Technical report

NTNU
Norges teknisk-naturvitenskapelige Universitet
TPG 4851, Experts in Teamwork - Gullfaks Village

Group 4

Project Report – Experts in Teamwork

Trondheim, May 3rd , 2010

Ashish Bhandari
Masoud Ghorbaniyan
Katrin Jacobsen
Saran Sirimongkolrat
Ria Amelia Susanto

NTNU
Det skapende universitet

PART B

Improved Oil Recovery with Smart Wells

Table of Contents

Acknowledgement **9**
Abstract **10**
1. Smart Well Technology **12**
1.1 Motivation 12
1.2 Smart Well Definition 13
1.2.1 *Schlumberger's Definition* 13
1.2.2 *Well Dynamics' Definition* 13
1.2.3 *IWRG Definition* 14
1.2.4 *Baker Hughes' Definition* 14
1.3 Elements of Smart/Intelligent Wells 15
1.4 Smart Wells Controling Methods 18
1.4.1 Reactive Control Strategies 19
1.4.2 Proactive Control Strategies 19
1.5 Intelligent Well pros and cons 20
1.6 Operational Risks& Challenges in Smart Well Completion [4] 20
1.7 Smart Well Technology in Gullfaks Sør from SPE Paper [9] 21
2. Inflow Control Devices **22**
2.1 Introduction to Passive Inflow Control 22
2.2 Well Life Inflow Control Requirements 23
2.3 Passive Inflow Control Devices Reducing Heel to Toe Effect 24
2.3.1 Heel to Toe effect 24
2.4 Passive ICD Consideration Factor 25
2.4.1 Reservoir modeling 25
2.4.2 Reservoir condition and recovery challenges 25
2.4.3 Annular flow 26
2.5 Design Inflow Control Device 26
2.5.1 Design considerations 26
2.5.2 Reliability 27
2.6 Equipment to design a well completion with ICD 29

2.6.1 Swellable packers 31
2.6.2 Gravel pack 31
2.6.3 Mechanical shutoff 32
2.7 Types of Passive Inflow Control Devices 33
2.7.1 Helical-channel-based ICD 34
2.7.2 Orfice/Nozzle-based ICD 36
2.7.3 Hybrid/spiral type ICD 37
2.7.4 Halliburton and FlowReg ICD 37
2.8 Advantages and Disadvantages each PICD type 39
2.8.1 Helical-Channel/Labyrinth- type restrictor 39
2.8.2 Orifice/Nozzle-type restrictor 39
2.8.3 Hybrid/Spiral- type restrictor 39
2.9 Benefits of passive inflow control device technology 40
2.9.1 Success factors of PICD Technology 40
2.10 Challenges and Risk of Inflow Control 42
3. Smart Well Simulation 44
3.1 Introduction to Gullfaks sør reservoir 44
3.2 The trajectory of the smart well 44
3.3 Procedure of making smart well 48
3.4 Result of the simulation 48
3.4.1 The result in gas production 52
3.4.2 The result in oil production 54
3.4.3 The result in water production 55
4. Inflow Control Device Simulation 58
4.1 The ICD Well Trajectory Segments and The ICD Segments 58
4.2 Procedure of making ICD 58
4.3 The ICD Reservoir Simulation Result 63
4.3.1 Field Gas Oil Ratio (FGOR) 63
5. Reservoir Simulation Comparision: Smart Well, ICD, And Extended Case 68
6. Economic Evaluation 72
6.1 Cost Data And Economic Assumptions 72

6.2 Result from economics evaluation 74
6.3 Decision tree diagram 75
6.4 Sensitivity analysis 76
7. Conclusion 78
8. Recommendatios 78
9. Additional Work Report 79
9.1 Comparison ICD with different ICD strength 79
9.2 Comparison RONALDO with smart well ,ICD and RONALDO without smart well (RONALDO REFERENCE) 82
9.3 Inconsistency ICD RONALDO 86
10. Bibliography 88
11. Appendix A: Challenge no. 3 Description 90
Challenge 3. Improved oil recovery with smart wells **90**
12. Appendix B: Economic Calculation 91
12.1 Base Case: Extended Case 91
12.2 Sensitivity Case: Extended Case 92
12.2.1 Sensitivity Case: +5% of Oil and Gas Price 92
12.2.2 Sensitivity Case: -2% of Oil and Gas Price 94
12.2.3 Sensitivity Case: +30 % of Oil and Gas Production 95
12.2.4 Sensitivity Case: -30 % of Oil and Gas Production 96
12.2.5 Sensitivity Case: +40 % of Investment Cost 97
12.2.6 Sensitivity Case: -40 % of Investment Cost 98
12.3 Base Case: Smartwell Case 99
12.4 Sensitivity Case: Smartwell Case 100
12.4.1 Sensitivity Case: +5% of Oil and Gas Price 100
12.4.2 Sensitivity Case: -2% of Oil and Gas Price 101
12.4.3 Sensitivity Case: +30 % of Oil and Gas Production 102
12.4.4 Sensitivity Case: -30 % of Oil and Gas Production 103
12.4.5 Sensitivity Case: +40 % of Investment Cost 104
12.4.6 Sensitivity Case: -40 % of Investment Cost 105
12.5 Base Case: ICD Case 106
12.6 Sensitivity Case: ICD Case 107

12.6.1 Sensitivity Case: +5% of Oil and Gas Price 107
12.6.2 Sensitivity Case: -2% of Oil and Gas Price 107
12.6.3 Sensitivity Case: +30 % of Oil and Gas Production 109
12.6.4 Sensitivity Case: -30 % of Oil and Gas Production 110
12.6.5 Sensitivity Case: +40 % of Investment Cost 111
12.6.6 Sensitivity Case: -40 % of Investment Cost 112
13. Appendix C: HPHT Packer 113

Table of Figures

Figure 1: Demand of Energy 12
Figure 2: Schlumberger's Model for Smart Well Technology Process 13
Figure 3: Well Dynamics Elements of Smart Well Technology 14
Figure 4: Smart well completion 16
Figure 5: Well performance of well in terms of GOC and OWC 22
Figure 6: Timeline of passive ICD performance (Garcia, 2009) 23
Figure 7: Heel-Toe structure of a Horizontal well 24
Figure 8: The annulus flow equivalent to a pipe lying beside the tubing (Al-Mutairi, 2008) 26
Figure 9: Zonal isolation with packer (Statoil, Larsen) 29
Figure 10: Standalone screen 30
Figure 11: Annular packer 30
Figure 12: Swellable packers 30
Figure 13: Gravel as zonal isolation (Larsen, Statoil) 32
Figure 14: Mechanical shutoff options for PICD and screen completions 33
Figure 15: Channel-based ICD screen (Moen et. al., NTNU) 35
Figure 16: A nozzle based ICD screen (Moen et. al., NTNU) 35
Figure 18: Existing helical (channel-based) ICD design creates the desired flowing pressure loss via friction as fluid passes through the channel(s). 36
Figure 17 : New hybrid ICD design uses a distributive restrictive geometry which is less sensitive to erosion and maintains the plugging-resistance flow area of the helical design. 36
Figure 19 : FloReg ICD 38
Figure 20: EquiFlow ICD 38
Figure 21: Ideal PICD flow performance characteristic for Gas and Oil wells (R. Freyer, 2002) ..... **Feil! Bokmerke er ikke definert.**
Figure 22: FGOR and FWCT in the extended case 44
Figure 23 : The location of the added well in the extended case 45
Figure 24: WGPT for well W1, W2W3,W4W5,W6W7 46
Figure 25: WOPT for well W1,W2W3,W4W5,W6W7 46
Figure 26 : The location of the new 5 branches smartwell 47
Figure 27: Well status at the beginning of simulation in extended case 49
Figure 28: Well status at the end of simulation in the extended case 49
Figure 29: Well status at the beginning of simulation in smart well case 50
Figure 30: Well status at the end of simulation in smart well case 50
Figure 31: FPR for extended case and smart well case 51
Figure 32: FGOR for extended case and smart well case 52
Figure 33: FGPR for extended case and smart well case 52
Figure 34: FGPT for extended case and smart well case 53
Figure 35: FOPR for extended case and smart well case 54
Figure 36: FOPT for extended case and smart well case 54
Figure 37: FWCT for extended case and smart well case 55

Figure 38: FWPR for extended case and smart well case 56
Figure 39: FWPT for extended case and smart well case 56
Figure 40: Second Trial : Multilateral-well with ICD 60
Figure 41: Final ICD 61
Figure 42: QC from branch no. 5: Segment no. 163 to 200 62
Figure 43: Five branches well with ICD model like in Troll's ICD model 62
Figure 44: ICD FGOR vs Extended Case FGOR 63
Figure 45: ICD FOPR vs Extended Case FOPR 64
Figure 46: ICD FOPT vs Extended Case FOPT 64
Figure 47: ICD FGPR vs Extended Case FGPR 65
Figure 48: ICD FWPR vs Extended Case FWPR 66
Figure 49: ICD reservoir pressure vs Extended Case reservoir pressure 67
Figure 50: FOPT: Smartwell, ICD, and Extended Case 68
Figure 51: FGOR: Smartwell, ICD, and Extended Case 69
Figure 52: FOPR: Smartwell, ICD, and Extended Case 69
Figure 53: FGPR: Smartwell, ICD, and Extended Case 70
Figure 54: FWPR: Smartwell, ICD, and Extended Case 70
Figure 55: Reservoir Pressure: Smartwell, ICD, and Extended Case 71
Figure 56: Sensitivity Analysis Curve 77
Figure 57: FGOR 100ICD and SICD 79
Figure 58: FWCT 100ICD and 100ICD 80
Figure 59: FOPR 100ICD and SICD 80
Figure 60: FOPT of 100ICD and SICD 81
Figure 61: FGOR when RONALDO at 800 Sm3/day 82
Figure 62: FGOR when RONALDO at 2300 Sm3/day 83
Figure 63: FOPR of RONALDO Smartwell, ICD and Reference 84
Figure 64: FOPT of RONALDO Smartwell, ICD and Reference 84
Figure 65: FPR of RONALDO Smartwell, ICD and Reference 85
Figure 66: WOPR RONALDO 86
Figure 67: WOPT RONALDO 86

Acknowledgement

The special thank goes to our supervisors, Ole Jørgen Birkeland and Knut Müller, at Statoil. Especially, we would like to thank Knut for introducing us to the technical concepts of Smart wells and ICDs, and Ole Jørgen for his guidance that enabled us to make progress in all aspects of our project. The Technical aspect of this report would not have been possible without their supervision and support. The co-operation is indeed much appreciated.

Besides our supervisors, we especially want to thank Petter Eltvik and Eli Gule at Statoil for being so generous and providing us valuable information about Part A of the assignment. We are especially grateful to Eli for her contribution and suggestions to improve our simulations in Part B.

We owe our deepest gratitude to Professor Jon Kleppe and Jan Ivar Jensen for whose encouragement and support from the initial to the final level enabled us to develop our cooperation and understanding for this course.

We also want to thank our Teaching Assistants Daniel Solheim and Ida Aasen for such a wonderful semester.

At last but not least, we thank the entire unit of IPT and Experts-in-Teamwork for making our journey so memorable.

Abstract

In this project, we did literature study to answer point no.1 and no.4 as problem description in Appendix A, reservoir simulation with smart well and inflow control device technology and economic calculation to answer point no.2 and no.3 as problem description in Appendix A.

In literature study, the report includes introduction to smart well and ICD technology, equipments of Smart well and ICD, design consideration, advantages and disadvantages these technologies. The mainly advantage of smart well is better in reservoir management and optimization in production and injection however the disadvantage is the complexity of well completion and the cost per well is higher than conventional well. The advantage of ICD is self regulating but the big drawback is the low bottom hole pressure.

