UIS BUSINESS SHCOOL

New investment models for gas infrastructure on the Norwegian continental shelf

"What purpose has new investment models for the gas infrastructure for realization of new gas resources on the NCS"

Thomas Moltubakk Holsen, 207325

7/14/2014

Universitetet i Stavanger

DET SAMFUNNSVITENSKAPELIGE FAKULTET,
HANDELSHØGSKOLEN VED UIS

MASTEROPPGAVE

STUDIEPROGRAM:	OPPGAVEN ER SKREVET INNEN FØLGENDE SPESIALISERINGSRETNING:
Anvendt Finans	Finansiell Økonomi ER OPPGAVEN KONFIDENSIELL? (**NB**! Bruk rødt skjema ved konfidensiell oppgave)

TITTEL: Nye investeringsmodeller for gass infrastruktur på Norsk Kontinentalsokkel

ENGELSK TITTEL: New investment models for gas infrastructure on the Norwegian Continental Shelf

FORFATTER(E)		VEILEDER:
Studentnummer:	Navn:	Klaus Mohn
207325……	Thomas Moltubakk Holsen…….	
……	…….	

OPPGAVEN ER MOTTATT I TO – 2 – INNBUNDNE EKSEMPLARER

Stavanger, ……/…… 2014 Underskrift administrasjon:……

EXECUTIVE SUMMARY

This master thesis is a study of how new investment models for gas infrastructure can contribute to realization of new gas resources on the NCS. It analyzes the separation of gas infrastructure from the rest of the field development and compares the result with the present investment model. The analysis also explores new potential investors that could invest in large gas infrastructure projects.

The findings indicate that the IRR of the new model gives a higher rate of return on the field development by separating gas infrastructure from the rest of the field development. The results show a difference of 4,48% between the present and the new investment model, which indicate that a separation of gas infrastructure can lead to realization of more gas resources on the NC. The IRR is mentioned her since it is an important financial decision making tool in this thesis.

The study explores the gas infrastructure history on the NCS and explains the corporate structure and the regulations of different companies, organisations and governmental bodies.

The regulation of the gas transportation tariff is important for the analysis to be able to calculate the cash flow for the gas infrastructure investment. The IRR indicates that there are two potential investors of the gas infrastructure for the new investment model, which are Investment funds and the Norwegian government. Since the tariff is regulated to yield a reasonable rate of return of 7%, other potential investors indicate that the rate of return is too low to be profitable. E&P companies have to find large gas reservoirs to compensate for the regulated rate of return to meet their rate of return demands for investing.

The analysis is based on modern financial decision making theories. Studies show that choosing the new investment model could relieve E&P companies form binding large amounts of capital in gas infrastructure; this gives them the opportunity to dedicate their capital to their core competence areas, exploration and production

FOREWORD

I would like to thank all actors who have contributed to this master thesis: With their knowledge of the subject, their support and their questions. Thanks to my UIS supervisor, Klaus Mohn, and thanks to TOTAL E&P Norge: for giving me the opportunity to write this thesis, and for consulting me through the process.

Thomas Moltubakk Holsen 14.07.2014

DEFINITIONS

1 GSm^3 = 1 Billion Standard Cubic Meters, measures volume of gas

BSGI Report – Barents Sea Gas Infrastructure Report

E&P Companies– Exploration and production Companies

EU – European Union

Gassco AS – Operator of the gas pipeline system on the NCS, State owned company

Gassled JV – A joint venture of companies that owns most of the pipeline infrastructure on the NCS

HSE – Health, Safety & Environment

IPO – Initial Public Offering

IRR - Internal rate of return

MPE – Ministry of Petroleum and energy

NCS – Norwegian Continental shelf

NPV - Net present value

SDFI - The State's direct financial interest

TPA – Third Party Access

WACC - Weighted average cost of capital

LIST OF FIGURES

LIST OF GRAPHS

LIST OF TABLES

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 RESEARCH QUESTION

Gas infrastructure consists of gas pipelines, processing terminals and receiving terminals for gas. This thesis assesses how the gas infrastructure on the NCS is financed today, and how possible new gas infrastructure could be financed in the future. The research will look at how new investment models can affect the project economy for a field when separating the gas infrastructure from the rest of the field development.

1.2 MOTIVATION

There are three basic motivators for this thesis. First, Gassco, the Norwegian gas infrastructure operator stated "*The rate of return from field investments could be improved if separated from investments in the gas transportation system with regulated return.*[1]"

Second, the increasing cost of production of oil and gas on the NCS has received attention in the industry and among international investors. This has increased focus on separating costs that are within the core business of the oil companies.

Third, in 2013 the Ministry of Petroleum and Energy (MPE) adjusted the controlled tariff and increased focus on which entities could be interested in investing in separate, upcoming infrastructure investments and how these could be financed.

These three challenges combined has been the motivation to write the thesis and answer the research question on how alternative financial models can affect the project economy and realization of new gas resources in the NCS.

[1] (Gassco AS, 2014)

1.3 METHOD

The method used to answer the main research question is a combination of explanatory assessment and case testing. The thesis is divided into five parts to reach the conclusion.

It will begin with a theoretical part to give an academic foundation on the research. Second, the thesis will focus on the background and organisation of the gas industry on the NCS. The third and fourth part of the thesis gives a more specific view on how infrastructure gets financed and who could be able to finance an infrastructure investment NCS.

Last, the analysis will consist of a scenario analysis of two cases. The two cases will focus on the separation of gas infrastructure on the NCS and compare and interpret the findings.

1.4 TOTAL E&P NORGE

This thesis is written with guidance from Total E&P Norge. Their focus has been to provide the thesis with as much accurate information as possible, both thru their experience and knowledge from infrastructure investments on the NCS, and from their general knowledge of the industry.

The French company Total S.A is the world's fifth largest Oil and Gas Company and has its headquarters in Paris, France. There are approximately 97,000 employees working in Total S.A today, and they have operations in more than 130 countries, worldwide. [2]

Total E&P Norge is part of the Total S.A group and has revenues of around 50 BNOK a year. There are 322 employees in Total E&P Norge, which are engaged in the exploration and production of oil and gas on the NCS. They produce about 275,000

[2] (TOTAL SA)

barrels of oil equivalents every day, and are working to strengthen their position as an operator on the NCS.[3]

DISCLAIMER: This Master thesis is written by the candidate alone and any and all interpretations, finding and opinions presented herein are those of the candidate, and does not reflect or intend to reflect the interpretations, opinions or intentions of Total E&P Norge AS.

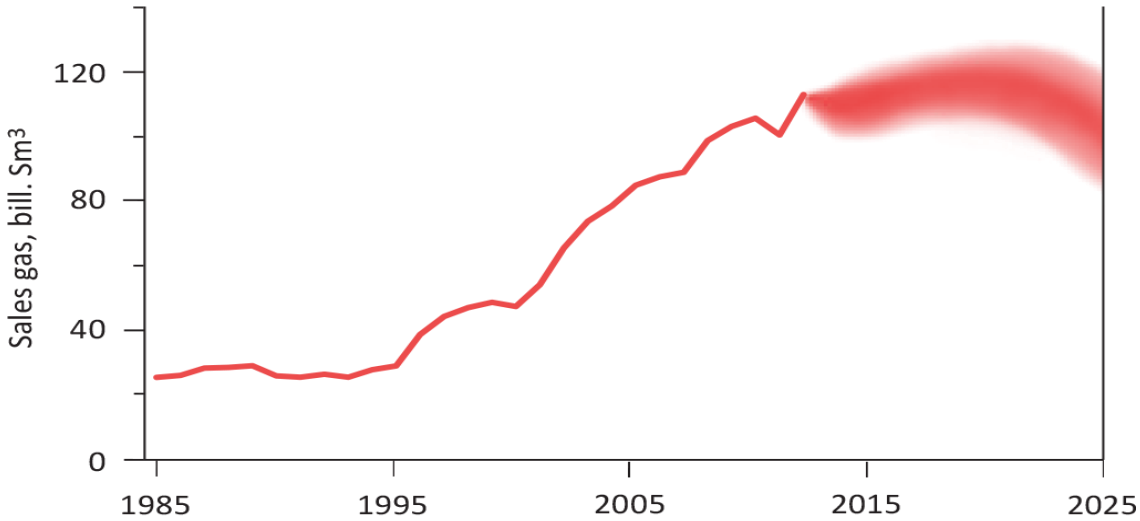
1.5 HISTORY OF THE GAS INFRASTRUCTURE IN NORWAY

On the 23rd of December 1969 Philips Petroleum found the first oil and gas field on the NCS[4]. The field was called Ekofisk, and soon became the largest offshore oil reservoir in the world. The newly discovered resources confirmed that there was oil and gas on the NCS. This lay the foundation for a new industry in Norway. In the years after the Ekofisk discovery more fields were discovered on the NCS and the gas production increased. This also increased the need for infrastructure to transport the hydrocarbons to shore and further to the European market. In 1977 the first offshore gas pipe line was built, Norpipe and later the same year the Frigg pipeline was ready for operation. The network has developed at the pace of the NCS and is now recognised as the largest and most advanced offshore gas infrastructure network.

[3] (TOTAL E&P Norge)

[4] NPD.no (http://npd.no/no/Publikasjoner/Faktahefter/Fakta-2013/)

The gas pipe network consists of almost 8000km of offshore pipelines that transport gas from the gas-producing fields on the NCS to the UK and Europe. Approximately 95% of the 109 GSm3 of the natural gas produced in Norway gets exported via the gas pipe network operated by Gassco AS every year[5]. The network is owned by Gassled JV and operated by Gassco AS. Gassled JV is a joint venture of investors, whereas Gassco AS is fully state owned company. The graph below shows a historical view of the gas sold form Norwegian fields over time. In addition, it shows some of the estimated gas sales until 2025. The level of gas sales is estimated to decrease from 2020. However, this may be stabilized if development of new gas fields keep growing.

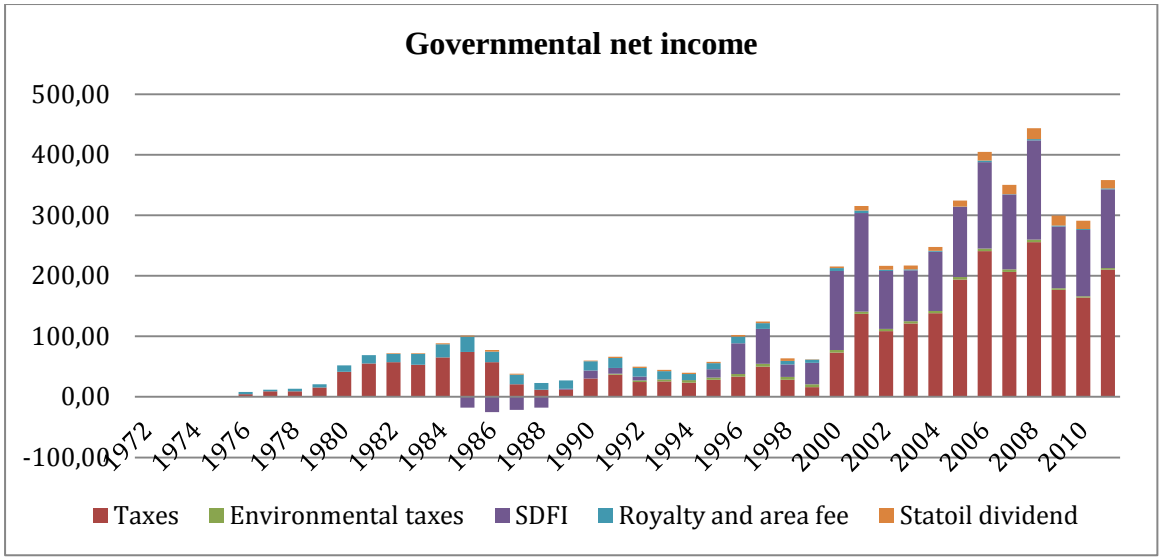


GRAPH 1, GAS SALES FROM NORWEGIAN FIELDS (MPE)[6]

The net income the the Norwegian government has generated from the petroleum production is shown in graph 2. This gives a visual impression of how important the industry is for the Norwegian government.

[5] Gassco/Oljedirektoratet

[6] (Norwegian Ministry of Petroleum and energy, 2013)



GRAPH 2, GOVERNMENTAL NET INCOME OVER TIME, IN BILL.NOK[7]

To transport gas via the Norwegian gas infrastructure network the shipper has to pay a fee per sm^3 of transported gas. The price changes according to which zone the shipper transport its gas.

[7] (Norwegian Ministry of Petroleum and energy, 2013)

The network is split into nine different zones, from A to I. Each zone represents a geographical area, a pipeline or a process plant that is linked to the network. The price setting in the different areas will be discussed later in chapter 3.4.

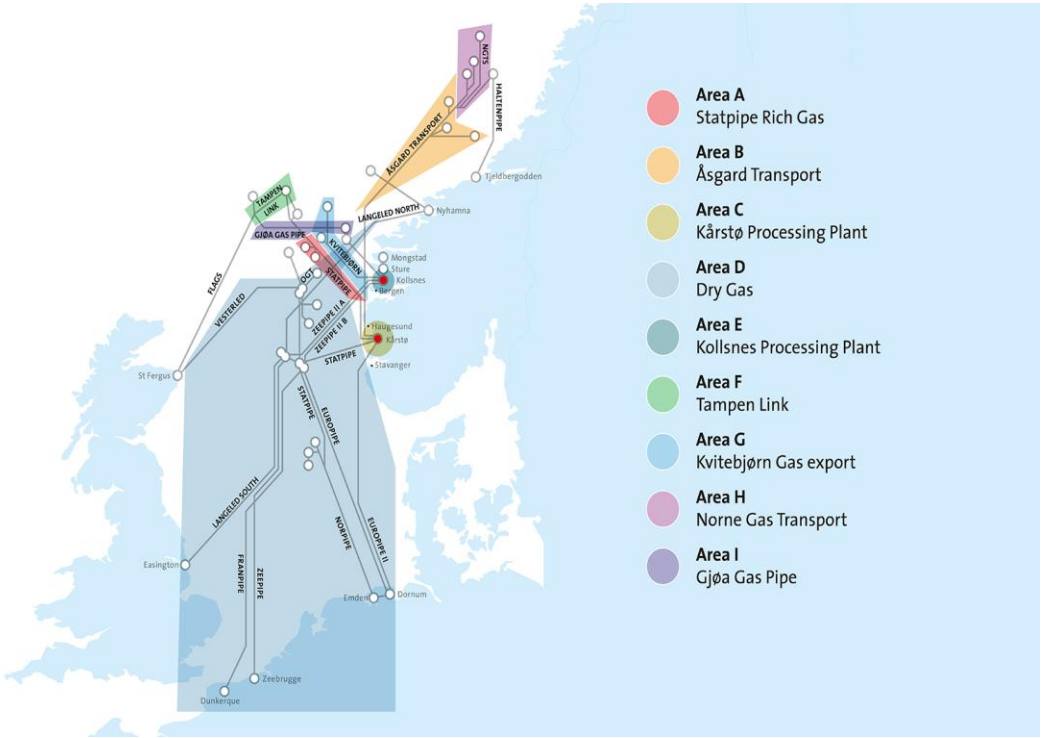


FIGURE 1-1, AREA DISCRIPTION OF THE GAS NETWORK ON THE NCS[8]

As seen in graph 1 and 2, the oil and gas sales has provided the Norwegian government with large economical resources for several decades. To maintain a high production level on the NCS of both oil and gas, new oil and gas fields needs to be discovered and developed, which can contribute to the future economy of both E&P companies and the income for the Norwegian government. However, development of new fields comes at a great cost and, for some fields it is also necessary to build gas infrastructure. The development of such fields demands large investment with relatively high risk attached to it.

