.705	-123.504	991.375
Profit before tax:		10.433.389	10.666.635	23.613.524	24.187.007	47.052.284	48.596.421
Used deployment cost against taxes/ rapid depreciation							
		32%	*32%*	*33%*	*34%*	*34%*	*35%*
Corporate tax (20%):	20%	521.669	853.331	1.889.082	2.418.701	4.705.228	4.859.642
Profit/loss:		**9.911.719**	**9.813.304**	**21.724.442**	**21.768.306**	**42.347.055**	**43.736.779**
		30%	*30%*	*30%*	*30%*	*31%*	*32%*
ROS		**31,2%**	**30,9%**	**31,5%**	**31,6%**	**32,0%**	**33,0%**

As seen in this prediction the project indicates profit from the first year of operations and profit is expected the following years.

Profitability analyses

At Helguvík project we will be using the discount factor of 15% in expected return of net present value (NPV), which gives us EUR 89.427.385 million over 10 years period and internal rate of return (IRR) of 86,2%.

Table 23 Shows estimated IRR and NPV from Helguvík project

	0-1	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Revenue:			31.780.800	31.780.800	68.858.400	68.858.400	132.420.000	132.420.000
Operational Cost:			19.435.561	19.435.561	41.699.249	41.699.249	80.216.828	79.787.569
Share capital:	1000000	14.388.567	14.388.567	17.388.567	17.388.567	21.368.567	21.368.567	21.368.567
Investment:	-1000000	-17.851.423		-15.000.000		-19.900.000		
Loan capital:		4.462.856		12.000.000		15.920.000		
Operational Capital Need	100000	100.000						
New Equity needed	-1000000	-13.288.567	0	-3.000.000	0	-3.980.000	0	0
Income:			26.484.000	31.780.800	62.678.800	68.858.400	121.826.400	132.420.000
Operational cost:	900000		-17.815.931	-19.435.561	-39.843.942	-41.699.249	-77.007.029	-79.823.341
Cash Flow from Operations	900000		**8.668.069**	**12.345.239**	**22.834.858**	**27.159.151**	**44.819.371**	**52.596.659**
Equity Inflow :	-1000000	-13.288.567		-3.000.000		-3.980.000		
Principal Payment of loans:		0	-594.540	-594.540	-2.193.176	-2.193.176	-4.314.033	-4.314.033
Financial items:		0	-210.551	22.695	-414.778	158.705	-123.504	991.375
Corporate tax:				-521.669	-853.331	-1.889.082	-2.418.701	-4.705.228
Free Cash flow to equity	-1000000	**-13.288.567**	**7.862.978**	**8.251.725**	**19.373.573**	**19.255.598**	**37.963.133**	**44.568.773**
		280						

	IRR	86,2%
NPV	89.427.385	15%

Cash at beginning of period	100.000	100.000	7.962.978	19.214.703	38.588.276	61.823.874	99.787.008
Cast at end of period	100.000	7.962.978	19.214.703	38.588.276	61.823.874	99.787.008	144.355.781
Interest income:		82.914	279.477	594.407	1.032.572	1.661.899	2.510.602
Interest paid on long term loans:		-293.465	-256.782	-1.009.185	-873.866	-1.785.402	-1.519.227
Finical items - total:		-210.551	22.695	-414.778	158.705	-123.504	991.375

6. Grundartangi

Grundartangi is located in Hvalfjarðarsveit in Hvalfjörður, which is in Faxaflóa area on the west coast of Iceland, within 49 km from Reykjavík. Grundartangi is an industrial site that has been developing as a part of Faxaflóahafnir (Associated Icelandic Ports (AIP)), which is an independently operated company in ownership of some of the largest municipals on the southwest coast, one of which being the City of Reykjavík. The landmass is a former agricultural field and the total area is about 439 hectares, of which some 311 hectares may be developed as building sites from now, and 50 hectares can be additionally be created by landfills with ease. The port was opened in 1978 to serve the Elkem Island which is a ferrosilicon plant and since then the site has grown considerably. In 1998 a new aluminum smelter was launched by Norðurál at the site and in 2006 it was enlarged further. According to AIP four sites have been allocated for smaller companies, but remaining area for further development is around 160 hectares (AIP, 2011).

The harbor facilities:

The harbor was open in 1978 with the arrival of Elkem Island. Since 1978 the quay has gone through two enlargements, first in 1998 and the second in 2006. The total length of the quay is now 670 meters and the depth is from 10 to 14 meters (AIP, 2011).

Road connections:

The industrial site at Grundartangi is very close to the national highway and within 49 kilometers distance from Reykjavík which makes this site very attractive considering that available work force is within 40 minutes' drive from location. Another noteworthy factor is the short distance between Grundartangi and Keflavík International Airport which is about 90 kilometers (AIP, 2011).

Kemira: Was founded Finland in year 1920 as a state own chemical plant that was mainly producing sulphuric acid. In the years around 1950 the company began to move towards production of industrial chemicals and began expanding their production with new chemical factories around Finland. Kemira began operating in the international level in the beginning of the 1960s and has expanded increasingly since then. Kemira was changed in 1994 and today Kemira is a private company

listed in the Helsinki Stock Exchange (since 1994) as the state of Finland is the major shareholder with about 53, 8% of the company shares. Kemira has long experience and state-of-the-art knowledge about bleaching additives used in chemical and mechanical pulp production and in deinked pulp bleaching. The optimized use and effectiveness of these chemicals is always tested at each pulp process (Kemira, 2011).

Kemira is planning to raise a bleaching chemical factory in Iceland and is looking at two locations, Grundartangi and Bakki. Grundartangi is considered more favorable site of the two because it is has more basic infrastructure in place and is more advanced as an industry site. Kemira does not have to undertake environmental assessment for raising their factory either in Bakki or in Grundartangi. But at Grundartangi the main problem for Kemira is the lack of electricity on the south and west coast of Iceland. There might be a solution to this problem as currently HS Orka and Norðurál have a case in the arbitral tribunal in Sweden (where Magma Energy the majority owner of HS Orka has the address for service) about agreement HS Orka selling Norðurál electricity in Helguvík. If HS Orka wins this case in Sweden than the company has enough electricity for Kemira, but HS Orka loses this case at Swedish court than Kemira is forced to move its focus to Bakki.

Investment in Grundartangi

There are few benefits that are gained by locating AGC factory at Grundartangi if Kemira has the opportunity build their factory at that location. By having Kemira operations at Grundartangi there is no need for hydrogen electrolyser and that does lower the investment cost significantly at phases. However the location does require additional investment for building tanks for storages of raw material and products.

Table 24 Shows AGC Investment estimate at Grundartanga- phase 1, 2 and 3

Phase 1 - 30.000 tons capacity:	**Euro**		**Depreciation**	
Connector to RARIK	748.428	5%	10,0%	
Design, engineering, construction management:	1.500.000	9%	10,0%	
Land, building and premises:	1.200.000	8%	3,0%	
Storage tanks:	2.917.926	18%	10,0%	
Hydrogen electrolyser:	0	0%	12,5%	
Evaporators and distillation:	3.800.000	24%	10,0%	
Other fixtures and fittings:	3.200.000	20%	10,0%	
Contingency:	2.500.000	16%	10,0%	
Total: -10 % /+35% accuracy	**15.866.354**	**100%**	**1.502.635**	annually
Year 0-2				

Phase 2 - 35.000 tons capacity:		
Total investment: -10 % /+35% accuracy Year 3-4	**13.000.000**	**9,5%**
Phase 3 - 60.000 tons capacity:		
Total investment: -15/+-50 % accuracy Year 5-6	**17.900.000**	**9,5%**

But initial expected investment had been calculated by IPD as EUR 16. 6 million and there of equity need is expected to be EUR 12.450 million, and loan capital EUR 4.150 million. The new estimates show however that investment needed is EUR 15.866 million. With this new information the equity needed is EUR 11.399 million and to increase the loan capital to EUR 3.966 million.

Table 25 Shows IPD estimated investment, equity and loan capital structure at Grundartangi

	Investment		Equity		Loan capital
	Euro	%	Euro	%	Euro
Phase 1	15.866.354	100%	11.899.765	25%	3.966.588
Phase 2	13.000.000	100%	2.600.000	80%	10.400.000
Phase 3	17.900.000	100%	3.580.000	80%	14.320.000

Pro forma financials

In the table below are major assumptions that are made for this profitability analysis. The following assumptions are based on the presence of Kemira at that location; otherwise the project would not be of any benefits at all to other locations and there for of no interest either IPD or AGC.

Table 26 Shows financial assumptions in the Grundartangi project

Parameter	Units	Phase 1	Phase 2	Phase 3
Electrical cost	**Euro/KWh**	**0,023**	**0,023**	**0,023**
Cost of steam equivalent	**Euro/ton**	**15**	**6**	**6**
Crude Glycerin	**Euro/ton**	**280**	**280**	**280**
Propylene glycol	**Euro/ton**	**1150**	**1150**	**1150**
Ethylene glycol	**Euro/ton**	**850**	**850**	**850**
Ethanol	**Euro/ton**	**700**	**700**	**700**
Methanol	**Euro/ton**	**700**	**700**	**700**

With Kemira operating at Grundartangi the possibility that AGC factory could buy all or part of the hydrogen that Kemira produces as a byproduct.

As shown in table above the investment at Grundartangi is little bit lower than originally expected in AGC plans and this is due to the fact that no hydrogen electrolyser is needed at the location and that availability of hydrogen from Kemira factory close to AGC factory. Kemira is expected to produce hydrogen in the quantity of at least 4000m^3 per hour and that is more than enough for AGC factory needs. IPD and AGC representatives have informally discussed with Kemira representatives about the possibility of selling hydrogen to AGC factory and the indications have been quite positive. Kemira is willing to sell AGC their byproduct hydrogen at the price of EUR 700 per ton if AGC factory is close to Kemira production.

Table 27 Shows expected power consumption of AGC factory

	Phase 1	Phase 2	Phase 3	Total
Transmission cost	149.186	285.850	559.180	994.216
Electrical consumption(w.electrolyzer) - full capacity: kW	1.180	2.360	4.720	8.260
Number of hours:	8.300	8.300	8.300	
Gigawatthours:	9,794	19,588	39,176	68,6
Electrical cost -Euro/kWh	0,023	0,023	0,023	
Total cost at full capacity: Euro	**374.448**	**736.374**	**1.460.228**	**2.571.050**
Thermal power consumption: kW	8.500	17.000	34.000	59.500
Converted to steam equiv. (t/h, 12 bar): t/h	14	28	56	97
Operating hours per year:	8.300	8.300	8.300	
Cost of steam equivalent: Euro pr ton	15	6	6	
Total thermal power cost at full capacity: Euro	**1.731.682**	**1.385.345**	**2.770.691**	**5.887.718**
Hydrogen power consumption: Nm3/h	900	1.800	3.600	6.300
Converted to t/h	0,08	0,16	0,32	0,567
Number of hours	8.300	8.300	8.300	
Cost of hydrogen: Euro pr. Ton	700	700	700	
Total hydrogen power cost at full capacity: Euro	**470.610**	**941.220**	**1.882.440**	**3.294.270**
Tank storage rental (Euro Per Year)	**0**	**0**	**0**	**0**
Thermal power generated with electricity: Gigawatthours - efficiency 1,1	77,6	155,2	310,4	543,2

There is no available steam in any form at Grundartangi at this moment, but for the first phase of the AGC factory there will be enough hydrogen production from Kemira factory. IPD estimates that Kemira is releasing 4000m^3 of hydrogen per hour and that would be sufficient to use 3000m^3 of hydrogen to produce steam and use 1000m^3 of hydrogen in the reaction to the glycol. The price for hydrogen produced steam is expected to be EUR 15 per ton. For the second and third phase calls for bigger solution and the possibility is that Elkem Ísland does produce enough heat in their production but for AGC factory there would have to be added steam boilers to Elkem factory. If Elkem would build the steam boilers at their premises as IPD expects the price of steam per ton would around EUR 6 so that Elkem would be able to receive adequate revenues from their investment in those steam boilers.

Summary of projected financial return

By calculating the assumptions from the pro forma figure and intertwining them with IPD other estimations, we have the opportunity to estimate the profit and loss for the first 6 years or until AGC factory has the capabilities to reach full productions capacity.

Table 28 Shows estimated profit and loss from Grundartangi project

EUR		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Total sales - CIF:		**33.105.000**	**33.105.000**	**71.727.500**	**71.727.500**	**137.937.500**	**137.937.500**
Marketing cost:		1.324.200	1.324.200	2.869.100	2.869.100	5.517.500	5.517.500
Total sales, net		**31.780.800**	**31.780.800**	**68.858.400**	**68.858.400**	**132.420.000**	**132.420.000**
Variable cost:							
Cost of raw material:		11.538.462	11.538.462	25.000.000	25.000.000	48.076.923	48.076.923
Sea freight cost:		1.701.191	1.701.191	2.948.731	2.948.731	4.961.807	4.532.548
Product trucking cost:		213.994	213.994	463.654	463.654	891.643	891.643
Electrical cost:		374.448	374.448	1.110.822	1.110.822	2.571.050	2.571.050
Hydrogen cost		470.610	470.610	1.411.830	1.411.830	3.294.270	3.294.270
Thermal energy cost:		1.731.682	1.731.682	3.117.027	3.117.027	5.887.718	5.887.718
Catalyst cost		1.648.352	1.648.352	3.571.429	3.571.429	6.868.132	6.868.132
Royalty:		317.808	317.808	688.584	688.584	1.324.200	1.324.200
		17.996.546	17.996.546	38.312.077	38.312.077	73.875.743	73.446.484
		54%	54%	53%	53%	54%	53%
Fixed cost:							
Salaries and wages		722.775	722.775	1.001.625	1.001.625	1.252.425	1.252.425
Maintenance		634.654	634.654	1.154.654	1.154.654	1.870.654	1.870.654
Insurance		118.998	118.998	216.498	216.498	350.748	350.748
Storage Tank Rental		0	0	0	0	0	0
Other fixed cost		395.770	395.770	589.350	589.350	847.960	847.960
		1.872.197	1.872.197	2.962.127	2.962.127	4.321.787	4.321.787
Total costs		19.868.743	19.868.743	41.274.204	41.274.204	78.197.530	77.768.271
		6%	6%	4%	4%	3%	3%
EBITDA:		**11.912.057**	**11.912.057**	**27.584.196**	**27.584.196**	**54.222.470**	**54.651.729**
		36%	*36%*	*38%*	*38%*	*39%*	*40%*
Depreciation		1.502.635	1.502.635	2.733.811	2.733.811	4.429.044	4.429.044
		5%	*5%*	*4%*	*4%*	*3%*	*3%*
Financial items:		-181.017	41.575	-290.277	281.669	121.177	1.257.300
Profit before tax:		10.228.404	10.450.996	24.560.109	25.132.055	49.914.603	51.479.985
Used deployment cost against taxes/ rapid depreciation							
		31%	*32%*	*34%*	*35%*	*36%*	*37%*
Corporate tax (20%):	20%	511.420	836.080	1.964.809	2.513.205	4.991.460	5.147.998
Profit/loss:		**9.716.984**	**9.614.917**	**22.595.300**	**22.618.849**	**44.923.143**	**46.331.986**
		29%	*29%*	*32%*	*32%*	*33%*	*34%*

As seen on table above this is a very profitable project and shows very good profit for the first 6 years of operations, and the possibly to increase further in the next 10 years or so.

Profitability analyses

At Grundartangi project the discount factor of 15% is used in expected return of net present value (NPV), which gives us EUR 95.347.804 million over 10 years period and internal rate of return (IRR) of 93,2%.

Table 29 Shows estimated IRR and NPV from Grundartangi project

	0-1	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Revenue:			31.780.800	31.780.800	68.858.400	68.858.400	132.420.000	132.420.000
Operational Cost:			19.868.743	19.868.743	41.274.204	41.274.204	78.197.530	77.768.271
Share capital:	1000000	12.899.765	12.899.765	15.499.765	15.499.765	19.079.765	19.079.765	19.079.765
Investment:	-1000000	-15.866.354		-13.000.000		-17.900.000		
Loan capital:		3.966.588		10.400.000		14.320.000		
Operational Capital Need	100000	100.000						
New Equity needed	-1000000	-11.799.765	0	-2.600.000	0	-3.580.000	0	0
Income:			26.484.000	31.780.800	62.678.800	68.858.400	121.826.400	132.420.000
Operational cost:	900000		-18.213.014	-19.868.743	-39.490.416	-41.274.204	-75.120.586	-77.804.043
Cash Flow from Operations	900000		**8.270.986**	**11.912.057**	**23.188.384**	**27.584.196**	**46.705.814**	**54.615.957**
Equity Inflow :	-1000000	-11.799.765		-2.600.000		-3.580.000		
Principal Payment of loans:		0	-528.428	-528.428	-1.913.912	-1.913.912	-3.821.617	-3.821.617
Financial items:		0	-181.017	41.575	-290.277	281.669	121.177	1.257.300
Corporate tax:				-511.420	-836.080	-1.964.809	-2.513.205	-4.991.460
Free Cash flow to equity	-1000000	**-11.799.765**	**7.561.541**	**8.313.784**	**20.148.116**	**20.407.145**	**40.492.168**	**47.060.180**
		280						
	IRR	93,2%						
NPV	95.347.804	15%						
Cash at beginning of period		100.000	100.000	7.661.541	18.575.325	38.723.441	62.710.585	103.202.753
Cast at end of period		100.000	7.661.541	18.575.325	38.723.441	62.710.585	103.202.753	150.262.933
Interest income:			79.815	269.802	589.222	1.043.080	1.706.142	2.606.472
Interest paid on long term loans:			-260.832	-228.228	-879.499	-761.411	-1.584.966	-1.349.172
Finical items - total:			-181.017	41.575	-290.277	281.669	121.177	1.257.300

7. Bjarnarflag

Bjarnarflag is in Norðurþing municipality on the north-east coast of Iceland, Landsvirkjun and the Icelandic government, where the industrial ministry and Invest in Iceland agency are the most active players. Norðurþing is in Northeast Iceland, a large area stretching from the north east coast into the glaciers in the central highlands. Norðurþing Municipality was formed in a merger of four small municipalities in the election year of 2006 (Norðurþing, 2011). Húsavík (population of 2.229) is the largest town in Norðurþing with about 80% of population of the municipal and is mostly famous for tourism (whale watching) and services. Previously it was known for its fishing industry where the main source of employment in Húsavík lay along other light industry and services to surrounding farmers in the area. The total population in Norðurþing is 2.926 and has been decreasing about 16% since 1990 (Hagstofa Íslands, 2011). The new town council of Norðurþing municipality which was elected in 2010 election, have been persistently lobbying for developing future industry cites in Bakki area. The town council and Atvinnuþróunarfélag Þingeyjinga (AÞ) (e. North-East Iceland Development Agency) have been following up every lead to gain fortune.

Picture 3 Norðurþing municipal
Source: Invalid source specified..

There has been much speculation about the future of this site from politicians and media alike but new arriving industries have been put under pressure to build up their businesses by the Icelandic government, Norðurþing municipal and Landsvirkjun to use the geothermal energy that is available in Bjarnarflag, Þeistareykir and Krafla. At least 10 interested parties of power intensive users are viewing Bakki as a possible site for their operation according to Edvarð Guðnason (Guðnason, 2011) at Landsvirkjun.

Roads

The significance of roads is crucial to the project of Bjarnarflag as the distance between Bjarnarflag and Húsavík is considerable higher than in other locations that are investigated in this report. As does the fact that it may be problematic to interest skilled and educated work

force to work at location such as Bjarnarflag due to the length of distance from populated areas such as Húsavík or Akureyri.

The highway nr.87 is named Kísilvegur and connects Húsavík and Mývatnssveit. A private road in the ownership of Landsvirkjun links highway nr.87 and Krafla area. The distance between Húsavík (Bakki) and Bjarnarflag is about 69 kilometers and Vegagerðin provides snowplowing at least two days per week during winter time.

A gravel road is currently under construction between Húsavík and Þeistareykjum and future plans are that new layer of paved surface will come around when decisions are made about what kind of services level the area will need from Vegagerðinn. It is estimated that the road will be close to 28 kilometers (Reynisson, 2011).

A road tunnel in the area between Akureyri and Húsavík are currently in the process of funding constructed at Vaðlaheiði. This road tunnel will shorten the road between Akureyri and Húsavík considerably, taking the road from 91 km to 75 km or 16 km, but more importantly the road tunnel will take out the equation of difficulty of hazardous winter weather that frequently accurse the area and will shorten the time of traveling by 10 minutes and there for making traveling between Akureyri and Húsavík take around 51 minutes, an improvement of 10 minutes. The current estimate of increased traffic between Akureyri and Húsavík due to this project is around 21% and it will strengthen Akureyri as a leading town in the northern part of Iceland. Full construction of Vaðlaheiðargöng is expected to take at least 3 years from now. (Reinhardsson, 2006, pp. 2 - 8).

Harbor

The harbor facilities are good at Húsavík. The depth at the harbor is 10 meters and the longest peer is 130 meters, with future possibility to increase the depth to 12 meters and the length of the peer to 180 meters so up to 40.000 ton cargo/bulk ships can dock according to managing director of NEIDA (Reynisson, 2011).

Labor force

In our estimate we presume that the labor force that is available to work at the G2G factory would be mostly based on the local residents in the area of Reykjahlíð. Those residents at Reykjahlíð used to formed the labor source in Silicon factory at Mývatn but where closed in 2004.

Investment in Bjarnarflag

This site is located inland of Norðurþing and can easily be described as a "greenfield" project as there are no facilities or infrastructure to add to the factory. But locating close to Bjarnarflag power plant gives AGC factory lower cost of energy as the closeness eliminates transmissions fees to Landsnet or the small distributors in the area. It also gives AGC opportunity to use otherwise unused steam from the power plant and as well as hydrogen which is expected to be around 1100m^3 at the site. The investment at Bjarnarflag is expected to be lower in the phase 1 beginning because of availability of hydrogen, but the amount of hydrogen was not expected to be enough quantity for phase 2 and 3. However today it is expected to have enough hydrogen for phase 2 and 3 as well. There for the expected investment cost of EUR 2 million in phase 2 and EUR 4 million in phase 3 are withdrawn from our calculation. AGC needs to invest in connectors between the factory and Bjarnarflag power plant and the cost is expected to be around EUR 748. 428.

Table 30 Shows AGC Investment estimate at Bjarnarflagi- phase 1, 2 and 3

Phase 1 - 30.000 tons capacity:	**Euro**		**Depreciation**	
Connectors to Bjarnarflag power plant	748.428	5%	10%	
Design, engineering, construction management:	1.500.000	10%	10,0%	
Land, building and premises:	1.000.000	7%	3,0%	
Storage tanks:	2.537.327	17%	10,0%	
Hydrogen electrolyser:	0	0%	12,5%	
Evaporators and distillation:	3.800.000	25%	10,0%	
Other fixtures and fittings:	3.200.000	21%	10,0%	
Contingency:	2.500.000	16%	10,0%	
Total: -10 % /+35% accuracy	**15.285.755**	**100%**	**2.132.160**	annually
Year 0-2				
Phase 2 - 35.000 tons capacity:				
Total investment: -10 % /+35% accuracy	**16.000.000**		**13,9%**	
Year 3-4				
Phase 3 - 60.000 tons capacity:				
Total investment: -15/+-50 % accuracy	**17.900.000**		**13,9%**	
Year 5-6				

AGC needs to build 2 extra storage tanks at the size of 5000m^3 at the facilities in Bjarnarflag and rent some old storage tanks in Húsavík for both glycerin and the glycols. The investment at Bjarnarflag is expected to be around EUR 15.285 million, there of EUR 11.464 million in equity and further EUR 3.821 million in loan capital.