To improve oil recovery in Gullfaks South, we will drill a multilateral well with 5 branches. Then to optimize oil recovery, we will try to use smart well and/or ICD well to get better reservoir management which reduce early gas breakthrough so reservoir pressure can be maintained to get higher recovery factor. But, we will consider executing the projects based on the NPV project.

In the simulation part, since the main problem from the reservoir is significant high GOR which is about 14000 Sm3/Sm3, we use smart well and ICD to overcome this problem. In the extended case we add 4 producer wells with 7 branches but in this task we have to add a producer with 5 branches. In order to easily compare to the extended case, we choose 5 branches from 7 branches in the extended case by selecting the branches that has a high performance. Finally we choose W1, W2W3, W4W5 to make a 5 branches production well with new name 'RONALDO'. We make the new well 'RONALDO' to be a smart well by dividing the well into 200 segments and control the gas production by shutting the segments which have GOR higher than 10000 Sm3/Sm3. In ICD, there are 200 segments in the tubing and 199 segments in the ICD. We assume our ICD model is a channel type and use the value of the strength of ICD which is 0,00021 bar/m^6.

After running the simulation, we found that oil production in smart well case and ICD are higher than oil production in the extended case. Moreover the gas production and water production of smart well and ICD are also lower than extended case which are positive results by using smart well and ICD. The ICD case produce a bit more oil than in the smart well case.

We assume consistently comparison well cost in extended case and 'RONALDO' case, so we assumed it can be compared. We consider only net present value in economics evaluation and assume the cost of both smart well and ICD is same as a normal well. The payback periods of extended case which is in 2017 is shorter than the payback periods of smart well and ICD however at the end of simulation in 2037, both smart well and ICD has higher Net present value than extended case. The best alternative is ICD with the platform which returns highest net present value that is 2864 MNOK. Thus the ICD with platform case is the most recommended case to be done in the project considering particular our assumptions.
Based on sensitivity calculation the three projects, the NPV change is very sensitive to oil and gas price, hydrocarbon production, and investment cost. But, in this project we assume to consider NPV only to make decision.

We have three recommendations:

1. Further check ICD model because several segments in branch 3, 4 and 5 are gray in ECLIPSE 100

2. Adjust cost data and economic assumptions of smart well and ICD well to reality economic value to get better representative economic evaluation

3. Change the location and observe the result in the simulation to get maximum oil produced

We also add a part as additional work report which is part 9 as Statoil's suggestion to observe effect of ICD strength and further check from our group about our models.

1. Smart Well Technology

1.1 Motivation[1]

Oil and Gas have long been the energy source for the contemporary world. With the increasing demand of this kind of energy supply in the past few years as shown in figure 1, the limited resources of fuel energy have created countless problems and obstruction towards the economic growth. An important challenge in this current situation is to maximize recovery at a profitable rate.

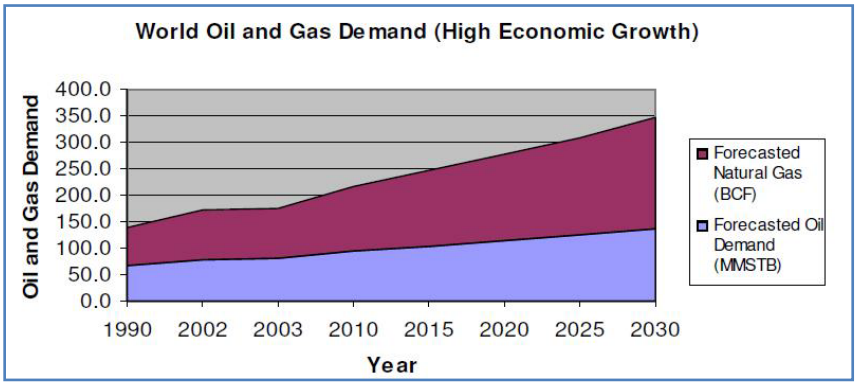


Figure 1: Demand of Energy

One of the aspects of new petroleum engineering technologies is to ease the production of new reservoir or increase the production rate. Slanted and horizontal well technology was developed in the early 1920's but was rarely used until the 1980's, after that new advancement in this technology, causes horizontal wells are common anymore. The industry is eager to consider new technology but with careful view till the technology is proved both theoretically and operationally.

In recent years, decline rate of reservoirs have increased. At the same time, reservoirs are becoming more complex. They are smaller, tighter and more remote. As a result, reservoir recovery rates are less than 35%. The goal of many operators is to increase recovery rates to 60% [2].One of the new technologies that have appeared in the past 10 years is called "Smart Well Technology[2]" or "Intelligent Well Technology[3]".

[1] [1, 2]
[2] (SWT)

1.2 Smart Well Definition

1.2.1 Schlumberger's Definition

A well equipped with monitoring equipment and completion components that can be adjusted to optimize production, either automatically or with some operator intervention. Figure shows the dynamic process of the Schlumberger model [1].

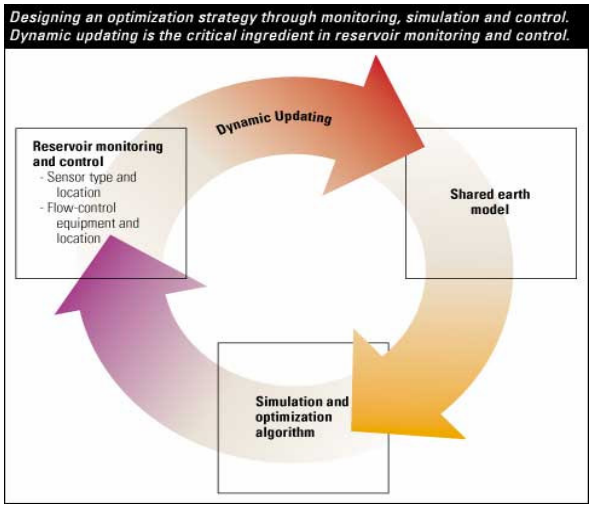


Figure 2: Schlumberger's Model for Smart Well Technology Process

1.2.2 Well Dynamics' Definition

Well Dynamics defines a smart well as a well that combines a series of components that collect, transmit and analyze completion, production and reservoir data, and enable selective zonal control to optimize the production process without intervention as shown in figure 3[1].

[3] (IWT)

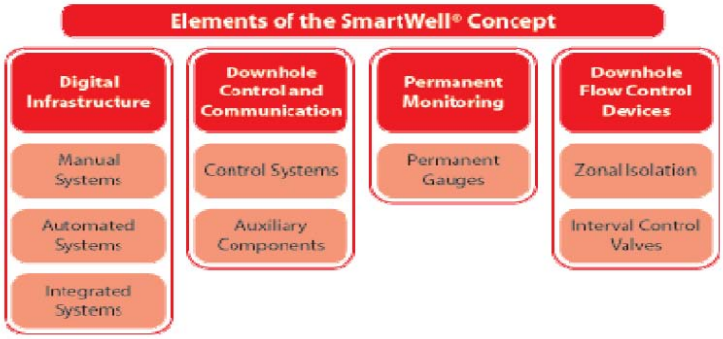


Figure 3: Well Dynamics Elements of Smart Well Technology

1.2.3 IWRG[4] Definition

IWRG defines an intelligent well as a well equipped with means to monitor specified parameters (e.g. fluid flow, temperature, pressure) and controls enabling flow from each of the zones to be independently modulated from a remote location (e.g. at the wellhead, or a nearby offshore platform, or a distant facility)[1].

1.2.4 Baker Hughes' Definition

Baker Hughes defines an intelligent well as implementation of fundamental process control downhole. Intelligent wells enable surveillance, interpretation and actuation in a continuous feedback loop, operating at or near real-time [1].

The first smart well was installed in August 1997 at Saga's Snorre Tension Leg Platform in the North Sea; more than 300 smart well have been installed all around the world, from mature land assets to deep water off the coast of Brazil [2]. To control flow from many laterals or zones utilizing down-hole control valves is the main aspect of the smart well technology [1].

SWT gives appropriate access to the operator to remotely monitor and control down-hole fluid production or injection without physical intervention. These facilities allow the

[4] Intelligent Well Reliability Group

optimization of hydrocarbon production, well utilization, and reservoir management processes. Electrical control systems and electronic sensors were applied at the early stages of development but the use of these equipments and systems decrease due to their poor reliability. With innovation in fiber optic sensors and hydraulic control systems the reliability of sensors and control systems have significantly improved, and the market adoption of this new technology is accelerating [2, 3].

Sensors and valves can be controlled independently; therefore, they can be employed in projects involving different objectives, such as production control of gas and water, production by different zones in stratified reservoirs, and margin fields, among others. They can be added flexibility to fields by allowing operation of valves to control production. This flexibility can be used, for example, to maximize NPV[5], to relieve risk, to improve oil production, to control water production or a combination of these objectives [3].

1.3 Elements of Smart/Intelligent Wells

The typical smart completion consists of:

- Inflow control valves[6];
- Permanent downhole gauge[7];
-Distributed temperature sensing[8];

The earliest DTS system installations consist of both types of single ended and double ended fiber optic cable. The recent DTS installations were done with a pre-installed fiber. In recent type the optical cable can run together with the completion string, so it doesn't need to pump down the fiber after completion [4].

Typical Downhole flow control devices being used in the industry are sliding sleever or ball-valve. Based on position of valve, there are different types of ICVs, such as binary

[5] Net Present Value
[6] (ICV)
[7] (PDHG)
[8] (DTS)

control (on/off), discrete positioning (a number of present fixed positions) or infinitely variable. For operating of these valves, hydraulic and electric systems are needed. Another type of downhole control device exists which name is Inflow Control Device[9]. ICD is typically installed and combined with a sand screen in an unconsolidated reservoir. The reservoir fluid runs from the formation through the sand screen and into the flow chamber, where it continues through one or more tubes. Tube lengths and IDs (inner diameter) are designed to induce the appropriate pressure drop to move the flow through the pipe at a steady pace [4].

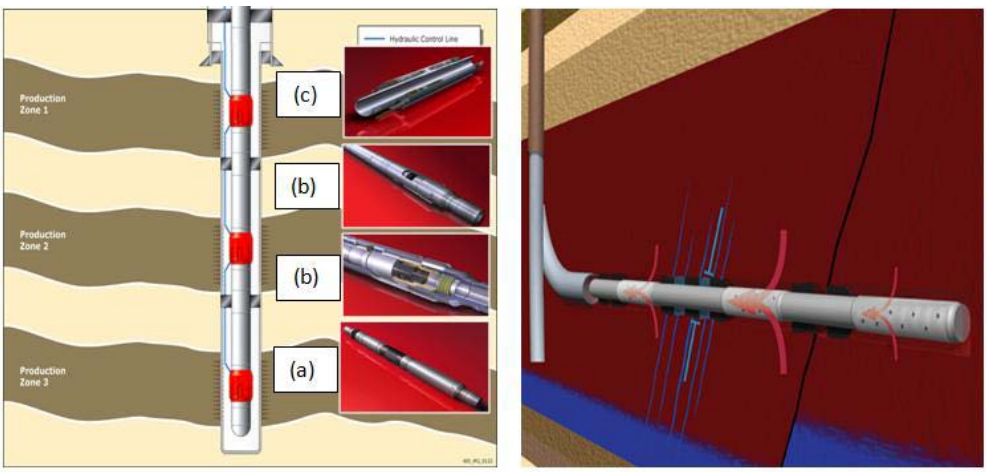


Figure 4: Smart well completion

As *shown* in the *figure above*, three main components required for a smart well HPHT[10] completion:

(a) **HF-1 Packer**: A production packer with the capability to feed through multiple hydraulic control line or TEC lines

(b) **Interval Control Valve:** A valve to control flow to or from the reservoir (i.e. injection or production)

[9] (ICD)

[10] High pressure/High temperature, wells deeper than 4000mTVD and/or wells that have an expected wellhead shut-in pressure bigger than or equal to 690bar (10000psi), and/or wells with temperatures higher than 150degC.

