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The effect of the Norwegian petroleum tax scheme, based upon the current market conditions for the supply industry.

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Foreword

This master dissertation is the final delivery at the postgraduate MBA program conducted at the Nord University and marks the end of 3 years of education in combination with my fulltime professional occupation. The background for the topics to cover is related to my occupation in the oil and gas industry, conducting subsea and marine operations in conjunction with offshore field developments. This is also the reason for writing the paper in the English language

A great thanks to the Nord University and mentor Terje Andreas Mathisen, not only assisting the master thesis, but also being patient and giving persons such as myself the opportunity to further gain and develop skills within the area business administration through their 3 year scholar scheme for people already employed in daily business.

It is also the time to acknowledge that the program has been challenging to combine with other duties, so to my family, as well as friends and work colleagues, supporting my quest and allowing me to spend time and effort into this matter. Thank you.

Erling Røise

Oslo, 2nd of December 2016

Summary

This paper makes considerations regarding the Norwegian petroleum tax scheme with respect to the current downturn in the oil and gas supply industry, and does reflections regarding the Norwegian administration's ability to act as a financial agent to fund the initial phase of investments in marginal oil and gas discoveries at the Norwegian continental shelf. Bringing along the hypothesis that the project net present value benefits from moving investments closer to or in the same period as income occur; hence marginal prospects may become more attractive for licensee owners in a business financial perspective. However can such financial model be justified?

The paper starts with the background and motivation for the research question, which is the stand still investment situation in the offshore oil and gas market, due to the recent slide in the crude prices. The level and uncertainty about the crude prices are currently creating a reluctant situation to invest in the market, not only affecting the business itself with its energy companies and supply industry, but also the tax income for the Norwegian society, still considering the oil and gas industry as the main contribution to the gross domestic product within the country. The research question becomes a quest to do some reflection regarding the Norwegian petroleum tax scheme and the effect of the recent system changes without going into the details regarding the reasoning behind the taxation system itself. In addition to the reflection done for the tax system, a plausible hypothesis if presented and the question become whether it is feasible, valid approach and is it socio-economic beneficial for the Norwegian society to potentially subsidies further more into future field developments in the initial phase to secure tax income, or does the existing tax mechanisms fulfill the potential to further develop the Norwegian continental shelf. The paper is considering discounted cash flow series with respect to net present value in a socio-economic context, where the theory part touch upon the weighted average cost of capital (WACC), the capital asset pricing model (CAPM), and discounted cash flow method using the net present value (NPV) as valuation technique in a socio-economic context. A model field is established and investigated with respect to the theory and hypothesis presented, and the model field results shows that the recent change in the tax system, particularly the reduction in uplift rate has done most effect to the rate of return after tax for the operators on the Norwegian continental shelf. With respect to the hypothesis presented, it seems to correspond with the theory and the applicable value additivity theorem, however other research regarding the topic and how the theory is

applied in this particular case is limited for the author, so the conclusion is that the topic is considered as valid for further investigation and research.

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Abbreviations and Definitions

boe	barrels of oil equivalents.
CAPEX	Capital Expenditures
CAPM	Capital Asset Pricing Model
DCF	Discounted Cash Flows
FV	Future value
IRR	Internal rate of return
NCS	Norwegain continental shelf.
NOK	Norwegian Krone
NPV	Net present value
OPEC	Organization of the Petroleum Exporting Countries
PV	Present value
r.v.	real value
USD	United States Dollar
US	United States

1 Introduction

1.1 Motivation

I have had the privileged to take part in an industrial journey among challenging and exciting development projects funded on the last decade's substantial growth in the crude price. A substantial increase as result of an imbalance in the world's total demand and production of oil, which made both new and previous offshore oil and gas discoveries in remote, harsh and deep environments sustainable to develop.

In a retro perspective, offshore oil and gas deposits has for a long time been considered as prosperous oil and gas reserves to recover and to supplement the world's demand beyond the conventional onshore resources. In the wake of eager to explore and develop new areas and immature discoveries, the need for more sophisticated assets, systems and solutions was initiated, giving source between contractors to supply the outmost and most technically sophisticated assets to meet the operators' expectations. In hindsight and with reflections to the current situation (2016) in the oil and gas supply industry, you could considered the industry and market as blinded by the enormous potential earnings ahead, rather than the potential downturn to follow as downturns usually come at some point. Being part of an industry heavily invested in high end assets with great capital and operating expenditures, it has been quite remarkable to see the oil price plunge from far beyond the 100's in 2014 and down to the 60's within a year, and even further down in the following six months, all the way down below the 30's in January 2016. Even though the industry got a pre-warning during the 2008 financial crisis, and was already aware of the need to be more cost efficient, the prosperous future suddenly vanish with currently OPEC and US tight oil production getting the blame for flooding the market with oil. The industry has gone from boom to chicken race, and I realize that this is going to be a long haul rather than a short dip in the market, and it is definite to challenge the financial decisions and funding, operating the seven seas. Not only does it challenge the previous prospects, but equally important the financial decisions to make for a sustainable industry to move ahead.

Except for the current remedy in the market to lay off assets, reduce the stock, and to bid well below sustainable levels as we try to adapt to the new market conditions, the motivation became what are the alternatives with respect to the current financial situation. The purpose of this paper has turned into looking at the effect of the tax scheme on the Norwegian continental shelf and if the Norwegian administration can be the key to move marginal field into operation and subsequent enhances the local market conditions for the supply industry.

1.2 Background

We have more than a decade behind us with strong and escalating crude prices only disturbed by a correction during the financial crisis in 2008 when the Brent crude index went from 141 USD/ boe in week 27 to 39 USD/boe in week 52 (SSB, 2015). Prior to the recent period we have to go back to the mid 70's and the following decade to find similar crude prices (r.v.), see Figure 2. For the interim period (approximately 20 years) the crude price has been in the price range within 17 to 43 USD/boe (r.v.), with an estimated average around 30USD/boe (r.v.) (BP, 2016).

According to statistics (IEA, 2016), oil and gas is still the primary energy source for transport, electric energy and heating globally, and the demand for oil can be considered as inelastic with respect to price on short term basis since oil and gas remain quite essential for the economies worldwide, and such the short term price is determined by the supply imbalance together with US dollar trading development. In general terms the crude oil trading price is driven by the expected daily world consumption, based on the projected economy growth for different regions (Asia and China as main drivers for the recent period) and the politics driven by the greatest producers for crude, condensate and natural gas (Wril, F. 2008).

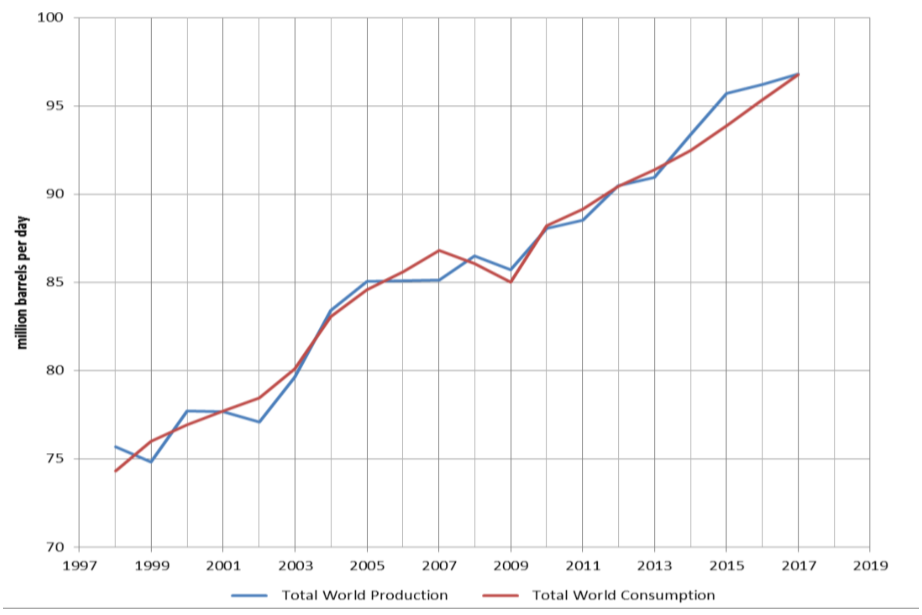

Figure 1 – Total production and consumption of petroleum & other liquids. Source: U.S. Energy Information Administration (U.S. EIA, 2016)

According to data series from U.S. Energy Information Administration (U.S. EIA, 2016) the daily global petroleum consumption increased during the period 2006-2015 (10 years) with an average one point five percent (1.47%) each year, and has been slightly higher than the supply side with an average one point four percent (1.38%) during the period. If we look at the last 5 years (2011-2015) the picture is slightly changed, where the daily global petroleum consumption increased with an average one point three percent (1.25%) each year, and has been slightly less than the supply side with an average one point seven percent (1.68%) during the period.

All together it is a history of about supply and demand, where the demand side has been slightly higher throughout the last decade, influenced by political and geographical events (Wril, F. 2008 & BP, 2016) such as sanctions (Iran), wars (Iraq and Afghanistan), and a substantial increase in the consumption from non-OECD countries compared to the OECD (U.S. EIA, 2016). Since 1998 the consumption in non-OECD countries has gone from 26.8 mboe/day to 47.6 mboe/day in 2015 (U.S. EIA, 2016), which results in an average increase in the consumption by 3.46% every year since 1998. Compared to the OECD countries with an average decline in the consumption of -0,15% in the same period (U.S. EIA, 2016).

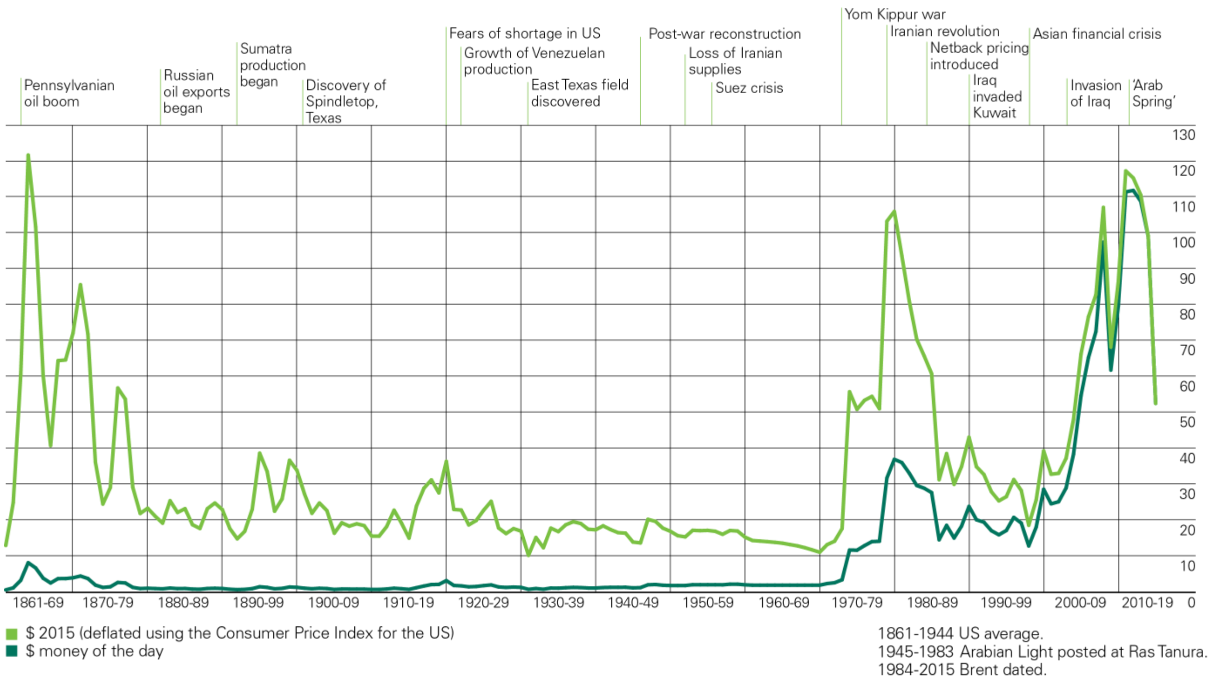

Figure 2 - Historical crude prices. Source: BP Statistical Review of World Energy 2016 (BP, 2016)

In a historical perspective the world's natural oil and gas resources has been considered as the so called conventional petroleum resources, where oil and gas deposits are found in sandstone or permeable rock formations that can be extracted using traditional methods, with few to several wells for each reservoir. The oil and gas resources are usually derived from kerogen deposits from other or deeper formations, but due to temperature and pressure hydrocarbons in form of crude, condensate or natural gas migrate into the permeable formation and are trapped by an impermeable cap rock formation functioning as a seal or cap over the reservoir. Conventional petroleum resources are extracted using traditional methods of drilling down through the cap rock formation, allowing crude, condensate and natural gas to flow freely up the well due to the differential pressure between the surface and the reservoir. Most of the resources that are extracted from conventional petroleum reserves are coming from land based facilities, which is considered as the most cost efficient resources to recover (Rystad, 2015), hence also the most profitable reserves.