Table 31 Shows IPD estimated investment, equity and loan capital structure at Bjarnarflag

	Investment		Equity		Loan capital
	Euro	%	Euro	%	Euro
Phase 1	15.285.755	100%	11.464.316	25%	3.821.439
Phase 2	16.000.000	100%	3.200.000	80%	12.800.000
Phase 3	17.900.000	100%	3.580.000	80%	14.320.000

Pro forma financials

In the table below there are major assumptions that are made for this profitability analysis. The following assumptions are based on the opportunity to connect to Bjarnarflag power plant and be able to retain the resources that the power plant is producing. Bjarnarflag is operational power plant and there for has advantage of Þeistárreykir which is not operational and is still under construction.

Table 32 Shows financial assumptions in the Bjarnarflag project

Parameter	Units	Phase 1	Phase 2	Phase 3
Electrical cost	**Euro/KWh**	**0,023**	**0,023**	**0,023**
Cost of steam equivalent	**Euro/ton**	**1,25**	**1,25**	**1,25**
Crude Glycerin	**Euro/ton**	**280**	**280**	**280**
Propylene glycol	**Euro/ton**	**1150**	**1150**	**1150**
Ethylene glycol	**Euro/ton**	**850**	**850**	**850**
Ethanol	**Euro/ton**	**700**	**700**	**700**
Methanol	**Euro/ton**	**700**	**700**	**700**

There are advantages of siting AGC factory at Bjarnarflag are very interesting when considering the elements of low cost of electricity, steam and hydrogen are realized as seen in table 33.

Table 33 Shows estimated power consumption at Bjarnarflag

	Phase 1	Phase 2	Phase 3	Total
Electrical consumption(w.electrolyzer) - full capacity: kW	1.180	7.360	19.720	28.260
Number of hours:	8.300	8.300	8.300	
Gigawatthours:	9,8	61,1	163,7	234,6
Electrical cost -Euro/kWh	0,023	0,023	0,023	
Total cost at full capacity: Euro	**225.262**	**1.405.024**	**3.764.548**	**5.394.834**
Thermal power consumption: kW	8.500	17.000	34.000	59.500
Converted to steam equiv. (t/h, 12 bar): t/h	14	28	56	97
Operating hours per year:	8.300	8.300	8.300	
Cost of steam equivalent: Euro pr ton	1,25	1,25	1,25	
Total thermal power cost at full capacity: Euro	**144.307**	**288.614**	**577.227**	**1.010.148**
Hydrogen power consumption: Nm3/h	900	1.800	3.600	6.300
Converted to t/h	0,08	0,16	0,32	0,567
Number of hours	8.300	8.300	8.300	
Cost of hydrogen: Euro pr. Ton	700	700	700	
Total hydrogen power cost at full capacity: Euro	**470.610**	**941.220**	**1.882.440**	**3.294.270**
Tank storage rental (Euro Per Year)	**432.000**	**432.000**	**432.000**	**1.296.000**
Thermal power generated with electricity: Gigawatthours - efficiency 1,1	77,6	155,2	310,4	543,2

In this estimate the hydrogen process cost is considered to be mainly in equipment to refine the hydrogen, and no additional investment would be needed and other than already stated in the investment, but cost of purifying the hydrogen is estimated by IPD to be around 700 per ton.

Transport

Because of Bjarnarflag location extra transportation cost is expected. The table below shows the expected cost of transportation between Húsavík and Bjarnarflag where the price is expected to be around EUR 7, 42 per ton. There are two roads available for trucking between Húsavík and Bjarnarflag. The main road is Kísilvegur which is operational about 75% of the year but has limitations during the harsh winters and therefore forces the trucks with trailers to use Reykjadalsvegur which is about 20 kilometers longer than Kísilvegur.

Table 34 Shows trucking cost expected between Húsavík and Bjarnarflag

	Phase 1	Phase 2	Phase 3
Glycerin	**41,21**	**89,29**	**171,70**
Kísilvegur 69 km	15.827 €	34.291 €	65.944 €
Reykjadalsvegur 92km	7.034 €	15.240 €	29.308 €
Total trucking	**22.861 €**	**49.531 €**	**95.253 €**

	Phase 1	Phase 2	Phase 3
Glycol	**29,10**	**63,05**	**121,25**
Kísilvegur 69 km	11.176 €	24.215 €	46.567 €
Reykjadalsvegur 92km	4.967 €	10.762 €	20.696 €
Total trucking	**16.143 €**	**34.977 €**	**67.263 €**

	Phase 1	Phase 2	Phase 3
Alcohols	**0,90**	**1,95**	**3,75**
Kísilvegur 69 km	346 €	749 €	1.440 €
Reykjadalsvegur 92km	154 €	333 €	640 €
Total trucking	**499 €**	**1.082 €**	**2.080 €**

This is between 10% and 20 % increase in cost of transport comparing with other locations and does make AGC more dependent on other companies in the transportation industry.

Summary of projected financial return

By calculating the assumptions from the pro forma figure and intertwining them with IPD other estimations, we have opportunity to estimate the profit and loss for the first 6 years or until AGC factory has the capabilities to reach full productions capacity.

Table 35 Shows estimated profit and loss from Bjarnarflag project

EUR		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Total sales - CIF:		**33.105.000**	**33.105.000**	**71.727.500**	**71.727.500**	**137.937.500**	**137.937.500**
Marketing cost:		1.324.200	1.324.200	2.869.100	2.869.100	5.517.500	5.517.500
Total sales, net		**31.780.800**	**31.780.800**	**68.858.400**	**68.858.400**	**132.420.000**	**132.420.000**
Variable cost:							
Cost of raw material:		11.538.462	11.538.462	25.000.000	25.000.000	48.076.923	48.076.923
Sea freight cost:		1.701.191	1.701.191	2.948.731	2.948.731	4.961.807	4.532.548
Product trucking cost:		559.267	559.267	1.211.744	1.211.744	2.330.277	2.330.277
Electrical cost:		225.262	225.262	1.630.286	1.630.286	5.394.834	5.394.834
Hydrogen cost		470.610	470.610	1.411.830	1.411.830	3.294.270	3.294.270
Thermal energy cost:		144.307	144.307	432.920	432.920	1.010.148	1.010.148
Catalyst cost		1.648.352	1.648.352	3.571.429	3.571.429	6.868.132	6.868.132
Royalty:		317.808	317.808	688.584	688.584	1.324.200	1.324.200
		16.605.257	16.605.257	36.895.524	36.895.524	73.260.590	72.831.332
		50%	50%	51%	51%	53%	53%
Fixed cost:							
Salaries and wages		722.775	722.775	1.001.625	1.001.625	1.252.425	1.252.425
Maintenance		611.430	611.430	1.251.430	1.251.430	1.967.430	1.967.430
Insurance		114.643	114.643	234.643	234.643	368.893	368.893
Storage Tank Rental		432.000	432.000	432.000	432.000	432.000	432.000
Other fixed cost		390.255	390.255	612.335	612.335	870.945	870.945
		2.271.103	2.271.103	3.532.033	3.532.033	4.891.693	4.891.693
Total costs		18.876.360	18.876.360	40.427.557	40.427.557	78.152.283	77.723.025
		7%	7%	5%	5%	4%	4%
EBITDA:		**12.904.440**	**12.904.440**	**28.430.843**	**28.430.843**	**54.267.717**	**54.696.975**
		39%	*39%*	*40%*	*40%*	*39%*	*40%*
Depreciation		2.132.160	2.132.160	4.363.949	4.363.949	6.860.762	6.860.762
		6%	*6%*	*6%*	*6%*	*5%*	*5%*
Financial items:		-161.721	80.033	-395.900	204.461	66.442	1.218.978
Profit before tax:		10.610.558	10.852.312	23.670.994	24.271.355	47.473.397	49.055.191
Used deployment cost against taxes/ rapid depreciation							
		32%	*33%*	*33%*	*34%*	*34%*	*36%*
Corporate tax (20%):	20%	530.528	868.185	1.893.680	2.427.135	4.747.340	4.905.519
Profit/loss:		**10.080.030**	**9.984.127**	**21.777.315**	**21.844.219**	**42.726.057**	**44.149.672**
		30%	*30%*	*30%*	*30%*	*31%*	*32%*
ROS		**31,72%**	**31,42%**	**31,63%**	**31,72%**	**32,27%**	**33,34%**

The Bjarnarflag project looks promising and offers good profit the first 6 years of operations.

Profitability analyses

The Bjarnarflag project is using the discount factor of 15% in expected return of net present value (NPV), which gives us EUR 96.921.861 million over 10 years period and internal rate of return (IRR) of 98,4%.

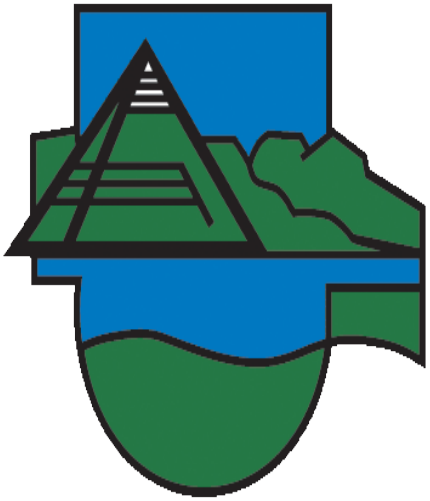
Table 36 Shows estimated IRR and NPV from Bjarnarflag project

	0-1	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Revenue:			31.780.800	31.780.800	68.858.400	68.858.400	132.420.000	132.420.000
Operational Cost:			18.876.360	18.876.360	40.427.557	40.427.557	78.152.283	77.723.025
Share capital:	1000000	12.464.316	12.464.316	15.664.316	15.664.316	19.244.316	19.244.316	19.244.316
Investment:	-1000000	-15.285.755		-16.000.000		-17.900.000		
Loan capital:		3.821.439		12.800.000		14.320.000		
Operational Capital Need	100000	100.000						
New Equity needed	-1000000	-11.364.316	0	-3.200.000	0	-3.580.000	0	0
Income:			26.484.000	31.780.800	62.678.800	68.858.400	121.826.400	132.420.000
Operational cost:	900000		-17.303.330	-18.876.360	-38.631.624	-40.427.557	-75.008.556	-77.758.797
Cash Flow from Operations	900000		**9.180.670**	**12.904.440**	**24.047.176**	**28.430.843**	**46.817.844**	**54.661.203**
Equity Inflow :	-1000000	-11.364.316		-3.200.000		-3.580.000		
Principal Payment of loans:		0	-509.091	-509.091	-2.214.302	-2.214.302	-4.122.008	-4.122.008
Financial items:		0	-161.721	80.033	-395.900	204.461	66.442	1.218.978
Corporate tax:				-530.528	-868.185	-1.893.680	-2.427.135	-4.747.340
Free Cash flow to equity	-1000000	**-11.364.316**	**8.509.858**	**8.744.854**	**20.568.789**	**20.947.322**	**40.335.143**	**47.010.834**
		280						

	IRR	98,4%
NPV	96.921.861	15%

Cash at beginning of period		100.000	100.000	8.609.858	20.554.712	41.123.500	65.650.822	105.985.965
Cast at end of period		100.000	8.609.858	20.554.712	41.123.500	65.650.822	105.985.965	152.996.798
Interest income:			89.566	299.909	634.258	1.097.996	1.764.998	2.663.206
Interest paid on long term loans:			-251.287	-219.876	-1.030.158	-893.535	-1.698.556	-1.444.228
Finical items - total:			-161.721	80.033	-395.900	204.461	66.442	1.218.978

8. Djúpivogur



Djúpivogur is an old fishing and merchant town on the east coast in Iceland. This town has always been a relatively small town with the population around 447 the 1st of December 2010 (SIS, 2011) if we compare them to the neighboring towns such as Höfn í Hornafirði or Eskifjörður, but it´s inhabitants have been resourceful by convening trading and fishing industry over the years. Service sector is growing mainly due to increasing tourism over the past few years (Djúpavogshreppur, 2011). Over the years the town has seen the fishing quota been sold out of the municipality do to various economic factors. There is an opportunity to take advantages of the situation as buildings and tanks that are not in use there are available at Djúpivogur and the municipality would welcome new business to the region. One of the problems in connection with selecting Djúpivogur is the lack of skilled work force and it would probably be problematic to secure highly educated work force in upper management that a factory of this caliber needs.

Harbor facility:

There are two piers in Djúpavogur (Djúpavogshreppur, 2011):

Djúpavogshöfn – Length of pier is 80 meters and maximum length of overall allowed ship is 120 meters. Depth is 5, 5 meters. Distance from centrum of Djúpivogur is 300 meters.

Gleðivík – Length of pier is 75 meters and maximum length of overall allowed ship is 110 meters. Distance from centrum of Djúpivogur is 1 kilometer.

Roads

Djúpivogur is very close to the highway and the distance to Höfn the next populated area is 103 kilometers and to Breiðdalsvík is 64 kilometers. There is little use of the highway as the harbor is within 300 meters distance from the factory.

Investment in Djúpivogur

There are many advantages to build AGC factory at Djúpivogur. One of them is availability of buildings and tanks that can easily be changed into a fully operational factory. Available buildings and tanks do make this opportunity more feasible, but with no available steam or

hydrogen at our disposal the investment does require additional investment of steam boiler and there is need for one additional tank of 5000m^3 for storage. Building AGC factory at Djúpivogur the capital investment cost is expected around EUR 18.105 million as shown below by using IPD estimated building needs.

Table 37 Shows AGC investment estimate at Djúpivogur - phase 1, 2 and 3:

Phase 1 - 30.000 tons capacity:	**Euro**		**Depreciation**	
Steam boiler	2.188.679	12%	10,0%	
Connector to Landsnet	748.428	4%	10,0%	
Design, engineering, construction management:	1.000.000	6%	10,0%	
Land, building and premises:	400.000	2%	3,0%	
Storage tanks:	1.268.664	7%	10,0%	
Hydrogen electrolyser:	3.000.000	17%	12,5%	
Evaporators and distillation:	3.800.000	21%	10,0%	
Other fixtures and fittings:	3.200.000	18%	10,0%	
Contingency:	2.500.000	14%	10,0%	
Total: -10 % /+35% accuracy	**18.105.771**	**100%**	**1.857.577**	annually
Year 0-2				
Phase 2 - 35.000 tons capacity:				
Total investment: -10 % /+35% accuracy	**15.000.000**		**10,3%**	
Year 3-4				
Phase 3 - 60.000 tons capacity:				
Total investment: -15/+-50 % accuracy	**21.900.000**		**10,3%**	
Year 5-6				

As seen in the table below the investment is high in the first phase, estimated EUR 18.105 million and the need equity is EUR 13.579 million and loan capital EUR 4.526 million.

Table 38 Shows IPD estimated investment, equity and loan capital structure at Djúpivogur

	Investment		**Equity**		**Loan capital**
	Euro	**%**	**Euro**	**%**	**Euro**
Phase 1	18.105.771	100%	13.579.328	25%	4.526.443
Phase 2	15.000.000	100%	3.000.000	80%	12.000.000
Phase 3	21.900.000	100%	4.380.000	80%	17.520.000

Pro forma financials

In table 39 below are major assumptions that are made for this profitability analysis.

Table 39 Shows financial assumptions in the Djúpivogur project

Parameter	Units	Phase 1	Phase 2	Phase 3
Electrical cost	Euro/KWh	0,023	0,023	0,023
Cost of steam equivalent	Euro/ton	15	15	15
Crude Glycerin	Euro/ton	280	280	280
Propylene glycol	Euro/ton	1150	1150	1150
Ethylene glycol	Euro/ton	850	850	850
Ethanol	Euro/ton	700	700	700
Methanol	Euro/ton	700	700	700

The main problem which our project in Djúpivogur is facing is the lack of steam and/or hydrogen, which makes all processes rely totally on electricity. At Djúpivogur AGC factory would have to use electricity to produce steam at the cost of 15 EUR per ton.

Table 40 Shows estimated power consumption at G2G factory

	Phase 1	Phase 2	Phase 3	Total
Transmission cost	330.968	455.781	872.533	1.659.283
Electrical consumption- full capacity: kW	6.180	12.360	24.720	43.260
Number of hours:	8.300	8.300	8.300	
Gigawatthours:	51,3	102,6	205,2	359,1
Electrical cost -Euro/kWh	0,02	0,02	0,02	
Total cost at full capacity: Euro	**1.510.730**	**2.815.305**	**5.591.581**	**9.917.617**
Thermal power consumption: kW	8.500	17.000	34.000	59.500
Converted to steam equiv. (t/h, 12 bar): t/h	14	28	56	97
Operating hours per year:	8.300	8.300	8.300	
Cost of steam equivalent: Euro pr ton	15	15	15	
Total thermal power cost at full capacity: Euro	**1.731.682**	**3.463.364**	**6.926.727**	**12.121.773**
Tank storage rental (Euro Per Year)	**200.000**	**200.000**	**200.000**	
Thermal power generated with electricity:				
Gigawatthours - efficiency 1,1	77,6	155,2	310,4	543,2

In Djúpivogur the energy cost is estimated around 9% of portion of sales in the first phase and will rise to 12% in the second phase and finally will be around 14% when it reaches the third phase of the project.

Summary of projected financial return

By calculating the assumptions from the pro forma figure and intertwining them with IPD other estimations, we have the opportunity to estimate the profit and loss for the first 6 years or until AGC factory has the capability to reach full productions capacity.

Table 41 Shows profit and loss during 6 years period expected

EUR		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Total sales - CIF:		**33.105.000**	**33.105.000**	**71.727.500**	**71.727.500**	**137.937.500**	**137.937.500**
Marketing cost:		1.324.200	1.324.200	2.869.100	2.869.100	5.517.500	5.517.500
Total sales, net		**31.780.800**	**31.780.800**	**68.858.400**	**68.858.400**	**132.420.000**	**132.420.000**
Variable cost:							
Cost of raw material:		11.538.462	11.538.462	25.000.000	25.000.000	48.076.923	48.076.923
Sea freight cost:		1.701.191	1.701.191	2.948.731	2.948.731	4.961.807	4.532.548
Product trucking cost:		207.821	207.821	450.279	450.279	865.922	865.922
Electrical cost:		1.510.730	1.510.730	4.326.035	4.326.035	9.917.617	9.917.617
Thermal energy cost:		1.731.682	1.731.682	5.195.045	5.195.045	12.121.773	12.121.773
Catalyst cost		1.648.352	1.648.352	3.571.429	3.571.429	6.868.132	6.868.132
Royalty:		317.808	317.808	688.584	688.584	1.324.200	1.324.200
		18.656.045	18.656.045	42.180.104	42.180.104	84.136.373	83.707.115
		56%	56%	59%	59%	61%	61%
Fixed cost:							
Salaries and wages		722.775	722.775	1.001.625	1.001.625	1.252.425	1.252.425
Maintenance		724.231	724.231	1.324.231	1.324.231	2.200.231	2.200.231
Insurance		135.793	135.793	248.293	248.293	412.543	412.543
Storage Tank Rental		200.000	200.000	300.000	300.000	600.000	600.000
Other fixed cost		417.045	417.045	629.625	629.625	926.235	926.235
		2.199.844	2.199.844	3.503.774	3.503.774	5.391.434	5.391.434
Total costs		20.855.889	20.855.889	45.683.877	45.683.877	89.527.807	89.098.549
		7%	7%	5%	5%	4%	4%
EBITDA:		**10.924.911**	**10.924.911**	**23.174.523**	**23.174.523**	**42.892.193**	**43.321.451**
		33%	*33%*	*32%*	*32%*	*31%*	*31%*
Depreciation		1.857.577	1.857.577	3.396.515	3.396.515	5.643.364	5.643.364
		6%	*6%*	*5%*	*5%*	*4%*	*4%*
Financial items:		-228.391	-22.621	-512.445	-16.259	-535.591	406.402
Profit before tax:		8.838.942	9.044.713	19.265.562	19.761.749	36.713.238	38.084.489
Used deployment cost against taxes/ rapid depreciation							
		27%	*27%*	*27%*	*28%*	*27%*	*28%*
Corporate tax (20%):	20%	441.947	723.577	1.541.245	1.976.175	3.671.324	3.808.449
Profit/loss:		**8.396.995**	**8.321.136**	**17.724.317**	**17.785.574**	**33.041.914**	**34.276.040**
		25%	*25%*	*25%*	*25%*	*24%*	*25%*
ROS		**26,42%**	**26,18%**	**25,74%**	**25,83%**	**24,95%**	**25,88%**

Profitability analyses

In the Djúpavogur project we are using the discount factor of 15% in expected return of net present value (NPV), which gives us EUR 68.844.894 million over 10 years period and internal rate of return (IRR) of 74,3%.

Table 42 Shows estimated IRR and NPV from Djúpavogur project

	0-1	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Revenue:			31.780.800	31.780.800	68.858.400	68.858.400	132.420.000	132.420.000
Operational Cost:			20.855.889	20.855.889	45.683.877	45.683.877	89.527.807	89.098.549
Share capital:	1000000	14.579.328	14.579.328	17.579.328	17.579.328	17.579.328	17.579.328	17.579.328
Investment:	-1000000	-18.105.771		-15.000.000		-21.900.000		
Loan capital:		4.526.443		12.000.000		17.520.000		
Operational Capital Need	100000	100.000						
New Equity needed	-1000000	-13.479.328	0	-3.000.000	0	-4.380.000	0	0
Income:			26.484.000	31.780.800	62.678.800	68.858.400	121.826.400	132.420.000
Operational cost:	900000		-19.117.899	-20.855.889	-43.614.878	-45.683.877	-85.874.146	-89.134.320
Cash Flow from Operations	900000		**7.366.101**	**10.924.911**	**19.063.922**	**23.174.523**	**35.952.254**	**43.285.680**
Equity Inflow :	-1000000	-13.479.328		-3.000.000		-4.380.000		
Principal Payment of loans:		0	-603.011	-603.011	-2.201.647	-2.201.647	-4.535.655	-4.535.655
Financial items:		0	-228.391	-22.621	-512.445	-16.259	-535.591	406.402
Corporate tax:				-441.947	-723.577	-1.541.245	-1.976.175	-3.671.324
Free Cash flow to equity	-1000000	**-13.479.328**	**6.534.699**	**6.857.332**	**15.626.252**	**15.035.372**	**28.904.833**	**35.485.103**
		280						
IRR	74,3%							
NPV 68.844.894	15%							
Cash at beginning of period		100.000	100.000	6.634.699	16.492.031	32.118.283	51.533.655	80.438.488
Cast at end of period		100.000	6.634.699	16.492.031	32.118.283	51.533.655	80.438.488	115.923.590
Interest income:			69.255	237.820	499.876	860.221	1.357.114	2.019.257
Interest paid on long term loans:			-297.646	-260.441	-1.012.321	-876.480	-1.892.705	-1.612.855
Finical items - total:			-228.391	-22.621	-512.445	-16.259	-535.591	406.402

9. Conclusions

The purpose this analysis was to determine if a business opportunity is possible, in fact practical and viable. In this study steps were taken to make this approach as to make a realistic looking as possible, and have tried to take in both positive and negative aspects of the business opportunity. Four cases were constructed, studied and evaluated: Helguvík Harbor, Grundartangi, Djúpivogur and Husavik/Bjarnarflag. Each location has a harbor that can accommodate at least 10.000Ton transport vessel.