To better understand the importance and difficulties of the investments in infrastructure on the NCS, as well as understanding the results of the analysis presented later on, the next chapter will go through general investment theory.

[8] (Gassco AS)

2.0 INVESTMENT THEORY

To understand how investments decisions are made, this chapter will focus on the theory behind investments. First, theory behind real and financial assets will explain the difference between assets and their value for an economy. Thereafter, theory of financial markets explains the risks in the investments and the importance of portfolio diversification. Last, the different tools needed to invest and determine whether the investment meets the criteria set by the investors will be explained

2.1 REAL- AND FINANCIAL ASSETS

All economies consist of both real- and financial assets. Real assets are the cornerstones in every economy, and include land, buildings, machines, and knowledge that can be used to produce goods and services. Financial assets are stocks and bonds that contribute little value to the direct creation of goods and services. Financial assets are claims to the income of real assets, which can be bought through shares in companies or governmental bonds which includes the shareholder in governmental profit.

According to (Levine, 2005) there are 5 different services that characterize a good financial system, these are needed to provide growth and financial stability, but there are large differences of how well these 5 functions are provided in different economies.

- Production of information e.g. about possible investments and allocate capital.
- Monitor investments and exert corporate governance after providing finance.
- Facilitate the trading, diversification, and management of risk.
- Mobilize and pool savings.
- Ease the exchange of goods and services.

All these functions are needed to provide growth and financial stability in a economy, according to (Levine, 2005) the financial system in Norway provides these functions well, and is looked upon as an advanced economy by IMF.[9]

The level of how well developed an economy is, often correlates with more structured and larger financial asset market, i.e. the United States. Large stock exchanges like NYSE, NASDAQ and Dow Jones, are good examples of facilitating trade for potential investors. Although financial assets do not directly contribute to the net income of the economy, large values are created for the economy in form of defining the allocation of income or wealth among investors. It makes it possible for people to invest in their future instead of consuming all their income as soon as they earn it.

One of the main differences between the two assets is how the easy the assets are to trade in different markets. Financial assets can be small shares of a company that is traded on the stock exchange daily, whereas a real asset, like an area of land, is not as easy to find a proper buyer for.

Commodities are easy assets to invest and sell compared to financing a railroad from New York to Los Angles. In the global financial market you can trade any kind of asset that is possible to put a price on. This includes both real and financial assets, and there are many differences between assets size, price, risk and rate of return.

In the next section some of the differences between the assets in the financial market will be explained.

2.2 FINANCIAL MARKETS

Most economies have a financial market, and in the largest financial markets there are many possibilities to trade in several different sectors and products. The financial markets play a central role in the allocation of capital resource, and the most important ones are the stock, bond, currency and commodity markets. There are different shareholders in the market: You do not have to be an investor or trade in single stocks to participate in the financial market. It is possible to invest thru

[9] (Internatinal Monetary Fund, 2014)

different index funds. E.g. If you want to follow the infrastructure market you can invest in iShares Global Infrastructure[10] (Bodie, Kane, & Marcus, 2011) that exposes their investors to companies that provide transportation, communication, water and electricity services.

2.2.1 INVESTMENT MANAGEMENT

For an investor or investment firm the main objective is to maximize the profit of the invested capital and minimize the risk. The assets with the highest risk are often the ones with the highest return, but also the assets that could generate the worst losses. An investor that wants a fast and high return on the invested capital would be interested in assets with high return and risk. An investor with a longer perspective on the investment would be wise to invest in less riskier assets, with a lower expected return.

To maximize the profit and still maintain a good rate of return, investors could diversify their investments. By diversification an investor can buy both risky and less risky assets that combined could give a more stable, and higher return than a single asset over time. Diversification creates an opportunity for the investor to buy assets in different industrial sectors, which could avert downward cycles in some markets and minimize the loss.

Infrastructure is an example of an asset that could help to diversify an investor's portfolio. A general point of view of infrastructure is that it is a stable long term investment. There is a need for infrastructure in most countries and societies, and this is often regulated by the authorities. Infrastructure can have an income that correlates with the economy of the country and the general growth in GDP. This makes it a valuable and stable asset for a portfolio that consists of riskier assets. If the return on an asset correlates with the national economy, it is important to invest in a stable and political reliable country. One of the indicators of this can be how well developed the financial system is.

[10] (iShares by BlackRock)

2.3 INVESTMENT DECISION RULES

This section will mainly focus on some financial models that are used for decision making in the analysis. The models that will be explained are cash flow model, Net Present Value model, internal rate of return, payback rule and the weighted average cost of capital.

2.3.1 NET CASH FLOW

Net cash flow describes the future income of an investment project divided into each year of the payback period (Berk & DeMarzo, 2011). The length of the payback period depends on the project. The reason to measure the net cash flow of the project is to find out if the investment is capable of a yearly return or a larger return over time, which is called the cumulative cash flow. The cumulative cash flow sums up the net cash flow for each year and calculates the total cash flow during the payback period. In the analysis in chapter 6 both the cumulative and net cash flow will be used to analyze the investment models. If discounted cumulative cash flow is lower than zero, then the project does not satisfy the investors return on the investment. (Berk & DeMarzo, 2011)

2.3.2 THE NET PRESENT VALUE AND THE NPV DECISION RULE

The NPV is the total of the present values of all project net cash flows. It is explained by the following formula:

$$NPV = \sum \frac{C_t}{(1+r)^t} - C_0$$

Explanation of the NPV formula: (Berk & DeMarzo, 2011)

t = Number of time periods

C_t = Net cash inflow during the period

C_0 = Initial investment

r = Discount rate

NPV decision rule:

"When making an investment decision, take the alternative with the highest NPV. Choosing this alternative is equivalent to receiving its NPV in cash today." (Berk & DeMarzo, 2011)

2.3.3 IRR, INTERNAL RATE OF RETURN

The internal rate of return, IRR, of an investment is the discount rate that sets the NPV of the projects cash flow equal to zero. This means that the NPV is negative for discount rates that are higher than the IRR, and the project shows no future increased value. (Berk, DeMarzo, 2011)

2.3.4 WEIGHTED AVERAGE COST OF CAPITAL

Weighted Average Cost of Capital is the effective after-tax cost of capital for the investor, the formula is shown under. (Berk & DeMarzo, 2011)

$$r_{wacc} = \frac{E}{E+D} r_E + \frac{D}{E+D} r_D (1 - \tau_C)$$

R_{wacc} = WACC rate

E = Value of investors Equity

D = Value of investors Debt

R_E = Equity interest rate

R_D = Debt interest rate

τ_C = Company tax

The WACC is often used as discount rate for the NPV to value a project.

2.3.5 PAYBACK RULE

The payback rule is also used during investment decisions. As opposed to the NPV model, the payback rule is for single, standalone projects within a company. The main criteria are that an investment should have a profitable return within a specific period

of time, defined as the payback period. The payback period is normally set to a few years, depending on the investor. For profit in a project the investment has to be paid back during the payback period, if not, the project will be rejected. (Berk & DeMarzo, 2011)

A challenge with this model is that it might reject projects that have a positive return after the payback period is over. By using the payback rule, investors could reject projects and loose potential profit for the company.

The payback rule does not take the cost of capital into consideration, which makes the foundation of the decision making less reliable comparing to the NPV method. The NPV takes the value of time and money to make it as reliable as possible into consideration.

In the analysis the IRR, WACC and th NPV model will be used to calculate income and costs of an infrastructure investment. Due to the uncertainty of the payback rule this will not be used.

3.0 BACKGROUND, GAS INFRASTRUCTURE ON THE NCS

3.1 THE YEAR 2001

The corporate structure of the pipeline network has not always been managed as today, namely with Gassco AS as a neutral operator of the network and Gassled JV as the direct owner of the network. This was initiated simultaneously as the IPO of Statoil ASA , in 2001. This, in addition to other factors, forced some changes to the organization of the gas infrastructure network on the NCS.

When the first pipes on the NCS were built they were financed, built and operated by the upstream companies on the NCS. The large oil companies almost had a monopoly on gas sales and gas transport for a long period of time. They could in consultancy with other companies decide the prices for transportation of gas on the NCS. The council that took these decisions was called GFU, (Gassforsyningsutvalget) or Gas

Negotiation Committee. GFU was set by Statoil and Norsk Hydro (Saga Petroleum was also a previous participant in GFU) (Austvik, 2003).They could sell and manage the gas from the fields on the resource owners' behalf because they owned and operated the system. The planning and development of the gas pipe network was managed by the Gas Supply Committee (FU, Forsyningsutvalget). They planned the development of the system along side with the upstream companies who developed the oil and gas fields. The reason for this organizational structure was to get the gas transport system as efficient as possible in the beginning. It was a sufficient way to manage a system that was still small and compact, with few pipelines to manage.

The system developed into a much larger network from 1977 to 2001, not only with pipelines but processing plants as well. (See table 1 and 2.)

In the 1990's the EU decided to liberalize the gas market to prevent monopolies of having ownership in all parts of the gas infrastructure network in Europe. This was done according to the EU's gas market directive for organization of transport operations.

The EU proposed three directives to liberalize the market for gas transport. (Austvik, 2003) The essential paragraphs of these three directives are stated under.

A. Make the market more transparent (EU, 1990)

B. Allow the transit of gas between high pressure transmission pipelines (EU, 1991)

C. Introduce third party access (TPA) to the transmission pipelines as well as splitting the transmission companies' function as both transporters and wholesalers (EU 1992)

Both paragraph A and B above were approved shortly after they were proposed, whereas paragraph C was approved and implemented as late as August 2001.

These directives were the main reason of the establishment of Gassled JV and Gassco AS. The Norwegian government had to organize the network for an independently

controlled transport system for the gas shipped from Norway to Europe. This was done by merging all the separate ownerships of the gas infrastructure into a network, Gassled, and presented each company with a share that represented their invested part of the gas infrastructure.

The second measure the government executed in 2001 was the establishment of a state owned independent company, Gassco, whose purpose is to operate the gas network on behalf of the owners and the Norwegian government. As a result, the NCS had a third party that could control the operations of the gas transport, as a neutral operator of the system. The new structure made the market more transparent and less monopolized in line with the EU directives.

The next two sections will describe more about the main actors involved in the gas transportation network on the NCS today: Gassled JV and Gassco AS.

3.2 GASSLED JV

Gassled JV is a Joint venture company that owns most of the pipeline network on the NCS. "Table 1" shows an overview over the pipelines that are merged into the Gassled system.

Gas pipelines included in Gassled

Pipeline	Startup	Product	Start point	End point
Zeepipe				
Zeepipe 1	1993	Dry gas	Sleipner riser platform	Zeebrugge
Zeepipe 2A	1996	Dry gas	Kollsnes	Sleipner riser platform
Zeepipe 2B	1997	Dry gas	Kollsnes	Draupner E
Europipe 1	1995	Dry gas	Draupner E	Dornum/Emden
Franpipe	1998	Dry gas	Draupner E	Dunkerque
Europipe II	1999	Dry gas	Kårstø	Dornum
Norpipe AS	1977	Dry gas	Norpipe Y (Ekofisk Area)	Emden
Åsgard Transport	2000	Rich gas	Åsgard	Kårstø
Statpipe				
Zone 1	1985	Rich gas	Statfjord	Kårstø
Zone 4A	1985	Dry gas	Heimdal	Draupner S
Zone 4B	1985	Dry gas	Draupner S	Norpipe Y (Ekofisk Area)
Oseberg Gas Transport	2000	Dry gas	Oseberg	Heimdal
Vesterled (Frigg transport)	2001	Dry gas	Heimdal	St. Fergus
Langeled North	2007	Dry gas	Nyhamna	Sleipner Riser
Langeled South	2006	Dry gas	Sleipner	Easington
Tampen Link	2007	Rich gas	Statfjord	FLAGS
Norne Gas Transportation System	2001	Rich gas	Norne field	Åsgard Transport
Kvitebjørn gas pipeline	2004	Rich gas	Kvitebjørn	Kollsnes
Gjøa Gas Pipe	2010	Rich gas	Gjøa Field	FLAGS

TABLE 1, PIPELINES INCLUDED IN GASLED JV[11]

"Table 2" shows the terminal facilities that are included in the Gassled Network.

[11] (Staoil ASA)

Terminal facilities included in Gassled			
Terminal	Startup	Product	Location
Europipe Receiving Facilities	1995	Dry gas	Dornum, Germany
Europipe Metering Station	1995	Dry gas	Emden, Germany
Norsea Gas Terminal	1977	Dry gas	Emden, Germany
Kårstø Gas Processing Plant	1985	Dry gas/NGL	Kårstø, Norway
Easington Receiving Facilities	2006	Dry gas	Easington, UK
St.Fergus Terminal	1978	Dry gas	St. Fergus, Scotland
Kollsnes Gas Processing Plant	1996	Dry gas/NGL	Kollsnes, Øygarden Norway

TABLE 2, TERMINALS INCLUDED IN GASSLED JV[12]

After Gassled JV was established, most of the infrastructure was merged into Gassled JV. This was in line with the Third party access (TPA), proposed by the EU. The intention of the proposal was to prevent monopolies in the industry. The joint venture was created so that all of the former owners of infrastructure on the NCS, should now own their share in Gassled JV instead. The ownership structure in Gassled is shown in Table 3, with ownership figures from 2009-2010.

Ownership Structure Gassled	2009-2010
Petoro AS	38,43 %
Statoil ASA	32,07%
Exxon Mobil	9,40%
TOTAL E&P Norge	7,76%
Shell	5,34%
Norsea Gas AS	2,72%
ConocoPhillips Skandinavia AS	1,99%
Eni	1,52%
DONG E&P Norge AS	0,66%
GDF SUEZ E&P Norge AS	0,09%
RWE Dea Norge AS	0,02%

TABLE 3, OWNERSHIP STRUCTURE GASSLED JV[13]

[12] (Staoil ASA)

[13] (Staoil ASA)

The year after in 2011 the Ministry of Petroleum and Energy (MPE) allowed investors to buy upstream companies shares in Gassled JV. The result of this was a substantial change in the Gassled JV owner structure. Table 4 show the ownership structure of Gassled JV from the 5th of November 2012.