However, unconventional petroleum resources are usually defined as oil and gas resources found in a variety of solid rock formation or sand that needs to be extracted using additional effort and energy to release the hydrocarbons from the source rock or sand. Extraction of unconventional resource usually requires an extensive number of wells (oil shale) or energy to extract the oil from its source host (oil sands). Examples of unconventional resources include e.g. coal seam gas, tight oil and oil sand. These resources are widely spread around the world, but are also considered as cost inefficient resources to extract.

According to Figure 3, onshore production accounts for 2/3 of the daily oil and gas production in the world, where USA, Russia and Saudi Arabia are the major producers from onshore fields, while offshore production accounts for the last 1/3, where the majority of the production takes place offshore at shallow waters. About 9% is assumed to come from deep to ultra-deep waters (330m and below), and deep water fields are considered as a prosperous areas for exploration to meet future energy demands. From a market watch (Infield, 2014) back in January 2014, Infield analysts expected $650mUSD CAPEX related to offshore developments over the period 2014-2018.

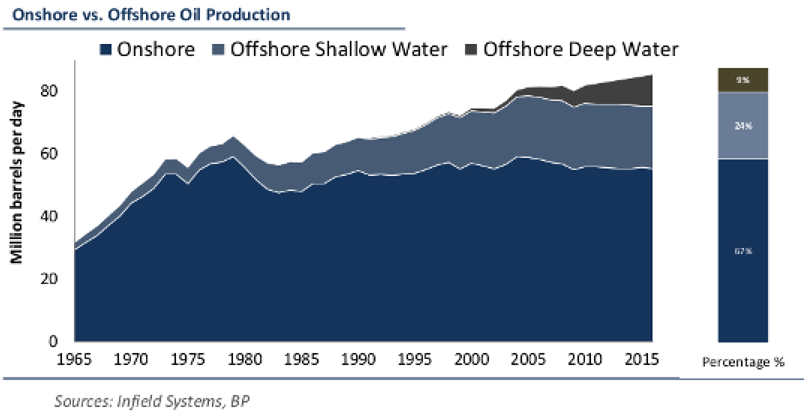

Figure 3 – Onshore vs. Offshore oil production – Graphical presentation. Source: (Kohl, K. 2014)

In 2006 cost related to exploration of the Norwegian continental shelf was 12 billion NOK (NPD, 2005), triple the amount in 2004 and twice as much as in 2005 (NPD, 2006). At the entry of 2014, international energy companies had used 36 billion NOK (NPD, 2015) in exploration during 2013 triple the amount used in 2006. Both minor, more remote and new discoveries were considered worth development due to the concurrent consensus to the oil price level and sustainability. In the same pace as the energy companies explore and developed new fields on the Norwegian continental shelf, so did the supply industry expand in number of employees and contracted new assets to gain its share and supply the market needs. In 2013 e.g. new orders for drill ships, jack-up rig and semi-submersible rigs almost peaked 100 orders (Cinnamon, O. 2015), taking the two succeeding years into account almost 250 new orders was set, reflecting the market outlook and optimism projected on very high day rates (above 500kUSD pr. Day) and a utilization near 100% for the operating market tonnage (IHS, 2016). By the entry of 2014 the contract value for contracting a new modern drillship could exceed 600 mUSD.

So what happens once the concurrent consensus to the oil price vanishes and the prosperous future is on hold?

Consider the Goliath development in the Barents Sea (NCS), with an anticipate break even at 65 USD/boe (Taraldsen, L. 2014) when filed for approval to the Norwegian governments in 2009. Five years later and approximately 14 billion NOK cost increase, break-even is suddenly estimated at 95 USD/boe (Taraldsen, L. 2014) as per Q2 2014. Break-even at 95 USD/boe may be acceptable as long as the crude price average remain at 2014 level (110usd/bbl Q1 2014, (U.S. EIA, 2016)), but looking at the current market the financial situation is probably more painful without knowing the actuals behind. The Goliath development is only one among many field developments currently set in production or yet to start in the north Atlantic basin, and a common question for several of these field developments is whether the current down turn was predicted or not.

The north Atlantic basin is solely related to offshore activity in one of the harshest environments on earth and it will never become a cheap place to run your energy business, nevertheless, two years after oil prices began their slide the north Atlantic basin is still a prosperous area related to offshore oil and gas resources. According to the current consensus amongst the energy analytic companies, the low prices are finally starting to brake production growth, but the question is when the market will recover to an equilibrium due to a massive inventory overhang and the uncertainty how US tight oil will respond if prices increase.

1.3 Research question

The current situation is in fact that the exploration and development of areas / licenses has more or less come to a full stop, awaiting the low price effect on the tight oil (US shale) and that OPEC unites reducing its total daily production. Meanwhile the supply industry lay off employees and cold stack its assets to turn the heat down, obviously to survive. A decade with high activity and boom in ordering new and sophisticated assets has come to an end where the asset portfolio is even bigger than ever, and although the industry seems to remain confident that the market will recover from the down turn, it is inevitable to understand that the supply industry is suffering due to the their recent investments.

Already it should be acknowledged that the offshore industry has to reduce its cost base and be more efficient to be able to meet the new market situation, not only today, but also for the future. Shall the Norwegian continental shelf continue to attract energy companies with respect to exploration and development of new discoveries, the associated cost developing these fields has to be sustainable in competition with unconventional resources which may create a crude price threshold in the future to come. With the current asset portfolio there are also thresholds for how far the rates can be reduced before bankruptcy is a fact, although bankruptcy may be the inevitable solution in the end.

Scrapping old assets, merges and less people becomes the remedy in the short run for the supply industry, in hope to avoid bankruptcy and to recover some of the current loss with better utilization and higher rates in a future market. But as long as the industry remain standstill, the supply industry is forced to continue its downsizing and reduce its cost base further, with the increased risk of another cost escalation ready to backfire once the energy market is ready to invest again. As result of the current situation pertaining to the above mentioned the following research question may arise;

Is there any financial remedy that may improve or unlock the current situation?

1.4 Delimitations

Due to the nature of offshore oil and gas deposits, different fields normally differ quite significant in composition, quality and quantity of crude, condensate or gas. In addition to the composition and quality of the reservoirs, the actual area and climate also affect the prospect of extracting the resources and what type of equipment and assets to deploy. That again implies that each field development is unique and the potential investments become irreversible in a high grade. The principle of sunk costs is highly applicable prior to investment decisions and it also affects the ability to enter the industry due to its capital demanding structure, which favors traditional energy companies due to its existing activity which generates the necessary cash flow to continue exploration and development of new areas.

Consequently I anticipated that the supply industry itself is unable to provide some kind of remedy or find its financial incentives to do so, other than being more cost efficient and promote new technology to solve the situation, mainly due to the potential risk premium to add-on due to the lack of collateral and the risk of default from the client. Most marine subcontractors will have e.g. its financials tied up to its installation vessels and fabrication yards, with the covenants that follow and its tangible assets as collateral, hence, shall the marine subcontractors also take additional risk in terms of providing extended credit to its clients, the assumption is that the risk premium will exaggerate the advantage.

Same considerations imply to external credit agents, similar to export credit solutions financing our new builds or tangible assets as collateral. Such agents could probably find ownership equal its outstanding financials in the field as collateral; however, this would only be considered as a regular loan or bond, which doesn’t improve the situation unless the interest was somehow significant less than normal for that typical energy company. And in case of no particular collateral to be made, the assumption would imply a risk premium similar to what the marine contractors could expect, which in most cases would be higher than what the energy companies themselves would manage to establish. Hence, it seems difficult to identify the plausible agent to provide any financial remedy without entering into too many areas. However, we may focus on the direct owner of the natural resources on e.g. the NCS, in this case the Norwegian administration and the society in general, and how they benefit from the oil and gas industry in a principal-agent perspective.

As such the research question will constitute the effect of the tax scheme for petroleum related activities in the Norwegian sector, by considering of the current, previous and potential tax schemes for a model field, to do some reflection regarding the Norwegian administration's ability to improve the business financial aspects of exploration and development at the Norwegian continental shelf and subsequently become the financial agent to move marginal discoveries into operation. Secondly, a hypothesis is that the project net present value benefits from moving the investments closer to or in the same period as income occur for the operation; hence this should improve the net present value for the operators. However can such financial model be justified by common valuation theory and socioeconomic considerations?

1.5 Structure of the research paper

The structure of the paper starts with the applicable theory applied for reflections and the hypothesis presented above in section 2 where I present the applicable theory for the research question and paper in particular.

I continue under section 3 to given an introduction to the Norwegian petroleum tax scheme, to further understand and develop the basis for calculating the cash flow series after-tax, as necessary to investigate the effect of the tax system and the effect of postponed investments for the operators and government.

In the following section 4 the method for this paper is presented and data for the model field. The question regarding validity and reliability is discussed as well as the limitations and weaknesses.

Section 5 present the result from the data series in basic, the complete data series are included in the appendix, it is only data series in tabular format presented under this section.

Results are presented under section 6 and the findings discussed. Section 7 is conclusions and summary of the work perform, and references and appendix in section 8 and 9 respectively.

2 Theory

2.1 Project valuation technique

Prior to making any investment decisions, the project value is subject to an assessment to conclude whether the project is worth doing generating added value for the company and stakeholders. Independent of the valuation technique, the key area of concern will always be to achieve the most realistic valuation of the project to avoid investments that potentially may deteriorate stakeholder values or diminish valuable investments.

According to Baker and English (2011, p.2) the "improper valuation can lead to incorrect decision despite the identification of potentially viable projects and estimation of their cash flows. Although many capital budgeting techniques are available for evaluation capital budgeting projects, the best methods typically recognize the amount, the time value and the riskiness for the project's cash flows." Furthermore, Baker and English (2011, p.20) presents the typical capital budgeting method to involve the three steps of "(1) estimating cash flows generated by the project, (2) finding an adequate discount rate for each cash flow, and (3) estimating the initial cost of the investment (Including opportunity costs). The main example of this is discounted cash flow (DCF) analysis, which is widely used in practice and occupies central stage in corporate finance and valuation textbooks", supported by Baker and English (2011, p.4) "Payne, Heath, and Gale (1999, p 16) make the following observation: *"According to theory, firms should use discounted cash flow methods to analyze capital budgeting alternatives. Within this theoretical frame, however, firms might evaluate somewhat similar projects differently.'*""

From an article by Berg et al. (2013) investigating the preferred valuation technique and yield requirement among the 500 largest firms in Norway, the survey concludes that the net present value and weighted average cost of capital is among the most widely used valuation technique among the category of the largest firms in the survey by 81% using this method, although it significantly differs in the category of smaller firms in the survey by only 25%.

For the purpose of this research paper, it seems to be support in the literature to conclude that the net present value method is the preferred method to proceed with, supported by the above mentioned.