(c) **Permanent Downhole Gauge Cluster:** A gauge package for data acquisition (i.e. pressure / temp) [5].

Sensors can be classified in:

- Single-point, where the process variable is monitored in a single point in the well (typical case of the Permanent Downhole Gauge, the PDG) or in several points but in a very low density (e.g. one point per interval);
- Quasi-distributed, where the variable is monitored in several points, in a high density array (e.g. several points per interval);
- Distributed, where the variable is monitored along the whole well on a given spatial resolution (e.g. measurement per meter as in most Distributed Temperature Sensors, DTS) [6].

-Downhole electronics provide real-time pressure and temperature measurements from gauges deployed close to the sand face. In parallel of these systems proved their value, the industry created additional parameters for monitoring in this system, such as flow rate and water content. These downhole sensors can be reached to perfect state by the initial development of electro-hydraulically actuated flow control systems. "*The oil field environment and downhole temperatures specifically, have introduced a fundamental challenge for these electronic systems whose failure rates approximately double with each 18°F (10°C) increase in temperature. Since smart well systems are essentially inaccessible once deployed, their value is directly linked to their longevity. Those early systems were soon abandoned due to their low reliability* [2]".

Various types of downhole sensors are used to control well performance by regarding to different zones. Single-point electric quartz crystal pressure and temperature sensors are multiplexed in a single electric conductor with accurate measurement of pressure and temperature for each zone.

- Optical fibers are used for measuring temperature and throughout the length of a wellbore. In years, Single point fiber optic pressure transducers are available but after 2003 multipoint or distributed fiber optic pressure sensing is being used and developed.

- Downhole flow meters work based on venture systems, or pressure drop correlations across flow control devices. New generation of flow meters based on passive optical fiber acoustic sensing are being developed. There are other sensors are being used such as water cut sensors, fluid density meters, micro seismic arrays, formation resistivity array and downhole chemical analysis sensors [4].

1.4 Smart Wells Controling Methods

There are two different kinds of controlling the inflow to a well including "Passive" and "Active" ways. If drive mechanisms of a well are well defined and configured as well as the reservoir geology then we can apply passive controlling method effectively. Therefore we can predict the inflow by using reservoir and well models assuming that the predicted inflow does not change dramatically during production period. Afterwards, we can maximize the hydrocarbon production by optimizing the inflow profile along the well by using special and fixed controlling devices installed previously. Active methods are divided to Reactive and Proactive methods which I am going to discuss about them in the following paragraphs [7, 8].

Active Methods

We can apply Active controlling methods by using Inflow Control Valves (ICV) which is installed in an intelligent well. We can optimize the inflow profile along the well by considering the monitoring data gathered from downhole sensors and the predictions of the reservoir and well models in order to be able to change the settings of these valves. Active controlling methods can be divided in two parts which are "Reactive" and "Proactive" ones.

1.4.1 Reactive Control Strategies

In Reactive methods, we can change the settings of inflow control valves with respect to the adverse changes in flow like the flowing of unwanted fluids which are measured within the well or the reservoir.

1.4.2 Proactive Control Strategies

These strategies which are called defensive strategies too, change the settings and the status of ICVs with respect to variations in flow that are measured within the reservoir but a certain distance away from the well. The major advantage of proactive strategy is that it can detect potential problems like incoming of unwanted fluids and prevent them from influencing on the production of the well.

Since the optimal response of the ICVs within a well, changes over the time, it can be an important challenge lying under proactive and reactive strategies, which is how to determine it. Considering a single well, making a balance between the demands of short term production recovery or NPV optimization and the long term ones can hard to do. The problem can be more challenging in cases of having multiple wells.

Among different controlling techniques to optimize the production of a simulated intelligent well, reactive and proactive methodologies have shown significant results in many production scenarios including the value added to the final outcome. On the contrary, these strategies are highly depended on the prediction models of the reservoir or the well, and therefore are uncertain to rely on. So we can say that the risk involved within these strategies is somehow high since these models are not strong enough to show the exact behavior of the reservoir. By taking a look at recent researches done about this, we come to this conclusion that it is better to update these models periodically based on the data acquired from the well. Therefore we can use the data to determine the best response over a fixed time interval until the next update. But, as I have mentioned above, this updated models can result in a poor control and can misconduct us. Therefore it is better to use a certain number of models to achieve our goal which is somehow expensive to gain [7, 8].

1.5 Intelligent Well pros and cons

A Summary of pros and cons used to evaluate smart well use is shown as follow [6]:

Pros

- Better reservoir management;
- Number of wells reduction in the field development plan;
- Production anticipation;
- Reduction of reservoir interventions;
- Production and injection optimization;
- Possible increment on ultimate recovery factor;
- Well equipment's condition monitoring;

Cons

- Increase in cost per well;
- Increase of well completion complexity;
- Possible increase of interventions due to equipment failures;

1.6 Operational Risks& Challenges in Smart Well Completion[11]

Considering torque and drag during running the smart completion components (hardware) is of great importance besides the need for justification of implementing smart well completion. While running smart equipments, “Junk in Hole” from drilling side of field development is the only problem. In this case, preventing equipments to get stuck whenever erratic torque and drag are detected is done in two steps, pulling all equipments out of the hole and then flushing the hole by means of coil tubing (CT) or other convenient tools.

The next challenge that should be solved after installation is failure and in a smart well, it is defined as the inability to cycle the valve to the expected situation. Loss of communication or physical failure (valve stuck or jammed) would lead to this condition.

Reliability is the most significant challenge in smart fulfillment. By increasing the number of the installed valve systems, the reliability will be enhanced. Implementing this method by Shell Company resulted in having no failure since 2002. A statistical analysis about well dynamics

[11] [4]

installation (mini-direct and digital hydraulics) in Shell based on the number of the failures presents a probability of 96% survival of zonal control system after 5 years and an estimate of the probability of 85%-90% over a period of 10 years since their first installation within Shell.

To monitor the reservoir without disturbing the production, Smart completion equipments will be left after well abandonment. Therefore, during casing cutting and setting abandonment plug or retrieving wellhead, there is a risk of sensor cable damage. Using cable-less power and communication systems leads to reduction of this risk. Nevertheless, lifetime of battery pack deployed downhole restricts the lifetime of overall system in this new configuration.

1.7 Smart Well Technology in Gullfaks Sør from SPE Paper [9]

Smart Well Technology was applied to a Horizontal Subsea Well at Gullfaks Sør.
The well experienced gas breakthrough after a short time. In the reservoir management plan, the reserves were reduced from 12,6 mill Sm3 in the PDO to 3,0 mill sm3 based on the gained production experience. Since 2002, qualifying the use of smart well technology to increase the recovery. The main focus for the GF Sør Statfjord Formation Reservoir heterogeneity and gas breakthrough limited the production. Consequently, surface operated downhole inflow control and multilateral wells were recognized as possible solutions for future wells.

In this paper[12], the solutions made for the fourth horizontal subsea well drilled in the GF Sør Statfjord Fm. late 2003 is described.on the other hand, to maximize the number of drainage points in reservoirs with limited economical reserves, the need for cheaper well and drilling solution from floating drilling units is designated .

[12] More information about the paper was on Smart Well Technology Applied to a Horizontal Subsea Well at Gullfaks Satellites, Svein Oddvar Netland, Vibeke Haugen, Bianc Samsonsen, Per Kr. Krogh, Statoil AS , SPE Annual Technical Conference and Exhibition, 26-29 September 2004, Houston, Texas

2. Inflow Control Devices

2.1 Introduction to Passive Inflow Control

Controlling inflow into long, extended-reach horizontal wellbores has received significant attention within the past decade. A considerable amount of test data and actual field installations have shown that balancing inflow over the entire production interval results in enhanced oil Inflow control aims at even inflow distribution.

The ICD completion solution is particularly associated with horizontal and multilateral wells. This completion promotes extended reservoir contact (ERC) and lower draw-downs due to a uniform distribution profile (Figure 5). Uneven drawdown leads to non-uniform inflow rate and areas of higher drawdown can increase the chances of sand failure.

Inflow control Devices, or ICDs, is a choking device installed as part of sandface completion hardware, developed to improve the well performance and enhance the well reservoir management. The ICD provides a controlled pressure drop which is a function of flow rate. An ICD is a passive flow restriction in the fluid flow path from the reservoir into the flow conduit. An ICD has ability to equalize the inflow along the well length is due to the difference of the physical laws governing fluid flow in (1) the reservoir and (2) through the ICD [23].

Figure 5: Well performance of well in terms of GOC and OWC

2.2 Well Life Inflow Control Requirements

An ICD must exhibit certain performance features during each phase of a well's life. Performance in all the production stages (years) of a well's life are characterized by some production phase. This is described in detail in Figure 6.

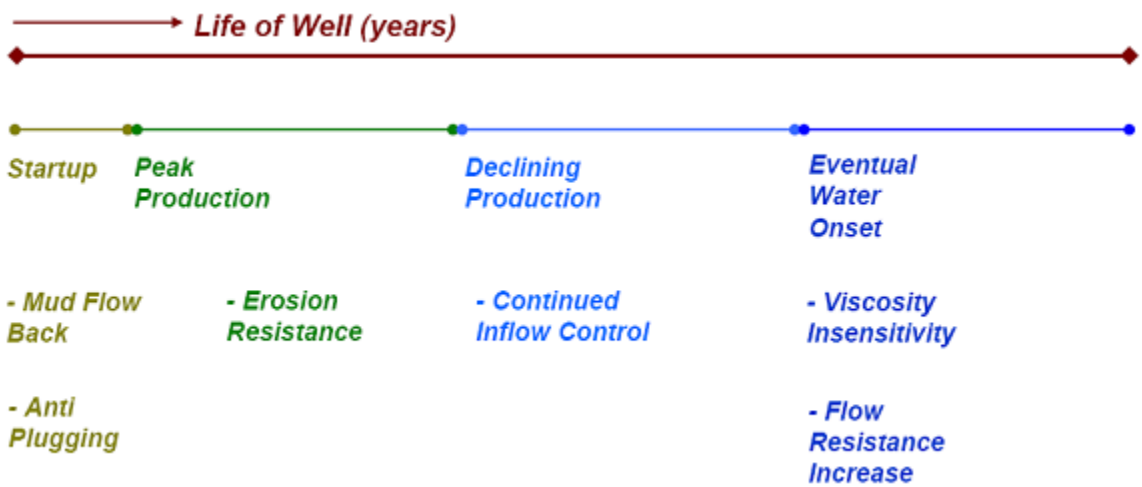


Figure 6: Timeline of passive ICD performance [13]

The timeline above depicts the desirable passive ICD performance features required to effectively produce and control the influx during the life of the well.

From startup, the ICD has a high level of plugging resistance for completion fluid. If the device has too small of a flow area, it may plug during this period. Thus a large flow area capable of producing fines and solids with minimal plugging potential is desired.

During peak production, the ICD will be exposed to high flow rates and must be erosion-resistant. If an ICD is not able to maintain a uniform flow in a completion, increased localized production will occur and lead to premature water or gas breakthrough.

During declining production, an ICD must continue to provide inflow control. If at this stage it has eroded or plugged, it is deemed ineffective. At eventual water onset, the ICD should provide an increase to flow resistance.

2.3 Passive Inflow Control Devices Reducing Heel to Toe Effect

The ICD is essentially a flow restriction device integral to each screen joint. By restricting free flow into the screen a normalizing effect is created by which all screen joints contribute equally to the production inflow. The tendency for greater production from the heel of the wellbore is eliminated[13] with a passive inflow control device.