Capex and Opex model was constructed for all the four cases. The dependent variables were assumed the same for all the four cases. These were labor cost, construction cost, raw material cost, income from products sold abroad, and foreign marketing, logistics and storage cost. The independent variables were case specific as they were different for each case. These were electricity cost for electrolyzing hydrogen or alternatively cost of purchasing hydrogen as a bi-product or cost of abstracting hydrogen from non-condensable gases at geothermal sites. Cost of steam and logistics and storage cost. Several cost assumption were made based on references from reputable sources and NPV and IRR were calculated for each site. The required WACC is set at 15% for these four cases. The result from these calculations are that Bjarnarflag/Helguvík that assumes abstraction of hydrogen from non-condensable gases and non-transmission tariffs of electricity scores the highest with 98,4% IRR and NPV EUR 96.921.861. The second highest score is at the Grundartangi site where it is assumed that hydrogen can be purchased from Proposed Sodium Chloride factory as a bi-product the IRR for that site is 93.2% and the NPV is EUR 95.347.804. The third site option is Helguvík where AGC is going to buy waste heat as steam from the Icelandic Silica Factory. This option yields IRR of 86, 2% and NPV of EUR 89.427.385. The forth option is Djúpivogur which were storage tanks and buildings could be donated. This option yields IRR of 74, 3% and NPV of EUR 68.844.894.

Even though all sites obviously yield acceptable outcomes, one shall keep in mind the accuracy of this study is -10% and + 35%. More studies, bids and calculations are clearly needed to tighten the outcome accuracy figures. Confirmed bids and detailed estimates will have to be conducted and analyses.

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Appendix – Helguvík

Fundamentals

1) Project timeline - capacity - investment:

	Production capacity in tpa							
Year/description:	**Phase 1**		**Phase 2**		**Phase 3**		**Total**	
(Feasibility study cost 1 M.euro)								
Investment - EURO:	17.851.423		15.000.000		19.900.000		52.751.423	
Capacity - tons(products):	30.000		35.000		60.000		125.000	
0								
1	30.000	100%					30.000	
2	30.000	100%					30.000	
3	30.000	100%	35.000	100%			65.000	
4	30.000	100%	35.000	100%			65.000	
5	30.000	100%	35.000	100%	60.000	100%	125.000	
6	30.000	100%	35.000	100%	60.000	100%	125.000	
7	30.000	100%	35.000	100%	60.000	100%	125.000	
8	30.000	100%	35.000	100%	60.000	100%	125.000	
9	30.000	100%	35.000	100%	60.000	100%	125.000	
10	30.000	100%	35.000	100%	60.000	100%	125.000	

2) G2G - Raw material usage/Product(s) distribution

Raw material / products		**Distrib. weight**	**Phase 1 MT/year**	**Phase 2 MT/year**	**Phase 3 MT/year**	**Total MT/year**
Production capacity			30.000	35.000	60.000	125.000
Crude Glycerin (crude 80%)			41.209	48.077	82.418	171.703
Net feedstock Glycerin (100 %)			32.967	38.462	65.934	137.363
Methane	1,5 % of feed Glycerin		495	577	989	2.060
Methanol		2,0%	600	700	1.200	2.500
Ethanol propanol		1,0%	300	350	600	1.250
Total Alcohols.		3,0%	900	1.050	1.800	3.750
Propylene glycol		86,0%	25.800	30.100	51.600	107.500
Ethylene glycol		11,0%	3.300	3.850	6.600	13.750
Total liquid Products.		100,0%	30.000	35.000	60.000	125.000
Total liquid products - excluding methane:			**30.000**	**35.000**	**60.000**	**125.000**

3) Estimated product price and raw material price - based on prices in September 2010.

	Euro/ton					
Chemicals:	**Price**	**Tons/a**	**Phase 1**	**Phase 2**	**Phase 3**	**Total**
			Total value in Euro			
Raw materials						
Crude Glycerin (80 %), ex-factory	**280**	NW-Europe	11.538.462	13.461.538	23.076.923	48.076.923
Glycols						
Propylene glycol	**1.150**	NW-Europe	29.670.000	34.615.000	59.340.000	123.625.000
Ethylene glycol	**850**	NW-Europe	2.805.000	3.272.500	5.610.000	11.687.500
	1.303	1083	32.475.000	37.887.500	64.950.000	135.312.500
Alcohols						
Ethanol	**700**	NW-Europe	210.000	245.000	420.000	875.000
Methanol	**700**	NW-Europe	420.000	490.000	840.000	1.750.000
	700		630.000	735.000	1.260.000	2.625.000
Gas						
Methane (0,714 kg/Nm^3)	**400**	NW-Europe	197.802	230.769	395.604	824.176
Total - without methane:			**33.105.000**	**38.622.500**	**66.210.000**	**137.937.500**
Total - average price pr MT			*1.104*	*1.104*	*1.104*	*1.104*
Total revenue - with methane			**33.302.802**	**38.853.269**	**66.605.604**	**138.761.676**

4) Freight cost - logistics:

Description	**Euro/MT**	
NW-Europe-Iceland, liquid cargo	25	Sea freight is very sensitive
Trucking - factory to harbor - liquid cargo	7,42	to size. 15 Euro/MT
Trucking & Storage factory to depot - alcohols	16,5	for 15.000 t lots and
Piping- factory to depot - methane	40	50 Euro/MT for 1.250 t lots.

5) Currency rates ISK to:

USD	116
EUR	159
GBP	183
NKR	21

6) Investment estimate - phase 1, 2 and 3:

Phase 1 - 30.000 tons capacity:	**Euro**		**Depreciation**	
Connector to Landsnet	748.428	4%	10,0%	
Design, engineering, construction management:	1.500.000	8%	10,0%	
Land, building and premises:	1.200.000	7%	3,0%	
Storage tanks:	1.902.995	11%	10,0%	
Hydrogen electrolyser:	3.000.000	17%	12,5%	
Evaporators and distillation:	3.800.000	21%	10,0%	
Other fixtures and fittings:	3.200.000	18%	10,0%	
Contingency:	2.500.000	14%	10,0%	
Total: -10 % /+35% accuracy	**17.851.423**	**100%**	**1.701.300**	annually
Year 0-2				
Phase 2 - 35.000 tons capacity:				
Total investment: -10 % /+35% accuracy	**15.000.000**		**9,5%**	
Year 3-4				
Phase 3 - 60.000 tons capacity:				
Total investment: -15/+-50 % accuracy	**19.900.000**		**9,5%**	
Year 5-6				

7) Power consumption:

	Phase 1	**Phase 2**	**Phase 3**	**Total**
Transmission cost	330.968	455.781	872.533	1.659.283
Electrical consumption(w.electrolyzer) - full capacity: kW	6.180	12.360	24.720	43.260
Number of hours:	8.300	8.300	8.300	
Gigawatthours:	51,3	102,6	205,2	359,1
Electrical cost -Euro/kWh	0,023	0,023	0,023	
Total cost at full capacity: Euro	**1.510.730**	**2.815.305**	**5.591.581**	**9.917.617**
Thermal power consumption: kW	8.500	17.000	34.000	59.500
Converted to steam equiv. (t/h, 12 bar): t/h	14	28	56	97
Operating hours per year:	8.300	8.300	8.300	
Cost of steam equivalent: Euro pr ton	4	4	4	
Total thermal power cost at full capacity: Euro	**461.782**	**923.564**	**1.847.127**	**3.232.473**
Tank storage rental (Euro Per Year)	**120.000**	**240.000**	**480.000**	**840.000**
Thermal power generated with electricity:				
Gigawatthours - efficiency 1,1	77,6	155,2	310,4	543,2

8) Employment - phase 1 + additional workers for expanding to phase 2 and 3:

	Unit cost	Phase 1		Phase 2		Phase 3	
Description	**pr year**	**Number**	**Euro**	**Number**	**Euro**	**Number**	**Euro**
Mgn. Director	58.125	1	58.125				
Production Dir.	55.350	1	55.350				
Laboratory Dir.	49.050	1	49.050				
Line staff	24.900	12	298.800	4	99.600	4	99.600
Maintenance	41.250	2	82.500	1	41.250	2	82.500
Quality assurance	40.950	2	81.900	1	40.950	1	40.950
Office workers	41.550	1	41.550	1	41.550		0
Various	27.750	2	55.500	2	55.500	1	27.750
Total:		**22**	**722.775**	9	278.850	8	250.800
			Phase 2 - total staff and cost:	**31**	**1.001.625**		
					Phase 3 - total staff and cost:	**39**	**1.252.425**

9) Marketing cost, license fee and cost of catalyst:

Description			**Phase 1**	**Phase 2**	**Phase 3**	**Total**
Marketing cost:	4,0%	of sales:	1.332.112	1.554.131	2.664.224	5.412.500
Royalty: 1% of sales	1%	Euro per t product.:	331.050	386.225	662.100	1.379.375
Catalyst cost	40	Euro per t product.:	1.200.000	1.400.000	2.400.000	5.000.000

10) Various fixed cost:

			Phase 1	**Phase 2**	**Phase 3**	**Total**
Maintenance:	4,0%	of investment:	714.057	600.000	796.000	2.110.057
Insurance:	0,75%	of investment:	133.886	112.500	149.250	395.636
Travels - staff:	7000	Euro per person	28.000	7.000	7.000	42.000
Telephone:	400	Euro per person	8.800	3.600	3.200	15.600
IT system:	1700	Euro per person	37.400	15.300	13.600	66.300
Security:		Estimate	60.000	15.000	15.000	90.000
Auditing and consulting:		Estimate	70.000	17.500	35.000	122.500
Various cost:		Estimate	210.429	154.180	203.810	568.419
Total - various fixed cost:			1.262.571	925.080	1.222.860	3.410.511
Percentage of total sales:			*3,8%*	*2,4%*	*1,8%*	*2,5%*

11) Transmission cost from Landsnet

			Phase 1 Tariff	Phase 2 Tariff	Phase 3 Tariff
Delivery Charge	39.029 €	€/year	39.029 €	39.029 €	39.029 €
Capacity charge	20.650 €	€/MW	127.618 €	255.236 €	510.473 €
Energy charge	1,045 €	€/MWh	53.588 €	107.177 €	214.353 €
Ancillary services	0,162 €	€/MWh	8.297 €	16.595 €	33.189 €
Transmission losses	0,368 €	*€/MWh*	*18.872 €*	37.745 €	75.489 €
		Total	**247.405 €**	**455.781 €**	**872.533 €**

12) Model to calculate strain

Startup cost	**1.273.835 €**
Percent per year	**0,08**
Portion of startup cost	**0,80**
MWh	**51.294 €**
Energy charge	**1,04 €**
MW	**6,18**
Capacity charge	**20.650 €**
Surcharge	**46,12%**

13) Model to calculate Landsnet tariff with strain

Usages		
Load capacity	6,18	MW
Energy	51.294	MWh
Utilization	8.300	hrs.
ISK/EUR	159,00	kr.

Tariff for intensive users		
Delivery Charge	39.029	EUR per year
Capacity charge	20.650	EUR per MW per year
Energy charge	1,04	EUR per MWh
Ancillary services	0,1618	EUR per MWh
Transmission losses	0,3679	EUR per MWh
Intensive users strain		
Delivery Charge	0	EUR per year
Capacity charge	9.523	EUR per MW per year
Energy charge	0,48	EUR per MWh
Ancillary services	0,0000	EUR per MWh
Transmission losses	0,0000	EUR per MWh

Additional fee		
Delivery charge	0	EUR
Capacity charge	58.851	EUR
Energy charge	24.712	EUR
Total for transmission	83.564	EUR

Up dated tariff		
Delivery Charge	39.029	EUR per year
Capacity charge	30.173	EUR per MW per year
Energy charge	1,53	EUR per MWh
Ancillary services	0,1618	EUR per MWh
Transmission losses	0,3679	EUR per MWh

Total tariff		
Delivery charge	39.029	EUR
Capacity charge	186.469	EUR
Energy charge	78.301	EUR
Ancillary services	8.297	EUR
Transmission losses	18.872	EUR
Total for transmission	330.968	EUR

Profit and loss

Sales, freight cost and marketing cost in €uro

	Description:		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
i)	**Glycols:**	Phase 1:	32.475.000	32.475.000	32.475.000	32.475.000	32.475.000	32.475.000	32.475.000	32.475.000	32.475.000	32.475.000
		Phase 2:			37.887.500	37.887.500	37.887.500	37.887.500	37.887.500	37.887.500	37.887.500	37.887.500
		Phase 3:					64.950.000	64.950.000	64.950.000	64.950.000	64.950.000	64.950.000
			32.475.000	32.475.000	70.362.500	70.362.500	135.312.500	135.312.500	135.312.500	135.312.500	135.312.500	135.312.500
	Product:											
	Glycols - sea freight:		623.081	623.081	1.080.008	1.080.008	1.817.321	1.817.321	1.817.321	1.817.321	1.817.321	1.817.321
	Glycols - trucking:		184.931	184.931	400.683	400.683	770.544	770.544	770.544	770.544	770.544	770.544
ii)	**Alcohols:**	Phase 1	630.000	630.000	630.000	630.000	630.000	630.000	630.000	630.000	630.000	630.000
		Phase 2			735.000	735.000	735.000	735.000	735.000	735.000	735.000	735.000
		Phase 3					1.260.000	1.260.000	1.260.000	1.260.000	1.260.000	1.260.000
			630.000	630.000	1.365.000	1.365.000	2.625.000	2.625.000	2.625.000	2.625.000	2.625.000	2.625.000
	Alcohols - trucking:		14.850	14.850	32.175	32.175	61.875	61.875	61.875	61.875	61.875	61.875
	Total sales		33.105.000	33.105.000	71.727.500	71.727.500	137.937.500	137.937.500	137.937.500	137.937.500	137.937.500	137.937.500
iii)	**Glycerin:**	Phase 1	11.538.462	11.538.462	11.538.462	11.538.462	11.538.462	11.538.462	11.538.462	11.538.462	11.538.462	11.538.462
	Feedstock	Phase 2			13.461.538	13.461.538	13.461.538	13.461.538	13.461.538	13.461.538	13.461.538	13.461.538
		Phase 3					23.076.923	23.076.923	23.076.923	23.076.923	23.076.923	23.076.923
			11.538.462	11.538.462	25.000.000	25.000.000	48.076.923	48.076.923	48.076.923	48.076.923	48.076.923	48.076.923
			35%	35%	35%	35%	35%	35%	35%	35%	35%	35%
	Crude Glycerin – sea freight:		1.030.220	1.030.220	1.785.714	1.785.714	3.004.808	2.575.549	2.575.549	2.575.549	2.575.549	2.575.549
iv)	Sea freight - total:		1.653.301	1.653.301	2.865.722	2.865.722	4.822.128	4.392.870	4.392.870	4.392.870	4.392.870	4.392.870
	Trucking - total:		199.781	199.781	432.858	432.858	832.419	832.419	832.419	832.419	832.419	832.419
	Tank storage rental		120.000	120.000	240.000	240.000	480.000	480.000	480.000	480.000	480.000	480.000
	Total freight and storage cost:		***1.973.082***	***1.973.082***	***3.538.580***	***3.538.580***	***6.134.547***	***5.705.289***	***5.705.289***	***5.705.289***	***5.705.289***	***5.705.289***

Energy cost

v)	**Electricity:**	Phase 1	1.510.730	1.510.730	1.510.730	1.510.730	1.510.730	1.510.730	1.510.730	1.510.730	1.510.730	1.510.730
		Phase 2			2.815.305	2.815.305	2.815.305	2.815.305	2.815.305	2.815.305	2.815.305	2.815.305
		Phase 3					5.591.581	5.591.581	5.591.581	5.591.581	5.591.581	5.591.581
			1.510.730	1.510.730	4.326.035	4.326.035	9.917.617	9.917.617	9.917.617	9.917.617	9.917.617	9.917.617
vi)	**Thermal energy:**	Phase 1	461.782	461.782	461.782	461.782	461.782	461.782	461.782	461.782	461.782	461.782
		Phase 2			923.564	923.564	923.564	923.564	923.564	923.564	923.564	923.564
		Phase 3					1.847.127	1.847.127	1.847.127	1.847.127	1.847.127	1.847.127
			461.782	461.782	1.385.345	1.385.345	3.232.473	3.232.473	3.232.473	3.232.473	3.232.473	3.232.473
vii)	**Total energy cost:**		1.972.512	1.972.512	5.711.381	5.711.381	13.150.089	13.150.089	13.150.089	13.150.089	13.150.089	13.150.089
	Proportion of sales:		*6%*	*6%*	*8%*	*8%*	*10%*	*10%*	*10%*	*10%*	*10%*	*10%*

Estimated profit and loss account:

UR		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
otal sales - CIF:		**33.105.000**	**3.105.000**	**1.727.500**	**1.727.500**	**37.937.500**	**37.937.500**	**37.937.500**	**37.937.500**	**37.937.500**	**37.937.500**
Marketing cost:		1.324.200	1.324.200	2.869.100	2.869.100	5.517.500	5.517.500	5.517.500	5.517.500	5.517.500	5.517.500
otal sales, net		**31.780.800**	**1.780.800**	**8.858.400**	**8.858.400**	**32.420.000**	**32.420.000**	**32.420.000**	**32.420.000**	**32.420.000**	**32.420.000**
'ariable cost:											
ost of raw material:		11.538.462	1.538.462	5.000.000	5.000.000	48.076.923	48.076.923	48.076.923	48.076.923	48.076.923	48.076.923
ea freight cost:		1.653.301	1.653.301	2.865.722	2.865.722	4.822.128	4.392.870	4.392.870	4.392.870	4.392.870	4.392.870
roduct trucking cost:		199.781	199.781	432.858	432.858	832.419	832.419	832.419	832.419	832.419	832.419
lectrical cost:		1.510.730	1.510.730	4.326.035	4.326.035	9.917.617	9.917.617	9.917.617	9.917.617	9.917.617	9.917.617
hermal energy cost:		461.782	461.782	1.385.345	1.385.345	3.232.473	3.232.473	3.232.473	3.232.473	3.232.473	3.232.473
atalyst cost		1.648.352	1.648.352	3.571.429	3.571.429	6.868.132	6.868.132	6.868.132	6.868.132	6.868.132	6.868.132
oyalty:		317.808	317.808	688.584	688.584	1.324.200	1.324.200	1.324.200	1.324.200	1.324.200	1.324.200
		17.330.215	7.330.215	8.269.973	8.269.973	75.073.892	74.644.633	74.644.633	74.644.633	74.644.633	74.644.633
		52%	52%	53%	53%	54%	54%	54%	54%	54%	54%
ixed cost:											
alaries and wages		722.775	722.775	1.001.625	1.001.625	1.252.425	1.252.425	1.252.425	1.252.425	1.252.425	1.252.425
Maintenance		714.057	714.057	1.314.057	1.314.057	2.110.057	2.110.057	2.110.057	2.110.057	2.110.057	2.110.057
ısurance		133.886	133.886	246.386	246.386	395.636	395.636	395.636	395.636	395.636	395.636
torage Tank Rental		120.000	120.000	240.000	240.000	480.000	480.000	480.000	480.000	480.000	480.000
Other fixed cost		414.629	414.629	627.209	627.209	904.819	904.819	904.819	904.819	904.819	904.819
		2.105.346	2.105.346	3.429.276	3.429.276	5.142.936	5.142.936	5.142.936	5.142.936	5.142.936	5.142.936
otal costs		19.435.561	9.435.561	1.699.249	1.699.249	80.216.828	79.787.569	79.787.569	79.787.569	79.787.569	79.787.569
		6%	6%	5%	5%	4%	4%	4%	4%	4%	4%
BITDA:		**12.345.239**	**2.345.239**	**7.159.151**	**7.159.151**	**52.203.172**	**52.632.431**	**52.632.431**	**52.632.431**	**52.632.431**	**52.632.431**
		37%	*37%*	*38%*	*38%*	*38%*	*38%*	*38%*	*38%*	*38%*	*38%*
epreciation		1.701.300	1.701.300	3.130.849	3.130.849	5.027.385	5.027.385	5.027.385	5.027.385	5.027.385	5.027.385
		5%	*5%*	*4%*	*4%*	*4%*	*4%*	*4%*	*4%*	*4%*	*4%*
inancial items:		-210.551	22.695	-414.778	158.705	-123.504	991.375	2.185.239	3.396.265	4.625.537	5.841.251
rofit before tax:		10.433.389	0.666.635	3.613.524	4.187.007	47.052.284	48.596.421	49.790.285	51.001.311	52.230.583	53.446.297
lsed deployment cost against taxes/ rapid depreciation											
		32%	*32%*	*33%*	*34%*	*34%*	*35%*	*36%*	*37%*	*38%*	*39%*
orporate tax (20%):	20%	521.669	853.331	1.889.082	2.418.701	4.705.228	4.859.642	5.476.931	6.120.157	6.267.670	7.482.482
rofit/loss:		**9.911.719**	**9.813.304**	**1.724.442**	**1.768.306**	**42.347.055**	**43.736.779**	**44.313.353**	**44.881.154**	**45.962.913**	**45.963.816**
		30%	*30%*	*30%*	*30%*	*31%*	*32%*	*32%*	*33%*	*33%*	*33%*
OS		**31,2%**	**30,9%**	**31,5%**	**31,6%**	**32,0%**	**33,0%**	**33,5%**	**33,9%**	**34,7%**	**34,7%**

Cash flow and equity

The following cash flow is based on the following assumptions:

	Investment		Equity		Loan capital
	Euro	%	Euro	%	Euro
Phase 1	17.851.423	100%	13.388.567	25%	4.462.856
Phase 2	15.000.000	100%	3.000.000	80%	12.000.000
Phase 3	19.900.000	100%	3.980.000	80%	15.920.000

Interest rate:

Euro loans:	Libor: 0,17%	Premium: 6,00%	Total: 6,17%
Euro deposits:			Total: 2,06%

Income:

Estimated length of time of receivables: 2 months 16,67% of the annual income

Cost:

Estimated length of time of payables: 1 months 8,33% of the annual cost 8 years

Year	Beginning of 0	1	2	3	4	5	6	7	8	9	10
Loan 1+first year interest	4.756.321										
Principal		-594.540	-594.540	-594.540	-594.540	-594.540	-594.540	-594.540	-594.540		
Interests:		-293.465	-256.782	-220.099	-183.416	-146.732	-110.049	-73.366	-36.683		
Loan 2 + first year interest			12.789.087								
Principal				-1.598.636	-1.598.636	-1.598.636	-1.598.636	-1.598.636	-1.598.636	-1.598.636	-1.598.636
Interests:				-789.087	-690.451	-591.815	-493.179	-394.543	-295.907	-197.272	-98.636
Loan 3 + first year interest					16.966.855						
Principal						-2.120.857	-2.120.857	-2.120.857	-2.120.857	-2.120.857	-2.120.857
Interest:						-1.046.855	-915.998	-785.141	-654.284	-523.427	-392.571

* Loans are paid out at the beginning of the year and accrue interest that year.