Ownership Structure Gassled	**05.11.2012**
Petoro AS*	45,79 %
Solvieig Gas Norway AS	24,76 %
Njord Gas Infrasructure AS	8,04 %
Silex Gas Norway AS	6,10 %
Infragas Norge AS	5,01 %
Statoil Petroleum AS	5,00 %
Norsea Gas AS	2,26 %
ConocoPhillips Skandinavia AS	1,68 %
DONG E&P Norge AS	0,98 %
GDF SUEZ E&P Norge AS	0,30 %
RWE Dea Norge AS	0,08 %

TABLE 4, OWNERSHIP STRUCTURE OF GASSLED JV[14]

**Petoro increased their interest by approximately 7%, while all other parties reduced their interest proportionally.[15]*

3.3 GASSCO AS

Gassco AS was established on the 14th of May 2001, and started operating the Norwegian gas pipe network from 1st of January 2002.

Gassco AS is a governmental owned company that operates the Norwegian offshore gas pipe network. Their goal is to operate the network without profit, just cover their operating cost so that the transportation cost of gas is held to its minimum.

The company divides its business into four main areas[16]:

[14] (Gassled JV)

[15] (Staoil ASA)

1. Technical operator of the network
    - Gassco AS has the main responsibility of technical operations on behalf of the joint ventures that own the network.
2. Infrastructure development
    - Gassco AS contributes to planning of future gas pipes and transport related facilities.
3. Capacity administration
    - Gassco AS allocates the capacity of the gas pipes and process plants
4. System operations
    - Ensure that Norwegian gas get to the right place with the right volume and right quality.

Gassco AS supports and facilitates the planning and development of new infrastructure network. The main planning, financing and development for fields are done by the E&P companies. Gassco AS is the operator of the gas infrastructure and administrates the transport and capacity for the shareholders. The MPE sets a tariff for transporting gas through the pipeline to ensure that the shareholders gets a reasonable rate of return on the capital invested. How the tariff is set is explained in the next section .

3.4 TARIFF REGULATION ON THE NCS

The tariff for gas transport on the NCS is regulated by the government. It is the MPE that sets the tariffs through separate regulations. This is done so the MPE can ensure that the profit on the NCS is taken from the production, and not from the transport system (Norwegian Ministry of Petroleum and energy, 2013).

The tariff is based on this formula, set by the MPE.

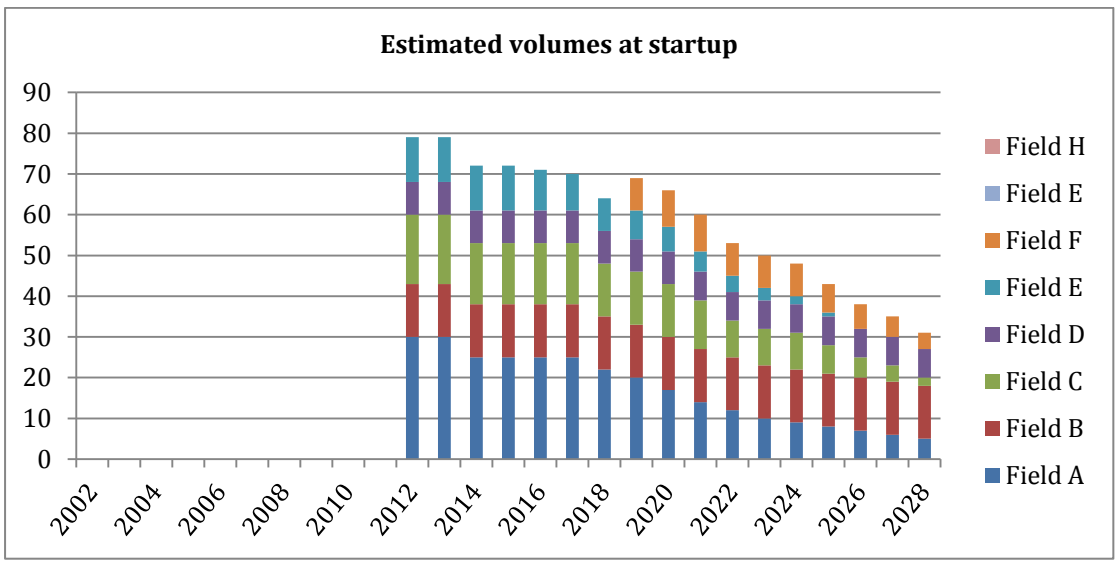
$$t = \left(K + \frac{I}{Q} + U \right) \bullet E + \frac{O}{Q}$$

[16] (Gassco AS)

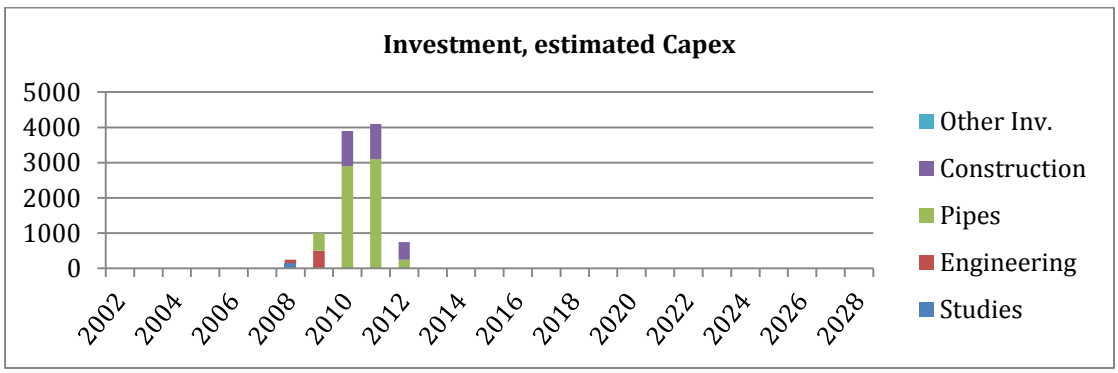
***K** represents the capital invested during the construction of the infrastructure.*
***O** represents the operational cost of the pipeline and small investments to the system.*
***I** represent the investments in the pipeline after the pipeline is built.*
***U** represents the investments to expand the pipeline system.*
*The **U** element has never been used by Gassco AS.*

3.4.1 THE K ELEMENT, RETURN ON CAPITAL OF INVESTMENT

After a pipeline has been built, the investors have a right to a reasonable return on their investment. This reasonable return has historically been set to 7%. The K element is calculated based on how much gas that is assumed to run though the pipeline in its lifetime. This implies that the higher the production estimates are in the field, the lower the K will be in the formula. Graph 3 and 4 below are examples to illustrate the calculation of the K value.



GRAPH 3, ESTIMATED VOLUMES AT STARTUP, GIVEN IN MILLION SM^3 (LEFT AXIS)



GRAPH 4, PIPELINE CAPEX, IN MILLION NOK (LEFT AXIS)

The two graphs show what the K element is based on:

A. The K element price is given in NOK/Sm^3

B. The CAPEX (graph 4) is divided into how much gas that is estimated to run through the pipeline in its lifetime (graph 3).

The CAPEX, plus the 7% in return is calculated as a cost per unit, NOK/Sm^3, to ensure that the investors get their return when the field has produced the estimated volume.

3.4.2 THE O ELEMENT, OPERATIONAL COST

When production of gas and the operation of the pipeline starts, there is an additional operational cost for the pipeline. Also included in the O element are small investments that cover maintenance of the pipeline. There are restrictions on the size of these investments, and the following table (table 5) shows what restrictions there are on the O element each year. If the planned investment exceeds these limits, the investment is calculated as an I-element. When Gassco AS calculates investments in the O element, it is returned within the same year. These investments do not include a rate of return as the K element does.

Area	Upper limit of O the element
A & B	40 m. NOK x E
C	250 m. NOK x E
D	200 m. NOK x E
E	250 m. NOK x E
F	40 m. NOK x E
G	40 m. NOK x E
H	40 m. NOK x E
I	40 m. NOK x E

TABLE 5, UPPER LIMITS OF THE O ELEMENT

3.4.3 THE I ELEMENT, INVESTMENTS ON THE PIPELINE

Table 5 shows the limits of investment in each area of the O element. If the amount gets higher than the limits above it is structured as an investment in the I element. These are investments paid back over several years, unlike the O element that pays

back the same year. The I element includes the 7% reasonable rate of return that is given in the K element.

3.4.4 THE U ELEMENT, EXPANDING OF THE PIPELINE

The U element of the formula is covering project costs for expansion of the pipeline. The U element has never been used as by Gassco AS.

3.5 INFRASTRUCTURE ON THE NCS TODAY

The tariff regulation ensures that the tariffs are held at a reasonable level and that no one has a higher profit than the regulated profit on infrastructure investments.

It is assumed that E&P companies on the NCS have a rate of return goal of approximately 15% on their investments. The tariff regulation makes it challenging for them to reach their targets for rate of return.

According to the "Regulations to the Petroleum Act §62" (Lovdata), investors of gas infrastructure are entitled to a priority to book capacity in new gas infrastructure projects. This means that if E&P companies want to secure transport of gas to the market, it is necessary to invest in pipelines under the current regulations. The companies that do not invest can book the remaining capacity if and when it is available.

As explained earlier, investment funds have bought large shares in Gassled. This has freed capital to the E&P companies, which can be used to focus on exploration and production. This is positive for both investors, who look for a long-term investment, and for E&P companies who can free capital to focus production of oil and gas.

To make it beneficial for the investors on the NCS there has to be a reasonable profit for the investor to cover for the risk they take. The politics on the NCS has been considered reliable until the tariff was adjusted in 2013. The governmental decision to change the tariff has made it riskier for investors that look for a stable income over time. A return on an investment of 7% is a good investment for some investment companies. These are often large investment funds or investors that depend on long-term investments with stable income and low risk. For an E&P company with an

assumed rate of return of 15 %, the benefits of an investment in infrastructure at 7% would not generate any sufficient profit, but it would create a transportation opportunity from a future field development. And this is a valuable incentive for E&P companies.

The next chapter will focus on investments in the infrastructure segment and point out the special factors when investing in infrastructure in general and on the NCS

4.0 HOW INFRASTRUCTURE IS FINANCED

This chapter consists of two elements. First the different investment approaches that can be suitable for investors within infrastructure will be assessed. Subsequently possible investors for infrastructure will be analysed.

4.1 INFRASTRUCTURE INVESTMENTS

Infrastructure is an extensive term which includes most of buildings, roads and networks needed for the functioning of a community or society. The physical specifications can be divided into two types, economical and social sectors. The first, the economical infrastructure, includes transport, utilities, communication and renewable energy. And the second, the social infrastructure, also called public real estate, includes schools, hospitals, defence buildings, prisons, and stadiums. (Della Croce, 2012)

Economical infrastructure				**Social Infrastructure**
Transport	**Utilities**	**Communication**	**Renewable Energy**	**Public Real Estate**
Toll Roads	Water Supply	Mobile Network	Wind	Schools
Parking	Garbage Disposal	Satellites	Solar	Hospitals
Airports	Sewers	Internet	Wave	Prisons
Harbors	Pipelines		water	Military Bases
Tunnels				Parks
Bridges				Stadiums
Railway				

TABLE 6, ECONOMICAL INFRASTRUCTURE

The variety of infrastructure assets lead to disagreement on what types of infrastructural assets should be included in the model above. According to (Inderst, 2009) there are several characteristics that can identify an infrastructural asset, including several economic aspects that emphasize the limited competition of the marked, these are listed as followed.

- Economic: Natural monopolies
- Regulation: Controlled charges and fees.
- Concession from authorities: Long-dating contracts

Infrastructure assets typically show one or more of the following economic characteristics:

- High barriers to enter the market
- Economies of scale (e.g. high fixed, low variable cost)
- Inelastic demand for services (giving pricing power)
- Low operating cost and high target operating margins
- Long duration of the investment (25 to 99 years, etc.)

These characteristics give a good perspective of how an infrastructural asset is described as an asset class. Next, the infrastructural investment will be described and divided into different investment assets.

4.1.1 Greenfield versus Brownfield investments

There is a difference between investing in a business plan for a new railroad and investing money in a fully functional railroad that have a profitable return. The outcome of the investment can be the same for both alternatives but there is more risk involved in investing in a business plan than in an investment that gives a return. This is an example of the main difference between a Greenfield investment and a Brownfield investment, and in this section of the thesis these two terms will be explained more specifically.

Greenfield projects are uncompleted projects, or projects that not have been started yet. They may be in the construction, financing or planning stage and still need large

investments to get completed. In these types of projects the risk of things going wrong, delays or unforeseen problems are high, and can be intimidating for some investors.

Brownfield projects are finished, operating and already making a profit. This makes it safer to invest, since much of the risk already is eliminated in earlier processes.

Investors in Brownfield projects will typically be looking for a safe investment, with as little risk as possible and a long time horizon with a sustainable rate of return.

Investors looking for a greater profit in the long term often seek new projects that have the typical Greenfield project prerequisites. These investments often have a J-curved graph to describe them. There are large investments in the beginning of the project when the income is generated after some years and the market has grown into a profitable market. This profit can often be substantially larger than the capital expenditure that was invested at the start of the project, hence generating a substantially high profit.

To compare Greenfield and Brownfield projects with other asset classes, according to (Inderst, 2011) Greenfield and Brownfield infrastructure investments vary in relation to traditional asset classes; this is shown in Figure 2 below. The figure shows the correlation between expected risk and expected return among the different assets. Fixed income is at the bottom, with low risk and low return, while Brownfield projects have a medium risk and medium return. The two with the highest possible return are the Equities and the Greenfield projects. The figure below show a picture of the differences between assets class and where the Greenfield and Brownfield projects are located.