2.3.1 Heel to Toe effect

The ICDs have been developed to reduce the impacts of heel to toe pressure drop in order to minimize the toe to heel effects balancing the inflow profile. The heel to toe effect is a result of the friction pressure drop causing a variable draw-down along the well. In the heel of the well, the fluid meets less resistance compared to the fluid from the toe, because this fraction is also exposed to friction pressure drop along the length of the completion interval.

The high pressure at the heel section often causes a breakthrough of water and gas, and an uneven sweep of the drainage area. Consequently, this affects the production rate and the total oil recovery.

Frictional pressure drop in the horizontal completion causes the inflow to be distributed unevenly and to be greatest at the heel of the horizontal well.

Figure 7: Heel-Toe structure of a Horizontal well

The primary reason for developing inflow control device technology is to counteract the heel-to-toe effects. The ICDs can restrict the flow by creating an additional pressure drop for balancing the wellbore pressure drop.

[13] By eliminating the undesired water/gas breakthrough into the wellbore

2.4 Passive ICD Consideration Factor

2.4.1 Reservoir modeling

Reservoir modeling is applied for determining optimum vertical placement of the oil lateral and the orientation of the gas lateral as they affect the total recovery. Modeling of the *near-wellbore* fluid flow and simulations of flow *in* the completion are important measures for predicting the well behavior. A complete design of the passive inflow control devices depends on the results of well simulations and modeling techniques.

Reservoir modeling may prove to optimally control the commingled production and equalize the inflow from multiple layers in a reservoir. The uncertainties in the reservoir description are afflicted by many factors which affect design of the ICD completion. Also having sufficient knowledge about the reservoir pressure, the oil/gas saturation and the geology is important for appropriately designing the well completion. Understanding the formation permeability and productivity variations depend on the efforts of modeling.

2.4.2 Reservoir condition and recovery challenges

Horizontal wells can increase reservoir hydrocarbon recovery, but they also pose unique reservoir challenges. Without proactively managing inflow, destructive erosion of the sandface or early gas breakthrough is likely.

The reservoir conditions are dynamic since the initial conditions of the reservoir do not stay the same. Changes in fluid viscosity, density, and velocity may occur under different circumstances. The ICDs are installed permanently upon the completion of a well based on the initial reservoir conditions and some predictions of the reservoir performance.

The reservoir conditions have a major impact on the total recovery. The oil production rate is typically affected by the reservoir heterogeneities and the heel to toe effect, causing more imbalanced production profile.

2.4.3 Annular flow

An open annulus allow high rate of fluid inflow, after gas or water breakthrough from high productivity completion sections to result in high rate, annular flow along the whole zone.

Annular flow occurs unless there is isolation packer installed in the annular space between the ICD and the formation sandface at every ICD joint. Annular flow will exist if an annular space is not reduced or packed with gravel or collapsed formation sand.

Annular flow elimination is essential condition for achieving the regulatory effect if ICDs installed across heterogeneous formations. One method to fill the annulus outside the screen with gravel to support the formation is described in Augustine et al. Another way to achieve annular flow elimination is by installing Swellable packers [10].

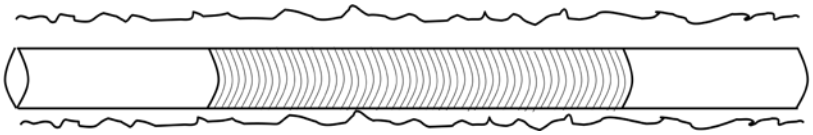


Figure 8: The annulus flow equivalent to a pipe lying besides the tubing [10]

2.5 Design Inflow Control Device

2.5.1 Design considerations

The ICD screens are either Orifice/nozzle-based (restrictive), Helical-channel/labyrinth pathway (frictional). Normally, the screens are not designed to prevent 100% blockage of all particles from the formation. During production, formation fines that are produced through the screen also pass through the ICD. These fines can and will erode an ICD over time if the fluid velocity is high enough and fines are in the flow stream.

ICD must be properly designed for to accomplish design purposes. Appropriate design for an ICD completion requires both good knowledge of the reservoir and the geology of the formation. Factors like permeability, reservoir pressure are critical for the design. Passive Inflow Control Devices are permanent downhole components that passively provide a preferential flow condition for oil versus water. The PICDs are not adjustable once they are installed in the well, thus the inflow control system does not

have any degrees of freedom to manipulate the flow path diameter. The location of the device and the relationship between rate and pressure drop are fixed. This makes the design of a well completion and inflow control devices more dependable on the structure of the well and the reservoir conditions.

A reasonable design of ICD completion may have promising potential to cut gas coning and water production as long as good zonal isolation across layers and sections exist. The zonal isolation delays the gas coning or water breakthrough and reduces annular flow capability.

The design of the optimal ICD depends on the reservoir pressure, the oil/water saturation distribution and the limits of permeability. The well characteristics often changes from initial flow input used to select the desired ICD. Hence, an ICD with automatic adjustment capability to compensate for changes in well inflow condition is desired.

2.5.2 Reliability

The reservoir challenges may change in the lifetime of the well is a critical reliability issue. Likewise, the impact of an inflow control device is a function of time. Since a typical well with ICD can be in production from 5 to > 20 years (Garcia, 2009) the long-term reliability is a crucial to the wells performance.

ICD reliability can be evaluated in term of erosion or plugging of the ICD flow restriction[14]. The plugging resistance is crucial to the performance of completion. Sand deposition can cause ICD plugging. The plugging potential of the ICDs due to sand deposition can be reduced significantly with Stand- Alone-Screen[15] (SAS). To ensure a minimum plugging risk, an ICD design process should take account of a minimum flow restriction diameter in case of an equipment failure for sand measuring or control. However, the sand deposition can be reduced by the utilization of gravel packs[16].

A significant factor in the reliability of an ICD is its ability to maintain uniform and controlled influx over the well life. Typically for horizontal wells in uniform formations the flow normalizing effect created by the ICD delays the onset of gas and/or water

[14] **Invalid source specified.**

[15] (J. Augustine, 2008) The SAS completion prevents the production of sufficiently large sand particles that may plug the ICD's flow restriction.

[16]

coning along the whole horizontal section. However, there are uncertainties with respect to drilling accuracy, and in heterogeneous formations localized gas breakthrough will damage the oil production. This is due to many variable factors such as the permeability distribution, the sand thickness, communication to the neighboring aquifers and gas cap.

2.6 Equipment to design a well completion with ICD

The completion designs vary a lot from one well to the next. Consequently, the equipment cost also varies due to the cost of purchase and installation. In addition to the regular components; e.g. wellheads, tubing and accessories, the ICDs are installed with other equipments for adding the features to the completion.

Figure 9: Zonal isolation with packer (Statoil, Larsen)

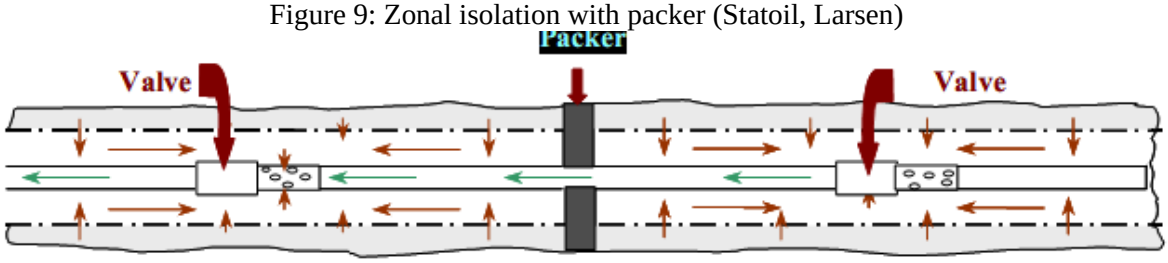


Figure 10: Annular packer

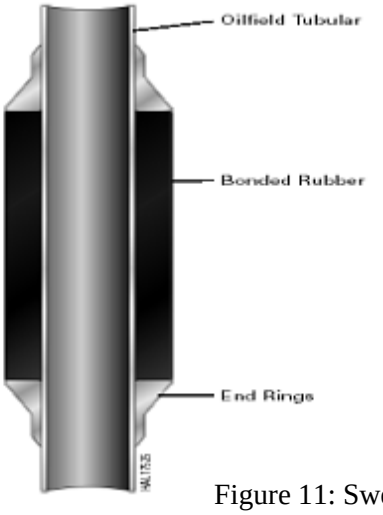


Figure 11: Swellable packers

Figure 12: Standalone screen

The ICD screens are more resistant to plugging and erosion because the ICD modules reduce axial annular flow (in the screen/wellbore) to a negligible level [18].

The ICD screens are usually combined with:

- Annular flow isolation in the form of Swellable packers (Figure 10)
- Gravel pack
- Mechanical shutoff

2.6.1 Swellable packers

Swellable packers use rubber around the packer that will expand when the hydrocarbons or water comes into contact. Expanding the rubber will ensure that the annulus is permanently sealed. Swellable packers are included to compartmentalize the reservoir sections below the fracture.

The number of zones controlled with ICDs is only limited by the number annular flow isolation packers employed and the additional ICDs and packers (Figure 9). An ICD completion can potentially have as many controlled intervals as required.

The use of annular packers can also provide the same annular flow constriction. How to design a screen based completion depends highly on the reservoir properties but also on vendor's philosophy.

2.6.2 Gravel pack

The ICD screens are gravel packed to restrict annular flow and give zonal isolation which optimizes regulation of reservoir heterogeneities. The gravel pack will assure efficient sand control by preventing annular flow and thus optimizing flow in the heterogeneous reservoir zones. The figure below, Figure 13 illustrates the packer installed with an ICD completion.

A successful installation of the ICD completion with gravel pack is performed by providing necessary zonal isolation. This characteristic has led to excellent field experiences in the use of these devices to control unwanted sand production.

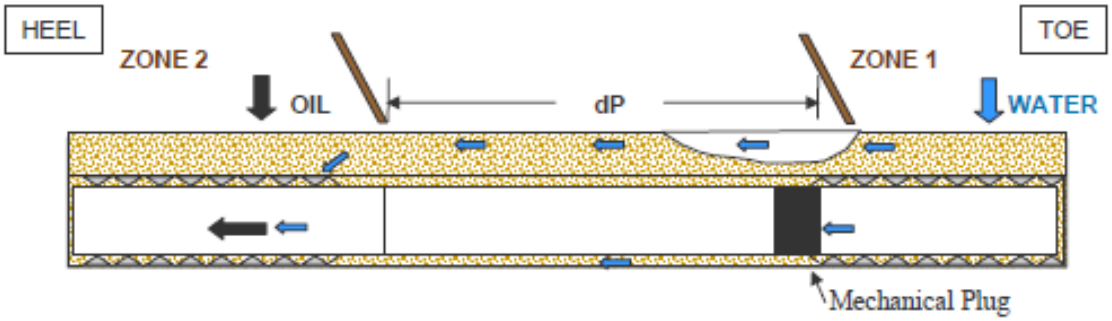


Figure 13: Gravel as zonal isolation (Larsen, Statoil)

2.6.3 Mechanical shutoff

A mechanical isolation is effective if the PICD cannot control the reservoir heterogeneities or the mobility ratio[17] where the water or gas will take the path of least flow resistance.

If a passive ICD completion is already in place and production logging tools detect water or gas production, then a mechanical shutoff technique with zonal isolation can be installed to improve the oil production from zones not already invaded by undesired fluid (e.g. gas or water).

A mechanical shutoff technique need to be coupled with PICD completions to open or close zones with the least amount of intervention (reduced operational cost).Two mechanical shutoff options can be implemented: *sliding sleeve with a PICD joint* or a *sliding sleeve assembly inside the PICD completions*.