Atlantic Green Chemicals - Glycerin to glycols - G2G

	0-1	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Revenue:			31.780.800	31.780.800	68.858.400	68.858.400	132.420.000	132.420.000	132.420.000	132.420.000	132.420.000	132.420.000
Operational Cost:			19.435.561	19.435.561	41.699.249	41.699.249	80.216.828	79.787.569	79.787.569	79.787.569	79.787.569	79.787.569
Share capital:	1000000	14.388.567	14.388.567	17.388.567	17.388.567	21.368.567	21.368.567	21.368.567	21.368.567	21.368.567	21.368.567	21.368.567
Investment:	-1000000	-17.851.423		-15.000.000		-19.900.000						
Loan capital:		4.462.856		12.000.000		15.920.000						
Operational Capital Need	100000	100.000										
New Equity needed	-1000000	-13.288.567	0	-3.000.000	0	-3.980.000	0	0	0	0	0	0
Income:			26.484.000	31.780.800	62.678.800	68.858.400	121.826.400	132.420.000	132.420.000	132.420.000	132.420.000	132.420.000
Operational cost:	900000		-17.815.931	-19.435.561	-39.843.942	-41.699.249	-77.007.029	-79.823.341	-79.787.569	-79.787.569	-79.787.569	-79.787.569
Cash Flow from Operations	900000		**8.668.069**	**12.345.239**	**22.834.858**	**27.159.151**	**44.819.371**	**52.596.659**	**52.632.431**	**52.632.431**	**52.632.431**	**52.632.431**
Equity Inflow :	-1000000	-13.288.567		-3.000.000		-3.980.000						
Principal Payment of loans:		0	-594.540	-594.540	-2.193.176	-2.193.176	-4.314.033	-4.314.033	-4.314.033	-4.314.033	-3.719.493	-3.719.493
Financial items:		0	-210.551	22.695	-414.778	158.705	-123.504	991.375	2.185.239	3.396.265	4.625.537	5.841.251
Corporate tax:				-521.669	-853.331	-1.889.082	-2.418.701	-4.705.228	-4.859.642	-5.476.931	-6.120.157	-6.267.670
Free Cash flow to equity	-1000000	**-13.288.567**	**7.862.978**	**8.251.725**	**19.373.573**	**19.255.598**	**37.963.133**	**44.568.773**	**45.643.995**	**46.237.732**	**47.418.318**	**48.486.519**
		280										

	IRR	86,2%
NPV	89.427.385	15%

Cash at beginning of period		100.000	100.000	7.962.978	19.214.703	38.588.276	61.823.874	99.787.008	144.355.781	189.999.775	236.237.507	283.655.824
Cast at end of period		100.000	7.962.978	19.214.703	38.588.276	61.823.874	99.787.008	144.355.781	189.999.775	236.237.507	283.655.824	332.142.344
Interest income:			82.914	279.477	594.407	1.032.572	1.661.899	2.510.602	3.438.290	4.383.140	5.346.236	6.332.458
Interest paid on long term loans:			-293.465	-256.782	-1.009.185	-873.866	-1.785.402	-1.519.227	-1.253.051	-986.875	-720.699	-491.206
Finical items - total:			-210.551	22.695	-414.778	158.705	-123.504	991.375	2.185.239	3.396.265	4.625.537	5.841.251

Tanks building estimates

Tank building estimates

Tank construction 2500m3	**212.068 €**
Sump and sewage system, filling station, fences	95.932 €
Piping to outer harbor	39.426 €
Fire extinguishing system with foam for methanol	93.029 €
Pumping system with a control house	36.439 €
Scada system	37.834 €
Miscellaneous and contingency	85.841 €
Design management	33.764 €
Total	**634.332 €**

Tank construction 1000m3	**84.827 €**
Sump and sewage system, filling station, fences	38.373 €
Piping to outer harbor	15.770 €
Fire extinguishing system with foam for methanol	37.212 €
Pumping system with a control house	14.575 €
Scada system	15.134 €
Miscellaneous and contingency	34.336 €
Design management	13.506 €
Total	**253.733 €**

Tank construction 4000m3	**339.308 €**
Sump and sewage system, filling station, fences	153.491 €
Piping to outer harbor	63.082 €
Fire extinguishing system with foam for methanol	148.846 €
Pumping system with a control house	58.302 €
Scada system	60.535 €
Miscellaneous and contingency	137.345 €
Design management	54.022 €
Total	**1.014.931 €**

Appendix – Grundartangi

Fundamentals

1) Project timeline - capacity - investment:

	Production capacity in tpa						
Year/description:	**Phase 1**		**Phase 2**		**Phase 3**		**Total**
(Feasibility study cost 1 M.euro)							
Investment - EURO:	15.866.354		13.000.000		17.900.000		46.766.354
Capacity - tons(products):	30.000		35.000		60.000		125.000
0							
1	30.000	100%					30.000
2	30.000	100%					30.000
3	30.000	100%	35.000	100%			65.000
4	30.000	100%	35.000	100%			65.000
5	30.000	100%	35.000	100%	60.000	100%	125.000
6	30.000	100%	35.000	100%	60.000	100%	125.000
7	30.000	100%	35.000	100%	60.000	100%	125.000
8	30.000	100%	35.000	100%	60.000	100%	125.000
9	30.000	100%	35.000	100%	60.000	100%	125.000
10	30.000	100%	35.000	100%	60.000	100%	125.000

2) G2G - Raw material usage/Product(s) distribution

Raw material / products		**Distrib. weight**	**Phase 1 MT/year**	**Phase 2 MT/year**	**Phase 3 MT/year**	**Total MT/year**
Production capacity			30.000	35.000	60.000	125.000
Crude Glycerin (crude 80%)			41.209	48.077	82.418	171.703
Net feedstock Glycerin (100 %)			32.967	38.462	65.934	137.363
Methane	1,5 % of feed Glycerin		495	577	989	2.060
Methanol		2,0%	600	700	1.200	2.500
Ethanol propanol		1,0%	300	350	600	1.250
Total Alcohols.		3,0%	900	1.050	1.800	3.750
Propylene glycol		86,0%	25.800	30.100	51.600	107.500
Ethylene glycol		11,0%	3.300	3.850	6.600	13.750
Total liquid Products.		100,0%	30.000	35.000	60.000	125.000
Total liquid products - excluding methane:			**30.000**	**35.000**	**60.000**	**125.000**

3) Estimated product price and raw material price

	Euro/ton					
Chemicals:	**Price**	**Tons/a**	**Phase 1**	**Phase 2**	**Phase 3**	**Total**
			Total value in Euro			
Raw materials						
Crude Glycerin (80 %), ex-factory	**280**	NW-Europe	11.538.462	13.461.538	23.076.923	48.076.923
Glycols						
Propylene glycol	**1.150**	NW-Europe	29.670.000	34.615.000	59.340.000	123.625.000
Ethylene glycol	**850**	NW-Europe	2.805.000	3.272.500	5.610.000	11.687.500
	1.210	1083	32.475.000	37.887.500	64.950.000	135.312.500
Alcohols						
Ethanol	**700**	NW-Europe	210.000	245.000	420.000	875.000
Methanol	**700**	NW-Europe	420.000	490.000	840.000	1.750.000
	700		630.000	735.000	1.260.000	2.625.000
Gas						
Methane (0,714 kg/Nm^3)	**400**	NW-Europe	197.802	230.769	395.604	824.176
Total - without methane:			**33.105.000**	**38.622.500**	**66.210.000**	**137.937.500**
Total - average price pr MT			*1.104*	*1.104*	*1.104*	*1.104*
Total revenue - with methane			**33.302.802**	**38.853.269**	**66.605.604**	**138.761.676**

4) Freight cost - logistics:

Description	**Euro/MT**	
NW-Europe-Iceland, liquid cargo	25	Sea freight is very sensitive
Trucking - factory to harbor - liquid cargo	7,42	to size. 15 Euro/MT
Trucking & Storage factory to depot - alcohols	16,5	for 15.000 t lots and
Piping- factory to depot - methane	40	50 Euro/MTfor 1.250 t lots.

5) Currency rates (ISK to) used in this report

USD	116,0
EUR	159,0
GBP	183,0
NKR	21,00

6) Investment estimate - phase 1, 2 and 3:

Phase 1 - 30.000 tons capacity:	**Euro**		**Depreciation**	
Connector to RARIK	748.428	5%	10,0%	
Design, engineering, construction management:	1.500.000	9%	10,0%	
Land, building and premises:	1.200.000	8%	3,0%	
Storage tanks:	2.917.926	18%	10,0%	
Hydrogen electrolyser:	0	0%	12,5%	
Evaporators and distillation:	3.800.000	24%	10,0%	
Other fixtures and fittings:	3.200.000	20%	10,0%	
Contingency:	2.500.000	16%	10,0%	
Total: -10 % /+35% accuracy	**15.866.354**	**100%**	**1.502.635**	annually
Year 0-2				
Phase 2 - 35.000 tons capacity:				
Total investment: -10 % /+35% accuracy	**13.000.000**		**9,5%**	
Year 3-4				
Phase 3 - 60.000 tons capacity:				
Total investment: -15/+-50 % accuracy	**17.900.000**		**9,5%**	
Year 5-6				

7) Power consumption:

	Phase 1	**Phase 2**	**Phase 3**	**Total**
Transmission cost	149.186	285.850	559.180	994.216
Electrical consumption(w.electrolyzer) - full capacity: kW	1.180	2.360	4.720	8.260
Number of hours:	8.300	8.300	8.300	
Gigawatthours:	9,794	19,588	39,176	68,6
Electrical cost -Euro/kWh	0,023	0,023	0,023	
Total cost at full capacity: Euro	**374.448**	**736.374**	**1.460.228**	**2.571.050**
Thermal power consumption: kW	8.500	17.000	34.000	59.500
Converted to steam equiv. (t/h, 12 bar): t/h	14	28	56	97
Operating hours per year:	8.300	8.300	8.300	
Cost of steam equivalent: Euro pr ton	15	6	6	
Total thermal power cost at full capacity: Euro	**1.731.682**	**1.385.345**	**2.770.691**	**5.887.718**
Hydrogen power consumption: Nm3/h	900	1.800	3.600	6.300
Converted to t/h	0,08	0,16	0,32	0,567
Number of hours	8.300	8.300	8.300	
Cost of hydrogen: Euro pr. Ton	700	700	700	
Total hydrogen power cost at full capacity: Euro	**470.610**	**941.220**	**1.882.440**	**3.294.270**
Tank storage rental (Euro Per Year)	**0**	**0**	**0**	**0**
Thermal power generated with electricity:				
Gigawatthours - efficiency 1,1	77,6	155,2	310,4	543,2

8) Employment - phase 1 + additional workers for expanding to phase 2 and 3:

Description	Unit cost pr year	Number	Phase 1 Euro	Number	Phase 2 Euro	Number	Phase 3 Euro
Mgn. Director	58.125	1	58.125				
Production Dir.	55.350	1	55.350				
Laboratory Dir.	49.050	1	49.050				
Line staff	24.900	12	298.800	4	99.600	4	99.600
Maintenance	41.250	2	82.500	1	41.250	2	82.500
Quality assurance	40.950	2	81.900	1	40.950	1	40.950
Office workers	41.550	1	41.550	1	41.550		0
Various	27.750	2	55.500	2	55.500	1	27.750
Total:		**22**	**722.775**	9	278.850	8	250.800
			Phase 2 - total staff and cost:	**31**	**1.001.625**		
					Phase 3 - total staff and cost:	**39**	**1.252.425**

9) Marketing cost, license fee and cost of catalyst:

Desription			Phase 1	Phase 2	Phase 3	Total
Marketing cost:	4,0%	of sales:	1.332.112	1.554.131	2.664.224	5.412.500
Royalty: 1% of sales	1%	Euro per t product.:	331.050	386.225	662.100	1.379.375
Catalyst cost	40	Euro per t product.:	1.200.000	1.400.000	2.400.000	5.000.000

10) Various fixed cost:

			Phase 1	Phase 2	Phase 3	Total
Maintenance:	4,0%	of investment:	634.654	520.000	716.000	1.870.654
Insurance:	0,75%	of investment:	118.998	97.500	134.250	350.748
Travels - staff:	7000	Euro per person	28.000	7.000	7.000	42.000
Telephone:	400	Euro per person	8.800	3.600	3.200	15.600
IT system:	1700	Euro per person	37.400	15.300	13.600	66.300
Security:		estimate	60.000	15.000	15.000	90.000
Auditing and consulting:		estimate	70.000	17.500	35.000	122.500
Various cost:		estimate	191.570	135.180	184.810	511.560
Total - various fixed cost:			1.149.422	811.080	1.108.860	3.069.362
Percentage of total sales:			*3,5%*	*2,1%*	*1,7%*	*2,2%*

11) Transmission cost

				Phase 1	Phase 2	Phase 3
Delivery Charge	12.521	€/year		12.521	12.521	12.521
Capacity charge	44,30	€/kw		52.276	104.552	209.105
Energy charge	8,62	€/kWh		84.389	168.777	337.554
			Total	149.186	285.850	559.180

Profit and loss

Sales, freight cost and marketing cost in Euro:

	Description:		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
i)	**Glycols:**	Phase 1:	32.475.000	32.475.000	32.475.000	32.475.000	32.475.000	32.475.000	32.475.000	32.475.000	32.475.000	32.475.000
		Phase 2:			37.887.500	37.887.500	37.887.500	37.887.500	37.887.500	37.887.500	37.887.500	37.887.500
		Phase 3:					64.950.000	64.950.000	64.950.000	64.950.000	64.950.000	64.950.000
			32.475.000	32.475.000	70.362.500	70.362.500	135.312.500	135.312.500	135.312.500	135.312.500	135.312.500	135.312.500
	Product:											
	Glycols - sea freight:		670.971	670.971	1.163.017	1.163.017	1.956.999	1.956.999	1.956.999	1.956.999	1.956.999	1.956.999
	Glycols - trucking:		199.144	199.144	431.479	431.479	829.768	829.768	829.768	829.768	829.768	829.768
ii)	**Alcohols:**	Phase 1	630.000	630.000	630.000	630.000	630.000	630.000	630.000	630.000	630.000	630.000
		Phase 2			735.000	735.000	735.000	735.000	735.000	735.000	735.000	735.000
		Phase 3					1.260.000	1.260.000	1.260.000	1.260.000	1.260.000	1.260.000
			630.000	630.000	1.365.000	1.365.000	2.625.000	2.625.000	2.625.000	2.625.000	2.625.000	2.625.000
	Alcohols - trucking:		14.850	14.850	32.175	32.175	61.875	61.875	61.875	61.875	61.875	61.875
	Total sales		33.105.000	33.105.000	71.727.500	71.727.500	137.937.500	137.937.500	137.937.500	137.937.500	137.937.500	137.937.500
iii)	**Glycerin:**	Phase 1	11.538.462	11.538.462	11.538.462	11.538.462	11.538.462	11.538.462	11.538.462	11.538.462	11.538.462	11.538.462
	Feedstock	Phase 2			13.461.538	13.461.538	13.461.538	13.461.538	13.461.538	13.461.538	13.461.538	13.461.538
		Phase 3					23.076.923	23.076.923	23.076.923	23.076.923	23.076.923	23.076.923
			11.538.462	11.538.462	25.000.000	25.000.000	48.076.923	48.076.923	48.076.923	48.076.923	48.076.923	48.076.923
			35%	35%	35%	35%	35%	35%	35%	35%	35%	35%
	Crude Glycerin - sea freight:		1.030.220	1.030.220	1.785.714	1.785.714	3.004.808	2.575.549	2.575.549	2.575.549	2.575.549	2.575.549
iv)	Sea freight - total:		1.701.191	1.701.191	2.948.731	2.948.731	4.961.807	4.532.548	4.532.548	4.532.548	4.532.548	4.532.548
	Trucking - total:		213.994	213.994	463.654	463.654	891.643	891.643	891.643	891.643	891.643	891.643
	Tank storage rental		-	-	-	-	-	-	-	-	-	-
	Total freight and storage cost:		***1.915.185***	***1.915.185***	***3.412.385***	***3.412.385***	***5.853.449***	***5.424.191***	***5.424.191***	***5.424.191***	***5.424.191***	***5.424.191***

Energy cost

v)	**Electricity:**	Phase 1	374.448	374.448	374.448	374.448	374.448	374.448	374.448	374.448	374.448	374.448
		Phase 2			736.374	736.374	736.374	736.374	736.374	736.374	736.374	736.374
		Phase 3					1.460.228	1.460.228	1.460.228	1.460.228	1.460.228	1.460.228
			374.448	374.448	1.110.822	1.110.822	2.571.050	2.571.050	2.571.050	2.571.050	2.571.050	2.571.050
vi)	**Thermal energy:**	Phase 1	1.731.682	1.731.682	1.731.682	1.731.682	1.731.682	1.731.682	1.731.682	1.731.682	1.731.682	1.731.682
		Phase 2			1.385.345	1.385.345	1.385.345	1.385.345	1.385.345	1.385.345	1.385.345	1.385.345
		Phase 3					2.770.691	2.770.691	2.770.691	2.770.691	2.770.691	2.770.691
			1.731.682	1.731.682	3.117.027	3.117.027	5.887.718	5.887.718	5.887.718	5.887.718	5.887.718	5.887.718
vii)	**Hydrogen energy:**	Phase 1	470.610	470.610	470.610	470.610	470.610	470.610	470.610	470.610	470.610	470.610
		Phase 2			941.220	941.220	941.220	941.220	941.220	941.220	941.220	941.220
		Phase 3					1.882.440	1.882.440	1.882.440	1.882.440	1.882.440	1.882.440
			470.610	470.610	1.411.830	1.411.830	3.294.270	3.294.270	3.294.270	3.294.270	3.294.270	3.294.270
	Total energy cost:		2.576.739	2.576.739	5.639.679	5.639.679	11.753.038	11.753.038	11.753.038	11.753.038	11.753.038	11.753.038
	Proportion of sales:		*8%*	*8%*	*8%*	*8%*	*9%*	*9%*	*9%*	*9%*	*9%*	*9%*

Estimated profit and loss account:

EUR		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Total sales - CIF:		**33.105.000**	**33.105.000**	**71.727.500**	**71.727.500**	**137.937.500**	**137.937.500**	**137.937.500**	**137.937.500**	**137.937.500**	**137.937.500**
Marketing cost:		1.324.200	1.324.200	2.869.100	2.869.100	5.517.500	5.517.500	5.517.500	5.517.500	5.517.500	5.517.500
Total sales, net		**31.780.800**	**31.780.800**	**68.858.400**	**68.858.400**	**132.420.000**	**132.420.000**	**132.420.000**	**132.420.000**	**132.420.000**	**132.420.000**
Variable cost:											
Cost of raw material:		11.538.462	11.538.462	25.000.000	25.000.000	48.076.923	48.076.923	48.076.923	48.076.923	48.076.923	48.076.923
Sea freight cost:		1.701.191	1.701.191	2.948.731	2.948.731	4.961.807	4.532.548	4.532.548	4.532.548	4.532.548	4.532.548
Product trucking cost:		213.994	213.994	463.654	463.654	891.643	891.643	891.643	891.643	891.643	891.643
Electrical cost:		374.448	374.448	1.110.822	1.110.822	2.571.050	2.571.050	2.571.050	2.571.050	2.571.050	2.571.050
Hydrogen cost		470.610	470.610	1.411.830	1.411.830	3.294.270	3.294.270	3.294.270	3.294.270	3.294.270	3.294.270
Thermal energy cost:		1.731.682	1.731.682	3.117.027	3.117.027	5.887.718	5.887.718	5.887.718	5.887.718	5.887.718	5.887.718
Catalyst cost		1.648.352	1.648.352	3.571.429	3.571.429	6.868.132	6.868.132	6.868.132	6.868.132	6.868.132	6.868.132
Royalty:		317.808	317.808	688.584	688.584	1.324.200	1.324.200	1.324.200	1.324.200	1.324.200	1.324.200
		17.996.546	17.996.546	38.312.077	38.312.077	73.875.743	73.446.484	73.446.484	73.446.484	73.446.484	73.446.484
		54%	54%	53%	53%	54%	53%	53%	53%	53%	53%
Fixed cost:											
Salaries and wages		722.775	722.775	1.001.625	1.001.625	1.252.425	1.252.425	1.252.425	1.252.425	1.252.425	1.252.425
Maintenance		634.654	634.654	1.154.654	1.154.654	1.870.654	1.870.654	1.870.654	1.870.654	1.870.654	1.870.654
Insurance		118.998	118.998	216.498	216.498	350.748	350.748	350.748	350.748	350.748	350.748
Storage Tank Rental		0	0	0	0	0	0	0	0	0	0
Other fixed cost		395.770	395.770	589.350	589.350	847.960	847.960	847.960	847.960	847.960	847.960
		1.872.197	1.872.197	2.962.127	2.962.127	4.321.787	4.321.787	4.321.787	4.321.787	4.321.787	4.321.787
Total costs		19.868.743	19.868.743	41.274.204	41.274.204	78.197.530	77.768.271	77.768.271	77.768.271	77.768.271	77.768.271
		6%	6%	4%	4%	3%	3%	3%	3%	3%	3%
EBITDA:		**11.912.057**	**11.912.057**	**27.584.196**	**27.584.196**	**54.222.470**	**54.651.729**	**54.651.729**	**54.651.729**	**54.651.729**	**54.651.729**
		36%	*36%*	*38%*	*38%*	*39%*	*40%*	*40%*	*40%*	*40%*	*40%*
Depreciation		1.502.635	1.502.635	2.733.811	2.733.811	4.429.044	4.429.044	4.429.044	4.429.044	4.429.044	4.429.044
		5%	*5%*	*4%*	*4%*	*3%*	*3%*	*3%*	*3%*	*3%*	*3%*
Financial items:		-181.017	41.575	-290.277	281.669	121.177	1.257.300	2.472.217	3.704.387	4.953.904	6.193.365
Profit before tax:		10.228.404	10.450.996	24.560.109	25.132.055	49.914.603	51.479.985	52.694.901	53.927.072	55.176.589	56.416.050
Used deployment cost against taxes/ rapid depreciation											
		31%	*32%*	*34%*	*35%*	*36%*	*37%*	*38%*	*39%*	*40%*	*41%*
Corporate tax (20%):	20%	511.420	836.080	1.964.809	2.513.205	4.991.460	5.147.998	5.796.439	6.471.249	6.621.191	7.898.247
Profit/loss:		**9.716.984**	**9.614.917**	**22.595.300**	**22.618.849**	**44.923.143**	**46.331.986**	**46.898.462**	**47.455.823**	**48.555.398**	**48.517.803**
		29%	*29%*	*32%*	*32%*	*33%*	*34%*	*34%*	*34%*	*35%*	*35%*

Cash flow and equity

Equity:

	Investment		Equity		Loan capital
	Euro	%	Euro	%	Euro
Phase 1	15.866.354	100%	11.899.765	25%	3.966.588
Phase 2	13.000.000	100%	2.600.000	80%	10.400.000
Phase 3	17.900.000	100%	3.580.000	80%	14.320.000

Interest rate:

Euro loans:	Libor: 0,17%	Premium: 6,00%	Total: 6,17%
Euro deposits:			Total: 2,06%

Income:

Estimated length of time of receivables: 2 months 16,67% of the annual income

Cost:

Estimated length of time of payables: 1 months 8,33% of the annual cost 8 years

Year	Beginning of 0	1	2	3	4	5	6	7	8	9	10
Loan 1+first year interest	4.227.420										
Principal		-528.428	-528.428	-528.428	-528.428	-528.428	-528.428	-528.428	-528.428		
Interests:		-260.832	-228.228	-195.624	-163.020	-130.416	-97.812	-65.208	-32.604		
Loan 2 + first year interest			11.083.875								
Principal				-1.385.484	-1.385.484	-1.385.484	-1.385.484	-1.385.484	-1.385.484	-1.385.484	-1.385.484
Interests:				-683.875	-598.391	-512.906	-427.422	-341.938	-256.453	-170.969	-85.484
Loan 3 + first year interest					15.261.643						
Principal						-1.907.705	-1.907.705	-1.907.705	-1.907.705	-1.907.705	-1.907.705
Interest:						-941.643	-823.938	-706.233	-588.527	-470.822	-353.116

*** Loans are paid out at the beginning of the year and accrue interest that year.**

NPV and IRR estimates

	0-1	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Revenue:			31.780.800	31.780.800	68.858.400	68.858.400	132.420.000	132.420.000	132.420.000	132.420.000	132.420.000	132.420.000
Operational Cost:			19.868.743	19.868.743	41.274.204	41.274.204	78.197.530	77.768.271	77.768.271	77.768.271	77.768.271	77.768.271
Share capital:	1000000	12.899.765	12.899.765	15.499.765	15.499.765	19.079.765	19.079.765	19.079.765	19.079.765	19.079.765	19.079.765	19.079.765
Investment:	-1000000	-15.866.354		-13.000.000		-17.900.000						
Loan capital:		3.966.588		10.400.000		14.320.000						
Operational Capital Need	100000	100.000										
New Equity needed	-1000000	-11.799.765	0	-2.600.000	0	-3.580.000	0	0	0	0	0	0
Income:			26.484.000	31.780.800	62.678.800	68.858.400	121.826.400	132.420.000	132.420.000	132.420.000	132.420.000	132.420.000
Operational cost:	900000		-18.213.014	-19.868.743	-39.490.416	-41.274.204	-75.120.586	-77.804.043	-77.768.271	-77.768.271	-77.768.271	-77.768.271
Cash Flow from Operations	900000		**8.270.986**	**11.912.057**	**23.188.384**	**27.584.196**	**46.705.814**	**54.615.957**	**54.651.729**	**54.651.729**	**54.651.729**	**54.651.729**
Equity Inflow :	-1000000	-11.799.765		-2.600.000		-3.580.000						
Principal Payment of loans:		0	-528.428	-528.428	-1.913.912	-1.913.912	-3.821.617	-3.821.617	-3.821.617	-3.821.617	-3.293.190	-3.293.190
Financial items:		0	-181.017	41.575	-290.277	281.669	121.177	1.257.300	2.472.217	3.704.387	4.953.904	6.193.365
Corporate tax:				-511.420	-836.080	-1.964.809	-2.513.205	-4.991.460	-5.147.998	-5.796.439	-6.471.249	-6.621.191
Free Cash flow to equity	-1000000	**-11.799.765**	**7.561.541**	**8.313.784**	**20.148.116**	**20.407.145**	**40.492.168**	**47.060.180**	**48.154.329**	**48.738.059**	**49.841.194**	**50.930.713**
		280										

	IRR	93,2%
NPV	95.347.804	15%

Cash at beginning of period		100.000	100.000	7.661.541	18.575.325	38.723.441	62.710.585	103.202.753	150.262.933	198.417.262	247.155.321	296.996.516
Cast at end of period		100.000	7.661.541	18.575.325	38.723.441	62.710.585	103.202.753	150.262.933	198.417.262	247.155.321	296.996.516	347.927.229
Interest income:			79.815	269.802	589.222	1.043.080	1.706.142	2.606.472	3.585.595	4.581.971	5.595.695	6.631.966
Interest paid on long term loans:			-260.832	-228.228	-879.499	-761.411	-1.584.966	-1.349.172	-1.113.378	-877.584	-641.790	-438.601
Finical items - total:			-181.017	41.575	-290.277	281.669	121.177	1.257.300	2.472.217	3.704.387	4.953.904	6.193.365

Additional

Constructions

Tank construction 2500m3	**212.068 €**
Sump and sewage system, filling station, fences	95.932 €
Piping to outer harbor	39.426 €
Fire extinguishing system with foam for methanol	93.029 €
Pumping system with a control house	36.439 €
Scada system	37.834 €
Miscellaneous and contingency	85.841 €
Design management	33.764 €
Total	**634.332 €**

Tank construction 1000m3	**84.827 €**
Sump and sewage system, filling station, fences	38.373 €
Piping to outer harbor	15.770 €
Fire extinguishing system with foam for methanol	37.212 €
Pumping system with a control house	14.575 €
Scada system	15.134 €
Miscellaneous and contingency	34.336 €
Design management	13.506 €
Total	**253.733 €**

Tank construction 4000m3	**339.308 €**
Sump and sewage system, filling station, fences	153.491 €
Piping to outer harbor	63.082 €
Fire extinguishing system with foam for methanol	148.846 €
Pumping system with a control house	58.302 €
Scada system	60.535 €
Miscellaneous and contingency	137.345 €
Design management	54.022 €
Total	**1.014.931 €**

Appendix – Bjarnarflag

Fundamentals

1. Project timeline - capacity - investment:

	Production capacity in tpa						
Year/description:	**Phase 1**		**Phase 2**		**Phase 3**		**Total**
(Feasibility study cost 1 M.euro)							
Investment - EURO:	15.285.755		16.000.000		17.900.000		49.185.755
Capacity - tons(products):	30.000		35.000		60.000		125.000
0							
1	30.000	100%					30.000
2	30.000	100%					30.000
3	30.000	100%	35.000	100%			65.000
4	30.000	100%	35.000	100%			65.000
5	30.000	100%	35.000	100%	60.000	100%	125.000
6	30.000	100%	35.000	100%	60.000	100%	125.000
7	30.000	100%	35.000	100%	60.000	100%	125.000
8	30.000	100%	35.000	100%	60.000	100%	125.000
9	30.000	100%	35.000	100%	60.000	100%	125.000
10	30.000	100%	35.000	100%	60.000	100%	125.000

2. G2G - Raw material usage/Product(s) distribution

Raw material / products		**Distrib. weight**	**Phase 1 MT/year**	**Phase 2 MT/year**	**Phase 3 MT/year**	**Total MT/year**
Production capacity			30.000	35.000	60.000	125.000
Crude Glycerin(crude 80%)			41.209	48.077	82.418	171.703
Net feedstock Glycerin(100 %)			32.967	38.462	65.934	137.363
Methane	1,5 % of feed Glycerin		495	577	989	2.060
Methanol		2,0%	600	700	1.200	2.500
Ethanol propanol		1,0%	300	350	600	1.250
Total Alcohols.		3,0%	900	1.050	1.800	3.750
Propylene glycol		86,0%	25.800	30.100	51.600	107.500
Ethylene glycol		11,0%	3.300	3.850	6.600	13.750
Total liquid Products.		100,0%	30.000	35.000	60.000	125.000
Total liquid products - excluding methane:			**30.000**	**35.000**	**60.000**	**125.000**

3. Estimated product price and raw material price - based on prices in September 2011.

	Euro/ton					
Chemicals:	**Price**	**Tons/a**	**Phase 1**	**Phase 2**	**Phase 3**	**Total**
			Total value in Euro			
Raw materials						
Crude Glycerin (80 %), ex factory	**280**	NW-Europe	11.538.462	13.461.538	23.076.923	48.076.923
Glycols						
Propylene glycol	**1.150**	NW-Europe	29.670.000	34.615.000	59.340.000	123.625.000
Ethylene glycol	**850**	NW-Europe	2.805.000	3.272.500	5.610.000	11.687.500
	1.210	1083	32.475.000	37.887.500	64.950.000	135.312.500
Alcohols						
Ethanol	**700**	NW-Europe	210.000	245.000	420.000	875.000
Methanol	**700**	NW-Europe	420.000	490.000	840.000	1.750.000
	700		630.000	735.000	1.260.000	2.625.000
Gas						
Methane (0,714 kg/Nm^3)	**400**	NW-Europe	197.802	230.769	395.604	824.176
Total - without methane:			**33.105.000**	**38.622.500**	**66.210.000**	**137.937.500**
Total - average price pr MT			*1.104*	*1.104*	*1.104*	*1.104*
Total revenue - with methane			**33.302.802**	**38.853.269**	**66.605.604**	**138.761.676**

4. Freight cost - logistics:

Description	**Euro/MT**	
NW-Europe-Iceland, liquid cargo	25	Sea freight is very sensi-
Trucking - factory to harbor - liquid cargo	7,42	tive to size. 15 Euro/MT
Trucking & Storage factory to depot - alcohols	16,5	for 15.000 t lots and
Piping- factory to depot - methane	40	50 Euro/MT for 1.250 t lots.

5. Currency rates (ISK to) used in this feasibility study:

USD	116,0
EUR	159,0
GBP	183,0
NKR	21,00

6. Investment estimate - phase 1, 2 and 3:

Phase 1 - 30.000 tons capacity:	**Euro**		**Depreciation**	
Connectors to Bjarnarflag power plant	748.428	5%	10%	
Design, engineering, construction management:	1.500.000	10%	10,0%	
Land, building and premises:	1.000.000	7%	3,0%	
Storage tanks:	2.537.327	17%	10,0%	
Hydrogen electrolyser:	0	0%	12,5%	
Evaporators and distillation:	3.800.000	25%	10,0%	
Other fixtures and fittings:	3.200.000	21%	10,0%	
Contingency:	2.500.000	16%	10,0%	
Total: -10 % /+35% accuracy	**15.285.755**	**100%**	**2.132.160**	annually
Year 0-2				
Phase 2 - 35.000 tons capacity:				
Total investment: -10 % /+35% accuracy	**16.000.000**		**13,9%**	
Year 3-4				
Phase 3 - 60.000 tons capacity:				
Total investment: -15/+-50 % accuracy	**17.900.000**		**13,9%**	
Year 5-6				

7. Power consumption:

	Phase 1	**Phase 2**	**Phase 3**	**Total**
Electrical consumption(w.electrolyzer) - full capacity: kW	1.180	7.360	19.720	28.260
Number of hours:	8.300	8.300	8.300	
Gigawatthours:	9,8	61,1	163,7	234,6
Electrical cost -Euro/kWh	0,023	0,023	0,023	
Total cost at full capacity: Euro	**225.262**	**1.405.024**	**3.764.548**	**5.394.834**
Thermal power consumption: kW	8.500	17.000	34.000	59.500
Converted to steam equiv. (t/h, 12 bar): t/h	14	28	56	97
Operating hours per year:	8.300	8.300	8.300	
Cost of steam equivalent: Euro pr ton	1,25	1,25	1,25	
Total thermal power cost of full capacity: Euro	**144.307**	**288.614**	**577.227**	**1.010.148**
Hydrogen power consumption: Nm3/hour	900	1.800	3.600	6.300
Converted to t/h	0,08	0,16	0,32	0,567
Number of hours	8.300	8.300	8.300	
Cost of hydrogen: Euro pr. Ton	700	700	700	
Total hydrogen power cost at full capacity: Euro	**470.610**	**941.220**	**1.882.440**	**3.294.270**
Tank storage rental (Euro Per Year)	**432.000**	**432.000**	**432.000**	**1.296.000**
Thermal power generated with electricity:				
Gigawatthours - efficiency 1,1	77,6	155,2	310,4	543,2

8. Employment - phase 1 + additional workers for expanding to phase 2 and 3:

	Unit cost	Phase 1		Phase 2		Phase 3	
Description	**pr year**	**Number**	**Euro**	**Number**	**Euro**	**Number**	**Euro**
Mgn. Director	58.125	1	58.125				
Production Dir.	55.350	1	55.350				
Laboratory Dir.	49.050	1	49.050				
Line staff	24.900	12	298.800	4	99.600	4	99.600
Maintenance	41.250	2	82.500	1	41.250	2	82.500
Quality assurance	40.950	2	81.900	1	40.950	1	40.950
Office workers	41.550	1	41.550	1	41.550		0
Various	27.750	2	55.500	2	55.500	1	27.750
Total:		**22**	**722.775**	9	278.850	8	250.800

Phase 2 - total staff and cost:	**31**	**1.001.625**

Phase 3 - total staff and cost:	**39**	**1.252.425**

9. Marketing cost, license fee and cost of catalyst:

Description			**Phase 1**	**Phase 2**	**Phase 3**	**Total**
Marketing cost:	4,0%	of sales:	1.332.112	1.554.131	2.664.224	5.412.500
Royalty: 1% of sales	1%	Euro per t product.:	331.050	386.225	662.100	1.379.375
Catalyst cost	40	Euro per t product.:	1.200.000	1.400.000	2.400.000	5.000.000

10. Various fixed cost:

			Phase 1	**Phase 2**	**Phase 3**	**Total**
Maintenance:	4,0%	of investment:	611.430	640.000	716.000	1.967.430
Insurance:	0,75%	of investment:	114.643	120.000	134.250	368.893
Travels - staff:	7000	Euro per person	28.000	7.000	7.000	42.000
Telephone:	400	Euro per person	8.800	3.600	3.200	15.600
IT system:	1700	Euro per person	37.400	15.300	13.600	66.300
Security:		estimate	60.000	15.000	15.000	90.000
Auditing and consulting:		estimate	70.000	17.500	35.000	122.500
Various cost:		estimate	186.055	163.680	184.810	534.545
Total - various fixed cost:			1.116.328	982.080	1.108.860	3.207.268
Percentage of total sales:			*3,4%*	*2,5%*	*1,7%*	*2,3%*

Profit and loss

Sales, freight cost and marketing cost in Euro:

	Description:		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
i)	**Glycols:**	Phase 1:	32.475.000	32.475.000	32.475.000	32.475.000	32.475.000	32.475.000	32.475.000	32.475.000	32.475.000	32.475.000
		Phase 2:			37.887.500	37.887.500	37.887.500	37.887.500	37.887.500	37.887.500	37.887.500	37.887.500
		Phase 3:					64.950.000	64.950.000	64.950.000	64.950.000	64.950.000	64.950.000
			32.475.000	32.475.000	70.362.500	70.362.500	135.312.500	135.312.500	135.312.500	135.312.500	135.312.500	135.312.500
	Product:											
	Glycols – sea freight:		670.971	670.971	1.163.017	1.163.017	1.956.999	1.956.999	1.956.999	1.956.999	1.956.999	1.956.999
	Glycols - trucking:		215.287	215.287	466.456	466.456	897.031	897.031	897.031	897.031	897.031	897.031
ii)	**Alcohols:**	Phase 1	630.000	630.000	630.000	630.000	630.000	630.000	630.000	630.000	630.000	630.000
		Phase 2			735.000	735.000	735.000	735.000	735.000	735.000	735.000	735.000
		Phase 3					1.260.000	1.260.000	1.260.000	1.260.000	1.260.000	1.260.000
			630.000	630.000	1.365.000	1.365.000	2.625.000	2.625.000	2.625.000	2.625.000	2.625.000	2.625.000
	Alcohols - trucking:		15.349	15.349	33.257	33.257	63.955	63.955	63.955	63.955	63.955	63.955
	Total sales		33.105.000	33.105.000	71.727.500	71.727.500	137.937.500	137.937.500	137.937.500	137.937.500	137.937.500	137.937.500
iii)	**Glycerin:**	Phase 1	11.538.462	11.538.462	11.538.462	11.538.462	11.538.462	11.538.462	11.538.462	11.538.462	11.538.462	11.538.462
	Feedstock	Phase 2			13.461.538	13.461.538	13.461.538	13.461.538	13.461.538	13.461.538	13.461.538	13.461.538
		Phase 3					23.076.923	23.076.923	23.076.923	23.076.923	23.076.923	23.076.923
			11.538.462	11.538.462	25.000.000	25.000.000	48.076.923	48.076.923	48.076.923	48.076.923	48.076.923	48.076.923
			35%	35%	35%	35%	35%	35%	35%	35%	35%	35%
	Crude Glycerin – sea freight:		1.030.220	1.030.220	1.785.714	1.785.714	3.004.808	2.575.549	2.575.549	2.575.549	2.575.549	2.575.549
	Crude Glycerin - trucking:		328.630	328.630	712.031	712.031	1.369.291	1.369.291	1.369.291	1.369.291	1.369.291	1.369.291
iv)	Sea freight - total:		1.701.191	1.701.191	2.948.731	2.948.731	4.961.807	4.532.548	4.532.548	4.532.548	4.532.548	4.532.548
	Trucking - total:		559.267	559.267	1.211.744	1.211.744	2.330.277	2.330.277	2.330.277	2.330.277	2.330.277	2.330.277
	Tank storage rental		432.000	432.000	432.000	432.000	432.000	432.000	432.000	432.000	432.000	432.000
	Total freight and storage cost:		***2.692.457***	***2.692.457***	***4.592.475***	***4.592.475***	***7.724.084***	***7.294.826***	***7.294.826***	***7.294.826***	***7.294.826***	***7.294.826***

Energy cost

v)	**Electricity:**	Phase 1	225.262	225.262	225.262	225.262	225.262	225.262	225.262	225.262	225.262	225.262
		Phase 2			1.405.024	1.405.024	1.405.024	1.405.024	1.405.024	1.405.024	1.405.024	1.405.024
		Phase 3					3.764.548	3.764.548	3.764.548	3.764.548	3.764.548	3.764.548
			225.262	225.262	1.630.286	1.630.286	5.394.834	5.394.834	5.394.834	5.394.834	5.394.834	5.394.834
vi)	**Thermal energy:**	Phase 1	144.307	144.307	144.307	144.307	144.307	144.307	144.307	144.307	144.307	144.307
		Phase 2			288.614	288.614	288.614	288.614	288.614	288.614	288.614	288.614
		Phase 3					577.227	577.227	577.227	577.227	577.227	577.227
			144.307	144.307	432.920	432.920	1.010.148	1.010.148	1.010.148	1.010.148	1.010.148	1.010.148
vii)	**Hydrogen energy:**	Phase 1	470.610	470.610	470.610	470.610	470.610	470.610	470.610	470.610	470.610	470.610
		Phase 2			941.220	941.220	941.220	941.220	941.220	941.220	941.220	941.220
		Phase 3					1.882.440	1.882.440	1.882.440	1.882.440	1.882.440	1.882.440
			470.610	470.610	1.411.830	1.411.830	3.294.270	3.294.270	3.294.270	3.294.270	3.294.270	3.294.270
viii)	**Total energy cost:**		840.179	840.179	3.475.036	3.475.036	9.699.252	9.699.252	9.699.252	9.699.252	9.699.252	9.699.252
	Proportion of sales:		*3%*	*3%*	*5%*	*5%*	*7%*	*7%*	*7%*	*7%*	*7%*	*7%*

Estimated profit and loss account:

EUR	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Total sales - CIF:	**33.105.000**	**33.105.000**	**71.727.500**	**71.727.500**	**137.937.500**	**137.937.500**	**137.937.500**	**137.937.500**	**137.937.500**	**137.937.500**
Marketing cost:	1.324.200	1.324.200	2.869.100	2.869.100	5.517.500	5.517.500	5.517.500	5.517.500	5.517.500	5.517.500
Total sales, net	**31.780.800**	**31.780.800**	**68.858.400**	**68.858.400**	**132.420.000**	**132.420.000**	**132.420.000**	**132.420.000**	**132.420.000**	**132.420.000**
Variable cost:										
Cost of raw material:	11.538.462	11.538.462	25.000.000	25.000.000	48.076.923	48.076.923	48.076.923	48.076.923	48.076.923	48.076.923
Sea freight cost:	1.701.191	1.701.191	2.948.731	2.948.731	4.961.807	4.532.548	4.532.548	4.532.548	4.532.548	4.532.548
Product trucking cost:	559.267	559.267	1.211.744	1.211.744	2.330.277	2.330.277	2.330.277	2.330.277	2.330.277	2.330.277
Electrical cost:	225.262	225.262	1.630.286	1.630.286	5.394.834	5.394.834	5.394.834	5.394.834	5.394.834	5.394.834
Hydrogen cost	470.610	470.610	1.411.830	1.411.830	3.294.270	3.294.270	3.294.270	3.294.270	3.294.270	3.294.270
Thermal energy cost:	144.307	144.307	432.920	432.920	1.010.148	1.010.148	1.010.148	1.010.148	1.010.148	1.010.148
Catalyst cost	1.648.352	1.648.352	3.571.429	3.571.429	6.868.132	6.868.132	6.868.132	6.868.132	6.868.132	6.868.132
Royalty:	317.808	317.808	688.584	688.584	1.324.200	1.324.200	1.324.200	1.324.200	1.324.200	1.324.200
	16.605.257	16.605.257	36.895.524	36.895.524	73.260.590	72.831.332	72.831.332	72.831.332	72.831.332	72.831.332
	50%	50%	51%	51%	53%	53%	53%	53%	53%	53%
Fixed cost:										
Salaries and wages	722.775	722.775	1.001.625	1.001.625	1.252.425	1.252.425	1.252.425	1.252.425	1.252.425	1.252.425
Maintenance	611.430	611.430	1.251.430	1.251.430	1.967.430	1.967.430	1.967.430	1.967.430	1.967.430	1.967.430
Insurance	114.643	114.643	234.643	234.643	368.893	368.893	368.893	368.893	368.893	368.893
Storage Tank Rental	432.000	432.000	432.000	432.000	432.000	432.000	432.000	432.000	432.000	432.000
Other fixed cost	390.255	390.255	612.335	612.335	870.945	870.945	870.945	870.945	870.945	870.945
	2.271.103	2.271.103	3.532.033	3.532.033	4.891.693	4.891.693	4.891.693	4.891.693	4.891.693	4.891.693
Total costs	18.876.360	18.876.360	40.427.557	40.427.557	78.152.283	77.723.025	77.723.025	77.723.025	77.723.025	77.723.025
	7%	7%	5%	5%	4%	4%	4%	4%	4%	4%
EBITDA:	**12.904.440**	**12.904.440**	**28.430.843**	**28.430.843**	**54.267.717**	**54.696.975**	**54.696.975**	**54.696.975**	**54.696.975**	**54.696.975**
	39%	*39%*	*40%*	*40%*	*39%*	*40%*	*40%*	*40%*	*40%*	*40%*
Depreciation	2.132.160	2.132.160	4.363.949	4.363.949	6.860.762	6.860.762	6.860.762	6.860.762	6.860.762	6.860.762
	6%	*6%*	*6%*	*6%*	*5%*	*5%*	*5%*	*5%*	*5%*	*5%*
Financial items:	-161.721	80.033	-395.900	204.461	66.442	1.218.978	2.451.578	3.702.015	4.970.436	6.230.402
Profit before tax:	10.610.558	10.852.312	23.670.994	24.271.355	47.473.397	49.055.191	50.287.791	51.538.228	52.806.649	54.066.615
Used development cost against taxes/ rapid depreciation										
	32%	*33%*	*33%*	*34%*	*34%*	*36%*	*36%*	*37%*	*38%*	*39%*
Corporate tax (20%): 20%	530.528	868.185	1.893.680	2.427.135	4.747.340	4.905.519	5.531.657	6.184.587	6.336.798	7.569.326
Profit/loss:	**10.080.030**	**9.984.127**	**21.777.315**	**21.844.219**	**42.726.057**	**44.149.672**	**44.756.134**	**45.353.641**	**46.469.851**	**46.497.289**
	30%	*30%*	*30%*	*30%*	*31%*	*32%*	*32%*	*33%*	*34%*	*34%*
ROS	**31,72%**	**31,42%**	**31,63%**	**31,72%**	**32,27%**	**33,34%**	**33,80%**	**34,25%**	**35,09%**	**35,11%**