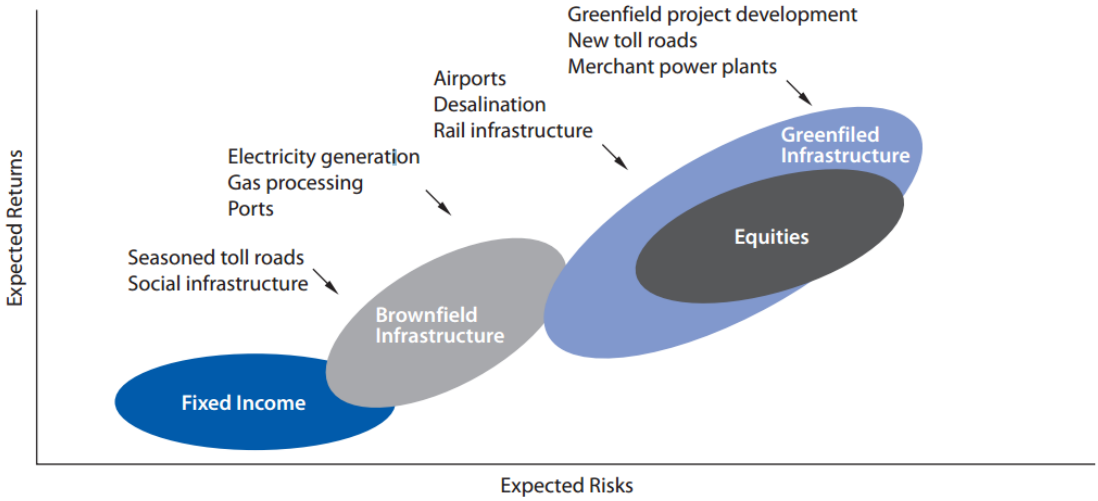


FIGURE 4-1, RISK RETURN PROFILES COMPARED WITH OTHER ASSET CLASSES[17]

On the NCS, Greenfield and Brownfield projects are valued in a different way. Since there are strict HSE rules on the NCS, it can be risky and costly to do maintenance or upgrades while the field is still producing oil and gas. Brownfield projects are categorized as a "live patient" for stakeholders. The field sometimes has to stay in production while upgrading since the cost of shutting down production is high. The risk of investing in a producing Brownfield project, compared to a Greenfield project that has no production, can be high.

As described above there are different elements of investment that attract different types of investors, often characterized by what kind of risk the investors are willing to take. In chapter 4.2 different types of investors will be described. First the pension funds that look at investing in Norway will be discussed, thereafter the Norwegian government infrastructure investment philosophy in Norway will be looked into. Lastly the possibility for private companies to invest in infrastructure is assessed. Later in the thesis these alternatives will be compared to find the most favourable alternative for future investment models on the NCS

[17] (Inderst, Papers.ssrn.com, 2011)

4.2 WHO HAS THE ABILITY TO INVEST IN INFRASTRUCTURE ON THE NCS

There are three types of investors that could have the ability and strategy to invest in the typical infrastructure projects on the NCS. Since the present investment model involves the E&P companies, this is the first type. The second type is the Norwegian government and the thesis will discuss how it would be willing and able to invest in infrastructure. The third type is the international pension funds.

When discussing the alternative investors the focus will be on the difference between the incentives to invest and what type focus they have on risk and return of capital.

4.2.1 FUNDING BY E&P COMPANIES

E&P companies have financed the existing pipeline network on the NCS. They have had reasonable returns on the investments and managed to make a stable and functional transportation network. However, as mentioned earlier in the thesis, the economic situation for the E&P companies on the NCS has changed over the later years due to higher cost of extracting oil and gas. This makes it harder for E&P companies to invest in projects with a fixed return on 7%. Since cost related to infrastructure can be a large part of a total field development cost, the return of the field has to be substantial in order to make the investment profitable.

The present investment model facilitates for the E&P companies to fund infrastructure on the NCS. Some of the large international companies that are active on the NCS would normally have easy access to capital through their parent company, whereas some of the minor companies do not necessarily have the same opportunities and have to obtain capital at a higher cost. How high their cost is will be explained more thorough in the analysis later in the thesis. The cost of investing is important, but for E&P companies there are other incentives to invest in infrastructure, as they need capacity in the pipelines to transport the produced gas to be able to sell it.

4.2.2 GOVERNMENTAL FUNDING

General infrastructure in Norway e.g. toll-roads, bridges or other infrastructure projects is financed by the Norwegian government. Governmental owned companies

are created to finance, build and maintain the infrastructure (PÖYRY, 2013). Two examples of this is the Public Road Administration who covers the public roads in Norway and Statnett who owns maintains and administrates about 90%[18] of the electrical grid network

The governmental funding of infrastructure on the NCS is not as integrated, as it is onshore. Gas infrastructure is financed in combination with the field development and the infrastructure normally gets transferred into Gassled when it is operational. In order to finance gas infrastructure on the NCS the government could either integrate it in the national budget, or let the Governmental Pension fund invest in the gas infrastructure.

The Governmental Pension fund has its own independent management and investment strategy. The fund is not directly controlled by the government, but it has strict guidelines set by the Norwegian Ministry of Finance. This indicates that the governmental pension fund will invest in projects that suit their portfolio in accordance with governmental guidelines.

Both of the alternatives can finance the project with equity or loan, but the weighting of this can vary, and in some cases investment funds and pension funds or the National budget is able to finance the whole investment solely by the use of equity.

4.2.3 LARGE INTERNATIONAL PENSION FUNDS

According to the OECD Large International Pension Fund Survey (Della Croce, 2012), there were 52 funds included in the survey that had a total of USD 7.7 trillion assets under management at the end of 2010. Of these assets the amount invested in infrastructure was 0.5% or USD 41.8 billion of the total assets in the survey. The numbers above show that there is a large potential for pension funds to invest in infrastructure in both national and international markets.

The Australian Pension fund was the first to look at infrastructure as a possible asset back in the 1990´s. The Canadian pension fund was also early to invest in the sector,

[18] (Nowegian Ministry of Petroleum and Energy)

and both the Australian and Canadian Pension fund have a much higher percentage of their portfolio in infrastructure then the rest of the world.

In later years international pension funds in Europe has seen the opportunities of investing in infrastructure and are slowly trying to get involved in the market.

5.0 ALTERNATIVE INVESTORS

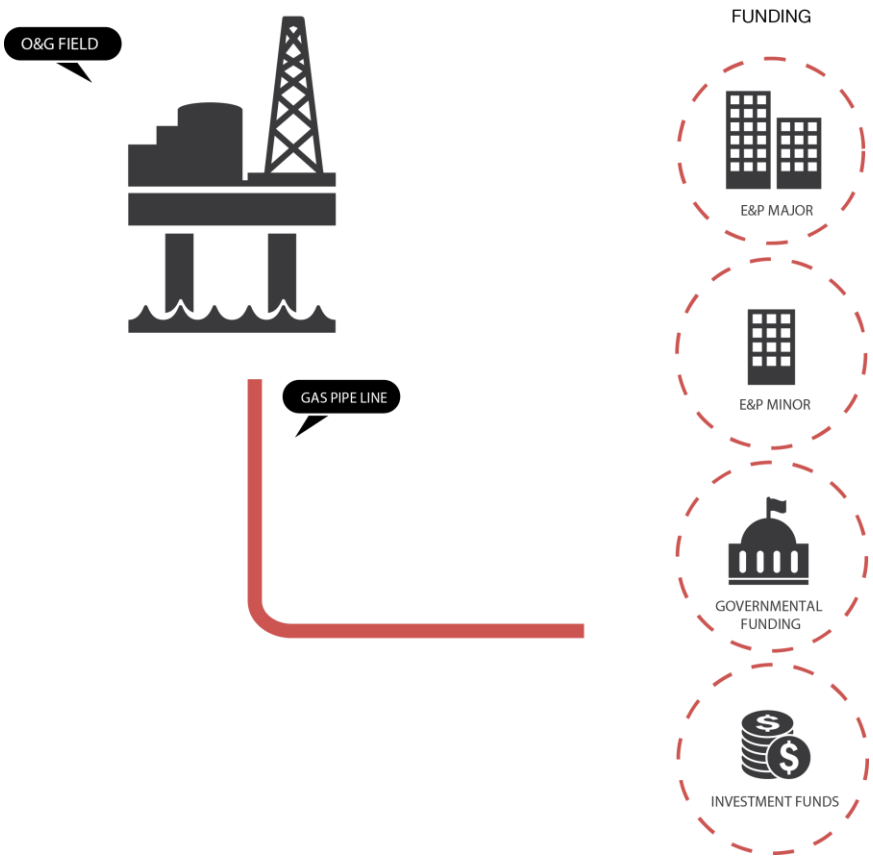
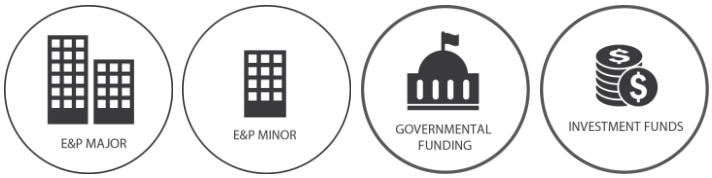


FIGURE 5-1, ALTERNATIVE INVESTORS FOR THE INFRASTURCTURE ON THE NCS

Figure 5-1 shows the financial separation of infrastructure on the NCS and how the alternative new investment model can appear. The figure shows the alternatives that are mentioned in chapter four, funding by E&P companies (Minor or Major), governmental funding and funding by investment funds. Whether these alternatives can contribute to realization of new gas resources on the NCS will be discussed in

chapter 5, the main analysis of the two investment models will be presented in chapter 6. The focus of the analysis will be to explore the potential benefits of separating the infrastructure investment form the rest of the field, and finding potential investors for the investment.

To make it easier to keep track on which alternative investor that has the attention in the thesis, each alternative will be explained with one of the symbols shown under.



This chapter shows four different investment alternatives. Three criteria in each alternative will be enlightened; the incentives, the risk and the cost of capital. When comparing the different alternatives to the same criteria's there will be some similarities in how the investors look them. The first section of this chapter will focus on the similarities. Later on there will be a more specific explanation of each alternative that will focus on what the investor looks into.

5.1 WHY INVEST IN INFRASTRUCTURE ON THE NCS?

This section focuses on the common incentives within the four alternatives that have been presented, and why the investors should invest in infrastructure on the NCS.

5.1.1 COMMON INCENTIVE FOR THE ALTERNATIVE INVESTORS

According to the investment theory as described in chapter 2, the main incentive for an investment is the potential rate of return. Investors would not invest in assets that have a negative rate of return and therefore positive rate of return is the motivation behind the investment.

5.1.2 COMMON RISK FOR THE ALTERNATIVE INVESTORS

The risk of investing in a pipeline on the NCS is mainly divided into two parts. Both of them will lead to either lower return on the investment or no return on the investment at all.

A risk for the investors is if the projected amount of gas produced from the field gets too low, or that production never starts. This is unlikely to happen, but if the projected amount of recoverable resources decreases to an amount that will be unprofitable for companies, the field will be shut down before production starts. The investor will have invested the total cost of a pipeline with no possible way to get return on the investment.

Another risky part of the investment is if the production starts with a high prospect for the field and the actual production never meets the expectations of the predictions. Since the tariffs K element is set in the beginning of production there may not be enough resources in the field to get to the point where the investors get their reasonable return on the investment. This is also an unlikely scenario, and normally it is the opposite way, that more volumes will utilize the infrastructure, hence pay tariff to the owners.

Due to the MPE's readjustment of the tariff there is a perception that there might be risk connected to the change in the stability of the future tariff level.

5.2 THE BENEFITS AND DISADVANTAGES OF E&P MAJORS INVESTING IN GAS INFRASTRUCTURE ON THE NCS

The model used on the NCS today is that the E&P companies investi in gas infrastructure. This will be the base-case in the analysis later in chapter 6. Section 5.2 looks at the different factors of why this may be a good alternative for future development of oil and gas on the NCS.

The structure of E&P´s investments are based on a project-to-project basis. E&P companies have an interest in producing and transporting their gas as reasonable as possible.

5.2.1 INCENTIVES

One of the characteristic incentives for E&P companies is the need for good transportation possibilities for the produced gas t in order to realize income. E&P companies may be willing to finance a pipeline if it gives a good transportation system. The only reason to invest in this transport system is if the resources in a field would cover the costs and lost rate of return.

Another incentive for E&P companies to invest in gas infrastructure is to secure transportation capacity. As explained earlier in the thesis, the investors of a pipeline have the first right to book capacity in the given pipe when it is operational. And if the E&P companies invest in pipelines in future projects it is assumed this privilege is continued.

5.2.2 Risk

No risk related to E&P specifically

5.2.3 Cost of Capital

A challenge for an E&P company when investing in infrastructure is the rate of return on the infrastructure investment is lower than their main activity, exploration and production. These investments are categorized as low risk projects compared to finding oil and gas, and have a lower rate of return. E&P companies have to have a large rate of return on their projects to be able to finance the exploration activity, and large investments with relative low return does not fit their portfolio.

This makes it hard for an E&P company to get funds to invest in projects that have a lower rate of return than 15%. Subsequently the cost of investing in gas infrastructure is high and it might lower the liquidity of the E&P company, and could result in a higher price for capital.

5.3 WHY SHOULD E&P MINORS INVEST IN GAS INFRASTRUCTURE ON THE NCS?

This section will also take a look at the E&P companies, but in this case it will be focused on the E&P minors on the NCS. The incentives and the risk of mainly the same in both alternatives but the section of how they raise capital and their cost of capital are possible a lot higher than the majors.

5.3.1 COST OF CAPITAL FOR E&P MINORS

It's assumed that minor E&P companies normally do not have the opportunity to acquire cheap capital at the same level as the major E&P companies. Since they have less production and larger costs connected to the amount of production, they take a larger risk. As the risk increases, the higher the cost to acquire capital will be.

5.4 WHY WOULD THE NORWEGIAN GOVERNMENT INVEST IN GAS INFRASTRUCTURE ON THE NCS?

This section explores why the Norwegian government should invest in infrastructure on the NCS. The Norwegian government is already a big investor on the NCS today, with its ownership Statoil ASA and Petoro AS.

5.4.1 INCENTIVES

The oil and gas industry is the one of the most important industries for the Norwegian government. To be able to ensure development of the industry the stakeholders has to minimize the production cost of oil and gas in the future. One of the reasons the Norwegian government should invest in infrastructure on the NCS is that it would lower the cost for the E&P companies to develop oil & gas fields. This would enable smaller fields that, given the situation today, would normally get classified as non-profitable to be developed.

Another reason of why the government has incentives to invest in infrastructure on the NCS is the macro economical perspective for the Norwegian society. A well developed oil and gas industry creates jobs and higher GDP for the time to come, and will benefit the Norwegian government in the long run.

5.4.2 Cost of Capital

According to the investment rules of the Norwegian Pension fund, it is not allowed to invest in infrastructure. This thesis looks at possible future solutions and the Norwegian pension fund is a very interesting alternative.

One of the reasons to let the Norwegian pension fund invest in the infrastructure on the NCS is that is has access to cheap capital, this make them attractive for the NCS since they have an AAA credit rating among several rating companies. (Trading Economics)

5.5 Why should investment funds invest in gas infrastructure on the NCS?

This section looks at the alternative for external investment funds on the NCS. The focus will be on Investment funds or large international financial institutions that have no other obligation to the NCS than investing in infrastructure.

5.5.1 Incentives

One of the advantages for an investment fund to invest in infrastructure on the NCS is the possibility of diversifying a portfolio. There is a relatively stable return of 7% which has low correlation with the stock market. This investment could be a part of the portfolio diversification and lower the overall risk.

An attractive investment has a good and stable return over a long period of time. Infrastructure investments fits this profile and this can attract investment funds to the NCS.