2.2 *Weighted Average Cost of Capital*

Financing your business is the act of funding the firm's short- and long run activity, including asset investments and purchases to be able to provide your commercial services or products to the market. Either you are the energy companies investing its capital in future resources and up-stream assets or the subcontractor's in its drilling rigs or construction vessels. All do raise capital to invest in its assets with expected future cash flow in return from an efficient market, usually with debt and equity combined in the best interest of the shareholders' dividends or appreciation, and the lenders' willingness to accept risk of default. Although the optimum financing rarely occur for any company, as you normally compete to access the same funding, your funding is related to a cost of capital defined as the expected return on its existing securities or assets (Brealey et al. 2014). The cost of capital should differ between each company, but normally correlate in the same the market for similar firms. Cost of capital rest on type of financing either raised by debt or equity, and if the business is financed exclusively through equity, cost of capital is referred to as cost of equity and vice versa for debt (Brealey et al. 2014). As already stated above, the act of funding is normally through a combination of debt and equity, as debt is usually promotional and tax-deductible rather than equity. As such the complete cost of capital is widely accepted as the weighted average from both sources through the following equation (Brealey et al. 2014, p.221).

$$\text{(1)} \qquad \text{WACC} = \frac{E}{V} r_e + \frac{D}{V} r_d + (1 - t_c)$$

Where;

- E denotes equity.
- D denotes debt.
- V denotes total value (equity + debt).
- r_e denotes return on equity.
- r_d denotes interest rate debt.
- t_c denotes marginal corporate tax.

Weighted average cost of capital (1) or WACC, is the combined measure of the company cost of capital (Brealey et al. 2014) and represent the expected rate of return for the company investments compared to other markets to invest in, or in other terms, the minimum rate of return to make added value of its investments in the home market.

2.2.1 Capital Asset Pricing Model

In equation (1) the cost of equity needs to be determined for the actual firm to evaluate its cost of capital, as described in section 2.1 this is supported through the capital asset pricing model (CAPM) equations (2), adding together the risk free rate of return with the market risk premium (Brealey et al. 2014, p.219).

$$(2) \qquad r_e = r_f + \beta(r_m - r_f)$$

Where; r_e - equals return of equity defined as the risk free rate - pluss the market risk premium defined as the market rate of return r_m - minus risk free rate $r_{f,}$ - multiplied with the company's market correlation factor - β.

Since the cost of capital denotes a hurdle rate that company must overcome to make added value, it is broadly used in the capital budgeting process to define whether the company should proceed with its investment or not. The interpretation of the risk free rate - r_f - is the expected rate of return from investments with absolutely no risk of financial loss over a given period of time. The typical definition of the risk free rate is commonly related to government securities as bonds or other types of debt covenants with a coupon interest upon maturity date (Brealey et al. 2014). According to the annual survey regarding the risk premium in the Norwegian market (PwC, 2015) conducted by PricewaterhouseCoopers in Norway, 33% of the firms responding to the survey uses the rate of 10 years Norwegian governmental bonds, 1.6% as per October 2015, as risk-free rate. While 24% uses a normalized long-term rate between 3 – 4%, with a median of 3.5%.

Market rate of return r_m - is normally the expected return form a diverse portfolio in the stock market (Brealey et al. 2014), or the company stock itself. This is the rate of return you should expect to get if the company could invest its capital in the stock market or its own average-risk business (Brealey et al. 2014), hence the minimum required return for company's future or existing investments. According to the annual survey regarding the risk premium in the Norwegian market (PwC, 2015), the market risk premium is in average 5.0% with a median of 5.2%. Taking this into account the market rate of return is expected to be in the range of 6.6% – 9.0% for the Norwegian market as per 2015.

The correlation factor – β - is representing the financial elasticity or the volatility of stocks relatively correlated to the overall market. The beta is estimated by regression and can be expressed as (Brealey et al. 2014, p.181);

(3) $$\beta = \frac{Cov(r_a, r_b)}{Var(r_b)}$$

Where;

- r_a - denotes the return of the stock.
- r_{ab} - denotes the return of the market or divers portfolio (benchmark index).
- *Cov* - denotes the covariance operator.
- *Var* - denotes the variance operator.

Equation (3) implies the systematic market risk, considered as a non-diversifiable risk taken by the investors, and represents the premium for additional risk related to the stock. I other terms, the stocks or market you operated within will correspond to the market changes according to the stock beta, as such a beta equal 1 will perfectly correspond to the market changes, while a lower or higher beta will respectively respond less or more to the overall market. It becomes a measure of stock volatility compared with the overall market. Same applies to company stocks with negative beta; the only difference is that they work in the opposite direction of the market.

Trying to determine the market beta for the oil and gas industry, the New York Universisty Stern School of Business (Damodaran, A. 2016) provides beta's by sector in the US. Since the major energy companies are international firms, the betas presented below are considered as representative for the North Sea region as well.

Table 1: US beta by industry. Source: NYU Stern (Damodaran, A. 2016)

Industry Name	Number of firms	Beta	Unlevered beta
Oil/Gas (Production and Exploration)	351	1.63	0.91
Oilfield Svcs/Equip.	143	1.74	1.29

Presented by the figures in table 1, major energy companies will probably tend to have an unlevered beta below one, as minor companies will tend to have a beta slightly higher due to anticipated higher leverage than major energy companies. This should also imply to the subcontractors industry, even though it might be more diversity between major and minor companies. For the purpose of this paper we focus on the unlevered beta for production and exploration companies as the research method described later on will consider equity only.

2.2.2 Debt

Debt is a good and reliable companion that makes firms able to expand and growth future income, but it is also a covenant that relies on the ability to cover your interest and amortize the debt. High and sustainable crude prices will in most cases provide comfortable income and default risk, and vice versa if the crude price plunge, questioning the company's ability to make their payments and risk of default. However, equity is the part you cannot get enough from, but does not want to risk; as such the ratio of equity increases the required rate of return as set forward in the WACC definition, equation (1).

The debt interest denoted as r_d - represent the level of interest the company will achieve in the market, and is prominently influence by the already existing debt to equity ratio as a figure of how much debt your business can handle without too much risk of default for the lenders. But also influence by the companies' track record what is down to credit rating, history and ability to provide collaterals or parent company guarantees. Poor track record or low equity ratio will tend to higher interest or risk premium for the lenders, and good performance and high equity will form the basis for low interest as lenders often do have primary security in the credit facilities issued to the firm.

2.2.3 Marginal corporate tax

Financial cost of debt is in most economies tax deductible to its marginal corporate tax rate, currently 25% (2016) for Norwegian entities, however for energy companies directly involved in exploration and production of petroleum on the Norwegian continental shelf, an additional petroleum tax apply which is currently 53% (2016), resulting in a marginal tax of 78%.

For the purpose of this paper I will touch upon the tax scheme in the next chapter for the purpose to determine the net cash flow after tax, hence, determine the actual cash flow for the Norwegian administration as result of the tax scheme. This paper will not touch upon history or justified reasons behind the tax level for petroleum activity at the Norwegian continental shelf, however for those who are interested in different aspects regarding the tax level reference is made to other article and papers[1)] regarding that topic in broader context.

[1)] interesting articles about the tax scheme and valuation fo r those who are interested. Osmundsen & Johnsen,2013 article in Samfunnsøkonomen Nr. 5 2013. Lund, 2013, artical in Samfunnsøkonomen Nr. 6 2013. Osmundsen, Johnsen, & Emhjellen, article in Samfunnsøkonomen Nr. 8 2013. Røkenes, T. (2014) Endring av petrolumsskatten, konsekvenser for utbygging.

2.3 Net Present Value

According to section 2.1 discounted cash flows (DCF) method appears to constitute the principal valuation techniques and net present value (NPV) assessment to evaluate the present value of your investments today with respect to future cash flows in return. It is founded on the ‘time value of money’ principal (Brealey et al. 2014), which due to the potential gain of interest money in hand today is worth more than tomorrow. So by knowing almost certain that the capital you have today is worth more tomorrow, so should your future investments do if you decide to invest what you got today in a future cash flow rather than making interest in the bank or through risk free securities or bonds. The future value (FV) can be expressed as in equation (4),

$$FV = PV(1+r)^n \tag{4}$$

Where;

- FV - denotes the future value.
- PV - denotes the present value.

- r - denotes the rate of return or interest.
- n - denotes the period or number of periods.

Equation (4) implies the 'time value of money' principal define as the present value today times the expected rate of return (or interest) accrued for a number of periods n. Once the period is more than one, the compound rate is taken into account for equation (4) (Brealey et al. 2014). To find the present value (PV) of a future value (FV) the rate of return flip side in the equation (4) and becomes future value FV discounted by the expected rate of return (or interest) reduced by n periods. The present value (PV) can be expressed as in equation (5),

$$PV = \frac{FV}{(1+r)^n} \tag{5}$$

Future cash flows rarely occur without taking the risk of investing today, as well as your stream of cash flows is expected to be on annual basis over a certain number of terms, rather than a super cash flow in the last term. Same applies for the investments to be undertaken, which may occur over a number of terms before you can harvest form the years investing. The oil and gas sector is traditionally well known for its extensive investments over many years to be able to produce future cash flow. As to better understand the present value of future investments, the net present value is established by the discounted cash flows based on the firm's discounting rate, normally the calculated WACC (eq.1) as presented in the previous section. The net present value of cash flows in perpetuity can be expressed as in equation (6).

$$NPV = \sum_{n=1}^{N} \frac{C_n}{(1+r)^n} + C_0 \tag{6}$$

Where;

- NPV - denotes the net present value in period 0.
- n - denotes the period.
- N- denotes the number of periods.
- C_n - denotes the net cash flow in period n.

- r - denotes the discount rate.
- C_0 - denotes the net cash flow in period 0.

Equation (6) will allow the firm to predict a negative or positive net present value of the investments to be undertaken, based on the predicted future discounted cash flows. As long as the net present value is above 0, the investment is regarded as acceptable with the assumptions that underlies equation (6). In its form the equation (6) is subject to the assumption that growth or risk is constant by time (Brealey et al. 2014), which might be reasonable assumption to make pending on the market stability in the short or long run. Nevertheless, the assumption of constant discount rate is subject to discussion and addressed in various papers and articles.

2.3.1 Internal rate of return

As the net present value method in section 2.3 calculates the net present value of the project or investment based on a fixed discount rate which implies all investments with a positive net present value as positive investments, does the Internal rate of return (IRR) method calculate the discount rate that makes the net present value of all future cash flows equal to zero (Brealey et al. 2014). The rule of acceptance for the IRR method is that the investment project is acceptable if the internal opportunity cost of capital is less than the projected internal rate of return for the investment project (Brealey et al. 2014, p.113). Calculating the IRR for the investment project rely on equation (6) as for the NPV method, however to find the internal rate of return it is necessary to iterate the equation (6) with various discounting rates until the net present value turns out to be zero.

2.3.2 Value additivity theorem

According to Brealey et al. (2014) the value additivity theorem implies that the value of different cash flows or investment projects as a whole must equal the net present value of the different cash flows in separate. The value additivity theorem can be expressed by the following equation (7).

$$NPV(a,b) = NPV(a) + NPV(b) \tag{7}$$

Where *a* and *b* - denotes the cash flow a and b, or project a and b.

The presence of arbitrage would be there if the value as a whole group of projects or investments does not equals the project or investments in separate, which would imply an inefficient market condition.

2.4 Socio-economic discount rate

Business financial and socio-economic analyses follows the same methods and principles as described above, however, where the business financial analysis has a well-defined target to optimize the stakeholders' wealth in the simple form of cash in return, the valuation target of socio-economic investments might be more diffuse to determine. For the purpose of this research paper, we shall not enter into socio-economic analysis in detail, however due to the tax scheme for petroleum activity and the added value in form of tax income for the society, it is necessary to determine what is the socio-economic discount rate which implies a positive cash flow to the society compared to the business financial discount rate.

According to the guidance to socio-economic analysis issued by the Norwegian ministry of finance (Finansdepartementet, 2005), the main acceptance criteria for socio-economic investments is that the benefit equals the cost for the society. In terms of the research question, the Norwegian administration is then willing to approve exploration and development of the Norwegian continental shelf, as long as the tax income equals or exceeds the tax deductions for such projects. In order to determine the normalized discount rate, the guidance to socio-economic analysis issued by the Norwegian ministry of finance provides a discretionary fixed discount rate of 4% for typical governmental projects (Finansdepartementet, 2005. p.82). And for governmental projects with a considerable systematic market risk a discretionary fixed discount rate of 6% is applicable. A discount rate of 6% is consistent with the discount rate assessed in various socio-economic impact assessments publicly available in connection with mandatory preparation of plan for development and operation (PUD) required by the operators to issue in connection with plan field developments.