Cash flow and equity

Equity:

	Investment		Equity		Loan capital
	Euro	%	Euro	%	Euro
Phase 1	15.285.755	100%	11.464.316	25%	3.821.439
Phase 2	16.000.000	100%	3.200.000	80%	12.800.000
Phase 3	17.900.000	100%	3.580.000	80%	14.320.000

Interest rate:

Euro loans:	Libor: 0,17%	Premium: 6,00%	Total: 6,17%
Euro deposits:			Total: 2,06%

Income:

Estimated length of time of receivables: 2 months 16,67% of the annual income

Cost:

Estimated length of time of payables: 1 months 8,33% of the annual cost 8 years

Year	Beginning of 0	1	2	3	4	5	6	7	8	9	10
Loan 1+first year interest	4.072.726										
Principal		-509.091	-509.091	-509.091	-509.091	-509.091	-509.091	-509.091	-509.091		
Interests:		-251.287	-219.876	-188.465	-157.054	-125.644	-94.233	-62.822	-31.411		
Loan 2 + first year interest			13.641.692								
Principal				-1.705.212	-1.705.212	-1.705.212	-1.705.212	-1.705.212	-1.705.212	-1.705.212	-1.705.212
Interests:				-841.692	-736.481	-631.269	-526.058	-420.846	-315.635	-210.423	-105.212
Loan 3 + first year interest					15.261.643						
Principal						-1.907.705	-1.907.705	-1.907.705	-1.907.705	-1.907.705	-1.907.705
Interest:						-941.643	-823.938	-706.233	-588.527	-470.822	-353.116

*** Loans are paid out at the beginning of the year and accrue interest that year.**

NPV and IRR estimates

	0-1	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Revenue:			31.780.800	31.780.800	68.858.400	68.858.400	132.420.000	132.420.000	132.420.000	132.420.000	132.420.000	132.420.000
Operational Cost:			18.876.360	18.876.360	40.427.557	40.427.557	78.152.283	77.723.025	77.723.025	77.723.025	77.723.025	77.723.025
Share capital:	1000000	12.464.316	12.464.316	15.664.316	15.664.316	19.244.316	19.244.316	19.244.316	19.244.316	19.244.316	19.244.316	19.244.316
Investment:	-1000000	-15.285.755		-16.000.000		-17.900.000						
Loan capital:		3.821.439		12.800.000		14.320.000						
Operational Capital Need	100000	100.000										
New Equity needed	-1000000	-11.364.316	0	-3.200.000	0	-3.580.000	0	0	0	0	0	0
Income:			26.484.000	31.780.800	62.678.800	68.858.400	121.826.400	132.420.000	132.420.000	132.420.000	132.420.000	132.420.000
Operational cost:	900000		-17.303.330	-18.876.360	-38.631.624	-40.427.557	-75.008.556	-77.758.797	-77.723.025	-77.723.025	-77.723.025	-77.723.025
Cash Flow form Operations	900000		**9.180.670**	**12.904.440**	**24.047.176**	**28.430.843**	**46.817.844**	**54.661.203**	**54.696.975**	**54.696.975**	**54.696.975**	**54.696.975**
Equity Inflow :	-1000000	-11.364.316		-3.200.000		-3.580.000						
Principal Payment of loans:		0	-509.091	-509.091	-2.214.302	-2.214.302	-4.122.008	-4.122.008	-4.122.008	-4.122.008	-3.612.917	-3.612.917
Financial items:		0	-161.721	80.033	-395.900	204.461	66.442	1.218.978	2.451.578	3.702.015	4.970.436	6.230.402
Corporate tax:				-530.528	-868.185	-1.893.680	-2.427.135	-4.747.340	-4.905.519	-5.531.657	-6.184.587	-6.336.798
Free Cash flow to equity	-1000000	**-11.364.316**	**8.509.858**	**8.744.854**	**20.568.789**	**20.947.322**	**40.335.143**	**47.010.834**	**48.121.026**	**48.745.325**	**49.869.907**	**50.977.662**
		280										

	IRR	98,4%
NPV	96.921.861	15%

Cash at beginning of period		100.000	100.000	8.609.858	20.554.712	41.123.500	65.650.822	105.985.965	152.996.798	201.117.824	249.863.149	299.733.056
Cast at end of period		100.000	8.609.858	20.554.712	41.123.500	65.650.822	105.985.965	152.996.798	201.117.824	249.863.149	299.733.056	350.710.718
Interest income:			89.566	299.909	634.258	1.097.996	1.764.998	2.663.206	3.641.479	4.637.588	5.651.681	6.688.730
Interest paid on long term loans:			-251.287	-219.876	-1.030.158	-893.535	-1.698.556	-1.444.228	-1.189.901	-935.573	-681.245	-458.328
Financial items - total:			-161.721	80.033	-395.900	204.461	66.442	1.218.978	2.451.578	3.702.015	4.970.436	6.230.402

Appendix - Djúpivogur

Fundamentals

1) Project timeline - capacity - investment:

	Production capacity in tpa						
Year/description:	**Phase 1**		**Phase 2**		**Phase 3**		**Total**
(Feasibility study cost 1 M.euro)							
Investment - EURO:	18.105.771		15.000.000		21.900.000		55.005.771
Capacity - tons(products):	30.000		35.000		60.000		125.000
0							
1	30.000	100%					30.000
2	30.000	100%					30.000
3	30.000	100%	35.000	100%			65.000
4	30.000	100%	35.000	100%			65.000
5	30.000	100%	35.000	100%	60.000	100%	125.000
6	30.000	100%	35.000	100%	60.000	100%	125.000
7	30.000	100%	35.000	100%	60.000	100%	125.000
8	30.000	100%	35.000	100%	60.000	100%	125.000
9	30.000	100%	35.000	100%	60.000	100%	125.000
10	30.000	100%	35.000	100%	60.000	100%	125.000

2) G2G - Raw material usage/Product(s) distribution

Raw material / products		**Distrib. weight**	**Phase 1 MT/year**	**Phase 2 MT/year**	**Phase 3 MT/year**	**Total MT/year**
Production capacity			30.000	35.000	60.000	125.000
Crude Glycerin (crude 80%)			41.209	48.077	82.418	171.703
Net feedstock Glycerin (100 %)			32.967	38.462	65.934	137.363
Methane	1,5 % of feed Glycerin		495	577	989	2.060
Methanol		2,0%	600	700	1.200	2.500
Ethanol propanol		1,0%	300	350	600	1.250
Total Alcohols.		3,0%	900	1.050	1.800	3.750
Propylene glycol		86,0%	25.800	30.100	51.600	107.500
Ethylene glycol		11,0%	3.300	3.850	6.600	13.750
Total liquid Products.		100,0%	30.000	35.000	60.000	125.000
Total liquid products - excluding methane:			**30.000**	**35.000**	**60.000**	**125.000**

3) Estimated product price and raw material price - based on prices in September 2010.

		Euro/ton				
Chemicals:	NW-Europe	**Price**	**Phase 1**	**Phase 2**	**Phase 3**	**Total**
			Total value in Euro			
Raw materials						
Crude Glycerin (80 %), ex-factory		**280**	11.538.462	13.461.538	23.076.923	48.076.923
Glycols						
Propylene glycol		**1.150**	29.670.000	34.615.000	59.340.000	123.625.000
Ethylene glycol		**850**	2.805.000	3.272.500	5.610.000	11.687.500
	1083	**1.210**	32.475.000	37.887.500	64.950.000	135.312.500
Alcohols						
Ethanol		**700**	210.000	245.000	420.000	875.000
Methanol		**700**	420.000	490.000	840.000	1.750.000
		700	630.000	735.000	1.260.000	2.625.000
Gas						
Methane (0,714 kg/Nm^3)		**400**	197.802	230.769	395.604	824.176
Total - without methane:			**33.105.000**	**38.622.500**	**66.210.000**	**137.937.500**
Total - average price pr MT			*1.104*	*1.104*	*1.104*	*1.104*
Total revenue - with methane			**33.302.802**	**38.853.269**	**66.605.604**	**138.761.676**

4) Freight cost - logistics:

Description	**Euro/MT**	
NW-Europe-Iceland, liquid cargo	25	Sea freight is very sensi-
Trucking - factory to harbor - liquid cargo	7,19	tive to size. 15 Euro/MT
Trucking & Storage factory to depot - alcohols	16,5	for 15.000 t lots and
Piping- factory to depot - methane	40	50 Euro/MT for 1.250 t lots.

5) Currency rates (ISK to :)

USD	116
EUR	159
GBP	183
NKR	21

6) Investment estimate - phase 1, 2 and 3:

Phase 1 - 30.000 tons capacity:	**Euro**		**Depreciation**	
Steam boiler	2.188.679	12%	10,0%	
Connector to Landsnet	748.428	4%	10,0%	
Design, engineering, construction management:	1.000.000	6%	10,0%	
Land, building and premises:	400.000	2%	3,0%	
Storage tanks:	1.268.664	7%	10,0%	
Hydrogen electrolyser:	3.000.000	17%	12,5%	
Evaporators and distillation:	3.800.000	21%	10,0%	
Other fixtures and fittings:	3.200.000	18%	10,0%	
Contingency:	2.500.000	14%	10,0%	
Total: -10 % /+35% accuracy	**18.105.771**	**100%**	**1.857.577**	annually
Year 0-2				
Phase 2 - 35.000 tons capacity:				
Total investment: -10 % /+35% accuracy	**15.000.000**		**10,3%**	
Year 3-4				
Phase 3 - 60.000 tons capacity:				
Total investment: -15/+-50 % accuracy	**21.900.000**		**10,3%**	

7) Power consumption:

	Phase 1	**Phase 2**	**Phase 3**	**Total**
Transmission cost	330.968	455.781	872.533	1.659.283
Electrical consumption(w.electrolyzer) - full capacity: kW	6.180	12.360	24.720	43.260
Number of hours:	8.300	8.300	8.300	
Gigawatthours:	51,3	102,6	205,2	359,1
Electrical cost -Euro/kWh	0,02	0,02	0,02	
Total cost at full capacity: Euro	**1.510.730**	**2.815.305**	**5.591.581**	**9.917.617**
Thermal power consumption: kW	8.500	17.000	34.000	59.500
Converted to steam equiv. (t/h, 12 bar): t/h	14	28	56	97
Operating hours per year:	8.300	8.300	8.300	
Cost of steam equivalent: Euro pr ton	15	15	15	
Total thermal power cost at full capacity: Euro	**1.731.682**	**3.463.364**	**6.926.727**	**12.121.773**
Tank storage rental (Euro Per Year)	**200.000**	**400.000**	**600.000**	**1.200.000**
Thermal power generated with electricity: Gigawatthours - efficiency 1,1	77,6	155,2	310,4	543,2

8) Employment - phase 1 + additional workers for expanding to phase 2 and 3:

	Unit cost	Phase 1		Phase 2		Phase 3	
Description	**pr year**	**Number**	**Euro**	**Number**	**Euro**	**Number**	**Euro**
Mgn. Director	58.125	1	58.125				
Production Dir.	55.350	1	55.350				
Laboratory Dir.	49.050	1	49.050				
Line staff	24.900	12	298.800	4	99.600	4	99.600
Maintenance	41.250	2	82.500	1	41.250	2	82.500
Quality assurance	40.950	2	81.900	1	40.950	1	40.950
Office workers	41.550	1	41.550	1	41.550		0
Various	27.750	2	55.500	2	55.500	1	27.750
Total:		**22**	**722.775**	9	278.850	8	250.800
			Phase 2 - total staff and cost:	**31**	**1.001.625**		
					Phase 3 - total staff and cost:	**39**	**1.252.425**

9) Marketing cost, license fee and cost of catalyst:

Description			**Phase 1**	**Phase 2**	**Phase 3**	**Total**
Marketing cost:	4,0%	of sales:	1.332.112	1.554.131	2.664.224	5.412.500
Royalty: 1% of sales	1%	Euro per t product.:	331.050	386.225	662.100	1.379.375
Catalyst cost	40	Euro per t product.:	1.200.000	1.400.000	2.400.000	5.000.000

10) Various fixed cost:

			Phase 1	**Phase 2**	**Phase 3**	**Total**
Maintenance:	4,0%	of investment:	724.231	600.000	876.000	2.200.231
Insurance:	0,75%	of investment:	135.793	112.500	164.250	412.543
Travels - staff:	7000	Euro per person	28.000	7.000	7.000	42.000
Telephone:	400	Euro per person	8.800	3.600	3.200	15.600
IT system:	1700	Euro per person	37.400	15.300	13.600	66.300
Security:		estimate	60.000	15.000	15.000	90.000
Auditing and consulting:		estimate	70.000	17.500	35.000	122.500
Various cost:		estimate	212.845	154.180	222.810	589.835
Total - various fixed cost:			1.277.069	925.080	1.336.860	3.539.009
Percentage of total sales:			*3,8%*	*2,4%*	*2,0%*	*2,6%*

11) Transmission charges

			Phase 1 Yearly fee	Phase 2 Yearly fee	Phase 3 Yearly fee
Delivery Charge	39.029 €	€/year	39.029 €	39.029 €	39.029 €
Capacity charge	20.650 €	€/MW	127.618 €	255.236 €	510.473 €
Energy charge	1,045 €	€/MWh	53.588 €	107.177 €	214.353 €
Ancillary services	0,162 €	€/MWh	8.297 €	16.595 €	33.189 €
Transmission losses	0,368 €	€/MWh	18.872 €	37.745 €	75.489 €
		Total	**247.405 €**	**455.781 €**	**872.533 €**

12) Landsnet transmission charges with strain

Usages		
Load capacity	6,18	MW
Energy	51.294,000	MWh
Utilization	8.300	hrs.
ISK/EUR	0,00	kr.

Tariff for intensive users		
Delivery Charge	39.029	EUR per year
Capacity charge	20.650	EUR per MW per year
Energy charge	1,04	EUR per MWh
Ancillary services	0,1618	EUR per MWh
Transmission losses	0,3679	EUR per MWh
Intensive users strain		
Delivery Charge	0	EUR per year
Capacity charge	9.523	EUR per MW per year
Energy charge	0,48	EUR per MWh
Ancillary services	0,0000	EUR per MWh
Transmission losses	0,0000	EUR per MWh

Additional fee		
Delivery charge	0	EUR
Capacity charge	58.851	EUR
Energy charge	24.712,3203	EUR
Total for transmission	83.564	EUR

Up dated tariff		
Delivery Charge	39.029	EUR per year
Capacity charge	30.173	EUR per MW per year
Energy charge	1,53	EUR per MWh
Ancillary services	0,1618	EUR per MWh
Transmission losses	0,3679	EUR per MWh

Total tariff		
Delivery charge	39.029	EUR
Capacity charge	186.469	EUR
Energy charge	78.301	EUR
Ancillary services	8.297	EUR
Transmission losses	18.872	EUR
Total for transmission	330.968	EUR

Profit and Loss

Sales, freight cost and marketing cost in EUR:

	Description:		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
i)	**Glycols:**	Phase 1:	32.475.000	32.475.000	32.475.000	32.475.000	32.475.000	32.475.000	32.475.000	32.475.000	32.475.000	32.475.000
		Phase 2:			37.887.500	37.887.500	37.887.500	37.887.500	37.887.500	37.887.500	37.887.500	37.887.500
		Phase 3:					64.950.000	64.950.000	64.950.000	64.950.000	64.950.000	64.950.000
			32.475.000	32.475.000	70.362.500	70.362.500	135.312.500	135.312.500	135.312.500	135.312.500	135.312.500	135.312.500
	Product:											
	Glycols – sea freight:		670.971	670.971	1.163.017	1.163.017	1.956.999	1.956.999	1.956.999	1.956.999	1.956.999	1.956.999
	Glycols - trucking:		192.971	192.971	418.104	418.104	804.047	804.047	804.047	804.047	804.047	804.047
ii)	**Alcohols:**	Phase 1	630.000	630.000	630.000	630.000	630.000	630.000	630.000	630.000	630.000	630.000
		Phase 2			735.000	735.000	735.000	735.000	735.000	735.000	735.000	735.000
		Phase 3					1.260.000	1.260.000	1.260.000	1.260.000	1.260.000	1.260.000
			630.000	630.000	1.365.000	1.365.000	2.625.000	2.625.000	2.625.000	2.625.000	2.625.000	2.625.000
	Alcohols - trucking:		14.850	14.850	32.175	32.175	61.875	61.875	61.875	61.875	61.875	61.875
	Total sales		33.105.000	33.105.000	71.727.500	71.727.500	137.937.500	137.937.500	137.937.500	137.937.500	137.937.500	137.937.500
iii)	**Glycerin:**	Phase 1	11.538.462	11.538.462	11.538.462	11.538.462	11.538.462	11.538.462	11.538.462	11.538.462	11.538.462	11.538.462
	Feedstock	Phase 2			13.461.538	13.461.538	13.461.538	13.461.538	13.461.538	13.461.538	13.461.538	13.461.538
		Phase 3					23.076.923	23.076.923	23.076.923	23.076.923	23.076.923	23.076.923
			11.538.462	11.538.462	25.000.000	25.000.000	48.076.923	48.076.923	48.076.923	48.076.923	48.076.923	48.076.923
			35%	35%	35%	35%	35%	35%	35%	35%	35%	35%
	Crude Glycerin – sea freight:		1.030.220	1.030.220	1.785.714	1.785.714	3.004.808	2.575.549	2.575.549	2.575.549	2.575.549	2.575.549
iv)	Sea freight - total:		1.701.191	1.701.191	2.948.731	2.948.731	4.961.807	4.532.548	4.532.548	4.532.548	4.532.548	4.532.548
	Trucking - total:		207.821	207.821	450.279	450.279	865.922	865.922	865.922	865.922	865.922	865.922
	Tank storage rental		200.000	200.000	400.000	400.000	600.000	600.000	600.000	600.000	600.000	600.000
	Total freight and storage cost:		***2.109.012***	***2.109.012***	***3.799.010***	***3.799.010***	***6.427.729***	***5.998.470***	***5.998.470***	***5.998.470***	***5.998.470***	***5.998.470***

Energy cost

v)	**Electricity:**	Phase 1	1.510.730	1.510.730	1.510.730	1.510.730	1.510.730	1.510.730	1.510.730	1.510.730	1.510.730	1.510.730
		Phase 2			2.815.305	2.815.305	2.815.305	2.815.305	2.815.305	2.815.305	2.815.305	2.815.305
		Phase 3					5.591.581	5.591.581	5.591.581	5.591.581	5.591.581	5.591.581
			1.510.730	1.510.730	4.326.035	4.326.035	9.917.617	9.917.617	9.917.617	9.917.617	9.917.617	9.917.617
vi)	**Thermal energy:**	Phase 1	1.731.682	1.731.682	1.731.682	1.731.682	1.731.682	1.731.682	1.731.682	1.731.682	1.731.682	1.731.682
		Phase 2			3.463.364	3.463.364	3.463.364	3.463.364	3.463.364	3.463.364	3.463.364	3.463.364
		Phase 3					6.926.727	6.926.727	6.926.727	6.926.727	6.926.727	6.926.727
			1.731.682	1.731.682	5.195.045	5.195.045	12.121.773	12.121.773	12.121.773	12.121.773	12.121.773	12.121.773
vii)	**Total energy cost:**		3.242.412	3.242.412	9.521.081	9.521.081	22.039.389	22.039.389	22.039.389	22.039.389	22.039.389	22.039.389
	Proportion of sales:		*9%*	*9%*	*12%*	*12%*	*14%*	*14%*	*14%*	*14%*	*14%*	*14%*

Estimated profit and loss account:

EUR	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Total sales - CIF:	**33.105.000**	**33.105.000**	**71.727.500**	**71.727.500**	**137.937.500**	**137.937.500**	**137.937.500**	**137.937.500**	**137.937.500**	**137.937.500**
Marketing cost:	1.324.200	1.324.200	2.869.100	2.869.100	5.517.500	5.517.500	5.517.500	5.517.500	5.517.500	5.517.500
Total sales, net	**31.780.800**	**31.780.800**	**68.858.400**	**68.858.400**	**132.420.000**	**132.420.000**	**132.420.000**	**132.420.000**	**132.420.000**	**132.420.000**
Variable cost:										
Cost of raw material:	11.538.462	11.538.462	25.000.000	25.000.000	48.076.923	48.076.923	48.076.923	48.076.923	48.076.923	48.076.923
Sea freight cost:	1.701.191	1.701.191	2.948.731	2.948.731	4.961.807	4.532.548	4.532.548	4.532.548	4.532.548	4.532.548
Product trucking cost:	207.821	207.821	450.279	450.279	865.922	865.922	865.922	865.922	865.922	865.922
Electrical cost:	1.510.730	1.510.730	4.326.035	4.326.035	9.917.617	9.917.617	9.917.617	9.917.617	9.917.617	9.917.617
Thermal energy cost:	1.731.682	1.731.682	5.195.045	5.195.045	12.121.773	12.121.773	12.121.773	12.121.773	12.121.773	12.121.773
Catalyst cost	1.648.352	1.648.352	3.571.429	3.571.429	6.868.132	6.868.132	6.868.132	6.868.132	6.868.132	6.868.132
Royalty:	317.808	317.808	688.584	688.584	1.324.200	1.324.200	1.324.200	1.324.200	1.324.200	1.324.200
	18.656.045	18.656.045	42.180.104	42.180.104	84.136.373	83.707.115	83.707.115	83.707.115	83.707.115	83.707.115
	56%	56%	59%	59%	61%	61%	61%	61%	61%	61%
Fixed cost:										
Salaries and wages	722.775	722.775	1.001.625	1.001.625	1.252.425	1.252.425	1.252.425	1.252.425	1.252.425	1.252.425
Maintenance	724.231	724.231	1.324.231	1.324.231	2.200.231	2.200.231	2.200.231	2.200.231	2.200.231	2.200.231
Insurance	135.793	135.793	248.293	248.293	412.543	412.543	412.543	412.543	412.543	412.543
Storage Tank Rental	200.000	200.000	300.000	300.000	600.000	600.000	600.000	600.000	600.000	600.000
Other fixed cost	417.045	417.045	629.625	629.625	926.235	926.235	926.235	926.235	926.235	926.235
	2.199.844	2.199.844	3.503.774	3.503.774	5.391.434	5.391.434	5.391.434	5.391.434	5.391.434	5.391.434
Total costs	20.855.889	20.855.889	45.683.877	45.683.877	89.527.807	89.098.549	89.098.549	89.098.549	89.098.549	89.098.549
	7%	7%	5%	5%	4%	4%	4%	4%	4%	4%
EBITDA:	**10.924.911**	**10.924.911**	**23.174.523**	**23.174.523**	**42.892.193**	**43.321.451**	**43.321.451**	**43.321.451**	**43.321.451**	**43.321.451**
	33%	*33%*	*32%*	*32%*	*31%*	*31%*	*31%*	*31%*	*31%*	*31%*
Depreciation	1.857.577	1.857.577	3.396.515	3.396.515	5.643.364	5.643.364	5.643.364	5.643.364	5.643.364	5.643.364
	6%	*6%*	*5%*	*5%*	*4%*	*4%*	*4%*	*4%*	*4%*	*4%*
Financial items:	-228.391	-22.621	-512.445	-16.259	-535.591	406.402	1.425.500	2.459.600	3.510.980	4.546.218
Profit before tax:	8.838.942	9.044.713	19.265.562	19.761.749	36.713.238	38.084.489	39.103.587	40.137.687	41.189.067	42.224.305
Used deployment cost against taxes/ rapid depreciation										
	27%	*27%*	*27%*	*28%*	*27%*	*28%*	*28%*	*29%*	*30%*	*31%*
Corporate tax (20%): 20%	441.947	723.577	1.541.245	1.976.175	3.671.324	3.808.449	4.301.395	4.816.522	4.942.688	5.911.403
Profit/loss:	**8.396.995**	**8.321.136**	**17.724.317**	**17.785.574**	**33.041.914**	**34.276.040**	**34.802.192**	**35.321.164**	**36.246.379**	**36.312.903**
	25%	*25%*	*25%*	*25%*	*24%*	*25%*	*25%*	*26%*	*26%*	*26%*
ROS	**26,42%**	**26,18%**	**25,74%**	**25,83%**	**24,95%**	**25,88%**	**26,28%**	**26,67%**	**27,37%**	**27,42%**