5.5.2 Risk

The NCS has been looked upon as a stable and secure place to invest in from a political context. This was reduced in 2013 when the MPE lowered the K element in the tariff by 90%, after much of the shares were bought by international investment companies. This has become an issues some of the companies have raised a lawsuit against the Norwegian government. Decisions like this have increased the risk of investing in NCS related to gas infrastructure.

5.5.3 Cost of capital

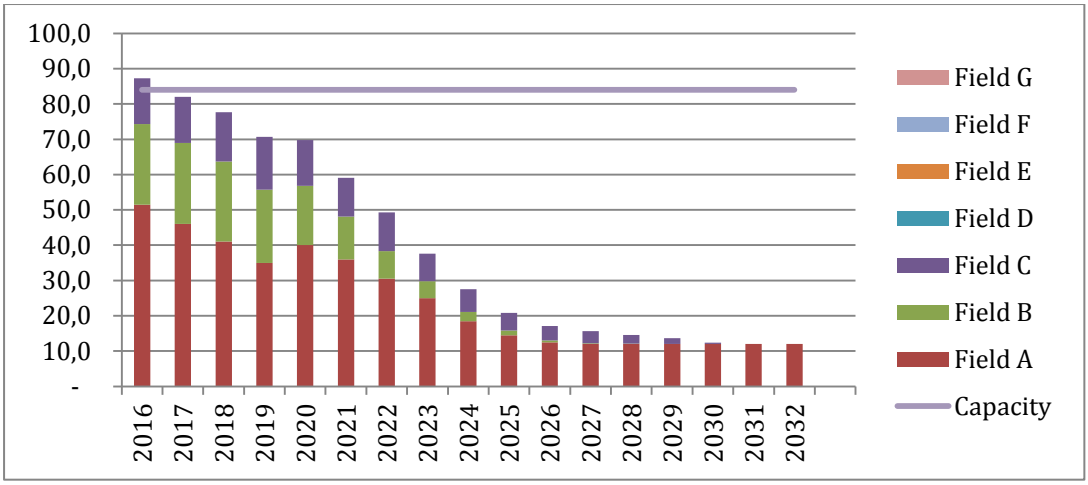
Big international funds have per definition normally access to a reasonable amount of capital, and are able to invest in large project over a long period of time. Infrastructure investments have been a more and more attractive type of investment over the last ten years. Since investment funds have a relatively easy access to large amount of capital, they may be able to finance infrastructure on the NCS.

5.6 Capacity challenges for new investment models

All companies that produce gas wants to sell their gas in the market to obtain a return on the development, and they want to sell it as soon as possible.

The present booking system for the transport of gas gives the companies that invest in gas infrastructure the benefit of booking their needed capacity before other companies. This means that other companies that need capacity have to wait until there is available capacity in the pipeline before they can book anything.

If the new investment model allows external investors to finance the gas infrastructure, it could be a challenge to choose which company that gets the advantage of booking capacity first. Not being able to sell the produced gas to the market for a time could be a huge disadvantage for the producer.



GRAPH 5, BOOKING SCHEDULE FOR A PIPELINE

Graph 6 illustrates this by showing an example of a booking schedule which shows little available capacity in the beginning.

The challenge is that new investors don't share the E&P companies' need of transportation, and could possibly create an undefined situation regarding booking of capacity. This thesis acknowledges the challenge, but will not consider this in the analysis.

6.0 ANALYSIS

This chapter will analyse the two different cases with regard to investment models for gas infrastructure on the NCS. It will also analyse the four investor alternatives that have been explained and discussed in chapter 5, and how they are qualified as investors for the new investment model. The four alternatives will be implemented in the two cases and will be analysed on how large their risk adjusted rate of return is. The purpose of this is to evaluate if the new investment model is viable and to get a view on which of the alternatives that generate most profit for the NCS. This will help assess if the new investment model contribute to realizing new gas resources in the NCS.

The two cases presented below are based on the CAPEX shown in the BSGI report (Gassco AS, 2014)

Cost component	Cost	Unit
Drilling (low energy reservoirs)	564	MNOK/well
Drilling (high energy reservoirs)	780	MNOK/well
Subsea production system	540	MNOK/well
Subsea compression	450	MNOK per MSm³/d
Power cable	14 740	NOK/meter cable
Onshore pre-compression	1 800	MNOK per 20 MSm³/d capacity
Pipelines	Gassco's cost estimate model	
Export pipeline 42"	24 000	MNOK
Export pipeline 32"	17 400	MNOK
Umbilicals	12 120	NOK/meter
LNG facility	60 000	MNOK for 5 Mtpa train
LNG brownfield at Melkøya	Input from Snøhvit license	
LNG lifetime extension at Melkøya	Input from Snøhvit license	
Processing node offshore	24 570	MNOK per 20 MSm³/d facility
Processing node onshore	22 540	MNOK per 20 MSm³/d facility
Export compression	5 430	MNOK per 20 MSm³/d facility

TABLE 7, CAPEX FROM THE BSGI REPORT [19]

In the BSGI report Gassco AS considers different scenarios for the development of the Barents Sea. The different volume scenarios have an impact on the result. As an

[19] (Gassco AS, 2014)

assumption for the two scenarios the volume of the discovery will be set to 400 GSm^3.

6.1 THE ANALYTICAL METHOD

This chapter will present two different scenarios, the present investment model and the new investment model. The present investment model assumes that E&P companies finance the gas infrastructure, whereas the new investment model assumes external investors that finance the gas infrastructure. It will be important to look at how it can be economic beneficial for the investors as well as for the E&P companies.

6.1.1 CASE DESCRIPTION OF GAS INFRASTRUCTURE

Volume	400 GSm^3
Gas infrastructure CAPEX	80 BNOK
Rate of return on CAPEX[20]	7%
Time horizon	2014-2045
Loan reimbursement (Loan/Equity)	6 yrs, (term loan)
Rate Loan/Equity for investor[21]	50%
Interest rate, loan/equity)[22]	5%
Norwegian tax rules, offshore/onshore	51%,27% and uplift deprecation 22%
Inflation rate	2%

TABLE 8, FINANCIAL INFORMATION FOR THE BASE CASE[23]

In the BSGI report there are several costs that are estimated for the different transportation alternatives in relation to the future Barents Sea development. This thesis does not base its scenario in the Barents Sea development, but the figures in the report will be used as an example to show the effect of separating the cost for development of the field and the infrastructure.

Table 7 shows the cost of investing in infrastructure from the Barents Sea to the Norwegian Sea, and estimates it to be 80 BNOK. This includes a pipeline with a

[20] According to the standard tariff regulations. (Solveig Gas Norway)

[21] Base case, will be set to 50% as long as nothing else is mentioned

[22] Base case, will be set to 5% as long as nothing else is mentioned

[23] (Gassco AS, 2014)

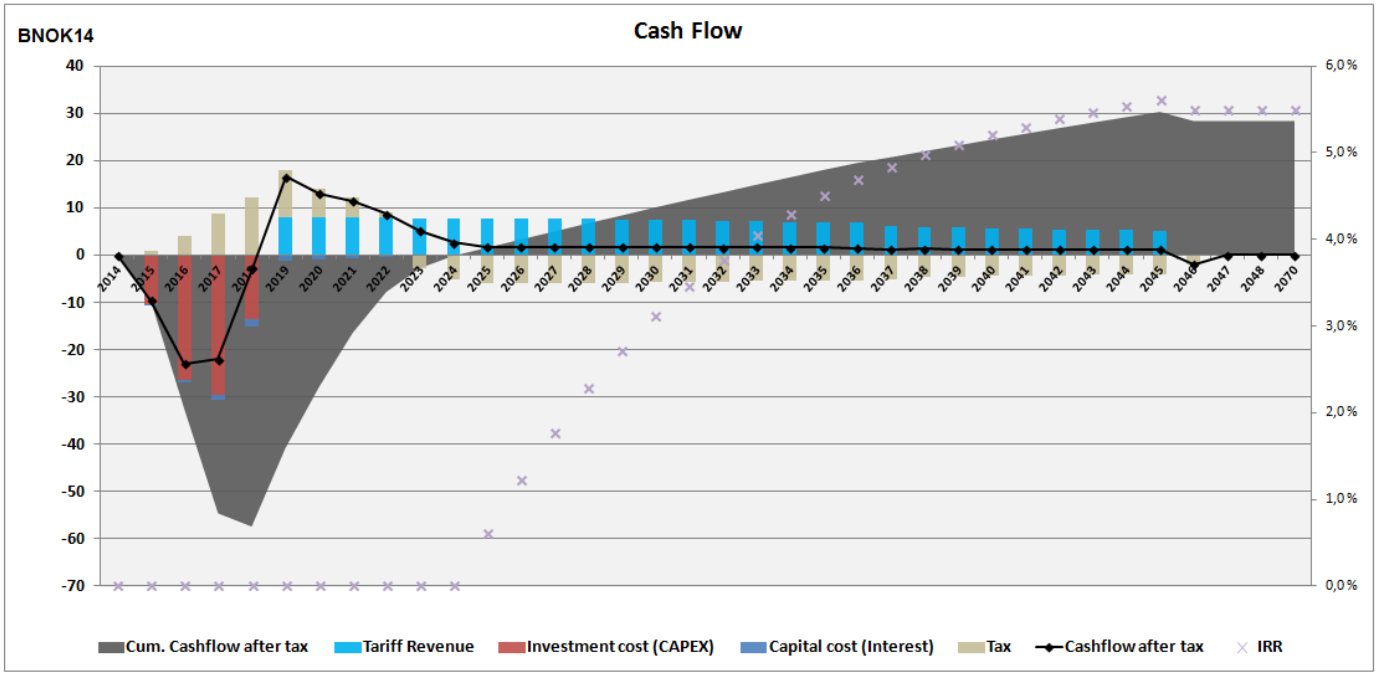
diameter of 42", a processing node onshore and export compression. This will be the gas infrastructure CAPEX of the following analysis.

The CAPEX and volumes are set in the case, but for the potential investors that would be interested in investing in infrastructure there could be a difference in the discounting rate of the investment. In the following section there will be an analysis of how much each investor would have to pay for the investment. Every investor has to pay the same CAPEX, but each investor has its own WACC and risk adjusted NPV which implies an impact on the rate of return. In this case the CAPEX is set and therefore the next section will determine the difference between each investor is able to finance the investment. This will be done to determine what purpose the investment models have for the development of the infrastructure on the NCS.

6.2 WHAT IS THE COST OF BUILDING THE BASE CASE GAS INFRASTRUCTURE?

This section will estimate the return of the development of the gas infrastructure. The total return on the project will have to be higher than the investors risk adjusted rate of return to show interest in the project. The numbers of this project will be found and in the appendix, but the context of the analysis will be explained along with the graphs and tables in this section.

Graph 7, shows the cash flow of the gas infrastructure project. It does not consider the field development or any other costs than the CAPEX investment. The graph shows the startup of the investment from 2014 until the CAPEX is finished funded in 2018. After this the production and revenue starts. The estimated field size of 400 GSm^3 is estimated to end production by the year 2045. This gives a yearly cash flow rate after tax displayed by the black line in the graph. The total IRR for this project is estimated to be 5,49% which gives a reasonable return depending on the investor. The grey field shows the cumulative cash flow over time and gives total revenue of 28 BNOK14 after tax. The scenario is given with the assumption in the base case where the interest rate for the loan is 5% and a payback period of a 6 year, financed by 50% equity and 50% loan. (Appendix1 &4)



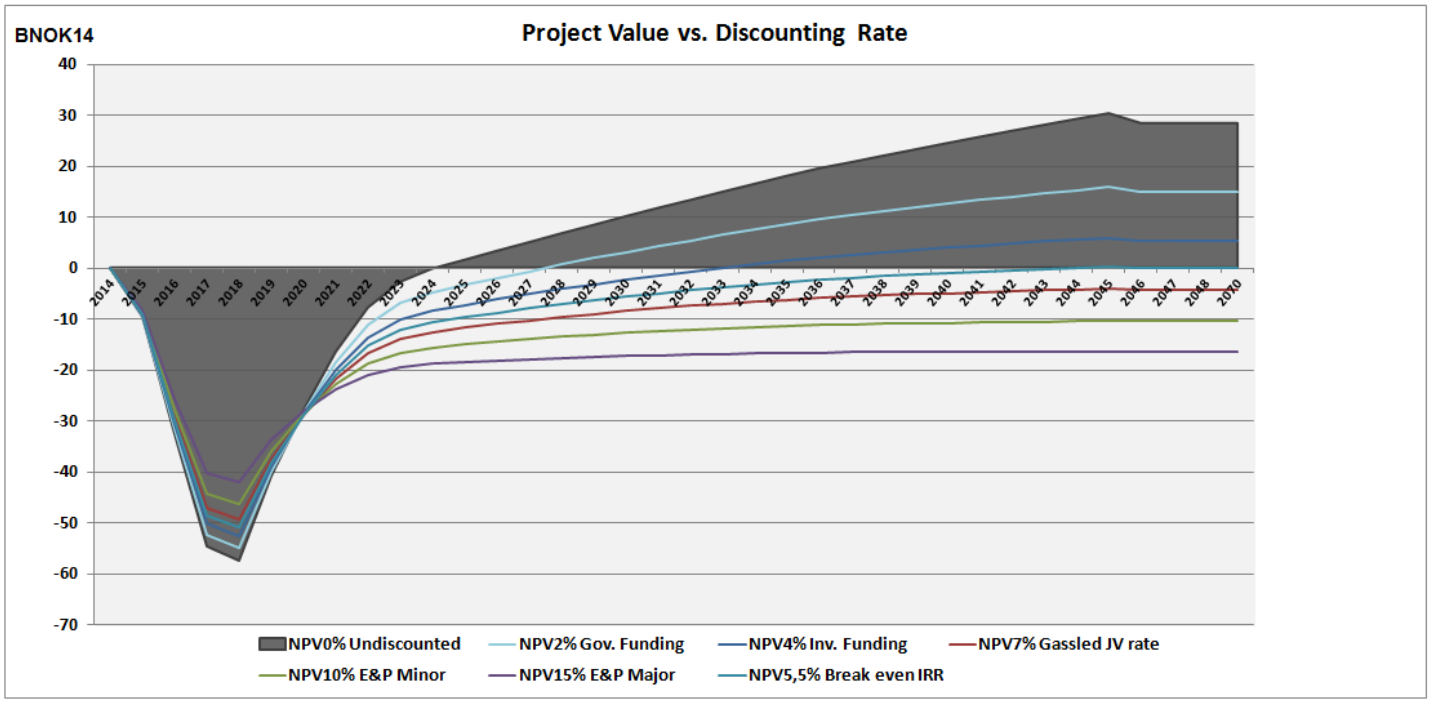
GRAPH 6, CASH FLOW FOR PIPELINE CAPEX, BASE CASE, IRR IN % (APPEDIX 1&4)

The revenue of Graph 6 is based on the calculation of the K element from the tariff formula. This gives a return on the investment of 7% percent before tax. However, due to taxes and capital cost the final IRR of the investment ends at 5,49% post tax.