These six design cases are potential options for water and gas control: (1) open annulus with standard screen, (2) gravel pack with standard screen, (3) gravel pack with ICD completions, (4) gravel pack with sliding sleeve, (5) gravel pack and standard screen with sliding sleeve and zonal isolation & (6) gravel pack with sliding sleeve and zonal isolation. An illustration of various completion designs is presented in Figure 14.

[17] The water or gas will take the path of least flow resistance.

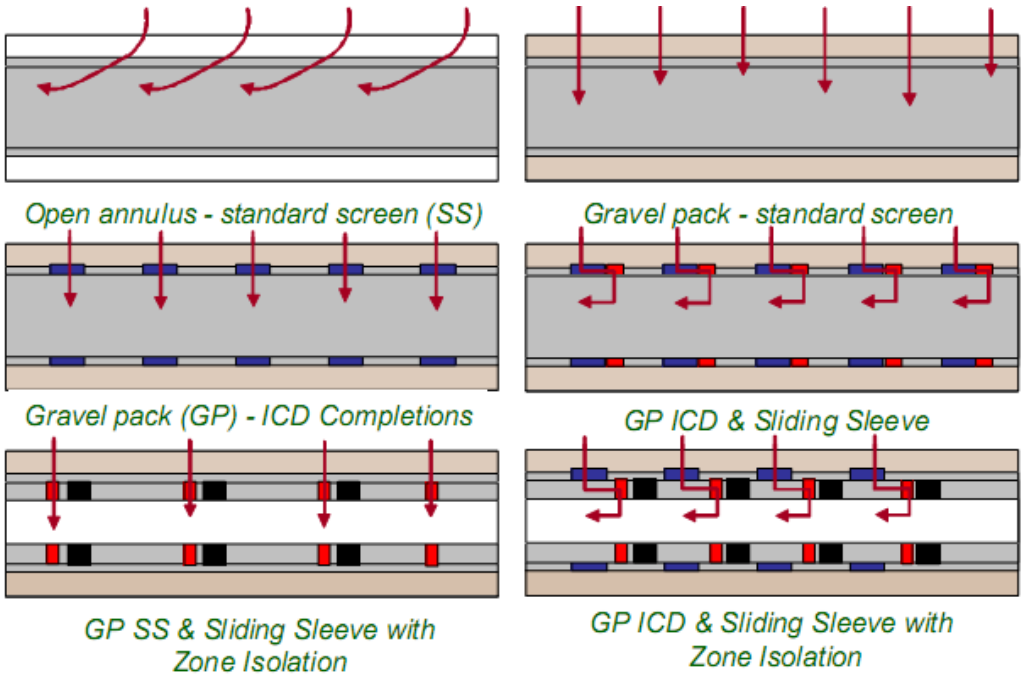


Figure 14: Mechanical shutoff options for PICD and screen completions

The first case does require additional intervention to close the sliding sleeve. The second case requires a second annular space with a sliding sleeve and PICD, which could promote additional pressure drop through the completion depending on the flow rate and therefore promote uneven influx through the completion. Additional description of sliding sleeve PICD completions is given in [19].

2.7 Types of Passive Inflow Control Devices

Various types of ICDs are constructed with equivalent methods to obtain a desired pressure drop. The principles of design of ICDs are the same, even though the detailed composition may vary from one to another. The design premises depend on the reservoir conditions and the actual pressure drop desired for the inflow regulation.

The ICDs are designed to apply a specific differential pressure at a certain flow rate. The induced pressure drop across each ICD unit is based on the *pre-set design* depending on the reservoir conditions that are targeted for equalizing the pressure. The ICDs have a pre-set flux rate associated with the completion which matches the requirements for the reservoir.

Many different Inflow Control Devices have been developed to fit according to the reservoir conditions and to give the desired pressure drop in the completion. Currently, there are three primary types of ICD designs in the industry:

- Helical-channel/labyrinth-based inflow control device – e.g. *Channel-type ICD*
- Orifice/nozzle-based inflow control device – e.g. *Nozzle-type ICD*
- Hybrid/spiral-based inflow control device – e.g. *Spiral-type ICD*

The ideal solution is to provide the lower viscosity sensitivity of the restrictive device with the low erosion and high plugging resistance level of the frictional design. This means using the restrictive pressure loss mechanism while limiting the fluid velocity through the device below the critical level, which will minimize erosion potential.

The most commonly used ICDs belong to two different categories of ICDs, the so-called *Channel-type* and N*ozzle-type* ICD [21]. These three PICD designs apply three different methods to generate a pressure drop.

There are also variations of channel design and nozzle design. Even with different configurations, the basic principles of how the ICDs work are the same. The following categories are the main classification of the ICDs.

The ideal solution is to provide the lower viscosity sensitivity of the restrictive device with the low erosion and high plugging resistance level of the frictional design. This means using the restrictive pressure loss mechanism while limiting the fluid velocity through the device below the critical level, which will minimize erosion potential.

2.7.1 Helical-channel-based ICD

The Helical-channel (Fig. 18), use surface friction to generate a pressure drop. The Helical-channel design is one or more flow channels that are wrapped around (labyrinth form) the base pipe of the screen. This ICD is designed to create a pressure drop while the fluid travels a crooked pathway changing its directions numerous times.

These designs provide for a distributed pressure drop over a relatively long area, versus the instantaneous loss using an Orifice. Using friction to create a flow resistance allows the use of a channel with a larger cross-sectional area than an Orifice-based ICD. This inflow device imposes a differential pressure by "means of" multiple helical channels through preset dimensions (diameter and length) at a specified flow rate. The Helical-

channel based ICD reduces the chances of erosion and plugging. This ICD form can cause problems in maintaining a uniform influx in wells where there is a larger difference between viscosities of the oil and produced water or gas.

The Orfice-based and Channel-based ICDs are presented in the schematic illustration below:

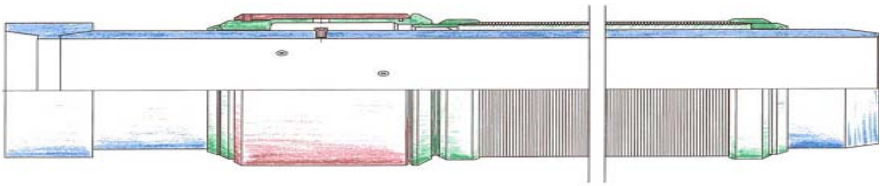


Figure 16: Channel-based ICD screen (Moen et. al., NTNU)

Figure 15: A nozzle based ICD screen (Moen et. al., NTNU)

Figure 17: Existing helical (channel-based) ICD design creates the desired flowing pressure loss via friction as fluid passes through the channel(s).

Figure 18 : New hybrid ICD design uses a distributive restrictive geometry which is less sensitive to erosion and maintains the plugging-resistance flow area of the helical design.

2.7.2 Orfice/Nozzle-based ICD

The Orifice/Nozzle-based ICDs use an instantaneous fluid constriction to generate a differential pressure across the device. This method essentially forces the fluid from a larger area down through small-diameter ports, creating a flow resistance.

The change in pressure while flowing is what allows an ICD to function. This ICD varies the Orifices/Nozzles with different flow characteristics and differential pressure. This configuration has multiple orifices to create flow resistance and an optimal pressure drop. The ICDs of this type have resistance that varies with the adjustment of open Orifices/Nozzles. The Nozzles have arbitrary diameter to create flow resistance and to produce a desired velocity. Figure 16 illustrates the Nozzle type ICD.

This design is chosen to make it as easy as possible to allow the fluids to pass through. The nozzles are the only flow constrictions in the system. This makes it easy to control the performance of the system. An additional pressure resistance is generated in the device as fluid flows and passes through a number of preconfigured nozzles. An advantage of this ICD type is its design simplicity.

2.7.3 Hybrid/spiral type ICD

The Hybrid ICD is *not* a friction based unit. This design has a series of bulkheads incorporated in the design, each of which has one or more slots.

The primary pressure drop mechanism is restrictive, but in a distributive configuration, as described in [20].

This configuration is also found in a new design which is adjustable hybrid ICD design. The erosion-resistance level of the adjustable hybrid ICD is attributed to its large flow areas, which allow reduced velocities throughout the ICD. The main features of this ICD are displayed in Figure 17 above.

2.7.4 Halliburton and FlowReg ICD

Different ICD vendors have different approaches when it comes to design. The unique design characteristics of individual screens have different average drawdown pressure and pressure distribution schemes [20].

In Halliburton's EquiFlow ICD (Figure 20), the fluid flows through the five components: 1) production through screen; 2) into inlet tube; 3) across tube chamber; 4) into outlet tube; and 5) into the base pipe and then to surface.

Weatherford offers a similar solution for reducing early water or gas production in horizontal wells – the FloReg ICD (Figure 19), which can be supplied with choice of sand screens. The device enables a predetermined setting of the desired pressure drop (heel-to-toe) along the production string, using multiple open or closed flow ports to provide the required reservoir management.

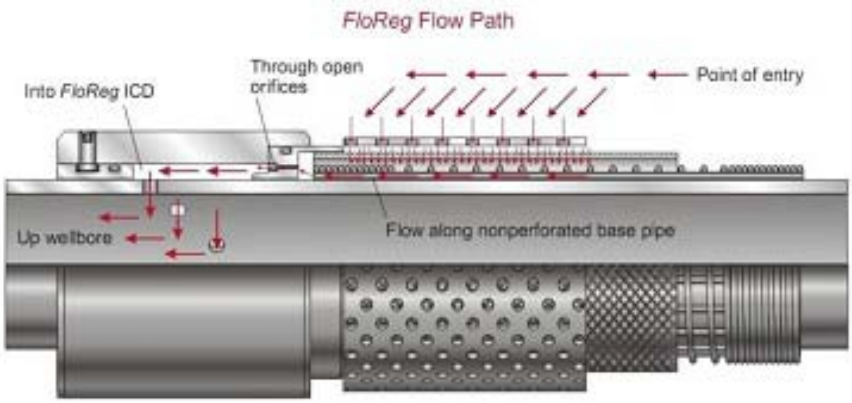


Figure 19 : FloReg ICD

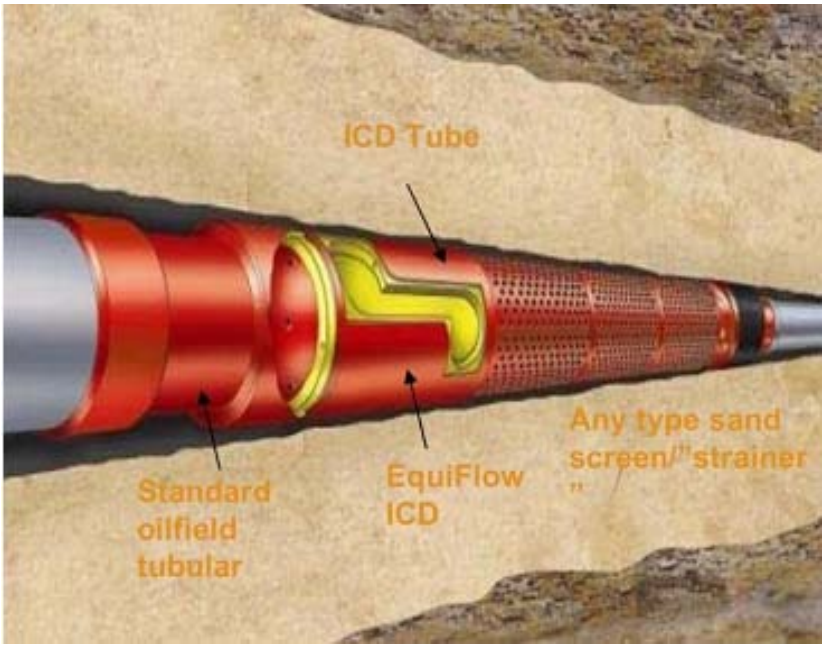


Figure 20: EquiFlow

2.8 Advantages and Disadvantageseach PICD type

2.8.1 Helical-Channel/Labyrinth- type restrictor

The ICD design best suited for a long service life uses a helical flow channel located in the screen assembly between the filter cartridge and the opening into the screen body. The helical flow channel creates a very precise, and repeatable, pressure drop for a specified fluid density and flow rate. The flow restriction is created by the fluid friction with the walls of the helical channels.