Cash flow and equity

The following cash flow is based on the following assumptions:

a) Equity:

	Investment		Equity		Loan capital
	Euro	**%**	**Euro**	**%**	**Euro**
Phase 1	18.105.771	100%	13.579.328	25%	4.526.443
Phase 2	15.000.000	100%	3.000.000	80%	12.000.000
Phase 3	21.900.000	100%	4.380.000	80%	17.520.000

b) Interest rate:

Euro loans:	Libor: 0,17%	Premium: 6,00%	Total: 6,17%
Euro deposits:			Total: 2,06%

c) Income:

Estimated length of time of receivables: 2 months 16,67% of the annual income

d) Cost:

Estimated length of time of payables: 1 months 8,33% of the annual cost 8 years

Year	Beginning of 0	1	2	3	4	5	6	7	8	9	10
Loan 1+first year interest	4.824.089										
Principal		-603.011	-603.011	-603.011	-603.011	-603.011	-603.011	-603.011	-603.011		
Interests:		-297.646	-260.441	-223.235	-186.029	-148.823	-111.617	-74.412	-37.206		
Loan 2 + first year interest			12.789.087								
Principal				-1.598.636	-1.598.636	-1.598.636	-1.598.636	-1.598.636	-1.598.636	-1.598.636	-1.598.636
Interests:				-789.087	-690.451	-591.815	-493.179	-394.543	-295.907	-197.272	-98.636
Loan 3 + first year interest					18.672.067						
Principal						-2.334.008	-2.334.008	-2.334.008	-2.334.008	-2.334.008	-2.334.008
Interest:						-1.152.067	-1.008.058	-864.050	-720.042	-576.033	-432.025

*** Loans are paid out at the beginning of the year and accrue interest that year.**

Atlantic Green Chemicals - Glycerin to glycols - G2G

	0-1	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Revenue:			31.780.800	31.780.800	68.858.400	68.858.400	132.420.000	132.420.000	132.420.000	132.420.000	132.420.000	132.420.000
Operational Cost:			20.855.889	20.855.889	45.683.877	45.683.877	89.527.807	89.098.549	89.098.549	89.098.549	89.098.549	89.098.549
Share capital:	1000000	14.579.328	14.579.328	17.579.328	17.579.328	17.579.328	17.579.328	17.579.328	17.579.328	17.579.328	17.579.328	17.579.328
Investment:	-1000000	-18.105.771		-15.000.000		-21.900.000						
Loan capital:		4.526.443		12.000.000		17.520.000						
Operational Capital Need	100000	100.000										
New Equity needed	-1000000	-13.479.328	0	-3.000.000	0	-4.380.000	0	0	0	0	0	0
Income:			26.484.000	31.780.800	62.678.800	68.858.400	121.826.400	132.420.000	132.420.000	132.420.000	132.420.000	132.420.000
Operational cost:	900000		-19.117.899	-20.855.889	-43.614.878	-45.683.877	-85.874.146	-89.134.320	-89.098.549	-89.098.549	-89.098.549	-89.098.549
Cash Flow from Operations	900000		**7.366.101**	**10.924.911**	**19.063.922**	**23.174.523**	**35.952.254**	**43.285.680**	**43.321.451**	**43.321.451**	**43.321.451**	**43.321.451**
Equity Inflow :	-1000000	-13.479.328		-3.000.000		-4.380.000						
Principal Payment of loans:		0	-603.011	-603.011	-2.201.647	-2.201.647	-4.535.655	-4.535.655	-4.535.655	-4.535.655	-3.932.644	-3.932.644
Financial items:		0	-228.391	-22.621	-512.445	-16.259	-535.591	406.402	1.425.500	2.459.600	3.510.980	4.546.218
Corporate tax:				-441.947	-723.577	-1.541.245	-1.976.175	-3.671.324	-3.808.449	-4.301.395	-4.816.522	-4.942.688
Free Cash flow to equity	-1000000	**-13.479.328**	**6.534.699**	**6.857.332**	**15.626.252**	**15.035.372**	**28.904.833**	**35.485.103**	**36.402.847**	**36.944.001**	**38.083.265**	**38.992.337**
		280										

	IRR	74,3%
NPV	68.844.894	15%

Cash at beginning of period		100.000	100.000	6.634.699	16.492.031	32.118.283	51.533.655	80.438.488	115.923.590	152.326.437	189.270.438	227.353.703
Cast at end of period		100.000	6.634.699	16.492.031	32.118.283	51.533.655	80.438.488	115.923.590	152.326.437	189.270.438	227.353.703	266.346.041
Interest income:			69.255	237.820	499.876	860.221	1.357.114	2.019.257	2.758.504	3.512.755	4.284.285	5.076.879
Interest paid on long term loans:			-297.646	-260.441	-1.012.321	-876.480	-1.892.705	-1.612.855	-1.333.005	-1.053.155	-773.305	-530.661
Finical items - total:			-228.391	-22.621	-512.445	-16.259	-535.591	406.402	1.425.500	2.459.600	3.510.980	4.546.218

Appendix A

A.1

Data for business cases

Andri Ottesen [andri.ottesen@gmail.com]

Aðgerðir
Viðtakandi:
GunnlaugurF Gmail [com.gmail@gunnlaugurf]; arnfinnur.ottesen@gmail.comIndriði ; Waage
Viðhengi:
logistic Krafla Husavik.pptxMB 2) (]Opna sem vefsíðu[

18. ágúst 2011 17:16
Sælir allir

Hérna eru smá upplýsinar fyrir verkefnin.

Verðin fyrir technical grade 5000 T bulk af propylyne glycols eru 1300 E samkvæmt síma samtali við HELM í síðustu viku. Ohætt er að miða við 250 E á tonnið af gyseríni. Það verð miðast við að þeir taki 5% í markaðsgjald (ekki innifalið) en munu fyrirframgreiða fyrir samleiðsluna í staðinn um leið og hún er komin í skip.

Í viðhenginu eru myndir af husavik og samgangur við Kroflu og kostnaður við flutninga og geymslu.

Við fengum verðhugmyndir frá aðilum sem erum með tankana í leigu í Helguvik. Tveir 16 T tankar (fyrir P-glycol og glyserin) og einn 4T tankur fyrir E-glycol kostar um 36.000 E á mánuði.

Kveðja

Andri

A.2

2011/9/12 Andri Ottesen <andri.ottesen@gmail.com>

Sælir félagar

Hérna er ástæða vegna þess að við bæði CRI og AGC er að líta á Grundartanga til að reisa verksmiðju við hliðina á Kemira. Það er vegna þess að gert er ráð fyrir að kaupa vetnið þar á 700 Euro per tonn á meðan með öllu innitöldu þá gætu þessi fyrirtæki framleitt það sjálft fyrirr 2000 Euro. Kemira mun sennilega byggja á Grundartanga ef HS orka vinnur mál gegn Century Aluminum um hvort þeir þurfi að

afhenda orkuna til þeirra. Ef HS vinnur málið þá eiga þeir nóga orku til að selja til nokkra fyrirtækja á suður vestur hluta landsins. Ef þeir vinna ekki málið þá er ekki til orka fyrir Kemira og þeir verða að flytja sig til Bakka á Húsavík sem þeir munu sennilega neita vegna þessa hvað svæðið er lítð þróað Green field verkefni. Vetnið sem þeir setja fra ser nægir í um 150.000 t framleiðslu.

Colocated with Sodium Chlorine and Chlorine Alcali factories: Case of Kemira coming to Iceland

About KEMIRA

Kemira is a 2 billion euro chemical company, headquartered in Finland with global operations focusing on the pulp and paper industry and water treatment industry.

Kemira plans in Iceland:

Kemira is planning to build a 100.000 MT/annum Sodium Chlorate plant. The Sodium chlorate ($NaClO_3$) is used for the onsite production of chlorine dioxide (ClO_2) a primary chemical for paper bleaching. Current annual global production of sodium chlorate is around 1 million tones and Kemira has over 40% market share. Feedstock required are 55.000 MT NaCl and 50.000 MT water per annum along with steam and some HCl and NaOH. Electricity required for the plant is 500 GWh per annum or the equivalent of a 60 MW plant. 70% of their production cost is electricity and their aim was to obtain electricity prices of around 30USD/MWh. The footprint of the proposed plant will be roughly 100x100 meters and involves an estimated 50 million euro investment. The primary market for their product is in Brazil and the major challenges are associated with logistics of the product delivery to the market. It will likely need to be shipped out in containers (10 per day) so there is a need for proximity to a container harbor. Logistics will be the deciding factor for their decision to go ahead. Building time of the factory is two years.

Opportunity for CRI

If Kemira plans will realize its plans it will produce 5600 MT/annum of atmospheric pressured Hydrogen that meets CRI requirement . However for Kemira the hydrogen is a byproduct which they have little or no market for. For CRI this amount of hydrogen is enough for about 24 million liter production of renewable methanol. This could potentially save CRI significant amounts of capital for its first CSP and operational expenses if CRI is able to purchase hydrogen cheaper then CRI can make it themselves, which is likely scenario.

Favorite spot of location is currently Grundartangi next to Fero Silicon and aluminum factory and relatively close to cement factory that could be a source of CO_2 industrial emission CRI needs. Kemira can only sell a small portion of the hydrogen to the aluminum or ferro

silicon industries as propane replacement, or about 5% of the total hydrogen production. The price they are likely to pay for the hydrogen in such case is about 500.000 USD. It would take 32,5 MW for CRI to make 5600 MT/annum of hydrogen at a price of about 7 million dollars in electric cost, assuming 2,5 cent per kwh. If CRI offer to pay 1 million for the hydrogen which is double what they would other vice get CRI could save 6 million on Opex yearly and about 10 million USD savings in Capex which is a cost of 13 electrolizers needed to produce this amount and about 600.000 USD in annualized opex for refurbishment.
Kemira might be persuaded to be collocated with CRI at Krafla as the change in the electrical law can lowered Kemira power prices from 3 Cents per Kwh to 2,5 Cents as they can be except from the transportation fee if they are collocated with CRI. This will lower the overall operational expenditure of Kemira of about 12%, which can be used to pay for extra transportation cost to move 10 containers per day to Husavik harbor.

kveðja

Andri

A3
AGS a þrem stöðum á Island

Andri Ottesen [andri.ottesen@gmail.com]

Aðgerðir
Viðtakandi:
Arnfinnur Ottesen [com.gmail@ottesen.arnfinnur]; Indriði Waage

13. september 2011 08:42
Sælir

Smá update á casinu eftir að hafa hitt Godivary Refinaries og þeirra agent í Hollandi um helgina.

Við ættum að taka verðið á glyserini upp í 280 og einnig að lækka verð á propyline glycol um 50 evrur. Ættum að hækka viðhaldskostnaðinn úr 2,5% i 4%. Markaðskostnaðinn úr 3,5 í 4%. Sem mundi þa covera uppskipun, geymslu í Hollandi.

Við yrðum að hækka geymslukostnaðinn í Helguvík, þ.e. ef við fáum allt leigt um 200000 e á ári. upp i svona 400,000

Ef við byggjum við hliðina á Kemira þá er líklegt verð á vetni um 700 Evrur (miðað við 2000 E ef við gerum það sjálfi- uppreiknaður opex og capex). Kemira er orðin mjög heit fyrir Grundartanga en fær ekki raforku nema HS orka vinni málið geng Century Aluminum um að neyðast að veita þeim orku í Helguvik. Útkoma úr því máli skýrist á næstu mánuðum. Kemira er líka búinn að fá úrskurð um að þeir þurfi ekki að fara í fullt umhverfismat sem flýtir þeirra byggingu um 6 mánuði. Gallinn við Grundartanga er að það er eingin gufa þar sem er mjög mikilæg fyrir okkar starfssemi. Það yrði því að breynna hluta af vetninu til að búa til gufu og forna þannig allt að þriðjung vetnisins - sem kæmi svo sem ekki að sök því þarna verður til vetni fyrir 150.000t verksmiðju en við þurfum bara tvo þriðju þes vetnis. Mjog sennilega þarf AGC að keppa við CRI eða sameinast um kaupin á vetni að einhverju leyti.
Það er svo sem nógur hita utblastur frá Elcem a Grundartanga, en til þess að hægt verði að nýta hana í formi gufu þá þarf að setja upp gufu katla sem væri fjárfesting upp á 3 milljónir dollara og til að fá hana til baka þá verður kannski allir að kaupa gufu af þeim á um 5 evrur á tonnið.

Ef HS orka tapar málinu verður ekki til næg orka á Grundartanga og eini kostur fyrir Kemira verður að fara á Bakka sem þeir eru ekkert ægilega spenntir fyrir því það er alveg Greenfield verkefni. Það er ekkert þar nuna. Verður að byggja allt upp frá grunni af gjaldþrota bæjarfélagi - áhættan og töfin er mikil og það einnig að sigla með vöruna í 1,5 dag lengur. Þetta eru þættir sem raforkuverðið verður að koma upp á móti með eða verkefnið dettur einfaldlega niður. Einnig er nálægt við hæft starfsfólk þá minni og lífskilyrði á alþjóðlegum mælikvarða sennilega minni og erfiðara að laða að erlent starfsfólk til Norðurlands. Eg held að það yrði þá lagt gufuleiðsla til bakka og verðið að gufu þar yrði um 3 evrur á tonnið. Alls er óvíst að Kemira hafi einfaldlega áhuga á að reisa verksmiðju fyrir norðan.

AGC reiknar með að fá alla gufu sem þeir þarfnast frá Islenska kísilfelaginu. Þeir geta skaffað gufu fyrir 150.000 T framleiðslu. Hins vegar þá væri það 3 millljona framkvæmd fyrir þá að setja upp 2 gufukatla. Kostar um 2 milljónir að setja upp fyrsta og 1 milljón extra að setja upp hinn. til að fá þá fjárfestingu til baka þá verða þeir að selja gufuna til AGC um 3,5 e a tonnið og AGC verður þá að vera til staðar að geta tekið við henni.

Þess vegna er líklegt að gufan verði fengin annars staðar í fyrsta áfanga í Helguvík. Það væri þörf fyrir um 15000 T af gufu. 5000 ton af gufu mundu koma frá Kalka, sorpbrennslustöðinni. Þar er gufuketill til staðar. Reiknað er með að verð á þeirri gufu yrði um 3 e fyrir tonnið. Restin af gufunni kæmi frá Sildarvinnslunni úr rafskautakötlum sem eru ekki reknir nema mánuð á ári. Verðið frá þeim yrði svona um 11 e á tonnið. Það væri þá einn mánuður á ári sem ekki væri hægt að reka annan rafgreinin og verksmiðjan AGC yrði aðeins í hálfum afkostum. Hin vegar þegar farið eru í næstu fasa þá væri

þessi tenging tekinn út við síldarbræðsluna og sett við Islenkska Kisil felagið. Sem sagt að meðalverðið á gufu í fyrsta fasa verður eitthvað um 7-8 evrur en fer svo í 3,5 í næsta fasa.

Eg vona að þetta skýri eitthvað.

Indriði - Þu munt þurfa að skýra mismunadi opex og capex á hverjum stað fyrir utan aðgengi að hæfu starfsfólki, landi etc. Flutningum ut af sjó og geymslu á aflurðum og aðföngum.

Við Gulli erum að reyna að hitta forstjóra Indverska fyrirtækisins í Berlín í 5 oktober og taka eftir það einhverja ákvörðun um framhaldið.

Munið að allt sem er hér sett fram er trúnaðarmál milli okkar og ætti ekki að fara lengra á þessu stigi.

kveðja

Andri

A.4

Andri Ottesen [andri.ottesen@gmail.com]

Aðgerðir
Viðtakandi:
Arnfinnur Ottesen [com.gmail@ottesen.arnfinnur]; Indriði WaageGunnlaugurF Gmail ; [gunnlaugurf@gmail.com]

22. september 2011 22:40

Notandi svaraði 23.9.2011 08:40.
Sæll Addi

Eg get staðfest þessi verð. Heimild er Rajiv Rangarajan, Director Somaiya Biorefinaries BV - Head trader for chemicals in Holland Office. Heimsókn Íslandi 4 september. - Þetta verð er fyrir technical grade, bulk propylin glycol.

Sömuleiðis sagði hann okkur að hækka markaðskostnaðinn í 4% af veltu og innifalið í því er geymslugjald, dreifing og fjármögnun(flýtigjaldi til að fá greitt á mánaðarfresti) í Hollandi.

Einnig sagði hann okkur að hækka verðið á glyserini upp í 280.
Loks ættu geymslugjöldin á Íslandi að vera um 400.000 E á ári miðað við að legjum 16.000 T fyrir glysserin, 4000 T fyrir P glycols (þyrftum að leggja nýjar leiðslur) og látum byggja 4 150.000 l tanka

(3 fyrir e glycols og 1 fyrir alcohols). Þar sem framleiðslan verður eitthvað minni í byrjun þá er örygglega hægt að semja um grace period sem er kannski eitthvað 300.000 E á ári fyrir fysta fasa.

Við getum reiknað með 50 E á tonnið á flutning á glysseríni til Íslands miðað við 6000T skip með 3 tankrýmum og notað svo sama skipið út fyllt 3700 T af P glycols sem ættu að fylla tvö tankrými af 3 og notað svo síðasta tankrýmið til að flytja 500 t af e glycol sem hægt er að nota í gluggahreinsivökva og rúðupiss
kostnaður af þeim flutning er innifallin í flutningi á glyserininu og uppskipunin og geymslukostnaðurinn innifalinn í markaðsgjaldinu.

Vona að þetta hjálpi.

kveðja
Andri

A.5

Andri Ottesen [andri.ottesen@gmail.com]

Aðgerðir
Viðtakandi:
Indriði Waage

23. september 2011 16:20
Sjálfsagt væri hægt að fá gufu frá þessari verksmiðju fyrir 150.000 tonna framleiðslu. Kemira notar gufu sjálft þannig að þeir mundu taka hluta af þessu og AGC gæti tekið restina.
Þetta væri sjálfsagt fjármögnun upp á 2,5 milljón evra en ef þetta er sellt á milli 4-5 e á tonnið þá yrði það 3-4 ár að borga sig til baka.
Húsavík er að vísu með hitaveitu sem er með einhverja gufu, en þetta er mjög lítil hitaveita að ég held bara 5 mw. en það væri jafnvel hugsanlegt að það nægði í fyrsta áfangann.

Eins væri hægt að fá gufu frá Elkem á grundartanga en það er miklu erfiðara að byggja inn gufukatla eftir á og mundi kosta það að það yrði að stöðva framleiðslu í ienhverntíma.
Það yrði mun stærri fjárfesting mundi ég halda og þyrfti að standa undri hærri verðum.

kveðja

Andri

A.6

4 staðarvalskostir á Íslandi - Kostnaðargreining.

Andri Ottesen [andri.ottesen@gmail.com]

Aðgerðir
Viðtakandi:
Indriði Waage Arnfinnur Ottesen ;[com.gmail@ottesen.arnfinnur]; GunnlaugurF Gmail [com.gmail@gunnlaugurf]

23. september 2011 21:21
Sæll Indriði

Við erum að ræða þessa þrjá-fjóra staðarvalskosti (austurland sem er svona null case).

1. Helguvík sem Addi er raunar búinn að gera - Rafgreining - Gufa frá Islenska Kíselfélaginu.Leiga á einum 4000m3 tanki. Í fyrsta áfanga er gufan fengin frá Kölku 4 tonn á tímann á 4€ og 10 tonn til viðbótar frá Sildarvinnslunni á 15€ meðalverð sé 10€ ca. I seinni áföngum er öll gufa keypt á 4€ per tonn.

2. Grundartangi. byggir á því að fá vetni frá Kemira á 700 € per tonn og gufu með brennslu á vetni sem jafngildir
Kemira er að losa 4000 m3 af vetni á klst. Við mundum nota 3000m3 af því til að framleiða gufu og 1000 m3 í efnhvörf sem vetni. Með þessu móti þá mundi kostar tonnið af gufunni 15€.
Í seinni fara er reiknað með að semja við Elkem um að þeir setji upp gufuketil í afgasrör. 6€ tonn.

3. Husavík/Bjarnarflag. Gerir ráð fyrir að upp og útskipun yrði á Húsavík. Byggja þarf 10.000m3 tanka rými í fyrsta áfanga 30.000 ikr. per m3. Reiknað er með að taka útblástur úr virkjun sem er fullur af vetnisríku gasi og fullhreina það sem er 1100 m3 á klst sem nægir í fyrsta fasa gefið það 90 MW virkjun. Þessi vetnikostnaður mælist ekki beint heldur er einungis tækjum og tólum til þess að hreinsa gasið. Stofnkostnaður í Bjarnarflagi er sá sami og í Helguvík gróft á litið. Gufuverð yrði um 3 € per tonn. Í næstu fasa er gert ráð fyrir rafgreiningu á sama hátt og í Helguvík. Þarna þarf að reiknast exstra flugningskostnaður til og frá hafnar þar sem geymslutankarnir eru.

4. Austurland - Djúpavogur þar er höfn og tankar og hús. 5000 m3 ónýttir tankar en hins vegar engin gufa, né vetni.
Gufu og vetni þyrfti að framleiða með rafmagni. Gufa mundi kosta um 15€ á tonnið og rafgreinikostnaður eins og í Helguvík. Hins vegar þá væri hægt að fá byggingar og tanka næstum gefins. Útvega þyrfti viðbótartankarými upp á 5000m3 á sömu kjörum og áður.

A.7

Andri Ottesen [andri.ottesen@gmail.com]

Aðgerðir

Viðtakandi:

Indriði Waage

Afrit:

Arnfinnur Ottesen [com.gmail@ottesen.arnfinnur] ;GunnlaugurF Gmail [com.gmail@gunnlaugurf]

Viðhengi:

trucking and storage at H~1.pptxMB 2) (]Opna sem vefsíðu[

24. september 2011 10:13

Notandi svaraði 26.9.2011 13:01.