2.5 Summary

During the course of this section I have established support in the literature that project valuation techniques based on discounted cash flows methods such as the net present value method, together with the capital asset pricing model and weighted average cost of capital is widely recognized and accepted methods for capital budgeting and valuation. Followed by a presentation of the methods in detail and expressed the mathematical definitions. We have also touched upon the internal rate of return (IRR) and the value additivity theorem which we will come back to in method description and conclusion, respectively section 4 and section 7. And we have identified an applicable discount rate for socio-economic analysis, together with applicable risk-free rate, expected market premium and unlevered beta for large and well established firms.

3 Norwegian tax scheme

3.1 Petroleum tax system

For the purpose of this research paper, it will be necessary to calculate the net cash flow after tax as well as the tax cash flow itself. Hence it is necessary to understand the tax scheme for companies directly involved in the extraction, processing and pipeline export of crude, condensate or natural gas subsea at the Norwegian continental shelf (Petroleumskatteloven, LOV-1975-06-13-35. §1). According to the petroleum tax act §2 the tax system is based on the ordinary corporate tax act (Skatteloven, LOV-1999-03-26-14) with a set of exemptions set forth in the petroleum tax act (Petroleumskatteloven, LOV-1975-06-13-35) as set out in the following sections. As such, companies operating at the Norwegian continental shelf are subject to net income corporate tax of 25% (p.t.2016) and investment adjusted income tax of 53% (p.t.2016), and in total the marginal tax rate is 78%. In the recent years there have been some changes to the tax scheme as found in Table 2.

According to the Norwegian ministry of petroleum and energy Norskpetroleum.no (2016) “the overall objective of Norway’s petroleum policy has always been to provide a framework for the profitable production of oil and gas in the long term. It has also been considered important to ensure that as large as possible a share of the value creation accrues to the state, so that it can benefit society as a whole. This is partly obtained by the tax system.”

Further to statement above the reasoning for the additional petroleum tax is the historical extraordinary return on extraction, processing and export of petroleum, and the understanding that the petroleum resources belong to the public in general, hence, the tax scheme shall ensure that the wealth created as result of petroleum activity shall benefit the state and public in general (Norskpetroleum.no, 2016).

Table 2: Recent changes in tax scheme. Source: www.skatteetaten.no (Skattetaten.no, 2016)

Period	Corporate tax	Petroleum tax	Uplift (4 years)
-> May 2013	28%	50%	30%
2014	28%	50%	22%
2015	27%	51%	22%
2016 - >	25%	53%	22%

3.2 Depreciation

According to the petroleum tax act §3 cost related to long-term assets in form of pipelines and offshore production assets or facilities, and associated assets or equipment can be depreciated over 6 years, linear deprecation 16 1/3 each year, from the year of investment regardless of the service life for the field (Petroleumskatteloven, LOV-1975-06-13-35).

Hence, the main differences from the ordinary rules are the exemption that the depreciation begins already in the investment year as well as the depreciation if fixed to a certain period rather than the service life. As such the pipelines and production assets could be almost fully depreciated prior to first oil and net income. Depreciations do not necessarily follow each field in separate, but the company's petroleum activity as a whole, hence if the company is already in tax position due to existing activity the company is able to deduct the depreciation to its existing income. If the company in not in tax position yet, they are able to carry forward losses to offset profits in future tax years including interest (Petroleumskatteloven, LOV-1975-06-13-35. § 3c).

3.3 Net financial cost

According to the petroleum tax act § 3d (Petroleumskatteloven, LOV-1975-06-13-35- § 3d) deduction for net financial expenses incurred on interest-bearing liabilities apply to the offshore activity. This includes the sum of interest including foreign currency exchange loss or gain on debt. The deduction is set as a percentage of the company's net financial expenses corresponding to 50 percent of the relationship between the depreciated asset value at the end of the fiscal year and the annual average interest-bearing debt throughout year. If the gain from currency exchange exceeds the sum of interest and foreign currency exchange losses on interest-bearing liabilities, the corresponding proportion of net investment income is treated as income. The following equation (8) may express the above mentioned.

$$(8) \qquad Offshore\ deduction = (Debt\ interest + foreign\ currency\ exchange\ loss\ or\ gain\ on\ debt) * 50\% \left(\frac{Depreciated\ value\ of\ offshore\ assets}{Average\ annual\ debt}\right)$$

Excess net financial cost incurred on interest-bearing liabilities not deductible offshore, pursuant to the provisions above, is applicable to deduct the onshore activity (Corporate tax only), as well as excess net financial income is taken as income onshore.

For the purpose of this research paper the impact of net financial cost in not taken into account in simplicity and for those who wants to investigate the matter in detail, reference is made to the petroleum tax act (Petroleumskatteloven, LOV-1975-06-13-35).

3.4 Uplift

According to the Norwegian ministry of petroleum and energy (Norskpetroleum.no, 2016) “the petroleum taxation system is intended to be neutral, so that an investment project that is profitable for an investor before tax is also profitable after tax. This ensures substantial revenues for Norwegian society and at the same time encourages companies to carry out all profitable projects. To ensure a neutral tax system, only the company's net profit is taxable, and losses may be carried forward with interests. Neutral properties in the tax system is also important when defining investment based tax deductions.”

Hence to make the tax scheme “neutral” the basis for calculating the petroleum tax is deducted with an extra investment based depreciation or shield accounting for 22% of the investment cost over 4 years starting from the fiscal year of the investment

(Petroleumskatteloven, LOV-1975-06-13-35. § 5). Similar to the depreciations, the "uplift" does not necessarily follow each field in separate, but the company's petroleum activity as a whole, hence if the company is already in tax position due to existing activity the company is able to deduct the uplift to its existing income. If the company in not in tax position yet, they are able to carry forward losses to offset profits in future tax years including interest (Petroleumskatteloven, LOV-1975-06-13-35. § 3c).

3.5 Summary

During the course of this section we have touch upon the Norwegian tax scheme with respect to firms directly involved in subsea petroleum activity at the Norwegian continental shelf, to be able to calculate the net cash flow after tax and the tax cash flows itself. The following **Error! Reference source not found.** summarize the steps of calculating the different tax bases and Table 2 list the historical rates back upon mid-2013, which is as far as I go back for the purpose of this paper.

Table 3 - Overview tax scheme for petroleum activity Source: Norwegian Ministry of Petroleum and Energy (Norskpetroleum.no, 2016)

	Operating income (norm price)
-	Operating expenses
-	Linear depreciations for investments (16.67% each year over 6 years)
-	Exploration expenses, Research & Development and decommissioning cost
-	Environmental taxes and area fees
-	Net financial costs
=	Corporate tax base (25% p.t. 2016)
-	Uplift (5.5% of investments for 4 years p.t.. May 2013)
=	Petroleum tax base (53% p.t. 2016)

4 Method and cases

4.1 Research method

The research method applied for this paper is considered as a pragmatic and simple deductive approach; with the purpose of identifying the net present value for a typical crude, condensate and natural gas field at the Norwegian continental shelf, evaluating the effect of the petroleum tax scheme in general and further in the end investigate the hypothesis set forth in section 1.4 bearing in mind the principals of available export credit facilities in the market e.g. the Norwegian export credit guarantee agency (GIEK) and the export-import bank of the United States (EXIM). As already stated in the introduction section 1.4, the purpose is not to investigate these credit facilities in particular as the lack of collateral in tangible assets is anticipated to turn this option down, however the state and public in general can be considered as a principal where the licensee owner (operator) is an agent for the principal. Hence, for the purpose of extraction of oil and gas resources, the benefit form tax income as an added value to the society will anyhow be present, independent of the value as long as the discounted cash flow is positive in a socio-economic context.

Deductive reasoning (Jacobsen, 2005) works from the more general to the more specific and can be considered as a top to down approach. We begin identifying the theory about our topic of interest, and then narrow that down into more specific hypotheses that we can test. In this case is it only one hypothesis and a general view on the effect of the tax scheme to consider. Once the hypotheses or purposes are in place, identify or collect observations to address the hypotheses is necessary. This paper is considered as a quantitative research to study the relationship between the present value of the discounted cash flows before and after tax. Ultimately this leads up to testing the hypotheses to confirm or disprove the original question. For this specific paper the calculated internal rate of return before and after tax will tell us the effect of the tax scheme and confirm or disprove the hypothesis presented.

4.1.1 Quantitative data

According to the Norwegian petroleum act (Petroleumsloven, LOV-1975-06-13-35, §4-2, §4-3) and the regulations to the act relating to petroleum activities (Petroleumsforskriften, FOR-1997-06-27-653, §20-22), the operators on behalf of the license owner group is required to present a plan for development and operation of the field prior to consent form the Ministry of petroleum and energy. This includes the preparation of a mandatory impact assessment of the environmental and socio-economic consequences of such petroleum activity. The impact assessment as part of the plan for development and operation is a public available report and contains a specific discounted cash flows valuation to determine whether the planned petroleum activity will be beneficial in a socio-economic context for the state and public in general.

For the purpose of this paper it is necessarily not essential to have exact data to prepare a model field for the further investigation and testing, neither is the information received from these impact assessments considered and evaluated as fully consistent or complete. However, since the information is public available and that it is possible to derive a realistic and highly representative picture for the discovery under development, with respect to service life, investments, production profile, and operating expenses, the reason to utilize the figures available rather than use completely fictive figures, is in fact the reliability with respect to others that may use the same data to replicate or repeat the work. The sources of data is among many and the data in the model field in the following sections is derived from the impact assessment related to production license PL435 (Zidane, 2013).

On the 3rd October 2016 the Norwegian Ministry of Petroleum and Energy, and the Norwegian Petroleum Directorate (NPD) received the final plan for development and operation (PDO) for the Dvalin (previously Zidane discovery) gas and condensate field in production license 435 (PL435) with expected investments in the excess of 10 billion NOK (2016 value). In connection with the delivery of the PDO, NPD stated the following (NPD, 2016), "the NPD is interested in ensuring that profitable projects are developed and, where possible, that such projects utilize existing infrastructure. We expect that realization of the resources in Dvalin will contribute to create value, both for the Norwegian society and for the licensees on Dalin, Heidrun and Polarled. In addition, the development of Dvalin could provide exciting opportunities for further development of other resources in the area"

The production license PL435 was awarded already in 2006 and the two discoveries named "Zidane" came in 2010. In 2013 the operator of the PL435 issued the socio-economic impact assessment (Zidane, 2013) for review and comments, with a forecast to start investments in 2014 and first oil in 2017. During the fall 2014, the operator of PL435 decided to postpone the delivery of the PDO to the NPD, due to the lack of sustainable estimate of the present value (Lehman, A. 2014). In the impact assessment (Zidane, 2013) from 2013, the PL435 is considered to have a time frame for development and production of 15 years, whereas 10 out of 15 years are related to the production of about 17.1 billion standard cubic meters with gas and a slight portion of condensate. The export value of the field is presented as 38.1 billion

NOK, the total cost to develop and operate the field is presented as 20.1 billion NOK, resulting in a total net cash flow of 18 billion NOK (all figures 2013 value).

4.1.2 Validity and reliability

The applied theory is considered as applicable for the purpose of this paper, the valuation technique is representative for what is presented by literature as the most common valuation technique adapted by most firms as outlined in section 2, and the quantitative data collected is public available open source. As such the data sets and the calculations performed within this paper is open for reproduction and further investigation if found interesting for other. As such the method is considered as both valid and reliable within the scope of the research question and delimitations set for the scope. It should also be emphasized that the consideration of validity and reliability is based on the following limitations and weaknesses by the work set forward in the following section.