The number of channels and their length can vary to create the desired flow restriction. This design maintains fluid flow velocity relatively low, when compared to an orifice-type restrictor, and results in very small erosion potential. This yields a product with a long service life.

2.8.2 Orifice/Nozzle-type restrictor

The benefits of an orifice- or nozzle-based PICD is its simplified design and easier adjustment immediately before running in a well should real-time data collected during drilling the well indicate the need to change flow resistance.
The disadvantage of the orifice- or nozzle-based PICD is the small diameter ports required to create flow resistance, which make it both prone to erosion from high-velocity fluid-borne particles during production and susceptible to plugging, especially during any period where mud flow-back occurs.

2.8.3 Hybrid/Spiral- type restrictor

Without the need to generate the pressure drop instantaneously, as with an orifice, the large flow areas of the hybrid PICD reduces erosion and plugging potential with a great amount.

Comparing the minimum flow area through the hybrid design to the existing helical design shows the hybrid design to be only slightly less than a three-channel PICD, but greater than a two-channel design. Since the amount of actual field experience with the

helical design indicates no plugging problems during initial well cleanup and production, it is anticipated the hybrid design will also be plugging-resistant.

2.9 Benefits of passive inflow control device technology

Potential benefits associated with an ICD completion are

- Optimize production
- Delay water progress and prevent gas coning in the reservoir.
- Minimize/Eliminate annular flow and thus reduce the risk of sand production and subsequent erosion "hot-spots".
- Improve well-cleanup and reduce the effect of formation damage cause by drilling of the well.

Passive control is effective when the distribution of formation properties such as permeability and connectivity to external drive, e.g. gas-cap, is well known. Passive control can be implemented in a variety of ways including liner completion with channel-based screens, branched liners as in multilateral wells, and cased completion with fixed chokes.

2.9.1 Success factors of PICD Technology

With the ICDs it is possible to optimize the recovery, and gain higher production rate in terms of extended reservoir contact. Typically for horizontal wells in uniform formations the flow normalizing effect created by the ICD delays the onset of gas and/or water coning along the whole horizontal section.

-Clean-up[18]

The passive inflow control completion, compared to other completions, has several benefits regarding improved oil recovery. The use of the ICD technology is significantly changing the clean-up performance.

[18] (S.L. Crow, 2008) PICD Clean up effect
[18] (S.L. Crow, 2008) (Birchenko, 2008)

By using a proper nozzle setting, the sections difficult to clean up is stimulated as an additional pressure drop is applied to these sections until they start contributing with a proper flow rate. PICDs reduce the impact of high permeability intervals with an improved well cleanup and sweep efficiency.

PICDs can provide improved well clean-up reducing the effect of formation damage caused by the drilling of the well. ICD completion combined with sand control technology has resulted in significant savings for the operator and improved production in horizontal oil wells.

-Gas coning

Beside the clean-up effect, equalizing the flux along the well path, gives reduced coning effects. Reduced annular flow reduces the risk of sand production behind the screen and subsequent plugging or erosion.
ICD completions restrict gas influx at the onset of gas breakthrough due to the (relatively) high volumetric flow rate of gas.

-Plugging/Erosion[19]

An ICD completion can contribute to minimize the annular flow and thus reduce the risk of sand production behind screen. Cutting-down the amount of sand production, may subsequently reduce the plugging and erosion[20]. This can effect optimize production and reduce the risk of sand production significantly, which in turn results in declining the plugging or erosion "hot-spots";

-Water coning

Inflow control devices have the potential to delay the water production and the gas breakthrough. ICDs can be good completion option for balancing oil and water inflow and thus delaying water coning. Mitigating the non-uniform production profile across the

[19] (J. Augustine, 2008)
[20] Erosion is expected to occur at higher permeability zones in heterogeneous formations.

horizontal hole, especially in the big fractured reservoirs may result in premature water production.

2.10 Challenges and Risk of Inflow Control

The ICD design has a significant impact on the performance of the system. The risk associated with the backflow of the drill fluid is highly dependent on design details of the hardware. The problems associated with pressure draw-down have an impact on the performance.

Without inflow control, a pressure drop along the well bore makes the draw-down higher in the heel than in the toe. This favors cleaning of mud cake from the heel, which reduces the draw-down available for cleaning of the lower sections. The draw-down available limits the maximum flow rate for clean-up, and thereby limits degree of removal of mud cake.

-Pressure drawdown[21]

Higher pressure drawdown around the Heel-section, as a result of frictional pressure drop of fluid flow in the wellbore, causes non-uniform fluid influx along the length of the wellbore. However, the increased wellbore length has led to some problems in producing from such a well.

The frictional pressure drop in the horizontal completion results in higher production rates at the heel. Frictional pressure drop in the horizontal completion causes the inflow to be distributed *unevenly* and to be greatest at the heel of the horizontal section. *Uneven drawdown* leads to a non-uniform inflow-rate, and areas of *higher drawdown* can increase the chance of sand failure.

Areas with *higher drawdown* at the places where high sand production is experienced, increase the chance of sand failure[22], they the rates may damage the screen. At places where high sand production is experienced because of higher draw-downs, the rates may damage the screen. This may lead to an *early* breakthrough of water or gas causing a

[21] (L.-B. Ouyang, 2006; Ouyang, 2009)
[22] (Garcia, 2009)

reduction in oil recovery. The consequences of the damage may affect the recoverable reserves and result in uneven sweep of the drainage area.

-Pressure draw-down reduction

The reduction of pressure drawdown reduces the amount of fluid (oil and water) that enters along the sections. The ICD settings are usually adjusted section by section according to layer location and the related layer-properties. For a *uniform ICD completion* the anticipated amount of inflow is achieved in terms of reducing water production.

-Shortcoming of PICDs

The key to achieving uniform flow across the completion is a screen technology that uses a helical-channel ICD mounted to the base. Typically for horizontal wells in uniform formations the flow normalizing effect created by the ICD delays the onset of gas and/or water coning along the whole horizontal section. However, there are uncertainties with respect to drilling accuracy, and in heterogeneous formations localized gas breakthrough will impair oil production. This is due to many variables such as the static effects of absolute permeability, permeability distribution and geometry (sand thickness and well elevation), dynamic effects of the wells distance to liquid contacts, global moments based on aquifer communication to surrounding aquifers and gas cap, neighboring wells and past production history.

3. Smart Well Simulation

3.1 Introduction to Gullfaks sør reservoir

From the extended case we found that the field gas oil [23]ratio at the end of simualtion is about 14000 Sm3/Sm3 and the field water cut [24]is about 0.28 which can be seen in figure 22. Thus the high GOR is the main problem in this reservoir which will result in low oil production rate since gas has a higher mobility ratio than oil and loss gas in the reservoir which can maintain the pressure in the reservoir. The higher gas production rate also leads the problem in the process on platform GFA too, so in the smart well model we have to control the gas and if the gas has reach the maximum amount we specified that zone will be shut which can be done remotely from the well.

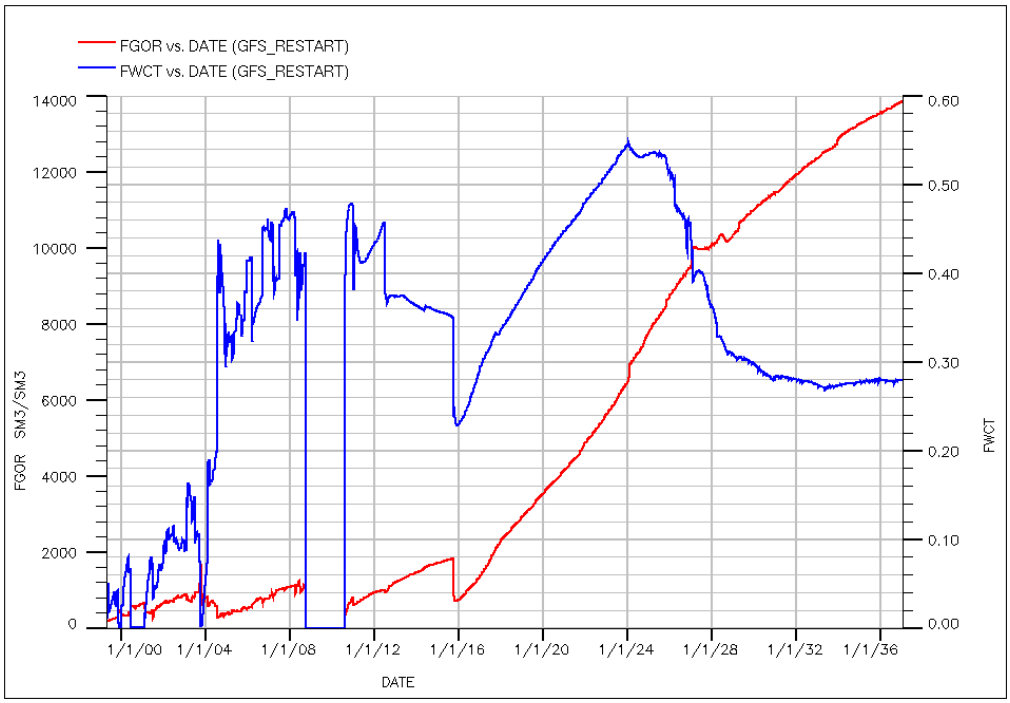


Figure 21: FGOR and FWCT in the extended case

3.2 The trajectory of the smart well

The assigned smart well has 5 branches, however the extended case which has 4 new production well has 7 branches, so we have to place the 5 branches of smart well in order to cover the area of the field so that the drainage area of the new smart well case will cover the area as much as in the extended case.

[23] FGOR
[24] FWCT

However we cannot make the 5 branches smart well to have the total length as long as the total length in the extended case because the number of branches is lower. Though we make 5 branches well to have the total length equal to the total length in the extended case, the length of each branch will be too long and will be not reasonable. In order to easily compare with the extended case we decided to place the well in the same trajectory of extended case. So we have to choose 5 from 7 branches in the extended case from the figure 23.

Figure 22 : The location of the added well in the extended case

Here are the W1, W2W3, W4W5, W6W7 comparisons.