Sæll Indriði

Eg gleymdi einu í gær. Raforkuverðið í Bjarnarflagi/Húsavík yrði 2,6 € en ekki 3€ eins og á öðrum stöðum þar sem verksmiðjan yrði beintengd virkjun og ekki því greitt fyrir tengigjald samkvæmt raforkulögum sem voru samþykkt um áramótin. Nátturúlegt vetni sem kemur þarna upp lækkar með tímanum allt að 3-5% á ári á sama hátt og óþéttanleg gös eins og CO2. Við ættum að eiga símafund um þessi case. Starfsfólk gæti verið svipað og vann í gömlu Kíselverksmiðjunni. Við mundum semja við ODR um alla flutninga og geymslu fyrir um 16,5 € á tonnið á bæði glysseríni og glycols og alcaholum. Þetta er reiknað út frá upplýsingum frá ODR frá því í Mars. Þetta er í fyrsta fasa. Reiknað er með að einingakostnaður fari niður um 30% fyrir hverja tvöföldun á verði því kominn niður í helming af þessari tölu fyrir seinasta fasann 120.000 T. Flutningskostnaður til og frá landi er sá sami til Evrópu.

kveðja

Andri

Appendix B

B.1

Frá: Indriði Waage
Sent: 28. október 2011 12:37
Viðtakandi: gudmunduri@landsnet.is
Efni: varðandi verð á flutningi

Indriði Waage

Sent Items
28. október 2011 12:37
Blessaður frændi

Hér er orkuþörf fyrirtækisins og stækkunarfastar. Við gerum ráð fyrir að fyrirtækið verði stækkað um helming 2-3 árum eftir að fyrsti fasi er fullkláraður og þriðji fasi síðan 2-3 árum efitr að sá annar hefur verið fullkláraður.

	Phase 1	Phase 2	Phase 3	Total
Electrical consumption(w.electrolyzer) - full capacity: kW	6.180	12.360	24.720	43.260
Numer of hours:	8.300	8.300	8.300	
Gigawatthours:	51,3	102,6	205,2	359,1

Ég þekki ekki hvaða spennu þessi rafgreinir þarf en veit að hann er ekki viðkvæmur fyrir flögti og við getum alveg notað ótrygga orku (þó svo við höfum ekki varaafl eins og tíðkast víst sbr. bræðslurnar).

Mig vantar upplýsingar um tengigjöld, og önnur gjöld sem til falla vegna flutnings. Eins vorum við að tala um rafspenna sem við þyrftum að hafa og eins þessa breittingu sem þið veitið í gegnum dreifiveiturnar.

Aðal spurningin eru svo auðvitað hvað erum við að spara okkur með því að tengjast ykkur umfram dreifiveiturnar (Rarik og Hs Orku sem dæmi).

Við erum að skoða þrjár staðsetningar

Bakki -

Grundartangi (Faxaflóahafnir)-

Helguvík -

B.2

gudmunduri@landsnet.is

Aðgerðir
Viðtakandi:
Indriði Waage
Viðhengi:
(2)Sækja öll viðhengi
111102 Indriði Waage - Gj~1.xlsxKB 22) (]Opna sem vefsíðu ;[Gróft mat á framkvæmdakos~1.docxKB 14) (]Opna sem vefsíðu[

22. nóvember 2011 08:47
Notandi svaraði 22.11.2011 09:03.
Sæll frændi

Ég gleymdi að senda þér þetta.

Bestu kveðjur

Guðmundur Ingi Ásmundsson
Aðstoðarforstjóri / Deputy CEO
Tel: + 354 563 9425 | gudmunduri@landsnet.is | www.landsnet.is

Gróft mat á framkvæmdakostnaði. Jarðstrengir, loftlínur, rofar og spennar.

Byggt á verðbanka Landsnets, verðlag miðast við september 2011.

Tekið saman af MÞP 17.11.2011.

Jarðstrengir	*Framkvæmdakostnaður*
66 kV – 35 MVA	36 mkr/km
66 kV – 50 MVA	43 mkr/km
132 kV – 100 MVA	59 mkr/km
132 kV – 150 MVA	73 mkr/km
220 kV – 250 MVA	127 mkr/km
220 kV – 400 MVA	209 mkr/km
Loftlínur	
66 kV – 50 MVA	35 mkr/km
132 kV – 150 MVA	40 mkr/km
220 kV – 400 MVA	58 mkr/km
Útivirki	
DCB – 220 kV rofi	215 mkr
DCB – 132 kV rofi	118 mkr
HB – 66 kV rofi	83 mkr
Spennir – 220 kV, 160 MVA	490 mkr
Spennir – 132 kV, 100 MVA	335 mkr
Spennir – 66 kV, 20 MVA	133 mkr
Innivirki	
GIS – 220 kV rofi	366 mkr
GIS – 132 kV rofi	226 mkr
GIS – 66 kV rofi	104 mkr
Spennir – 220 kV, 160 MVA	720 mkr
Spennir – 132 kV, 80 MVA	335 mkr
Spennir – 66 kV, 20 MVA	133 mkr

Mat á flutningsgjöldum

I. Útreikningar skv. núvarandi gjaldskrá fyrir stórnotendur:
Á við notendur sem tengjast Landsneti beint.

Áfangi	*Phase 1*	*Phase 2*	*Phase 3*
Viðbót (MW)	6,18	12,36	24,72
Afl alls (MW)	6,18	18,54	43,26
Nýtingart (h)	8300	8300	8300
Orka (MWh)	51.294	153.882	359.058

	Gjaldskrá		**Árlegt gjald**	**Árlegt gjald**	**Árlegt gjald**
Afhendingargjald	53.496	$/ár	53.496 $	53.496 $	53.496 $
Aflgjald	28.305	$/(MW·ár)	174.925 $	524.775 $	1.224.474 $
Orkugjald	1,432	$/MWh	73.453 $	220.359 $	514.171 $
		Alls flutn:	**301.874 $**	**798.630 $**	**1.792.141 $**
Kerfisþjónusta	25,72	kr/MWh	1.319.282 kr	3.957.845 kr	9.234.972 kr
Flutningstöp	58,50	kr/MWh	3.000.699 kr	9.002.097 kr	21.004.893 kr
		Alls ke. & töp	4.319.981 kr	12.959.942 kr	30.239.865 kr
		Alls*:	39.041.518 kr	104.818.333 kr	236.371.964 kr

**Miðað við gengi (kr/$):* *115,02*

II. Útreikningar skv. skilmálum B9:

Ef við segjum að þetta sé "minni stórnotandi" sem tengist inn á svæði dreifiveitu, þá bætist við viðbótargjald sbr. útreikninga hér að neðan.

Gerum ráð fyrir að kostnaður vegna niðurspenningar sé 1.746.032 $.

(Breytilegt eftir verkefni og þyrfti að athuga betur ef af yrði)

Álag reiknast á eftirfarandi hátt (sjá gr. 4 í skilmálum B9):

Höfum:

Stofnkostnaður	**1746032**
Árlegt hlutfall	**0,082**
Hlutdeild niðurspenningar	**0,8**
Orkumagn	**359.058**
Orkugjald	**1,432**
Afl	**43,26**
Aflgjald	**28.305**
þ.a. reiknum álag:	***6,59%***

Model fyrir útreikning á álagi

Notkun		
Load capacity	43	MW
Energy	359.058	MWh
Utilisation	8.300	hrs.
ISK/USD	115,02	kr.

Þetta eru forsendur varðandi notkun sem gengið er út frá

Gjaldskrá stórnotenda		
Delivery Charge	53.496	USD per year
Capacity charge	28.305	USD per MW per year
Energy charge	1,43	USD per MWh
Ancillary services	0,2236	USD per MWh
Transmission losses	0,5086	USD per MWh
Álag á stórnotendagjaldskrá		
Delivery Charge	0	USD per year
Capacity charge	1.865	USD per MW per year
Energy charge	0,09	USD per MWh
Ancillary services	0,0000	USD per MWh
Transmission losses	0,0000	USD per MWh

Þetta er stórnotendagjaldskráin eins og hún er á vef Landsnets

Þarna tökum við álag (reiknað í B43) og margföldum orku og aflgjald með því.
Þetta er í raun það álag sem kemur á gjaldskrá vegna niðurspenningar.

Aukagjald		
Delivery charge	0	USD
Capacity charge	80.667	USD
Energy charge	33.873	USD
Total for transmission	114.540	USD

Hér tökum við álagið úr töflunni á undan og reiknum hvað það þýðir í USD

m.v. það magn sem við erum með

Uppfærð gjaldskrá		
Delivery Charge	53.496	USD per year
Capacity charge	30.170	USD per MW per year
Energy charge	1,53	USD per MWh
Ancillary services	0,2236	USD per MWh
Transmission losses	0,5086	USD per MWh

Þetta er stórnotendagjaldskrá, leiðrétt m.v. ofangreint álag

Heildargjald		
Delivery charge	53.496	USD
Capacity charge	1.305.141	USD
Energy charge	548.044	USD
Ancillary services	80.290	USD
Transmission losses	182.619	USD
Total for transmission	2.169.591	USD

Þetta er útreikningur á heildarkostnaðnum, þ.e.a.s. Skv. stórnotendagjaldskrá

að viðbættu álagi

Mat á tengigjaldi

Sjá nánar skjal "gróft mat á framkvæmdakostnaði.docx"

Hugmynd af útfærslu:	
Jarðstrengur 66 kV - 35 MVA	36 mkr/km
Útivirki HB - 66 kV rofi	83 mkr

Appendix C

C.1

Varðandi símtalið áðan

hordurh@lv.is

30. september 2011 14:41
Sælir!

Ég gaf þér víst upp of lágt verð fyrir raforkuna áðan. Miðað er við $32 á MWst. Við seljum enga gufu svo ég get ekki gefið þér upp verð á henni. Raforkuverðið er óháð staðsetningu.

Með kveðju / Best regards,

Hörður Hauksson
Rekstrardeild aflstöðva - viðskiptaborð · Generation Planning - Supply and Trading
Sími / tel: +354 893 25 69 · GSM / mob: +354 893 25 69
hordurh@lv.is

Háaleitisbraut 68 · 103 Reykjavík · Iceland
Sími / tel: +354 515 9000 · landsvirkjun.is

From: Indriði Waage <indridi.waage@bifrost.is>
To: "hordurh@lv.is" <hordurh@lv.is>
Date: 30.09.2011 12:40
Subject: Varðandi símtalið áðan

Indriði Waage

Aðgerðir
Viðtakandi:
hordurh@lv.is
Sent Items
30. september 2011 12:40
Sæll og blessaður Hörður

Indriði Waage heiti ég og er meistaranemi í alþjóðlegum viðskiptum við háskólann á Bifröst. Ég er að vinna að meistararitgerð minni og er að leita eftir upplýsingngum frá ykkur varðandi hana. Þessi ritgerð er unnin sem algert trúnaðarmál og ekkert sem í hana fer mun bera fyrir sjónir almennings. Með örðum orðum þá lít ég svo á að það sem okkur fer á milli sé trúnaðarmál.
Til að kynna aðeins verkefnið mitt þá í grófum dráttum þá er ég að gera áræðanleikakönnun (e. due dilligence) fyrir fyrirhugaða verksmiðju sem mögulega á að byggja á Íslandi. Staðarkostir sem ég er að kanna eru í þremur sveitarfélögum og eru: Bakki við Húsavík, Grundartangi í Hvalfjarðarsveit og að síðustu Helguvík á Reykjanesi. Þeir voru valdir þar sem gert er ráð fyrir orkuríkum iðnaði á þessum stöðum og þar sem flest öll umgjörð sem hentar slíkum iðnaði er til staðar eða í nágrenni. Mitt

verkefni gerir ráð fyrir að reisingu á iðnaðarverksmiðju sem þarf 6 MW í fyrsta áfanga , en geri svo ráð fyrir að verksmiðjan stækki svo í tveimur áföngum til viðbótar á næstu 2 til 4 árum eftir reisingu fyrsta áfanga, þ.e næsti áfangi verið 12 MW og með síðasta áfanga krefjist verksmiðjan svo rúmlega 24 MW í heildarorkunotkun.

		fasar		
		1	2	3
		6 MW	12 MW	24 MW
Raforka	Verð			
	Tengigjald			

Verksmiðju þarfnast jafnframt iðnaðargufu í millipressu (medium pressure 12 Barg) fyrir framleiðslu sína og eykst gufuþörfin eftir stækkunarfösunum eins og sést að neðan. Helsta málið hér er að fá gufu sem er yfir 150 gráður, þar sem verkmsiðjan þarf gufu til eimmingar á afurð sinni. Þannig að verð á gufu per tonn og það magn sem við gætum fengið væri mjög vel þegið

		fasar		
		1	2	3
Gufa	verð			
	Magn			
	Tengigjald			

Þessi verksmiðja sem um ræðir er að framleiða umhverfisvæna afurðir, sem mun veita 20-30 starfsmönnum atvinnu á ársgrundvelli.
Það sem mig vantar helst er verð á rafmagni á hverri staðsetningu sem fyrirtækið gæti boðið og upplýsingar um gjöld sem falla til vegna tengingar.
Varðandi gufu þá vantar mig verð á gufu og hvort fyrirtækið geti afhent gufu á þessum áður tilgreindu stöðum.
Eins og sést á tölunum hér að ofan er um nokkuð stóra framkvæmd að ræða og því er mikilvægt að fá sem bestar upplýsingar um verð og magn. Bestu möguleg svör væru auðvitað í evrum, enda er verkefni sem þetta fýsilegur kostur fyrir erlenda fjárfesta.
Ég vona að þessar upplýsingar hjá mér séu nægjanlegar og vonandi getið þið orðið mér innan handar með þennan hluta verkefnisins. Ef ykkur finnst þessar upplýsingar ekki nógar eða einhverjar spurningar vakna um hvað betur mæti fara væru góð ráð vel þeginn.
Kveðja Indriði Waage
Meistaranemi við Háskólann á Bifröst
Sími 499 1019

C.2

Frá: edvard@lv.is [edvard@lv.is]
Sent: 11. október 2011 12:38
Viðtakandi: Indriði Waage
Efni: Re: Varðandi símtalið í gær

edvard@lv.is

11. október 2011 12:39
Sæll Indriði,

Varðandi magnið, þá er á þessu þremur svæðum talið vera a.m.k. 200 MW og jafnvel með frekari rannsóknum allt að 400 MW. Það er ekki búið að eyranmerkja neitt af þessu rafmagni neinum einum

aðila eða iðnaði.

Nýtingin á gufunni væri heppilegust innan 20 - 30 km frá borholunum. Nánast í öllum tilfellum er landið í kringum holurnar í einkaeign og þyrfti því að reikna með að kaupa eða leigja land af slíkum aðilum ef ætti að vera með iðnað þar. Hins vegar er iðnaðarlóð á Bakka í eigu Norðurþings og það ætti að vera hægt að nýta gufuna a.m.k. frá Þeistareykjum þar.

Vonað þetta gagnist.

Með kveðju / Best regards,

Edvard G Guðnason
Viðskiptastjóri · Business Director
Sími / tel: +354 515 90 39 · GSM / mob: +354 894 45 75
edvard@lv.is

Háaleitisbraut 68 · 103 Reykjavík · Iceland
Sími / tel: +354 515 9000 · landsvirkjun.is

From: Indriði Waage <indridi.waage@bifrost.is>
To: "edvard@lv.is" <edvard@lv.is>
Date: 11.10.2011 12:20
Subject: Varðandi símtalið í gær

Indriði Waage

Aðgerðir
Viðtakandi:
edvard@lv.is
Sent Items
11. október 2011 12:20
Sæll og blessaður Edvard

Mig langar til þess að þakka þér fyrir þær upplýsingar sem þú gafst mér upp í gær. Mig langar samt til að spyrja þig aðeins nánar um nokkra hluti. Sú fyrri snýr að hversu mikið er af ónýttri orku á þessum þremur svæðum þ.e Bjarnarflagi, Þeystárreykjum og Kröflu,(og er þá búið að eirnamerkja hana einhverjum ákveðnum iðnaði?), Hin síðari snýr að gufunni en þú gast mér upp að verð á henni væri ca. 200 ísl.krónur en þá yrði nýtingin að vera nálægt svæðinu og því spyr ég hver á landsvæðið í kringum borholurnar.

Kveðja
Indriði Waage
Meistaranemi við Háskólann á Bifröst
Lundi Svíþjóð

C.3

Frá: arnig@lvp.is [arnig@lvp.is]
Sent: 7. desember 2011 18:41
Viðtakandi: Indriði Waage

Afrit: edvard@lv.is
Efni: Re: Bjarnarflag

arnig@lvp.is

7. desember 2011 18:41

Sæll Indriði.

Áætlaður þrýstingur á mettaðri gufu er 10 bara, eða hiti um 180°C,

kv.

Árni Gunnarsson
Yfirverkefnastjóri · *Senior Project Manager*
Tölvupóstur / e-mail: arnig@lvp.is
Sími/tel: +354 515 8971 . Gsm/mobile: +354 824 7979

Landsvirkjun Power ehf.
Háaleitisbraut 68 · 103 Reykjavík · Iceland
Sími / tel: +354 515 8900 · Fax: +354 515 8904
www.landsvirkjun.is · *www.lvpower.com*

From: Indriði Waage <indridi.waage@bifrost.is>

To: "arnig@lvp.is" <arnig@lvp.is>

Date: 07.12.2011 15:27

Subject: Bjarnarflag

Indriði Waage

Aðgerðir

Viðtakandi:

arnig@lvp.is

Sent Items

7. desember 2011 15:27

Sæll og blessaður Árni

Indriði Waage heiti ég og er meistaranemi við Háskólann á Bifröst. Ég er að gera áræðanleikakönnun fyrir fyrirtæki sem hefur áhuga á að reisa verksmiðju á Íslandi. Leiðbeinandi minn er dr. Andri

Ottesen.

Ég er að kanna Bjarnarflag sem mögulegan statðsetningu fyrir þessa verksmiðju og hef áhuga á að fá rafmagn og gufu frá Bjarnaflagsvirkjun. Þær upplýsingar sem vantar eru um gufuna sem virkjuninn gefur frá sér.

mig vantar:
Hitan á gufunni (C°):
þrýstinginn á gufunnni (bar):

Ég var búinn að tala við hann Edvard G. hjá LV um verðin, en hann benti mér á að tala við þig um þessar tæknilegu upplýsingar.

Kveðja Indriði Waage

Appendix D

D.1

Glysirin.

Operations [Operations@nesskip.is]

20. október 2011 13:27
Já , það er sama verð.

Indriði Waage

Aðgerðir
Viðtakandi:
Operations [is.nesskip@Operations]
Sent Items
20. október 2011 12:32
Sæll og blessaður Már

Ég er að skoða fleiri staði á Íslandi varðandi flutning á glycerine til og frá landi. Væri verð á flutningi til Bakka á Húsavík eitthvað frábrugðið því verði sem þú gafst mér upp miðað við Akranes? það er 191 NOK per tonn.

kveðja Indriði

Frá: Operations [Operations@nesskip.is]
Sent: 30. september 2011 14:23
Viðtakandi: Indriði Waage
Efni: FW: Glysirin.

Operations [Operations@nesskip.is]

30. september 2011 14:23
Sent: 30. september 2011 10:36
To: Már Gunnarsson
Subject: SV: Glysirin.

Mar/Sigbjørn

Hallo

3500mts Glycerin Rotterdam Akranes NOK 268 pmt,-
2500mts Glycerin Akranes-Rotterdam NOK 341 pmt,-

3500mts Rotterdam-Akranes in combination 2500mts Akranes-Rotterdam NOK 191 pmt,-

Appendix E

E.1

Sæll

Tryggvi hjá Norðurþingi var í sambandi við mig og bað mig að svara fyrirspurn þinni.

a) Lóð yrði væntanlega leigð og lóðarleigan er ákveðin % af fasteignamati lóðar. Nú hafa lóðir á Bakka ekki verið metnar í fasteignamati enda er það venjulega ekki gert fyrr en þær verða veðhæfar, þ.e. búið er að framkvæma á þeim. Álagningarprósenta lóðarleigu er ákveðin árlega af sveitarstjórn á grundvelli laga um tekjustofna sveitarfélaga http://www.althingi.is/lagas/139a/1995004.html en skv. álagningarreglum í Norðurþingi 2011 er lóðarleiga vegna atvinnuhúsnæðis 2,5% af fasteignamati http://www.nordurthing.is/static/files/gjaldskrar/2010/2011_01_ALAGNING_GJALDA_2011.pdf

Með því að taka dæmigerða iðnaðarlóð í þegar byggði hverfi má áætla fasteignamat iðnaðarlóðar hér kr. 6.000 á m2 lóðarleiga fyrir 40.000m2 yrði því 40.000*6000*2,5% = 6.000.000 Lóðin yrði afhent í því ástandi sem hún er en tenging hennar við vegakerfi, veitur og fráveitur er á vegum sveitarfélagins nem hvað varðar rafmagn sem annað hvort er á vegum Landsnets, ef um stórnotanda (20MW eða meira)er að ræða en annars á vegum RARIK. Geri svo ráð fyrir að semja mætti við sveitarfélagið um ívilnun á þessum gjöldum og fleirum á grundvelli laga um ívilnanir http://www.althingi.is/lagas/139a/2010099.html

b) Núverandi hafnarmannvirki eru með 10 metra dýpi og lengsti kantur er 130 metrar. Hann getur því tekið við skipum með allt að 8,5 metra djúpristu og allt að 160-170 metra að lengd. Tiltölulega auðvelt er að dýpka niður í 12 metra (10,5 metra djúprista) og lengja kantinn upp í 180 metra. Gjaldskrá hafnarinnar er hér http://www.nordurthing.is/static/files/gjaldskrar/2010/2011_hofn.pdf en gera má ráð fyrir að unnt sé að semja um magnafslætti, a.m.k. í tiltekinn tíma.

c) Þjóðvegurinn á milli Húsavíkur og Mývatnssveitar (Bjarnarflag) er nr. 87 Kísilvegur: Af Hringvegi hjá Reykjahlíð í Mývatnssveit, um Hólssand, Hvammsheiði og

Reykjahverfi, á Norðausturveg hjá Laxamýri. Sjá vegaskrá http://www.vegagerdin.is/vefur2.nsf/Files/VegskraLysing/$file/Vegaskra_leidarlysing_31-01-2011.pdf bls. 11 Vegurinn er tvíbreiður lagður bundnu slitlagi að 11 km undanskyldum en heildarvegalengin á milli Húsavíkur og Bjarnarflags er tæpir 60 km. Vetrarþjónusta er á veginum skv. reglum Vegagerðarinnar tvo daga í viku, sjá kort http://www.vegagerdin.is/upplysingar-og-utgafa/leidbeiningar-og-stadlar/vetrarthjonusta/mokstursdagar/ Önnur leið liggur um Reykjadal sem öll er með bundnu slitlagi og vetrarþjónustu alla daga vikunnar en sú leið er um 80 km.

Verið er að byggja upp virkjanaveg frá Húsavík að Þeistareykjum sem, enn sem komið er, er malarvegur en verður lagður bundnu slitlagi síðar. Ekki er búið að skilgreina þjónustustig á veginum en eins og um aðra vegi hefur notkun áhrif á það þjónustustig sem skilgreint yrði. Vegalengdin er um 28 km.

Vona að þetta komi þér að gagni.

Bkv,

Reinhard Reynisson

Framkvæmdastjóri / Managing director

Atvinnuþróunarfélag Þingeyinga hf. / North East Iceland Development Agency

Garðarsbraut 5 - 640 Húsavík - Iceland
Sími/Tel: (+354) 464 0415
Gsm/Mobile: (+354) 863 6622
Vefur / Web: www.atthing.is
e-mail: reinhard@atthing.is