4.1.3 Limitations and weakness's

The research question is highly influenced by the profession of the author, and wide in its original definition, thus, the delimitations set restrict the scope of research, with respect to theory, selected method and data collected, to a narrow selection with respect to valuation techniques and parameters to consider. The paper only consider one valuation technique and does only present one hypothesis to test, which is considered as a restrictive limitation and weakens the validity and reliability of the work to a certain extend . The research method only considers companies already in tax position, hence, the model in not representative for companies required to carry losses ahead.

4.2 Model field

The model field is represented by cash flow series derived from the impact assessment for PL435 (Zidane, 2013), and a result summary for each applicable condition is shown in the following section 6.2. For the complete data set, reference is made to the appendix section. The research method encompasses the investigation of net present value before and after tax for the following cases.

4.2.1 Case 1

Case 1 commence with an initial condition to determine the 2016 tax level for petroleum activities on the Norwegian continental shelf. All cash flows series are discounted by 6% according to section 2.4, including the tax cash flows and net cash flows after tax. The discount rate is not adjusted for after-tax due to simplicity. The initial condition is followed by calculating the effect of previous tax schemes, back until May 2013, when the uplift rate was adjusted form 30% to 22%. Table 4 outlines the four different conditions and tax schemes to investigate for Case 1.

Table 4: Conditions to investigate for Case 1.

Conditions:	Corporate tax:	Petroleum tax:	Uplift (4 years):
Condition 1	25%	53%	22%
Condition 2	27%	51%	22%
Condition 3	28%	50%	22%
Condition 4	28%	50%	30%

4.2.2 Case 2

Case 2 is to calculate and investigate the effect of accelerated depreciation or full cost deduction, in other terms that the investment cost is completely deducted in the same manner as other operating cost. I use the 2016 tax scheme for this purpose and all cash flow series are discounted by 6% according to section 2.4, including tax cash flow and net cash flow after tax. Again, the discount rate is not adjusted for after tax due to simplicity.

Table 5: Conditions to investigate for Case 2.

Conditions:	Corporate tax:	Petroleum tax:	Uplift (4 years):
Condition 1	25%	53%	22%

4.2.3 Case 3

Case 3 encompass the hypothesis presented in section 1.4, and to test the hypothesis the following approach apply; moving the initial investment costs to the right for the operator, so all investment cost are accounted for in period 3. I maintain the 2016 as period 0 and I calculate the tax cash flows under such circumstances. Based on the calculated tax cash flows

I create a new cash flow series for the government, where the tax cash flows is the income, and the initial investment postpone to the right for the operator is included as investment cost in the first 3 periods (period 0 to period 2), until the investment cost returns in period 3.

The 2016 tax scheme will apply and all cash flow series are discounted by 6% according to section 2.4, including tax cash flow and net cash flow after tax. The discount rate is not adjusted for after tax, similar to the other two cases.

Table 6: Conditions to investigate for Case 3.

Conditions:	Corporate tax:	Petroleum tax:	Uplift (4 years):
Condition 1	25%	53%	22%

4.3 Summary

During the course of this section I have presented the research approach and touch upon the validity and reliability for the method, as well as the limitations and weaknesses for the research question and method in particular. Further the model field and the three case to investigate is identified and presented. The calculations will be enclosed in tabular format, under section 5 – data sets, and results presented and discussed in section 6.

5 Data sets

The following data sets present the results in tabular format. The results will be further elaborated and discussed in section 6.2. Full data set is enclosed as appendix.

5.1 Case 1

5.1.1 Condition 1

Table 7: Result Case 1 – Condition 1

	Operating income		38,100	mNOK
-	Operating expenses		8,000	mNOK
-	Field Investments		9,600	mNOK
-	Exploration and decommissioning cost		2,000	mNOK
-	Environmental taxes and area fees		500	mNOK
-	Net Financial Cost		-	mNOK
=	Net Income before corporate tax		18,000	mNOK
-	Uplift (5.5% of investments for 4 years)	22.00 %	2,112	mNOK
=	*Net Income before petroluem tax*		15,888	mNOK

	Corporate Tax	25.00 %	4,500	mNOK
+	Petroleum Tax	53.00 %	8,421	mNOK
=	Marginal Tax	78.00 %	12,921	mNOK
=	Net Income after tax		5,079	mNOK

	Description		NPV 6% [2016]	Total [mNOK]
	Operating income		24,350	38,100
-	Operating expenses		5,066	8,000
-	Field Investments		8,111	9,600
-	Production fees, CO2, area.		318	500
-	Exploration and decomissioning cost		1,305	2,000
-	Net Financial Cost		-	-
=	Net Cash Flow before tax		9,549	18,000
-	Marginal Tax	78.00 %	7,410	12,921
=	Net Cash Flow after tax		2,139	5,079

Calculated Internal Rate of Return	
IRR before tax	25.7 %
IRR after tax	14.6 %

5.1.2 Condition 2

Table 8: Result Case 1 Condition 2

	Operating income		38,100	mNOK
-	Operating expenses		8,000	mNOK
-	Field Investments		9,600	mNOK
-	Exploration and decommissioning cost		2,000	mNOK
-	Environmental taxes and area fees		500	mNOK
-	Net Financial Cost		-	mNOK
=	Net Income before corporate tax		18,000	mNOK
-	Uplift (5.5% of investments for 4 years)	22.00 %	2,112	mNOK
=	*Net Income before petroluem tax*		15,888	mNOK
	Corporate Tax	27.00 %	4,860	mNOK
+	Petroleum Tax	51.00 %	8,103	mNOK
=	Marginal Tax	78.00 %	12,963	mNOK
=	Net Income after tax		5,037	mNOK

	Description		NPV 6% [2016]	Total [mNOK]
	Operating income		24,350	38,100
-	Operating expenses		5,066	8,000
-	Field Investments		8,111	9,600
-	Production fees, CO2, area.		318	500
-	Exploration and decomissioning cost		1,305	2,000
-	Net Financial Cost		-	-
=	Net Cash Flow before tax		9,549	18,000
-	Marginal Tax	78.00 %	7,443	12,963
=	Net Cash Flow after tax		2,106	5,037

Calculated Internal Rate of Return	
IRR before tax	25.7 %
IRR after tax	14.4 %

5.1.3 Condition 3

Table 9: Result Case 1 Condition 3

	Operating income		38,100	mNOK
-	Operating expenses		8,000	mNOK
-	Field Investments		9,600	mNOK
-	Exploration and decommissioning cost		2,000	mNOK
-	Environmental taxes and area fees		500	mNOK
-	Net Financial Cost		-	mNOK
=	Net Income before corporate tax		18,000	mNOK
-	Uplift (5.5% of investments for 4 years)	22.00 %	2,112	mNOK
=	*Net Income before petroluem tax*		15,888	mNOK
	Corporate Tax	28.00 %	5,040	mNOK
+	Petroleum Tax	50.00 %	7,944	mNOK
=	Marginal Tax	78.00 %	12,984	mNOK
=	Net Income after tax		5,016	mNOK

	Description	NPV 6% [2016]	Total [mNOK]
	Operating income	24,350	38,100
-	Operating expenses	5,066	8,000
-	Field Investments	8,111	9,600
-	Production fees, CO2, area.	318	500
-	Exploration and decomissioning cost	1,305	2,000
-	Net Financial Cost	-	-
=	Net Cash Flow before tax	9,549	18,000

-	Marginal Tax	78.00 %	7,459	12,984
=	Net Cash Flow after tax		2,090	5,016

Calculated Internal Rate of Return	
IRR before tax	25.7 %
IRR after tax	14.4 %

5.1.4 Condition 4

Table 10: Result Case 1 Condition 4

	Operating income		38,100	mNOK
-	Operating expenses		8,000	mNOK
-	Field Investments		9,600	mNOK
-	Exploration and decommissioning cost		2,000	mNOK
-	Environmental taxes and area fees		500	mNOK
-	Net Financial Cost		-	mNOK
=	Net Income before corporate tax		18,000	mNOK
-	Uplift (5.5% of investments for 4 years)	30.00 %	2,880	mNOK
=	*Net Income before petroluem tax*		15,120	mNOK
	Corporate Tax	28.00 %	5,040	mNOK
+	Petroleum Tax	50.00 %	7,560	mNOK
=	Marginal Tax	78.00 %	12,600	mNOK
=	Net Income after tax		5,400	mNOK

	Description		NPV 6% [2016]	Total [mNOK]
	Operating income		24,350	38,100
-	Operating expenses		5,066	8,000
-	Field Investments		8,111	9,600
-	Production fees, CO2, area.		318	500
-	Exploration and decomissioning cost		1,305	2,000
-	Net Financial Cost		-	-
=	Net Cash Flow before tax		9,549	18,000
-	Marginal Tax	78.00 %	7,161	12,600
=	Net Cash Flow after tax		2,387	5,400

Calculated Internal Rate of Return	
IRR before tax	25.7 %
IRR after tax	15.7 %

5.2 Case 2

5.2.1 Condition 1

Table 11: Result Case 2 Condition 1

	Operating income		38,100	mNOK
-	Operating expenses		8,000	mNOK
-	Field Investments		9,600	mNOK
-	Exploration and decommissioning cost		2,000	mNOK
-	Environmental taxes and area fees		500	mNOK
-	Net Financial Cost		-	mNOK
=	Net Income before corporate tax		18,000	mNOK
-	Uplift (5.5% of investments for 4 years)	0.00 %	-	mNOK
=	*Net Income before petroluem tax*		18,000	mNOK
	Corporate Tax	25.00 %	4,500	mNOK
+	Petroleum Tax	53.00 %	9,540	mNOK
=	Marginal Tax	78.00 %	14,040	mNOK
=	Net Income after tax		3,960	mNOK

	Description		NPV 6% [2016]	Total [mNOK]
	Operating income		24,350	38,100
-	Operating expenses		5,066	8,000
-	Field Investments		8,111	9,600
-	Production fees, CO2, area.		318	500
-	Exploration and decomissioning cost		1,305	2,000
-	Net Financial Cost		-	-
=	Net Cash Flow before tax		9,549	18,000
-	Marginal Tax	78.00 %	7,448	14,040
=	Net Cash Flow after tax		2,101	3,960

Calculated Internal Rate of Return	
IRR before tax	25.7 %
IRR after tax	25.7 %

5.3 Case 3

5.3.1 Condition 1

Table 12: Result Case 3 Condition 1

	Operating income	38,100	mNOK
-	Operating expenses	8,000	mNOK
-	Field Investments	9,600	mNOK
-	Exploration and decommissioning cost	2,000	mNOK
-	Environmental taxes and area fees	500	mNOK

-	Net Financial Cost		-	mNOK
=	Net Income before corporate tax		18,000	mNOK
-	Uplift (5.5% of investments for 4 years)	22.00 %	2,112	mNOK
=	*Net Income before petroluem tax*		15,888	mNOK
	Corporate Tax	25.00 %	4,500	mNOK
+	Petroleum Tax	53.00 %	8,421	mNOK
=	Marginal Tax	78.00 %	12,921	mNOK
=	Net Income after tax		5,079	mNOK

	Description		NPV 6% [2016]	Total [mNOK]
	Operating income		24,350	38,100
-	Operating expenses		5,066	8,000
-	Field Investments		7,604	9,600
-	Production fees, CO2, area.		318	500
-	Exploration and decomissioning cost		1,305	2,000
-	Net Financial Cost		-	-
=	Net Cash Flow before tax		10,056	18,000
-	Marginal Tax	78.00 %	7,808	12,921
=	Net Cash Flow after tax		2,248	5,079

Calculated Internal Rate of Return	
IRR before tax	37.0 %
IRR after tax	17.2 %

	Description	NPV 6% [2016]	Total [mNOK]
	Marginal Tax (Income)	7,808	12,921
-	Field Investments (Credit)	-5,735	-6,600
-	Field Investments (Return)	5,228	6,600
-	Net Cash Flow - Government	7,301	12,921

6 Results

6.1 Calculated Cost of Capital

Based on equation (2) and the parameters we found in section 2.2.1, we may calculate the operators' cost of capital for a typical large size operator firm. As we disregard the debt, the weighted average cost of capital (eq.1) results in the share of equity times equation (2) which is the capital asset pricing model. The fraction of debt in the weighted average cost of capital equation (1) disappears and we threat the cost of capital as cost of equity. In section 2.2.1 we found that according to the survey (PwC, 2015) 33% of the firms responding to the survey uses the rate of 10 years Norwegian governmental bonds, 1.6% as per October 2015, as risk-free rate. While 24% uses a normalized long-term rate between 3 – 4%, with a median of 3.5%. Further in section 2.2.1 market risk premium is in average 5.0% with a median of 5.2%. Taking this into account the market rate of return is expected to be in the range of 6.6% – 9.0% for the Norwegian market as per 2015. We can then calculate the expected interval for the operators' rate of return, taking into account the unlevered beta of 0.91 for exploration and dev as we only consider the cost of equity. The upper bond will be;

$$r_e = 3.5\% + 0.91(5.2\%) = 8.2\% \quad (2)$$

Lower bound will then be;

$$r_e = 1.6\% + 0.91(5.2\%) = 6.3\% \quad (2)$$

The calculated cost of capital or rate of return represents what the operators' should as a minimum expect to get on their investments, is subject to the assumption that the firms' are solely financed by equity, and considered as nominal rate of return after tax. Based on the survey data (PwC, 2015) and the figures presented therein, the upper and lower bound as calculated above should be representative, however, it is challenging to determine exact. Back in mid-2013 a discussion regarding the changes in the tax scheme took place where one side proclaim 12.5 % before tax and 9% nominal after-tax as appropriate rate (Osmundsen & Johnsen, 2013), hence, we might not be far off depending on which side we support (Lund, 2013).