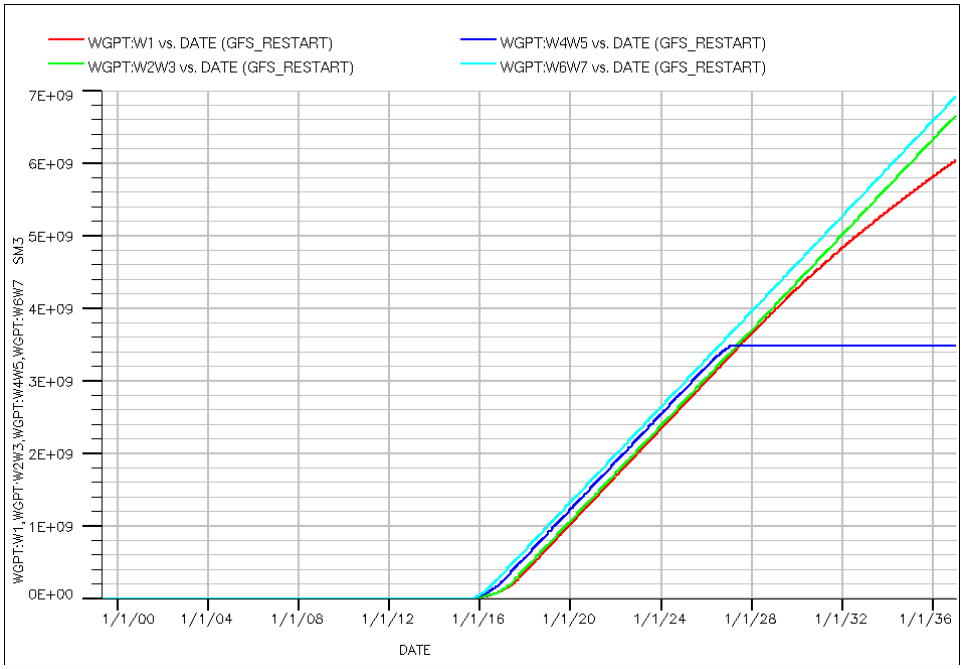


Figure 23: WGPT for well W1, W2W3,W4W5,W6W7

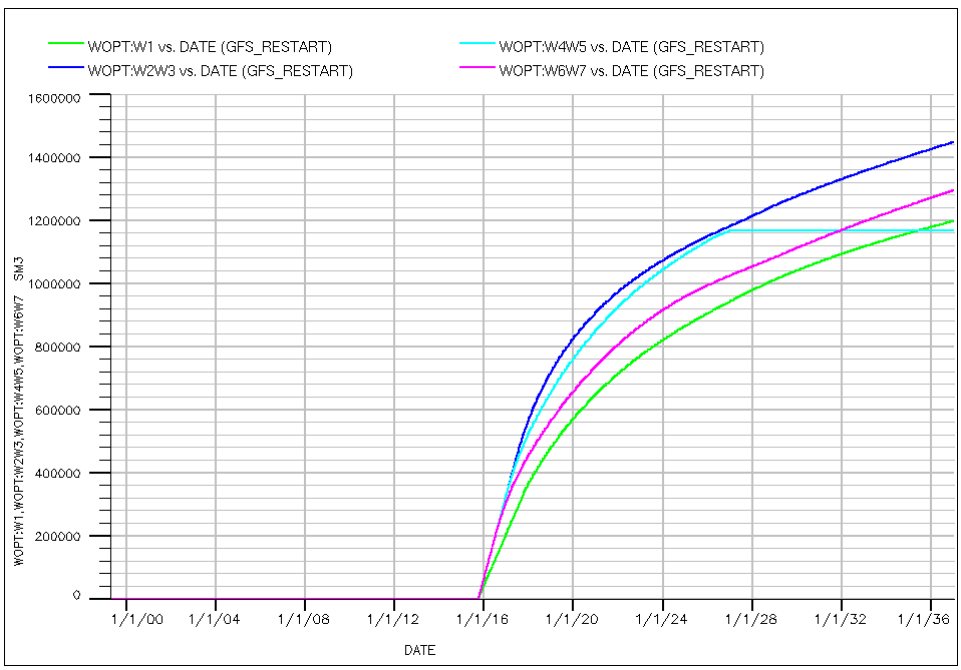


Figure 24: WOPT for well W1,W2W3,W4W5,W6W7

We see from the figure 25 that the W6W7 is the most closed to GI2 so the gas will be break through to this well more easily than other wells and the position of these 2 branches is placed near the production well G-4H. Moreover if we consider the cumulative gas production curve and cumulative oil production curve, we can find that

well W6W7 has the highest cumulative gas production and has the second lowest oil production. The cumulative oil production of W6W7 is higher than W1 because W6W7 has 2 branches while well W1 has only 1 branch. Thus, the well W6W7 has the worst performance compare to all of the well we added in the extended case . From this reason, we will eliminate this well and make 5 branches smart well from the trajectory of W1, W2W3, W4W5 and make the well head at the same position as W4W5 well. This 5-branch smart well is named 'RONALDO'

Because each added wells in the extended case (W1, W2W3, W4W5) has already divided in to many segments so for simplifying the task we then divided the smart well 'RONALDO' into the same segment as in the extended case. The list of the segments are

1. branch 1: from segment number 1 to 40
2. branch 2: from segment number 41 to 84
3. branch 3: from segment number 85 to 125
4. branch 4: from segment number 126 to 162
5. branch 5: from segment number 163 to 200

Each branches is connected to the first branch on segment number 1, we chose this model as this well can have a back pressure effect in this well so it will be more realistic to be used as shown in figure 26

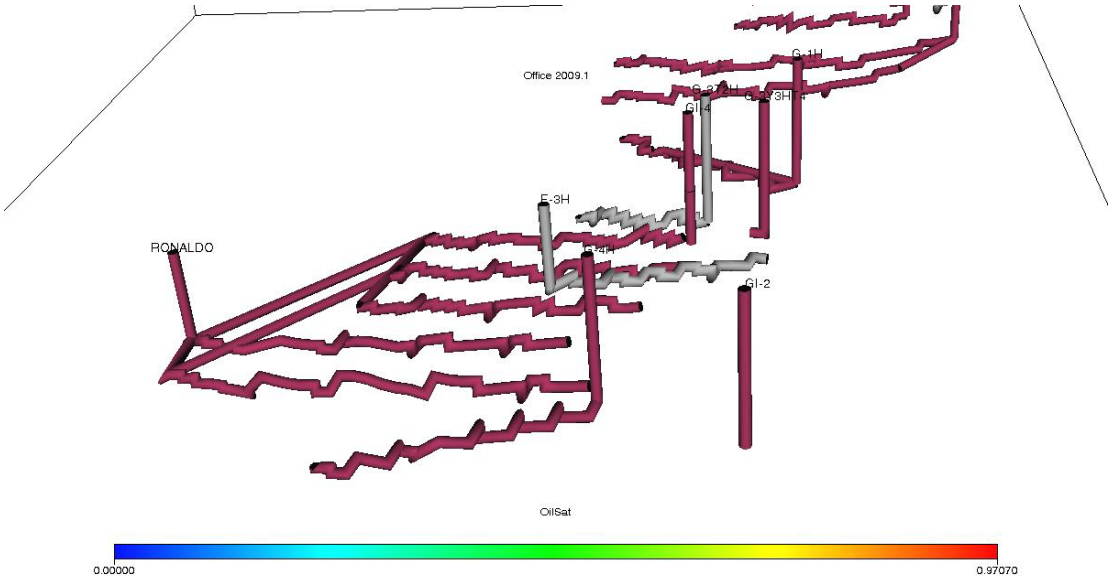


Figure 25 : The location of the new 5 branches smartwell

3.3 Procedure of making smart well

After we divided well "RONALDO" into 200 segments, we have to make the well to be smart by adding the command to open and close the well when it reaches the specific condition. At first we have no idea how to proceed it so we sent email to ask our advisor in STATOIL 'Ole Jorgen Birkenes' and he replied back some of the methods to use. Thus, we tried to build a model by using ACTIONS and WELOPEN commands. In the first command 'ACTIONS' is used to make a condition for the system, and the other command 'WELOPEN' is used for open and close the well in each segment. In this case we have to make a criterion which is the maximum amount of GOR because in our reservoir system the produced gas from the production well is the main problem.

In smart well case, if the GOR of each segment reaches the value we set, that segment will be closed automatically. So, we have to set the limit for GOR in each segments. We see from the FGOR of the extended case that it reaches the value of 14000 Sm3/Sm3 which is so high so we have to set a limit of GOR in a reasonable value. The high limit of GOR will lead each segment to produce longer before shut in but will result in high gas production, lead the pressure of the reservoir not to be maintained and may result in low oil production rate. While the low limit of GOR will lead each segment to produce shorter before shut in but produce with lower GOR so the pressure will be maintained. We try to optimize the value of GOR by trial and error and finally we get the optimum gas oil ratio limit for each segment to be 10000 Sm3/Sm3.

3.4 Result of the simulation

At first we tried to simulate the system until 2030 as in the extended case, however the result of field oil production total [25]of the smart well is still lower than the extended case but the smart well curve seem to go up continuously so we extended the case to 2037 and see the result.

The two below figures show the extended case in beginning and at the end of the simulation.

[25] FOPR

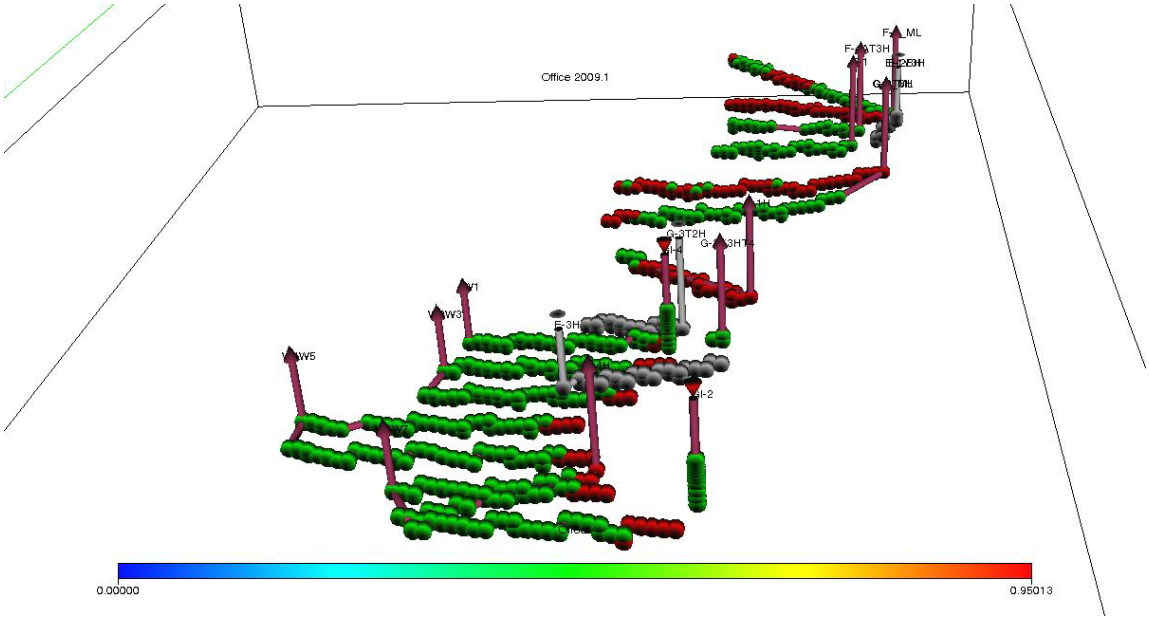


Figure 26: Well status at the beginning of simulation in extended case

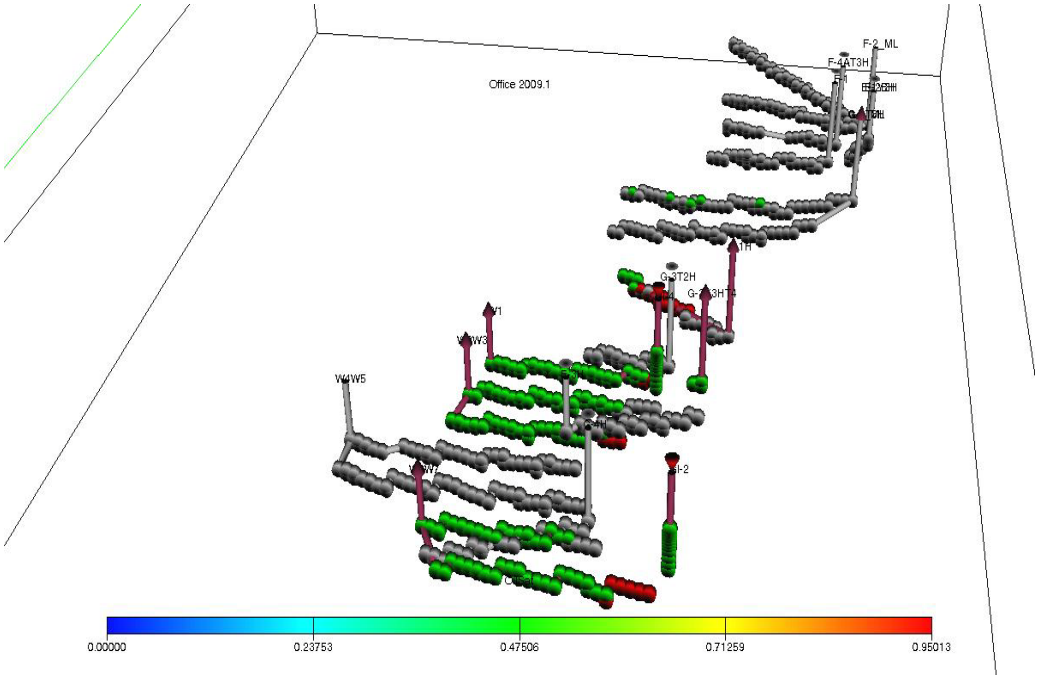


Figure 27: Well status at the end of simulation in the extended case

The two below figures show the smart well case in beginning and at the end of the simulation.