Graph 6 gives a visual impression of the fixed income, assumed the gas infrastructure gets into Gassled JV's portfolio. This gives a steady income of 7% of the CAPEX.

6.2.1 THE INVESTORS POINT OF VIEW IF THE INVESTMENT

In the previous section Graph 6 showed the investments cost and revenue. This section will give an overview of how the investor looks at the investment and which potential they have to make a profit of the investment. Investors will discount the investment to see how it will fit their portfolio, and then see if the investment is as valuable as expected. This is measured by the discounted NPV for each investor.



GRAPH 7, PROJECT VALUE VS. DISCOUNTING RATE (APPENDIX 1 & 4)

Graph 7 shows the NPV of the potential investors. This graph illustrates the differences between the different investors. Graph 6 is based on the base case which gives an IRR of 5,49%, and investors that has a higher expected rate of return than 5,49% sees no value in investing in this gas infrastructure, if the revenue is fixed at 7% before tax.

Two alternatives that could be satisfied with the investment are the "Governmental funding" and the "Investment funds". They have a lower expected rate of return and would potentially profit on the investment. However, looking at Graph 7 we also see that the two E&P alternatives are below the breakeven point of 5,49%, with the E&P majors that needs a 15% expected return, and the E&P minors that needs a 10% expected return to break even.

The graphs above only illustrates the gas infrastructure investment, and do not consider the whole project economy combined with an additional field investment. Section 6.3 will give an example of how the project economy would look like if both gas infrastructure and field infrastructure would be financed in the same project and by the same investor.

6.3 THE DIFFERENCE BETWEEN PRESENT AND FUTURE INVESTMENT MODEL

To show an example of how a potential infrastructure project could be financed, it is necessary to look at the field development cost. This includes investment for rigs, subsea installations and pipelines. The numbers from the base case is the foundation of the gas infrastructure investment. Assumptions have been made to the gas price be able to calculate the effect of separating the pipeline investment.

Volume	400 GSm^3
Gas transport infrastructure CAPEX	80 BNOK14
Rate of return on CAPEX[24]	7%
Time horizon	2014-2045
Loan reimbursement (Loan/Equity)	6 yrs, (term loan)
Rate Loan/Equity for investor[25]	50%
Interest rate, loan/equity)[26]	5%
Norwegian tax rules, offshore/onshore	51%,27% and uplift deprecation 22%
Inflation rate	2%
Field development (Field A)	30 BNOK14
Field development (Field B)	30 BNOK14
Total CAPEX for development	140 BNOK14
Gas price	2,2 $NOK14/Sm^3$

TABLE 9, FIELD ASSUMPTIONS AND PIPELINE DEVELOPMENT COST[27]

The purpose of this model is to explore the potential value of letting external investor finance the gas infrastructure instead of the present model, where E&P companies finance both field and gas infrastructure. Since the gas infrastructure could turn out to be beneficial for two of the investors the new investment model has a potential to be beneficial for both investors and E&P companies.

[24] According to the standard tariff regulations. (Solveig Gas Norway)

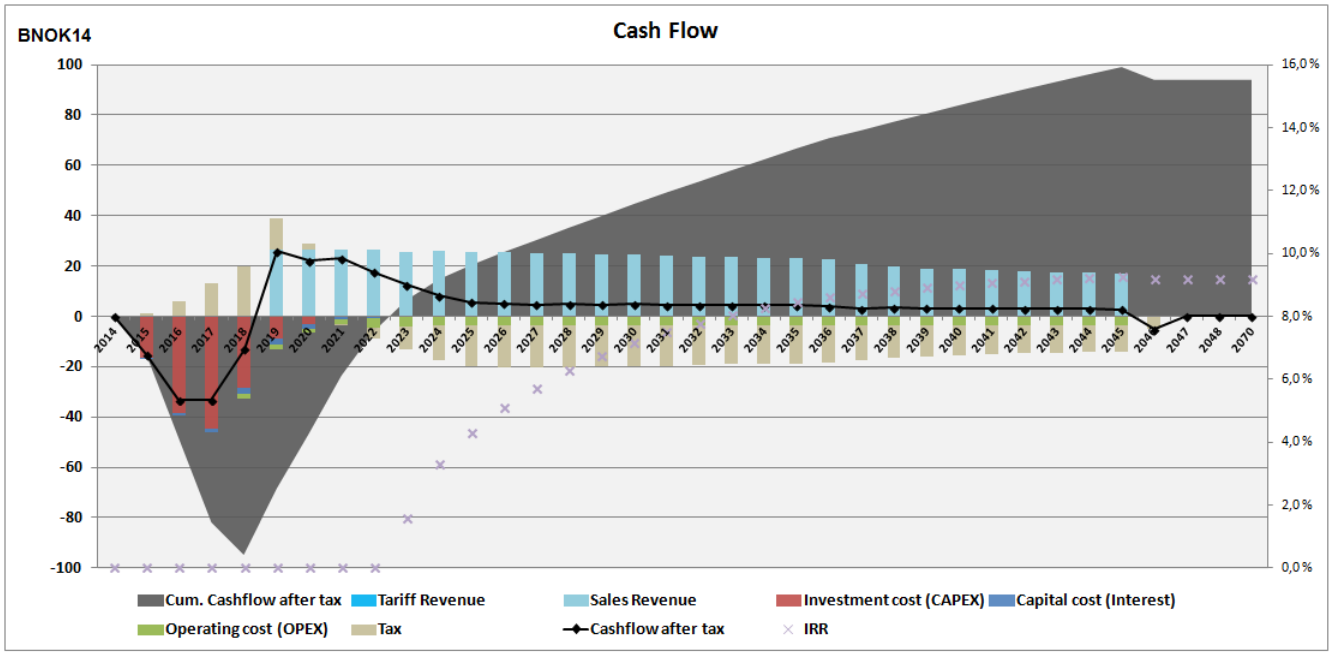
[25] Base case, will be set to 50% as long as nothing else is mentioned

[26] Base case, will be set to 5% as long as nothing else is mentioned

[27] (Gassco AS, 2014)

If an external investor agrees to finance the gas infrastructure with a rate of return of 7%, the E&P companies that depend on the transportation then finance the CAPEX through the tariff instead of an upfront investment. This section shows both models, each of them will be analyzed to find the benefits or disadvantages of the models. The first one is the present model where E&P companies finance the entire project.

6.3.1 PROJECT FINANCING BY E&P COMPANIES

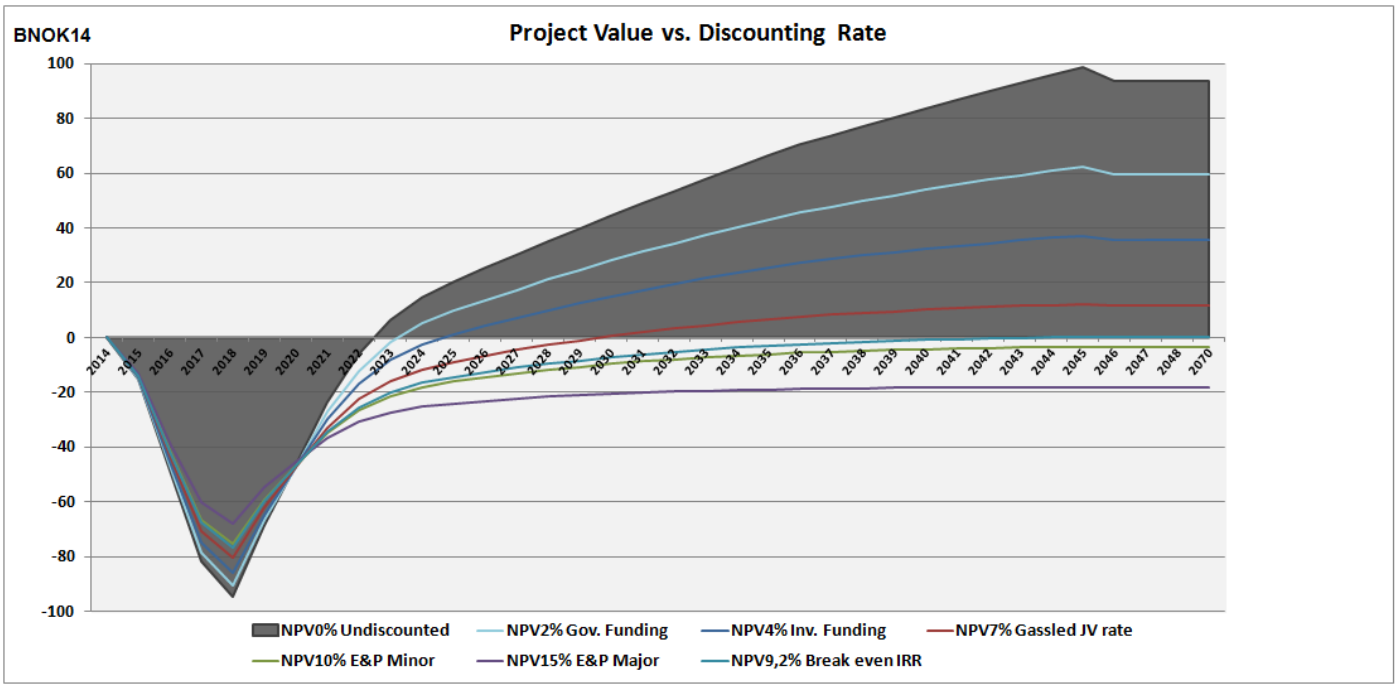


GRAPH 8, E&P COMPANIES FINANCE BOTH FIELD AND PIPELINE (APPENDIX 1 & 3)

Graph 8 shows the cash flow when an E&P company finances the entire project. The tariff revenues are not shown in the graph, because the tariff would be paid to the investors and will not be relevant for this example. The income of the field then relates to the net revenue of the gas sale from the gas field. The income in both scenarios will be the same, and it will be possible to compare them with each other.

The important numbers to notice in Graph 8 is the IRR, the top of the cumulative cash flow after tax and the bottom line of the cumulative cash flow after tax. The reason these are important is to be able to analyze the overall rate of return on the investment. The IRR in Graph 8 is calculated to 9,18%, and the total revenue of the investment in year 2046 is calculated to be 94 BNOK after tax. The bottom line of the cumulative cash flow shows an exposure of 95 BNOK14 in 2018.

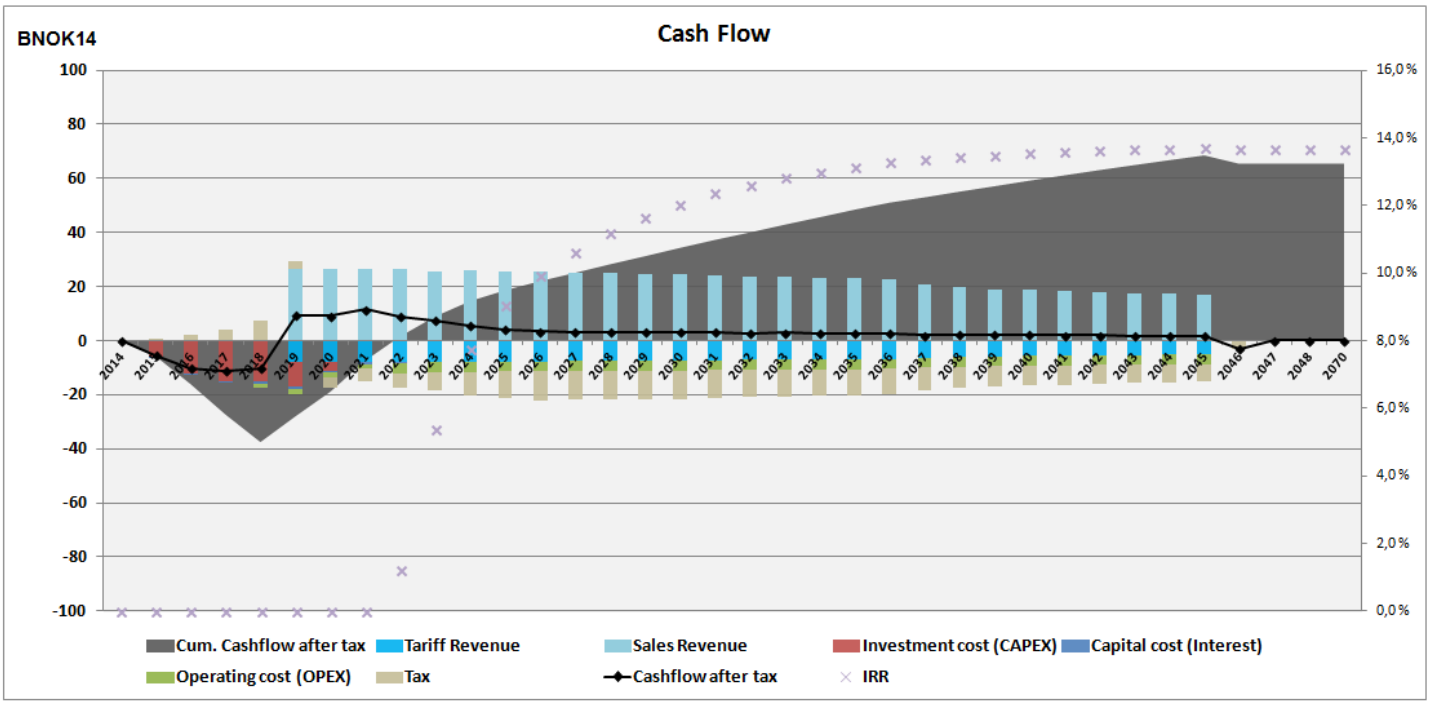
If we add the discounted NPV for the different investors to the graph, we see how the levels adjust compared to Graph 7 for the gas infrastructure.



GRAPH 9, RPOJECT VALUE VS. DISCOUNTING RATE (APPENDIX 1 & 3)

Graph 9 shows the different levels of discounted NPV each company wants to achieve for the project. The difference in the IRR makes a large difference compared to the gas infrastructure project shown in Graph 7. With a IRR of 9,18%, the E&P companies are closer to make a profit on the investment than with only the pipeline project. On the next page same project will be analyzed, however with an external investor financing the pipeline and the E&P companies taking the rest of the field investment.

6.3.2 SEPARATED FINANCING OF THE PIPELINE INFRASTRUCTURE



GRAPH 10, CASH FLOW FOR SEPARATED PROJECT (APPENDIX 1 & 2)

Graph 10 looks similar to graph 8, but has a smaller capital exposure in the investment period and a smaller cumulative cash flow after tax in year 2046. Since an external investor has financed the pipeline the total CAPEX is lower in this scenario. Since the transporter has to pay tariff to the investor, the invested capital has been distributed amongst the production years. For every Sm^3 with gas the producer send, part of the transportation cost goes to pay the CAPEX and the return of the gas infrastructure.