6.2 *Case results*

6.2.1 Case 1

For the first case I see that the difference in cash flow after tax for condition 1 to 3 is more or less insignificant, however there is a slight improvement for the operators' due to the decrease in corporate tax level. However, what does make a change is the uplift, as we can see for condition 4 the net present value of the return after tax is almost 300mNOK more than condition 3 and about 250mNOK more than today's tax scheme. So changes in the corporate tax level do slight adjustments to the tax income, and improves the balance, however, it is the uplift that matter and should be subject to further consideration with respect to the level and whether this level is beneficial for the Norwegian continental shelf under the current market conditions.

Table 13: Result Summary Case 1.

	Condition 1		Condition 2	
	NPV 6 %	Total	NPV 6 %	Total
Net Cash Flow before tax	9,549	18,000	9,549	18,000
Marginal Tax	7,410	12,921	7,443	12,963
Net Cash Flow after tax	2,139	5,079	2,106	5,037
IRR before tax	25.7 %		25.7 %	
IRR after tax	14.6 %		14.4 %	

	Condition 3		Condition 4	
	NPV 6 %	Total	NPV 6 %	Total
Net Cash Flow before tax	9,549	18,000	9,549	18,000
Marginal Tax	7,459	12,984	7,161	12,600
Net Cash Flow after tax	2,090	5,016	2,387	5,400
IRR before tax	25.7 %		25.7 %	
IRR after tax	14.4 %		15.7 %	

6.2.2 Case 2

Case 2 was the case where I looked into the accelerated depreciation, to consider full cost deduction the same year. As we see the, IRR, becomes the same before and after tax, hence tax scheme does not affect the rate of return and the tax system could be described as "neutral" without entering that discussion, but I may refer to (Røkenes, T. 2014) which deals with that topic. However the net present value after tax is better off in or equal as for two of the conditions in case 1.

Table 14: Result Summary Case 2.

	Condition 1	
	NPV 6 %	Total
Net Cash Flow before tax	9,549	18,000
Marginal Tax	7,448	14,040
Net Cash Flow after tax	2,101	3,960
IRR before tax	25.7 %	
IRR after tax	25.7 %	

6.2.3 Case 3

Case 3 is the case where I moved the investments to the right and let the government take the investments in the first three periods, while the operator return the credit in period 4. This seems to be favorable indeed as first anticipated, but the difference is more or less negligible compared to case 1 – condition 1 which is the current tax scheme today, and if we compare the net present value after tax with the case 1 – condition 4, which is the case before the change in uplift back in May 2013, the effect of higher uplift is definite the most favorable remedy for the market if we look at NPV of 6%. However, the IRR turns out better at 17.2% vs. 15.7%. It is also a question about the value additivity theorem do hold for this approach as the theorem implies that the value of different cash flows or investment projects as a whole must equal the net present value of the different cash flows in separate. If we look at the net cash flow before tax the difference between case 3 and case 1 – condition 1 is; 10,056mNOK – 9,549mNOK = 507mNOK. This is the same figure as if we look at the difference in the income for the government which becomes: 7.808mNOK – 7.301mNOK = 507mNOK. Last we check the difference between the net present value of the marginal tax case 3 vs. case 1 – condition 1: 7.808mNOK – 7.410mNOK = 398mNOK. Which is about 507mNOK x 0.78 = 395.5mNOK. So that is close.

So with respect to the hypothesis it seems according to what is done with in this paper that the hypothesis is potential valid, however, in lack of other literature regarding the same approach I would suggest that the topic is further investigated prior to make any conclusion.

Table 15: Result Summary Case 3.

	Condition 1	
	NPV 6 %	Total
Net Cash Flow before tax	10,056	18,000
Marginal Tax	7,808	12,921
Net Cash Flow after tax	2,248	5,079
IRR before tax	37.0 %	
IRR after tax	17.2 %	

6.3 Summary

During the course of this section I have presented and discussed the results from the data sets, and we can conclude that the expected rate of return for firms in the oil and gas industry should be in the range of 8.2% and 6.3%. With respect to the different cases and conditions applied we see that the change in uplift is the most governing effect on the net present value for the operators, hence, the most realistic outcome from this paper is the argument that the rate of uplift would be the best option to reconsider as a remedy for the industry. In case 3 we have seen that the hypothesis presented under section 1.4 may be valid and could result in a more beneficial condition for the operators, and subsequently the supply industry would be better off. However, this topic should be further evaluated prior to make any conclusions.

7 Conclusions

Through this research paper I have presented the background for the research question, and applied a set of applicable theory that shall be representative for the question to answer. With respect to the current downturn in the oil and gas supply industry, as the motivation to look into this topic to better understand and gain more knowledge, the conclusion regarding the effect of today's tax scheme is the obvious answer, that the reduction in the uplift effect definite do impact the income and makes the Norwegian continental shelf less attractive for energy companies. Subsequently this does impact the situation for the supply industry and the for the supply industry it is probably the time to make this adjustment a subject for debate. However, there are other aspect such as the environmental impact, cost of emission and the question about about the cost level which is not discussed in the this paper and which are inevitable topics to address before the debate regarding the tax system is applicable.

When it comes to the hypothesis presented the in this paper, the hypothesis and theoretical approach is subject to discuss and further evaluation, however it seems to be valid and maintain the value additivity theorem. Again the hypothesis is quite simple and does not taking into the consideration and aspect about the Norwegian administration as majority shareholder in one of the largest players at the Norwegian continental shelf through Statoil ASA, and through Petoro as licensee partner. This make the environment more complex and not consider in this paper, hence, all aspects should necessarily undergo thorough evaluation prior making any conclusions. The research paper itself does make a contribution to the debate and the general understanding among the people employed in the industry.

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9 Appendix

*Modelfield – cash flow series.

Model Field Case 1 - Condition 1

	Operating income		38,100	mNOK
-	Operating expenses		8,000	mNOK
-	Field Investments		9,600	mNOK
-	Exploration and decommissioning cost		2,000	mNOK
-	Environmental taxes and area fees		500	mNOK
-	Net Financial Cost		-	mNOK
=	Net Income before corporate tax		18,000	mNOK
-	Uplift (5.5% of investments for 4 years)	22.00 %	2,112	mNOK
=	*Net Income before petroluem tax*		15,888	mNOK
	Corporate Tax	25.00 %	4,500	mNOK
+	Petroleum Tax	53.00 %	8,421	mNOK
=	Marginal Tax	78.00 %	12,921	mNOK
=	Net Income after tax		5,079	mNOK

	Description		NPV 6% [2016]	Total [mNOK]
	Operating income		24,350	38,100
-	Operating expenses		5,066	8,000
-	Field Investments		8,111	9,600
-	Production fees, CO2, area.		318	500
-	Exploration and decomissioning cost		1,305	2,000
-	Net Financial Cost		-	-
=	Net Cash Flow before tax		9,549	18,000
-	Marginal Tax	78.00 %	7,410	12,921
=	Net Cash Flow after tax		2,139	5,079

			Fiscal Year				
2017	2018	2019	2020	2021	2022	2023	2024
-	-	-	1,400	5,600	5,800	5,800	5,800
-	-	-	350	1,110	1,110	1,110	1,220
700	2,400	3,500	3,000	-	-	-	-
10	30	30	30	40	40	40	40
-	500	200	400	-	-	-	-
-	-	-	-	-	-	-	-
-710	-2,930	-3,730	-2,380	4,450	4,650	4,650	4,540
-119	-907	-1,230	-1,044	1,964	2,190	2,383	2,696

-591	-2,023	-2,500	-1,336	2,486	2,460	2,267	1,844

Fiscal Year							
2025	2026	2027	2028	2029	2030	2031	2032
5,200	3,100	1,800	1,600	1,300	700	-	-
1,010	750	410	380	330	220	-	-
-	-	-	-	-	-	-	-
40	40	40	40	40	40	-	-
-	-	-	-	-	-	900	-
-	-	-	-	-	-	-	-
4,150	2,310	1,350	1,180	930	440	-900	-
2,847	1,802	1,053	920	725	343	-702	-
1,303	508	297	260	205	97	-198	-

Calculated Internal Rate of Return	
IRR before tax	25.7 %
IRR after tax	14.6 %

	Description	NPV 6% [2016]	Total [mNOK]
	Field Investments Year 1	574	700
+	Field Investments Year 2	1,856	2,400
+	Field Investments Year 3	2,553	3,500
+	Field Investments Year 4	2,064	3,000
=	Depreciations (Linear 6 years)	7,047	9,600
=	Depreciation Tax Shield 78%	5,496	7,488

Fiscal Year							
2017	2018	2019	2020	2021	2022	2023	2024
117	117	117	117	117	117	-	-
-	400	400	400	400	400	400	-
-	-	583	583	583	583	583	583
-	-	-	500	500	500	500	500
117	517	1,100	1,600	1,600	1,600	1,483	1,083
91	403	858	1,248	1,248	1,248	1,157	845

Fiscal Year							
2025	2026	2027	2028	2029	2030	2031	2032
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
500	-	-	-	-	-	-	-
500	-	-	-	-	-	-	-
390	-	-	-	-	-	-	-

	Description	NPV 6% [2016]	Total [mNOK]
	Field Investments Year 1 (22%)	133	154
+	Field Investments Year 2 (22%)	432	528
+	Field Investments Year 3 (22%)	594	770
+	Field Investments Year 4 (22%)	480	660
=	Uplift (22% over 4 years)	1,639	2,112
=	Uplift Tax Shield 53%	868	1,119

Fiscal Year

2017	2018	2019	2020	2021	2022	2023	2024
39	39	39	39	-	-	-	-
-	132	132	132	132	-	-	-
-	-	193	193	193	193	-	-
-	-	-	165	165	165	165	-
39	171	363	528	490	358	165	-
20	90	192	280	259	189	87	-

Fiscal Year

2025	2026	2027	2028	2029	2030	2031	2032
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

	Description	NPV 6% [2016]	Total [mNOK]
	Net incom before tax, depreciation & uplift	17,660	27,600
=	Marginal Tax 78% before depriciation & uplift	13,775	21,528
-	Depreciation Tax Shield	5,496	7,488
-	Uplift Tax Shield	868	1,119
=	Marginal Tax 78% after depriciation & uplift	7,410	12,921

Fiscal Year

2017	2018	2019	2020	2021	2022	2023	2024
-10	-530	-230	620	4,450	4,650	4,650	4,540
-8	-413	-179	484	3,471	3,627	3,627	3,541
91	403	858	1,248	1,248	1,248	1,157	845
20	90	192	280	259	189	87	-
-119	-907	-1,230	-1,044	1,964	2,190	2,383	2,696

Fiscal Year

2025	2026	2027	2028	2029	2030	2031	2032
4,150	2,310	1,350	1,180	930	440	-900	-
3,237	1,802	1,053	920	725	343	-702	-
390	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
2,847	1,802	1,053	920	725	343	-702	-

Model Field Case 1 - Condition 2

	Operating income		38,100	mNOK
-	Operating expenses		8,000	mNOK
-	Field Investments		9,600	mNOK
-	Exploration and decommissioning cost		2,000	mNOK
-	Environmental taxes and area fees		500	mNOK
-	Net Financial Cost		-	mNOK
=	Net Income before corporate tax		18,000	mNOK
-	Uplift (5.5% of investments for 4 years)	22.00 %	2,112	mNOK
=	*Net Income before petroluem tax*		15,888	mNOK
	Corporate Tax	27.00 %	4,860	mNOK
+	Petroleum Tax	51.00 %	8,103	mNOK
=	Marginal Tax	78.00 %	12,963	mNOK
=	Net Income after tax		5,037	mNOK

	Description		NPV 6% [2016]	Total [mNOK]
	Operating income		24,350	38,100
-	Operating expenses		5,066	8,000
-	Field Investments		8,111	9,600
-	Production fees, CO2, area.		318	500
-	Exploration and decomissioning cost		1,305	2,000
-	Net Financial Cost		-	-
=	Net Cash Flow before tax		9,549	18,000
-	Marginal Tax	78.00 %	7,443	12,963
=	Net Cash Flow after tax		2,106	5,037

Fiscal Year

2017	2018	2019	2020	2021	2022	2023	2024
-	-	-	1,400	5,600	5,800	5,800	5,800
-	-	-	350	1,110	1,110	1,110	1,220
700	2,400	3,500	3,000	-	-	-	-

10	30	30	30	40	40	40	40
-	500	200	400	-	-	-	-
-	-	-	-	-	-	-	-
-710	-2,930	-3,730	-2,380	4,450	4,650	4,650	4,540
-118	-903	-1,223	-1,034	1,973	2,197	2,386	2,696
-592	-2,027	-2,507	-1,346	2,477	2,453	2,264	1,844

			Fiscal Year				
2025	2026	2027	2028	2029	2030	2031	2032
5,200	3,100	1,800	1,600	1,300	700	-	-
1,010	750	410	380	330	220	-	-
-	-	-	-	-	-	-	-
40	40	40	40	40	40	-	-
-	-	-	-	-	-	900	-
-	-	-	-	-	-	-	-
4,150	2,310	1,350	1,180	930	440	-900	-
2,847	1,802	1,053	920	725	343	-702	-
1,303	508	297	260	205	97	-198	-

Calculated Internal Rate of Return	
IRR before tax	25.7 %
IRR after tax	14.4 %

	Description	NPV 6% [2016]	Total [mNOK]
	Field Investments Year 1	574	700
+	Field Investments Year 2	1,856	2,400
+	Field Investments Year 3	2,553	3,500
+	Field Investments Year 4	2,064	3,000
=	Depreciations (Linear 6 years)	7,047	9,600
=	Depreciation Tax Shield 78%	5,496	7,488

			Fiscal Year				
2017	2018	2019	2020	2021	2022	2023	2024
117	117	117	117	117	117	-	-
-	400	400	400	400	400	400	-
-	-	583	583	583	583	583	583
-	-	-	500	500	500	500	500
117	517	1,100	1,600	1,600	1,600	1,483	1,083
91	403	858	1,248	1,248	1,248	1,157	845

			Fiscal Year				
2025	2026	2027	2028	2029	2030	2031	2032
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

-	-	-	-	-	-	-	-
500	-	-	-	-	-	-	-
500	-	-	-	-	-	-	-
390	-	-	-	-	-	-	-

	Description	NPV 6% [2016]	Total [mNOK]
	Field Investments Year 1 (22%)	133	154
+	Field Investments Year 2 (22%)	432	528
+	Field Investments Year 3 (22%)	594	770
+	Field Investments Year 4 (22%)	480	660
=	Uplift (22% over 4 years)	1,639	2,112
=	Uplift Tax Shield 53%	836	1,077

			Fiscal Year				
2017	2018	2019	2020	2021	2022	2023	2024
39	39	39	39	-	-	-	-
-	132	132	132	132	-	-	-
-	-	193	193	193	193	-	-
-	-	-	165	165	165	165	-
39	171	363	528	490	358	165	-
20	87	185	269	250	182	84	-

			Fiscal Year				
2025	2026	2027	2028	2029	2030	2031	2032
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

	Description	NPV 6% [2016]	Total [mNOK]
	Net incom before tax, depreciation & uplift	17,660	27,600
=	Marginal Tax 78% before depriciation & uplift	13,775	21,528
-	Depreciation Tax Shield	5,496	7,488
-	Uplift Tax Shield	836	1,077
=	Marginal Tax 78% after depriciation & uplift	7,443	12,963

			Fiscal Year				
2017	2018	2019	2020	2021	2022	2023	2024
-10	-530	-230	620	4,450	4,650	4,650	4,540
-8	-413	-179	484	3,471	3,627	3,627	3,541

91	403		858	1,248	1,248	1,248	1,157	845
20	87		185	269	250	182	84	-
-118	-903		-1,223	-1,034	1,973	2,197	2,386	2,696

				Fiscal Year				
2025		2026	2027	2028	2029	2030	2031	2032
4,150	2,310		1,350	1,180	930	440	-900	-
3,237	1,802		1,053	920	725	343	-702	-
390	-		-	-	-	-	-	-
-	-		-	-	-	-	-	-
2,847	1,802		1,053	920	725	343	-702	-

Model Field Case 1 - Condition 3

	Operating income		38,100	mNOK
-	Operating expenses		8,000	mNOK
-	Field Investments		9,600	mNOK
-	Exploration and decommissioning cost		2,000	mNOK
-	Environmental taxes and area fees		500	mNOK
-	Net Financial Cost		-	mNOK
=	Net Income before corporate tax		18,000	mNOK
-	Uplift (5.5% of investments for 4 years)	22.00 %	2,112	mNOK
=	*Net Income before petroluem tax*		15,888	mNOK
	Corporate Tax	28.00 %	5,040	mNOK
+	Petroleum Tax	50.00 %	7,944	mNOK
=	Marginal Tax	78.00 %	12,984	mNOK
=	Net Income after tax		5,016	mNOK

	Description		NPV 6% [2016]	Total [mNOK]
	Operating income		24,350	38,100
-	Operating expenses		5,066	8,000
-	Field Investments		8,111	9,600
-	Production fees, CO2, area.		318	500
-	Exploration and decomissioning cost		1,305	2,000
-	Net Financial Cost		-	-
=	Net Cash Flow before tax		9,549	18,000
-	Marginal Tax	78.00 %	7,459	12,984
=	Net Cash Flow after tax		2,090	5,016

				Fiscal Year				
2017		2018	2019	2020	2021	2022	2023	2024

-	-	-	1,400	5,600	5,800	5,800	5,800
-	-	-	350	1,110	1,110	1,110	1,220
700	2,400	3,500	3,000	-	-	-	-
10	30	30	30	40	40	40	40
-	500	200	400	-	-	-	-
-	-	-	-	-	-	-	-
-710	-2,930	-3,730	-2,380	4,450	4,650	4,650	4,540
-118	-902	-1,219	-1,028	1,978	2,200	2,388	2,696
-592	-2,028	-2,511	-1,352	2,472	2,450	2,263	1,844

Fiscal Year

2025	2026	2027	2028	2029	2030	2031	2032
5,200	3,100	1,800	1,600	1,300	700	-	-
1,010	750	410	380	330	220	-	-
-	-	-	-	-	-	-	-
40	40	40	40	40	40	-	-
-	-	-	-	-	-	900	-
-	-	-	-	-	-	-	-
4,150	2,310	1,350	1,180	930	440	-900	-
2,847	1,802	1,053	920	725	343	-702	-
1,303	508	297	260	205	97	-198	-

Calculated Internal Rate of Return	
IRR before tax	25.7 %
IRR after tax	14.4 %

	Description	NPV 6% [2016]	Total [mNOK]
	Field Investments Year 1	574	700
+	Field Investments Year 2	1,856	2,400
+	Field Investments Year 3	2,553	3,500
+	Field Investments Year 4	2,064	3,000
=	Depreciations (Linear 6 years)	7,047	9,600
=	Depreciation Tax Shield 78%	5,496	7,488

Fiscal Year

2017	2018	2019	2020	2021	2022	2023	2024
117	117	117	117	117	117	-	-
-	400	400	400	400	400	400	-
-	-	583	583	583	583	583	583
-	-	-	500	500	500	500	500
117	517	1,100	1,600	1,600	1,600	1,483	1,083
91	403	858	1,248	1,248	1,248	1,157	845

Fiscal Year

2025	2026	2027	2028	2029	2030	2031	2032
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
500	-	-	-	-	-	-	-
500	-	-	-	-	-	-	-
390	-	-	-	-	-	-	-

	Description	NPV 6% [2016]	Total [mNOK]
	Field Investments Year 1 (22%)	133	154
+	Field Investments Year 2 (22%)	432	528
+	Field Investments Year 3 (22%)	594	770
+	Field Investments Year 4 (22%)	480	660
=	Uplift (22% over 4 years)	1,639	2,112
=	Uplift Tax Shield 53%	819	1,056

Fiscal Year

2017	2018	2019	2020	2021	2022	2023	2024
39	39	39	39	-	-	-	-
-	132	132	132	132	-	-	-
-	-	193	193	193	193	-	-
-	-	-	165	165	165	165	-
39	171	363	528	490	358	165	-
19	85	182	264	245	179	83	-

Fiscal Year

2025	2026	2027	2028	2029	2030	2031	2032
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

	Description	NPV 6% [2016]	Total [mNOK]
	Net incom before tax, depreciation & uplift	17,660	27,600
=	Marginal Tax 78% before depriciation & uplift	13,775	21,528
-	Depreciation Tax Shield	5,496	7,488
-	Uplift Tax Shield	819	1,056
=	Marginal Tax 78% after depriciation & uplift	7,459	12,984

Fiscal Year

2017	2018	2019	2020	2021	2022	2023	2024
-10	-530	-230	620	4,450	4,650	4,650	4,540
-8	-413	-179	484	3,471	3,627	3,627	3,541
91	403	858	1,248	1,248	1,248	1,157	845
19	85	182	264	245	179	83	-
-118	-902	-1,219	-1,028	1,978	2,200	2,388	2,696

			Fiscal Year				
2025	2026	2027	2028	2029	2030	2031	2032
4,150	2,310	1,350	1,180	930	440	-900	-
3,237	1,802	1,053	920	725	343	-702	-
390	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
2,847	1,802	1,053	920	725	343	-702	-

Model Field Case 1 - Condition 4

	Operating income		38,100	mNOK
-	Operating expenses		8,000	mNOK
-	Field Investments		9,600	mNOK
-	Exploration and decommissioning cost		2,000	mNOK
-	Environmental taxes and area fees		500	mNOK
-	Net Financial Cost		-	mNOK
=	Net Income before corporate tax		18,000	mNOK
-	Uplift (5.5% of investments for 4 years)	30.00 %	2,880	mNOK
=	*Net Income before petroluem tax*		15,120	mNOK
	Corporate Tax	28.00 %	5,040	mNOK
+	Petroleum Tax	50.00 %	7,560	mNOK
=	Marginal Tax	78.00 %	12,600	mNOK
=	Net Income after tax		5,400	mNOK

	Description	NPV 6% [2016]	Total [mNOK]
	Operating income	24,350	38,100
-	Operating expenses	5,066	8,000
-	Field Investments	8,111	9,600
-	Production fees, CO2, area.	318	500
-	Exploration and decomissioning cost	1,305	2,000
-	Net Financial Cost	-	-
=	Net Cash Flow before tax	9,549	18,000