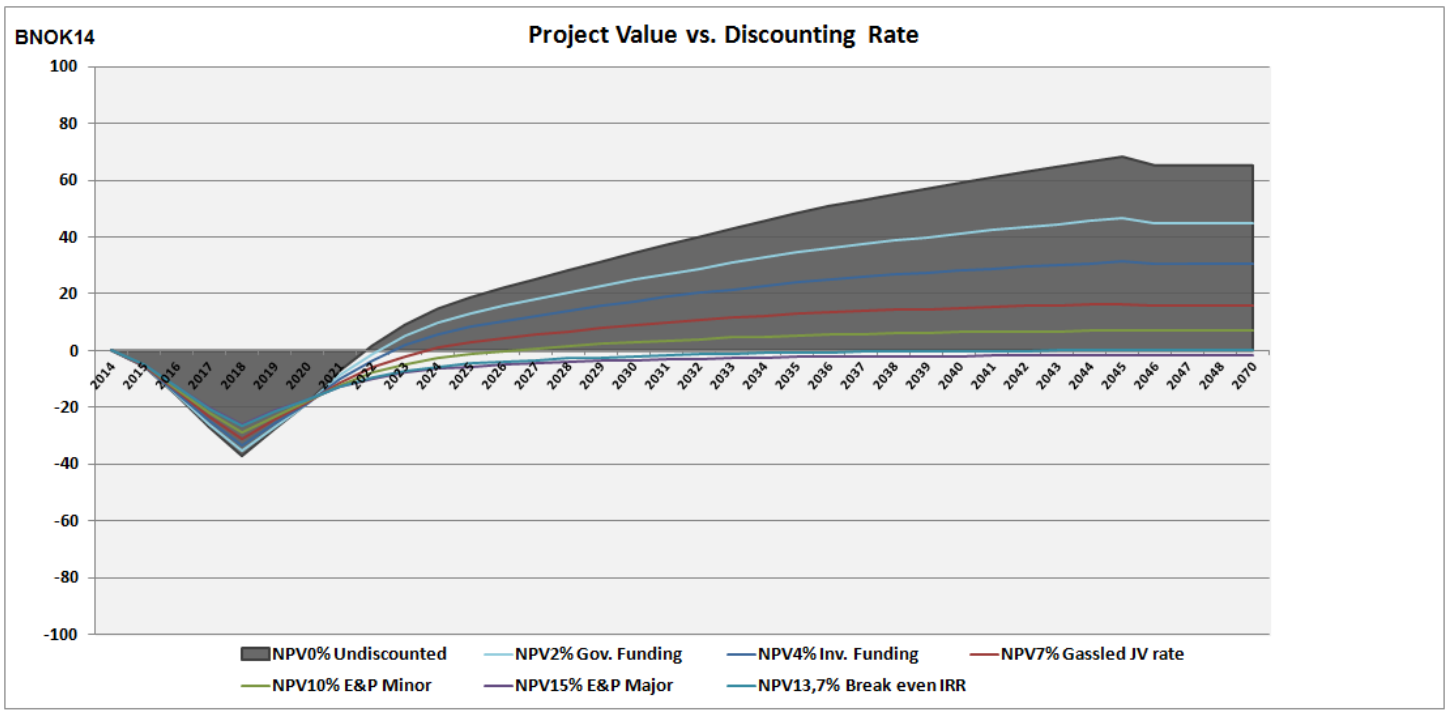
This gives a new IRR for this project. As seen in Graph 10 the IRR has risen to 13,66% for the entire project, this gives a difference of 4,48% in the IRR between the two different investment models. The cumulative cash flow gives a return of 66 BNOK14, which is lower than the model that is fully financed by E&P companies.

The differences between the two revenues are:

$$94\ BNOK14 - 66\ BNOK14 = 28\ BNOK14$$

The summation above shows the difference of 28 BNOK14, which is the same as the return on the separated pipeline investment. Even though the result of the cumulative cash flow is lower, the IRR rate makes the invested capital more profitable for the investor of the gas field than it would be if they financed both.

To show how the alternative investors come out on this model, the graph shows the discounted NPV for the different alternatives.



GRAPH 11, DISCOUNTED PROJECT VALUE (APPENDIX 1 & 2

As a result of the separation of infrastructure the IRR for the project will increase and there will be a small gap from the breakeven point, to the point of 15% discounted rate where E&P companies are. This indicates that it would be favorable for an E&P company to encourage the model where the infrastructure is separated from the field

6.4 INTERPRETATION OF THE ANALYSIS

In the previous section the difference between the present and the separate investment model were analysed but what does it actually mean? This section will interpret the figures and show the benefits and possible disadvantages of the separated investment model. The separated model shows that the IRR of the investment is larger than the

IRR of the present model, and the result shows a difference of 4,48%, from 9,18% to 13,66%. This shows that the separated model has a higher return on the invested capital and would make a better investment for the E&P companies. Since the pipeline has proven its potential in the analysis as the separate investment for two of the investors, it supports the realization of separate investment model. Comparing the two discounted graphs, Graph 9 and Graph 11, shows the different level of exposure for both scenarios. In Graph 9 the exposure is 95 BNOK14 in 2018 as its maximum, and Graph 11 shows an exposure of 37 BNOK14 in 2018 as its maximum. The same amount of capital is invested in both of the scenarios, but the time of investment is different for E&P. In the separated investment model the revenue for E&P companies is lower for each year since they pay tariff for transportation of the gas. This transportation cost pays for the gas infrastructure as well for the 7% return that the investor of the gas infrastructure is entitled. And the rate of return of 28 BNOK14 is the difference between the two models in the cumulative cash flow after tax at the end of production. It shows that the two different investment models have the same revenue from the development, and in 2046 the difference between the two models shows the same as the rate of return of the gas infrastructure investment.

The separate investment model allows E&P companies to free some of their capital and give them the opportunity to invest in several projects at the same time with a higher rate of return on the project. If E&P companies have to realize the project with the financial structure of the present model the exposure will be too high and the rate of return is too low with a field size of 400 GSm^3. The field has to generate higher profit for the E&P companies to invest in the project, since the cost of infrastructure is so high.

As shown in the analysis the gas infrastructure investment gives an acceptable rate of return for two of the investors, and the new investment model gives a better return for the E&P companies. This shows that it is beneficial for both new investors and E&P companies to encourage the separated model.

In a socio-economic point of view it could be beneficial to use the separated investment model for future developments where the infrastructure cost is high. If field reserve levels stay at the given level in the scenario, the profit of the field is too

low to cover for the infrastructure investment. It shows that the separation of the investment model could lower the exposure level and raise the rate of return of the project, which means that the project is more likely to be built even if the resource levels stay at the given level.

According to the analysis the most important incentive for the investors are met in two of the alternatives, which are; the Investment Funds and the Norwegian Government. For these two potential investors the investment is profitable since they have a lower expected rate of return then the other investors, they are able to acquire cheap capital and are satisfied with a lower rate of return as long as it is stable and predictable.

The new investment model shows a potential profit for both E&P companies and for the new potential investors. A challenge with the new investment model is the potential of over dimensioning the gas infrastructure to make higher profit for the investors. This could lower the economic barrier for field and gas infrastructure investments. Furthermore it could lead to development of small fields that not necessarily are economic profitable, to become profitable fields. Or, this could lead to development of unstable fields, which might end up being too small to generate profit. These are some of the potential challenges that have to be solved before a new investment model takes place. Before any investment process is started, the process has to be clarified between E&P companies and the potential investors.

As an investor the Norwegian Government has the opportunity to benefit from the investment in two ways, the profit directly from the investment and gain socioeconomic profit. If the infrastructure is built it can encourage E&P companies to discover and develop more fields around the infrastructure and create higher activity and a longer production on the NCS. The benefits from the new investment model, either it’s the Norwegian Government or an Investment fund, it would give the E&P companies a higher IRR on their field development. It could also generate profit for the Norwegian Government who would benefit from the new realization of gas resources.

To make Norway a more competitive actor in the international gas marked its important to maintain a low CAPEX. If the CAPEX increase it will make the production of gas from Norway more expensive and make it less competitive against other markets. The new model shows that getting a higher IRR can be achievable by letting external investors invest. With the present model the market situation would be harder, and could lower the expectations of new field developments on the NCS. This could imply that the E&P companies would then have to sell the gas at a higher price to be able to have the same IRR on the projects.

7.0 CONCLUSION

The purpose of this thesis is to explore if new investment models for infrastructure on the NCS have any effect on the realization of new gas resources. The problem formulation answered in this thesis is:

"What purpose has new investment models for infrastructure for realization of new gas resources on the NCS?"

The analysis shows that the new investment model for infrastructure could help realizing new gas resources on the NCS by letting external investors invest in large infrastructure projects. It shows that investment funds with a solid liquidity and the Norwegian Government are suitable investors for new infrastructure. Filed developments with large gas infrastructure investments financed by E&P companies, is not seen as the best alternative according to the analysis. This gives a lower IRR for the whole project.

All internal projects in E&P companies have to compete for the access to capital, and the soundest projects with the highest expected return are financed. Infrastructure investments on the NCS do not achieve the same expected return because of the regulation on the rate of return. When the cost of infrastructure is combined with the field development investment, the low return on the infrastructure could prevent the

whole field to be developed. The field's rate of return has to be substantially higher than 15% to be able to make up for low return on the infrastructure.

The socio-economic benefits of enabling external investors to invest in gas infrastructure on the NCS are the opportunity this gives to the realization of new gas resources. This encourages field development and could enable smaller fields to be economic profitable, since the transportation solution is present.

7.1 UNCERTAINTIES

The analysis is based on the numbers from the BSGI report. These numbers are gathered by a working group facilitated by Gassco AS, where many E&P companies that operate in the NCS participate. The numbers in this report are as accurate as possible, but are still just estimates of the real project cost.

To be able to make the base case of the infrastructure investment, the investment cost in the analysis is calculated on the background of investment history from the four different investment alternatives. Their real investment cost may vary from the example, however, this does not have a severely affect on the main conclusion of the thesis.

BIBLIOGRAPHY

Books:

Austvik, O. G. (2003). *Norwegian Natural Gas.* Eurpoa-programmet.

Berk, J., & DeMarzo, P. (2011). *Coporate Finance.* Pearson.

Bodie, Z., Kane, A., & Marcus, A. J. (2011). *Investments and Portfolio Management, Ninth edition.* McGraw-Hill.

Levine, R. (2005). *Handbook of Finacial Growth, Volume 1A.* Elsevier B.V.

Norwegian Ministry of Petroleum and energy. (2013). *FACTS 2013.* Norwegian Ministry of Petroleum and energy

Reports:

Della Croce, R. (2012). *Trends in Large Pension Fund Investment in Infrastructure, No. 29.* OECD Publishing.

Gassco AS. (2014). *Gassco.no*. Recieved from http://gassco.no/Documents/099808.pdf

Inderst, G. (2011). *Papers.ssrn.com.* Recieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1860947

Inderst, G. (2009). *Pension Fund Investment in Infrastructure, No. 32.* OECD Publishing

Internatinal Monetary Fund. (2014). *Global Financial Stability Report.* International Monetary Fund.

PÖYRY. (2013, December 17). *Muligheter og barrierer for finansiering av infrastrukturi Norge.*

Staoil ASA. (u.d.). *Statoil.com.* Recieved from http://www.statoil.com/annualreport2010/en/ouroperations/businessareas/naturalgas/pages/norway'sgastransportsystem.aspx

Web Sites:

Dagens Næringsliv. (u.d.). *DN.no*. Recieved from http://www.dn.no/nyheter/2013/11/06/statoil-laner-24-mrd

E24. (u.d.). *E24.no*. Recieved from://e24.no/boers-og-finans/norwegian-energy-company/obligasjonslaan-i-boks-noreco-hentet-300-millioner/20281464

Gassco AS. (u.d.). *Gassco AS*. Recieved from Gassco.no

Gassled JV. (u.d.). *Gassled*. Recieved from http://gassco.no/om-gassco/gassled/

iShares by BlackRock. (u.d.). Recieved from http://www.ishares.com/us/products/239746/ishares-global-infrastructure-etf

Lovdata. (u.d.). *Lovdata.no*. Recieved from http://lovdata.no/dokument/SF/forskrift/1997-06-27-653/KAPITTEL_10#KAPITTEL_10

Norges Bank. (u.d.). *Norges-Bank.no*. Recieved from http://www.norges-bank.no/Statistikk/Rentestatistikk/Statsobligasjoner-Rente-Daglige-noteringer/

Nowegian Ministry of Petroleum and Energy. (u.d.). *Regjeringen.no*. Recieved from http://www.regjeringen.no/nb/dep/oed/dok/NOU-er/2012/nou-2012-9/14/1.html?id=675589

Solveig Gas Norway. (u.d.). Recieved from http://www.rns-pdf.londonstockexchange.com/rns/0356L_1-2012-8-29.pdf

TOTAL E&P Norge. (u.d.). Recieved from total.no

TOTAL SA. (u.d.). Recieved from total.com

Trading Economics. (u.d.). Recieved from
http://www.tradingeconomics.com/norway/rating

APPENDIX 1, General assumptions

Tax System																						
Corporate Tax	27 %		27 %	27 %	27 %	27 %	27 %	27 %	27 %	27 %	27 %	27 %	27 %	27 %	27 %	27 %	27 %	27 %	27 %	27 %	27 %	27 %
Special Tax	51 %		51 %	51 %	51 %	51 %	51 %	51 %	51 %	51 %	51 %	51 %	51 %	51 %	51 %	51 %	51 %	51 %	51 %	51 %	51 %	51 %
Uplift	22 %		22 %	22 %	22 %	22 %	22 %	22 %	22 %	22 %	22 %	22 %	22 %	22 %	22 %	22 %	22 %	22 %	22 %	22 %	22 %	22 %
Offshore depreciation	6	years (straight line)	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Uplift depreciation	4	years (straight line)	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Financing																						
Interest rate	5,0 %		5,0 %	0 %	1 %	2 %	3 %	4 %	5 %	6 %	7 %	8 %	9 %	10 %	11 %	12 %	13 %	14 %	15 %	16 %	17 %	18 %
Loan reimbursement	6	years	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
% of CAPEX loan financed	50 %		50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %
Working Capital																						
Revenues recvd after	0	month	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Invoices paid after	0	months	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% of tax paid in the year	50 %		50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %

APPENDIX 2, New model (Cum. NPV, Input Data for Graph 11 &12, Sensitivities)

Cumulative Net Present Value, for new investment model

NPV0% Undiscounted	65 443
NPV2% Gov. Funding	44 835
NPV4% Inv. Fund	30 386
NPV7% Gassled JV rate	15 983
NPV8% E&P Minor	12 501
NPV10% E&P Minor	6 910
NPV15% E&P Major	-1 780
NPV13,7% Break Even II	0