-	Marginal Tax	78.00 %	7,161	12,600
=	Net Cash Flow after tax		2,387	5,400

Fiscal Year

2017	2018	2019	2020	2021	2022	2023	2024
-	-	-	1,400	5,600	5,800	5,800	5,800
-	-	-	350	1,110	1,110	1,110	1,220
700	2,400	3,500	3,000	-	-	-	-
10	30	30	30	40	40	40	40
-	500	200	400	-	-	-	-
-	-	-	-	-	-	-	-
-710	-2,930	-3,730	-2,380	4,450	4,650	4,650	4,540
-125	-933	-1,285	-1,124	1,889	2,135	2,358	2,696
-585	-1,997	-2,445	-1,256	2,561	2,515	2,293	1,844

Fiscal Year

2025	2026	2027	2028	2029	2030	2031	2032
5,200	3,100	1,800	1,600	1,300	700	-	-
1,010	750	410	380	330	220	-	-
-	-	-	-	-	-	-	-
40	40	40	40	40	40	-	-
-	-	-	-	-	-	900	-
-	-	-	-	-	-	-	-
4,150	2,310	1,350	1,180	930	440	-900	-
2,847	1,802	1,053	920	725	343	-702	-
1,303	508	297	260	205	97	-198	-

Calculated Internal Rate of Return	
IRR before tax	25.7 %
IRR after tax	15.7 %

	Description	NPV 6% [2016]	Total [mNOK]
	Field Investments Year 1	574	700
+	Field Investments Year 2	1,856	2,400
+	Field Investments Year 3	2,553	3,500
+	Field Investments Year 4	2,064	3,000
=	Depreciations (Linear 6 years)	7,047	9,600
=	Depreciation Tax Shield 78%	5,496	7,488

Fiscal Year

2017	2018	2019	2020	2021	2022	2023	2024
117	117	117	117	117	117	-	-
-	400	400	400	400	400	400	-
-	-	583	583	583	583	583	583

-	-	-	500	500	500	500	500
117	517	1,100	1,600	1,600	1,600	1,483	1,083
91	403	858	1,248	1,248	1,248	1,157	845

Fiscal Year							
2025	2026	2027	2028	2029	2030	2031	2032
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
500	-	-	-	-	-	-	-
500	-	-	-	-	-	-	-
390	-	-	-	-	-	-	-

	Description	NPV 6% [2016]	Total [mNOK]
	Field Investments Year 1 (22%)	182	210
+	Field Investments Year 2 (22%)	588	720
+	Field Investments Year 3 (22%)	810	1,050
+	Field Investments Year 4 (22%)	655	900
=	Uplift (22% over 4 years)	2,234	2,880
=	Uplift Tax Shield 53%	1,117	1,440

Fiscal Year							
2017	2018	2019	2020	2021	2022	2023	2024
53	53	53	53	-	-	-	-
-	180	180	180	180	-	-	-
-	-	263	263	263	263	-	-
-	-	-	225	225	225	225	-
53	233	495	720	668	488	225	-
26	116	248	360	334	244	113	-

Fiscal Year							
2025	2026	2027	2028	2029	2030	2031	2032
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

	Description	NPV 6% [2016]	Total [mNOK]
	Net incom before tax, depreciation & uplift	17,660	27,600
=	Marginal Tax 78% before depriciation & uplift	13,775	21,528

-	Depreciation Tax Shield	5,496	7,488
-	Uplift Tax Shield	1,117	1,440
=	Marginal Tax 78% after depriciation & uplift	7,161	12,600

Fiscal Year							
2017	2018	2019	2020	2021	2022	2023	2024
-10	-530	-230	620	4,450	4,650	4,650	4,540
-8	-413	-179	484	3,471	3,627	3,627	3,541
91	403	858	1,248	1,248	1,248	1,157	845
26	116	248	360	334	244	113	-
-125	-933	-1,285	-1,124	1,889	2,135	2,358	2,696

Fiscal Year							
2025	2026	2027	2028	2029	2030	2031	2032
4,150	2,310	1,350	1,180	930	440	-900	-
3,237	1,802	1,053	920	725	343	-702	-
390	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
2,847	1,802	1,053	920	725	343	-702	-

Model Field Case 2 - Condition 1

	Operating income		38,100	mNOK
-	Operating expenses		8,000	mNOK
-	Field Investments		9,600	mNOK
-	Exploration and decommissioning cost		2,000	mNOK
-	Environmental taxes and area fees		500	mNOK
-	Net Financial Cost		-	mNOK
=	Net Income before corporate tax		18,000	mNOK
-	Uplift (5.5% of investments for 4 years)	0.00 %	-	mNOK
=	*Net Income before petroluem tax*		18,000	mNOK
	Corporate Tax	25.00 %	4,500	mNOK
+	Petroleum Tax	53.00 %	9,540	mNOK
=	Marginal Tax	78.00 %	14,040	mNOK
=	Net Income after tax		3,960	mNOK

	Description	NPV 6% [2016]	Total [mNOK]
	Operating income	24,350	38,100
-	Operating expenses	5,066	8,000

-	Field Investments		8,111	9,600
-	Production fees, CO2, area.		318	500
-	Exploration and decomissioning cost		1,305	2,000
-	Net Financial Cost		-	-
=	Net Cash Flow before tax		9,549	18,000
-	Marginal Tax	78.00 %	7,448	14,040
=	Net Cash Flow after tax		2,101	3,960

Fiscal Year

2017	2018	2019	2020	2021	2022	2023	2024
-	-	-	1,400	5,600	5,800	5,800	5,800
-	-	-	350	1,110	1,110	1,110	1,220
700	2,400	3,500	3,000	-	-	-	-
10	30	30	30	40	40	40	40
-	500	200	400	-	-	-	-
-	-	-	-	-	-	-	-
-710	-2,930	-3,730	-2,380	4,450	4,650	4,650	4,540
-554	-2,285	-2,909	-1,856	3,471	3,627	3,627	3,541
-156	-645	-821	-524	979	1,023	1,023	999

Fiscal Year

2025	2026	2027	2028	2029	2030	2031	2032
5,200	3,100	1,800	1,600	1,300	700	-	-
1,010	750	410	380	330	220	-	-
-	-	-	-	-	-	-	-
40	40	40	40	40	40	-	-
-	-	-	-	-	-	900	-
-	-	-	-	-	-	-	-
4,150	2,310	1,350	1,180	930	440	-900	-
3,237	1,802	1,053	920	725	343	-702	-
913	508	297	260	205	97	-198	-

Calculated Internal Rate of Return	
IRR before tax	25.7 %
IRR after tax	25.7 %

Model Field Case 3 – Condition 1

	Operating income	38,100	mNOK
-	Operating expenses	8,000	mNOK
-	Field Investments	9,600	mNOK

-	Exploration and decommissioning cost		2,000	mNOK
-	Environmental taxes and area fees		500	mNOK
-	Net Financial Cost		-	mNOK
=	Net Income before corporate tax		18,000	mNOK
-	Uplift (5.5% of investments for 4 years)	22.00 %	2,112	mNOK
=	*Net Income before petroluem tax*		15,888	mNOK
	Corporate Tax	25.00 %	4,500	mNOK
+	Petroleum Tax	53.00 %	8,421	mNOK
=	Marginal Tax	78.00 %	12,921	mNOK
=	Net Income after tax		5,079	mNOK

	Description		NPV 6% [2016]	Total [mNOK]
	Operating income		24,350	38,100
-	Operating expenses		5,066	8,000
-	Field Investments		7,604	9,600
-	Production fees, CO2, area.		318	500
-	Exploration and decomissioning cost		1,305	2,000
-	Net Financial Cost		-	-
=	Net Cash Flow before tax		10,056	18,000
-	Marginal Tax	78.00 %	7,808	12,921
=	Net Cash Flow after tax		2,248	5,079

Fiscal Year

2017	2018	2019	2020	2021	2022	2023	2024
-	-	-	1,400	5,600	5,800	5,800	5,800
-	-	-	350	1,110	1,110	1,110	1,220
-	-	-	9,600	-	-	-	-
10	30	30	30	40	40	40	40
-	500	200	400	-	-	-	-
-	-	-	-	-	-	-	-
-10	-530	-230	-8,980	4,450	4,650	4,650	4,540
-8	-413	-179	-1,044	1,943	2,099	2,099	2,293
-2	-117	-51	-7,936	2,507	2,551	2,551	2,247

Fiscal Year

2025	2026	2027	2028	2029	2030	2031	2032
5,200	3,100	1,800	1,600	1,300	700	-	-
1,010	750	410	380	330	220	-	-
-	-	-	-	-	-	-	-
40	40	40	40	40	40	-	-
-	-	-	-	-	-	900	-

-	-	-	-	-	-	-	-
4,150	2,310	1,350	1,180	930	440	-900	-
1,989	1,802	1,053	920	725	343	-702	-
2,161	508	297	260	205	97	-198	-

Calculated Internal Rate of Return	
IRR before tax	37.0 %
IRR after tax	17.2 %

	Description	NPV 6% [2016]	Total [mNOK]
	Field Investments Year 1	-	-
+	Field Investments Year 2	-	-
+	Field Investments Year 3	-	-
+	Field Investments Year 4	6,606	9,600
=	Depreciations (Linear 6 years)	6,606	9,600
=	Depreciation Tax Shield 78%	5,153	7,488

			Fiscal Year				
2017	2018	2019	2020	2021	2022	2023	2024
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	1,600	1,600	1,600	1,600	1,600
-	-	-	1,600	1,600	1,600	1,600	1,600
-	-	-	1,248	1,248	1,248	1,248	1,248

			Fiscal Year				
2025	2026	2027	2028	2029	2030	2031	2032
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
1,600	-	-	-	-	-	-	-
1,600	-	-	-	-	-	-	-
1,248	-	-	-	-	-	-	-

	Description	NPV 6% [2016]	Total [mNOK]
	Field Investments Year 1 (22%)	-	-
+	Field Investments Year 2 (22%)	-	-
+	Field Investments Year 3 (22%)	-	-
+	Field Investments Year 4 (22%)	1,536	2,112
=	Uplift (22% over 4 years)	1,536	2,112

=	Uplift Tax Shield 53%	814	1,119

Fiscal Year 2017	2018	2019	2020	2021	2022	2023	2024
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	528	528	528	528	-
-	-	-	528	528	528	528	-
-	-	-	280	280	280	280	-

Fiscal Year 2025	2026	2027	2028	2029	2030	2031	2032
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

	Description	NPV 6% [2016]	Total [mNOK]
	Net incom before tax, depreciation & uplift	17,660	27,600
=	Marginal Tax 78% before depriciation & uplift	13,775	21,528
-	Depreciation Tax Shield	5,153	7,488
-	Uplift Tax Shield	814	1,119
=	Marginal Tax 78% after depriciation & uplift	7,808	12,921

Fiscal Year 2017	2018	2019	2020	2021	2022	2023	2024
-10	-530	-230	620	4,450	4,650	4,650	4,540
-8	-413	-179	484	3,471	3,627	3,627	3,541
-	-	-	1,248	1,248	1,248	1,248	1,248
-	-	-	280	280	280	280	-
-8	-413	-179	-1,044	1,943	2,099	2,099	2,293

Fiscal Year 2025	2026	2027	2028	2029	2030	2031	2032
4,150	2,310	1,350	1,180	930	440	-900	-
3,237	1,802	1,053	920	725	343	-702	-
1,248	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
1,989	1,802	1,053	920	725	343	-702	-

	Description	NPV 6% [2016]	Total [mNOK]
	Marginal Tax (Income)	7,808	12,921
-	Field Investments (Credit)	-5,735	-6,600
-	Field Investments (Return)	5,228	6,600
-	Net Cash Flow - Government	7,301	12,921

Fiscal Year

2017	2018	2019	2020	2021	2022	2023	2024
-8	-413	-179	-1,044	1,943	2,099	2,099	2,293
-700	-2,400	-3,500	-	-	-	-	-
-	-	-	6,600	-	-	-	-
-708	-2,813	-3,679	5,556	1,943	2,099	2,099	2,293

Fiscal Year

2025	2026	2027	2028	2029	2030	2031	2032
1,989	1,802	1,053	920	725	343	-702	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
1,989	1,802	1,053	920	725	343	-702	-