INPUT DATA for the graph

Tariff Revenue	MNOK14	-186 311	
Sales Revenue	MNOK14	613 709	
Investment cost (CAPEX)	MNOK14	-60 000	
Operating cost (OPEX)	MNOK14	-93 600	
Capital cost (Interest)	MNOK14	-5 032	
Tax	MNOK14	-203 323	
Cashflow before tax	MNOK14	273 798	20,67 %
Cashflow after tax	MNOK14	65 443	13,66 %
Cum. Cashflow before tax		273 798	
Cum. Cashflow after tax		65 443	
IRR	%	13,66 %	

Sensitivity - Economic Assumptions

Scenario	1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Cashflows																					
Revenues	-186 311	-186 311	-186 311	-186 311	-186 311	-186 311	-186 311	-186 311	-186 311	-186 311	-186 311	-186 311	-186 311	-186 311	-186 311	-186 311	-186 311	-186 311	-186 311	-186 311	-186 311
OPEX	93 600	93 600	93 600	93 600	93 600	93 600	93 600	93 600	93 600	93 600	93 600	93 600	93 600	93 600	93 600	93 600	93 600	93 600	93 600	93 600	93 600
Own cost	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CAPEX	60 000	60 000	60 000	60 000	60 000	60 000	60 000	60 000	60 000	60 000	60 000	60 000	60 000	60 000	60 000	60 000	60 000	60 000	60 000	60 000	60 000
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Financial fees	5 032	5 032	-	1 006	2 013	3 019	4 026	5 032	6 038	7 045	8 051	9 057	10 064	11 070	12 077	13 083	14 089	15 096	16 102	17 109	18 115
Working Capital	203 323	203 323	207 209	206 432	205 655	204 877	204 100	203 323	202 545	201 768	200 991	200 214	199 436	198 659	197 882	197 104	196 327	195 550	194 773	193 995	193 218
Before Tax Cashflow	273 798	273 798	273 798	273 798	273 798	273 798	273 798	273 798	273 798	273 798	273 798	273 798	273 798	273 798	273 798	273 798	273 798	273 798	273 798	273 798	273 798
After Tax Cashflow	65 443	65 443	66 589	66 360	66 130	65 901	65 672	65 443	65 214	64 985	64 756	64 527	64 298	64 069	63 839	63 610	63 381	63 152	62 923	62 694	62 465
Before Tax																					
NPV 0%	273 798	273 798	273 798	273 798	273 798	273 798	273 798	273 798	273 798	273 798	273 798	273 798	273 798	273 798	273 798	273 798	273 798	273 798	273 798	273 798	273 798
NPV 7%	75 419	75 419	75 419	75 419	75 419	75 419	75 419	75 419	75 419	75 419	75 419	75 419	75 419	75 419	75 419	75 419	75 419	75 419	75 419	75 419	75 419
NPV 10%	43 476	43 476	43 476	43 476	43 476	43 476	43 476	43 476	43 476	43 476	43 476	43 476	43 476	43 476	43 476	43 476	43 476	43 476	43 476	43 476	43 476
IRR	**20,67 %**	**20,67 %**	**20,67 %**	**20,67 %**	**20,67 %**	**20,67 %**	**20,67 %**	**20,67 %**	**20,67 %**	**20,67 %**	**20,67 %**	**20,67 %**	**20,67 %**	**20,67 %**	**20,67 %**	**20,67 %**	**20,67 %**	**20,67 %**	**20,67 %**	**20,67 %**	**20,67 %**
After Tax																					
NPV 0%	65 443	65 443	66 589	66 360	66 130	65 901	65 672	65 443	65 214	64 985	64 756	64 527	64 298	64 069	63 839	63 610	63 381	63 152	62 923	62 694	62 465
NPV 7%	15 982	**15 982**	**16 871**	**16 694**	**16 516**	**16 338**	**16 160**	**15 982**	**15 804**	**15 626**	**15 448**	**15 270**	**15 092**	**14 914**	**14 736**	**14 559**	**14 381**	**14 203**	**14 025**	**13 847**	**13 669**
NPV 10%	6 910	6 910	7 712	7 552	7 391	7 231	7 070	6 910	6 749	6 588	6 428	6 267	6 107	5 946	5 786	5 625	5 465	5 304	5 143	4 983	4 822
NPV 15%	-1 780	-1 780	-1 098	-1 234	-1 371	-1 507	-1 643	-1 780	-1 916	-2 052	-2 189	-2 325	-2 461	-2 598	-2 734	-2 871	-3 007	-3 143	-3 280	-3 416	-3 552
IRR	**13,66 %**	**13,66 %**	**14,16 %**	**14,06 %**	**13,96 %**	**13,86 %**	**13,76 %**	**13,66 %**	**13,57 %**	**13,47 %**	**13,37 %**	**13,28 %**	**13,18 %**	**13,09 %**	**12,99 %**	**12,90 %**	**12,81 %**	**12,72 %**	**12,63 %**	**12,53 %**	**12,44 %**

APPENDIX 3, Present model, (Cum. NPV, Input Data for Graph 9 & 10, Sensitivities)

Cumulative Net Present Value, for The Present Model

NPV0% Undiscounted	93 807
NPV2% Gov. Funding	59 754
NPV4% Investment Fund	35 754
NPV7% Gassled JV rate	11 693
NPV8% E&P Minor	5 853
NPV10% E&P Minor	-3 534
NPV15% E&P Major	-18 106
NPV9,2% Break Even IRR	0

INPUT DATA for the graph

Tariff Revenue	MNOK14	-	
Sales Revenue	MNOK14	613 709	
Investment cost (CAPEX)	MNOK14	-139 940	
Operating cost (OPEX)	MNOK14	-93 600	
Capital cost (Interest)	MNOK14	-11 736	
Tax	MNOK14	-274 626	
Cashflow before tax	MNOK14	380 169	12,97 %
Cashflow after tax	MNOK14	93 807	9,18 %
Cum. Cashflow before tax		380 169	
Cum. Cashflow after tax		93 807	
IRR	%	9,18 %	

Sensitivity - Economic Assumptions

Scenario	1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Cashflows																					
Revenues	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OPEX	93 600	93 600	93 600	93 600	93 600	93 600	93 600	93 600	93 600	93 600	93 600	93 600	93 600	93 600	93 600	93 600	93 600	93 600	93 600	93 600	93 600
Own cost	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CAPEX	139 940	139 940	139 940	139 940	139 940	139 940	139 940	139 940	139 940	139 940	139 940	139 940	139 940	139 940	139 940	139 940	139 940	139 940	139 940	139 940	139 940
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Financial fees	11 736	11 736	-	2 347	4 694	7 042	9 389	11 736	14 083	16 431	18 778	21 125	23 472	25 820	28 167	30 514	32 861	35 208	37 556	39 903	42 250
Working Capital	274 626	274 626	283 690	281 878	280 065	278 252	276 439	274 626	272 813	271 000	269 187	267 374	265 562	263 749	261 936	260 123	258 310	256 497	254 684	252 871	251 058
Before Tax Cashflow	380 169	380 169	380 169	380 169	380 169	380 169	380 169	380 169	380 169	380 169	380 169	380 169	380 169	380 169	380 169	380 169	380 169	380 169	380 169	380 169	380 169
After Tax Cashflow	93 807	93 807	96 479	95 944	95 410	94 876	94 341	93 807	93 273	92 738	92 204	91 670	91 135	90 601	90 067	89 532	88 998	88 464	87 929	87 395	86 861
Before Tax																					
NPV 0%	380 169	380 169	380 169	380 169	380 169	380 169	380 169	380 169	380 169	380 169	380 169	380 169	380 169	380 169	380 169	380 169	380 169	380 169	380 169	380 169	380 169
NPV 7%	75 419	75 419	75 419	75 419	75 419	75 419	75 419	75 419	75 419	75 419	75 419	75 419	75 419	75 419	75 419	75 419	75 419	75 419	75 419	75 419	75 419
NPV 10%	28 037	28 037	28 037	28 037	28 037	28 037	28 037	28 037	28 037	28 037	28 037	28 037	28 037	28 037	28 037	28 037	28 037	28 037	28 037	28 037	28 037
IRR	**12,97 %**	**12,97 %**	**12,97 %**	**12,97 %**	**12,97 %**	**12,97 %**	**12,97 %**	**12,97 %**	**12,97 %**	**12,97 %**	**12,97 %**	**12,97 %**	**12,97 %**	**12,97 %**	**12,97 %**	**12,97 %**	**12,97 %**	**12,97 %**	**12,97 %**	**12,97 %**	**12,97 %**
After Tax																					
NPV 0%	93 807	93 807	96 479	95 944	95 410	94 876	94 341	93 807	93 273	92 738	92 204	91 670	91 135	90 601	90 067	89 532	88 998	88 464	87 929	87 395	86 861
NPV 7%	11 692	**11 692**	**13 823**	**13 397**	**12 971**	**12 544**	**12 118**	**11 692**	**11 266**	**10 839**	**10 413**	**9 987**	**9 561**	**9 134**	**8 708**	**8 282**	**7 856**	**7 429**	**7 003**	**6 577**	**6 151**
NPV 10%	-3 534	-3 534	-1 590	-1 979	-2 368	-2 756	-3 145	-3 534	-3 922	-4 311	-4 700	-5 088	-5 477	-5 866	-6 254	-6 643	-7 032	-7 420	-7 809	-8 198	-8 587
NPV 13%	-13 441	-13 441	-11 664	-12 020	-12 375	-12 730	-13 086	-13 441	-13 797	-14 152	-14 508	-14 863	-15 218	-15 574	-15 929	-16 285	-16 640	-16 996	-17 351	-17 706	-18 062
IRR	**9,18 %**	**9,18 %**	**9,62 %**	**9,53 %**	**9,44 %**	**9,35 %**	**9,27 %**	**9,18 %**	**9,09 %**	**9,00 %**	**8,92 %**	**8,83 %**	**8,75 %**	**8,66 %**	**8,58 %**	**8,50 %**	**8,42 %**	**8,33 %**	**8,25 %**	**8,17 %**	**8,09 %**

APPENDIX 4

The gas infrastructure only (Cum. NPV, Input Data for Graph 7 & 8, Sensitivities)

Cumulative Net Present Value, gas infrastructure

NPV0% Undiscounted	**28 364**
NPV2% Gov. Funding	**14 920**
NPV4% Inv. Fund	**5 367**
NPV7% Gassled JV rate	**-4 290**
NPV8% E&P Minor	**-6 647**
NPV10% E&P Minor	**-10 445**
NPV15% E&P Major	**-16 326**
NPV5,5% Break Even IRR	**0**

INPUT DATA for the graph

Tariff Revenue	MNOK14	186 311	
Investment cost (CAPEX)	MNOK14	-79 940	
Capital cost (Interest)	MNOK14	-6 704	
Tax	MNOK14	-71 303	
Cashflow before tax	**MNOK14**	**106 371**	**7,00 %**
Cashflow after tax	**MNOK14**	**28 364**	**5,49 %**
Cum. Cashflow before tax		106 371	
Cum. Cashflow after tax		28 364	
IRR	%	5,49 %	

Sensitivity - Economic Assumptions

Scenario	1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Cashflows																					
Revenues	186 311	186 311	186 311	186 311	186 311	186 311	186 311	186 311	186 311	186 311	186 311	186 311	186 311	186 311	186 311	186 311	186 311	186 311	186 311	186 311	186 311
OPEX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Own cost	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CAPEX	79 940	79 940	79 940	79 940	79 940	79 940	79 940	79 940	79 940	79 940	79 940	79 940	79 940	79 940	79 940	79 940	79 940	79 940	79 940	79 940	79 940
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Financial fees	6 704	6 704	-	1 341	2 682	4 023	5 363	6 704	8 045	9 386	10 727	12 068	13 408	14 749	16 090	17 431	18 772	20 113	21 453	22 794	24 135
Working Capital	71 303	71 303	76 481	75 446	74 410	73 374	72 339	71 303	70 268	69 232	68 196	67 161	66 125	65 090	64 054	63 018	61 983	60 947	59 912	58 876	57 840
Before Tax Cashflow	106 371	106 371	106 371	106 371	106 371	106 371	106 371	106 371	106 371	106 371	106 371	106 371	106 371	106 371	106 371	106 371	106 371	106 371	106 371	106 371	106 371
After Tax Cashflow	28 364	28 364	29 890	29 585	29 280	28 974	28 669	28 364	28 059	27 753	27 448	27 143	26 838	26 532	26 227	25 922	25 617	25 311	25 006	24 701	24 396
Before Tax																					
NPV 0%	106 371	106 371	106 371	106 371	106 371	106 371	106 371	106 371	106 371	106 371	106 371	106 371	106 371	106 371	106 371	106 371	106 371	106 371	106 371	106 371	106 371
NPV 7%	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
NPV 10%	-15 439	-15 439	-15 439	-15 439	-15 439	-15 439	-15 439	-15 439	-15 439	-15 439	-15 439	-15 439	-15 439	-15 439	-15 439	-15 439	-15 439	-15 439	-15 439	-15 439	-15 439
IRR	**7,00 %**	**7,00 %**	**7,00 %**	**7,00 %**	**7,00 %**	**7,00 %**	**7,00 %**	**7,00 %**	**7,00 %**	**7,00 %**	**7,00 %**	**7,00 %**	**7,00 %**	**7,00 %**	**7,00 %**	**7,00 %**	**7,00 %**	**7,00 %**	**7,00 %**	**7,00 %**	**7,00 %**
After Tax																					
NPV 0%	28 364	28 364	29 890	29 585	29 280	28 974	28 669	28 364	28 059	27 753	27 448	27 143	26 838	26 532	26 227	25 922	25 617	25 311	25 006	24 701	24 396
NPV 7%	-4 290	**-4 290**	**-3 048**	**-3 297**	**-3 545**	**-3 793**	**-4 042**	**-4 290**	**-4 538**	**-4 787**	**-5 035**	**-5 283**	**-5 532**	**-5 780**	**-6 028**	**-6 277**	**-6 525**	**-6 773**	**-7 022**	**-7 270**	**-7 518**
NPV 10%	-10 443	-10 443	-9 303	-9 531	-9 759	-9 987	-10 215	-10 443	-10 671	-10 899	-11 128	-11 356	-11 584	-11 812	-12 040	-12 268	-12 496	-12 724	-12 953	-13 181	-13 409
NPV 13%	-14 450	-14 450	-13 400	-13 610	-13 820	-14 030	-14 240	-14 450	-14 660	-14 870	-15 080	-15 290	-15 500	-15 710	-15 920	-16 130	-16 340	-16 550	-16 760	-16 970	-17 180
IRR	**5,49 %**	**5,49 %**	**5,91 %**	**5,82 %**	**5,74 %**	**5,66 %**	**5,58 %**	**5,49 %**	**5,41 %**	**5,33 %**	**5,25 %**	**5,17 %**	**5,09 %**	**5,02 %**	**4,94 %**	**4,86 %**	**4,79 %**	**4,71 %**	**4,64 %**	**4,56 %**	**4,49 %**