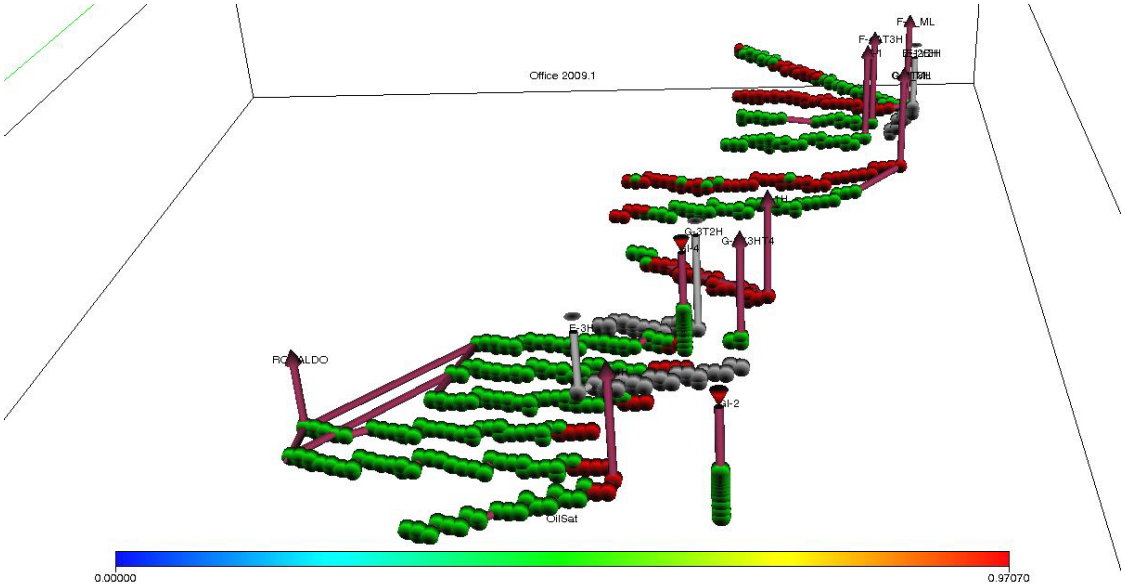


Figure 28: Well status at the beginning of simulation in smart well case

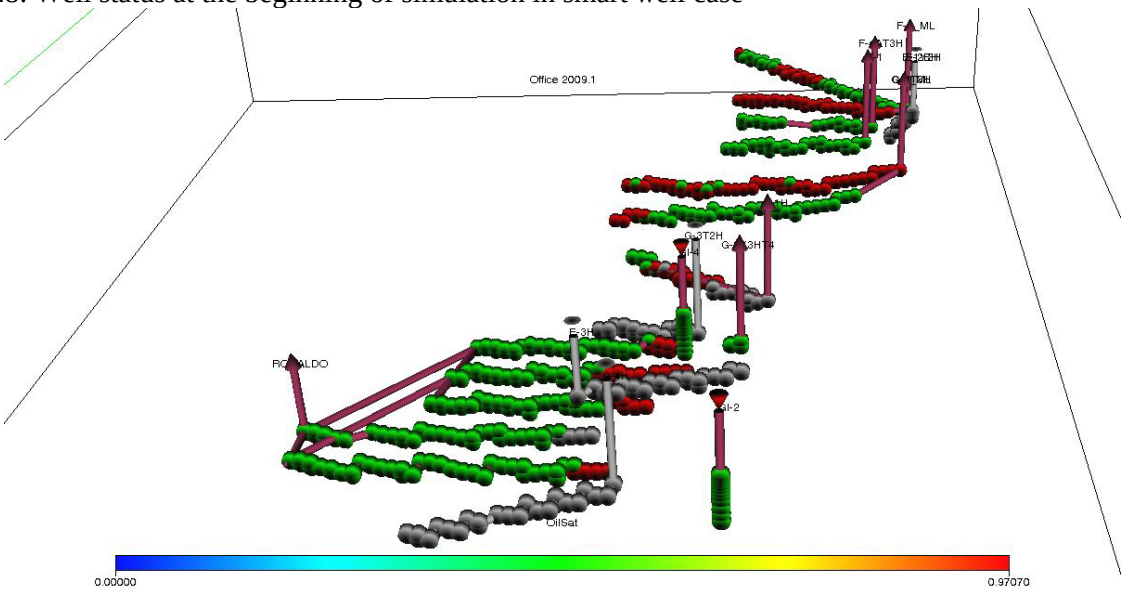


Figure 29: Well status at the end of simulation in smart well case

We can see from the well trajectory from both cases that after the production to 2037 the number of the wells that is shut (due to the lower pressure) in the extended case is higher than the number of the well that is shut in smart well case.

Moreover, at the end of simulation, the numbers of segments of the production well in the extended case are shut higher than the number of segments in the smart well case. These results from the production well cannot produce oil anymore due to the lag of

pressure. While in the smart well case, the pressure is high and the well can open to produce oil. We can see it from the field reservoir pressure [26]in Figure 31 .

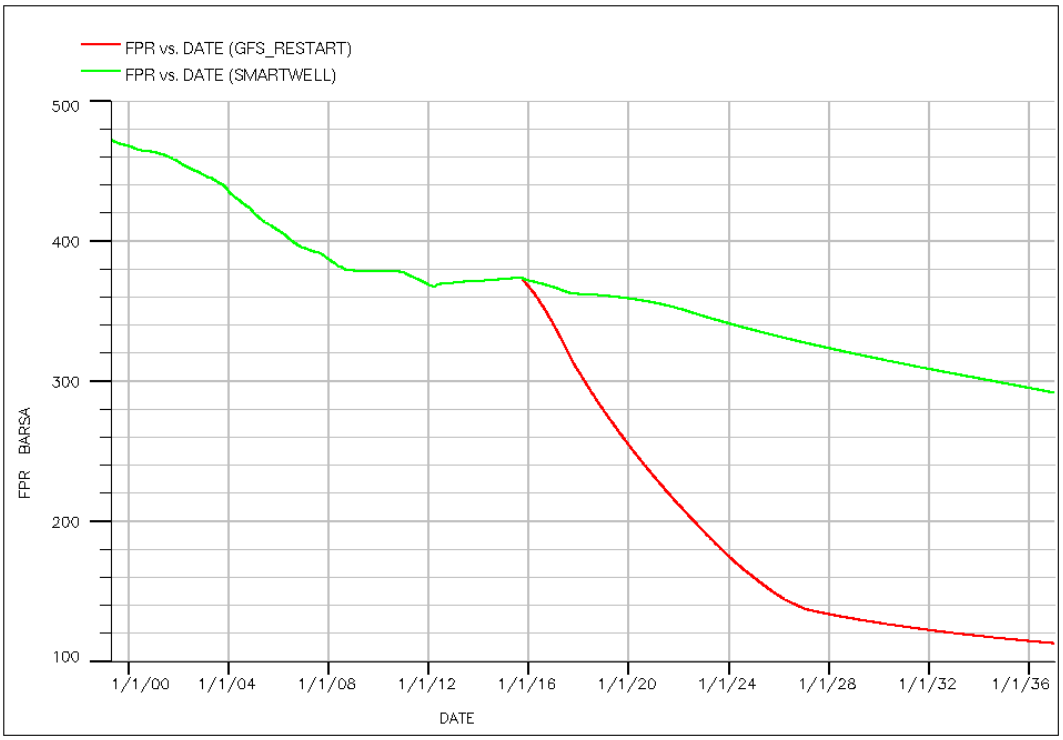


Figure 30: FPR for extended case and smart well case

In the smart well case, the segment will be shut if the GOR is higher than 10000 Sm3/Sm3 so if one of the segment has a higher GOR than criteria, that segment will be shut and result in higher oil production. The reason for high oil production when we shut the segments which has high GOR is because gas has a higher mobility ratio when produce with gas, the gas will come to the producer fast and leave the oil in the reservoir , even though we produce longer we cannot produce significantly more oil in the system. Another reason is the gas is left in the reservoir can maintain the pressure in the reservoir which extend the plateau rate of oil production. The smart well case which can be maintained the reservoir pressure has the higher possibility to have higher cumulative oil production.

[26] FPR

3.4.1 The result in gas production

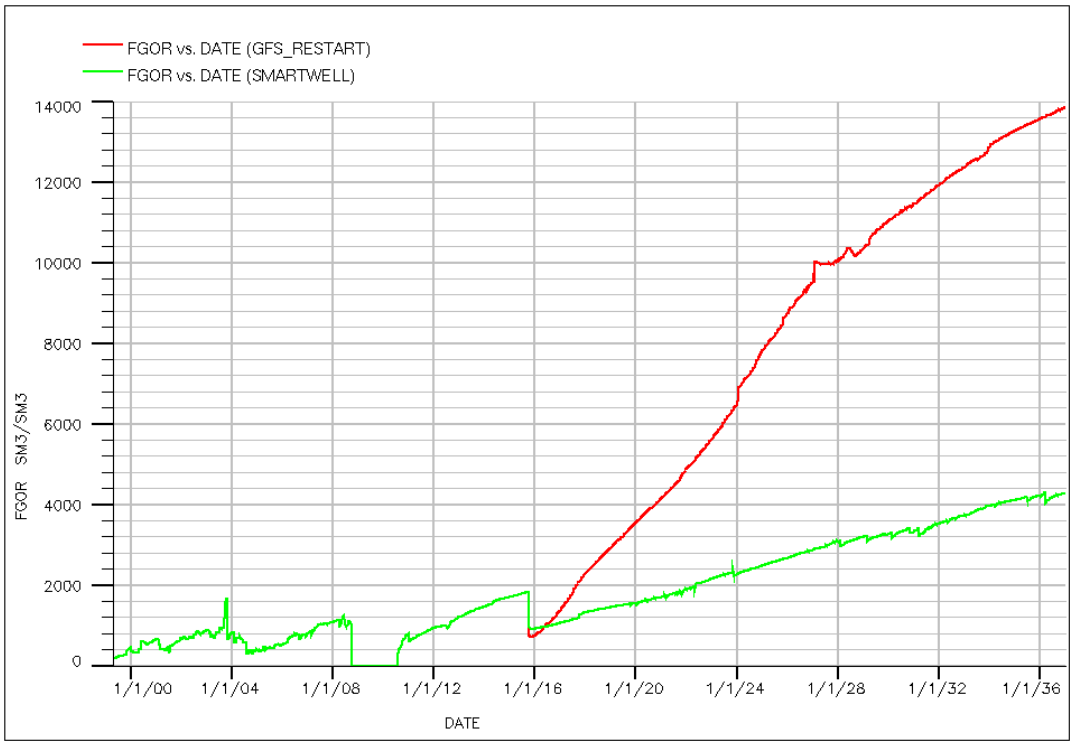


Figure 31: FGOR for extended case and smart well case

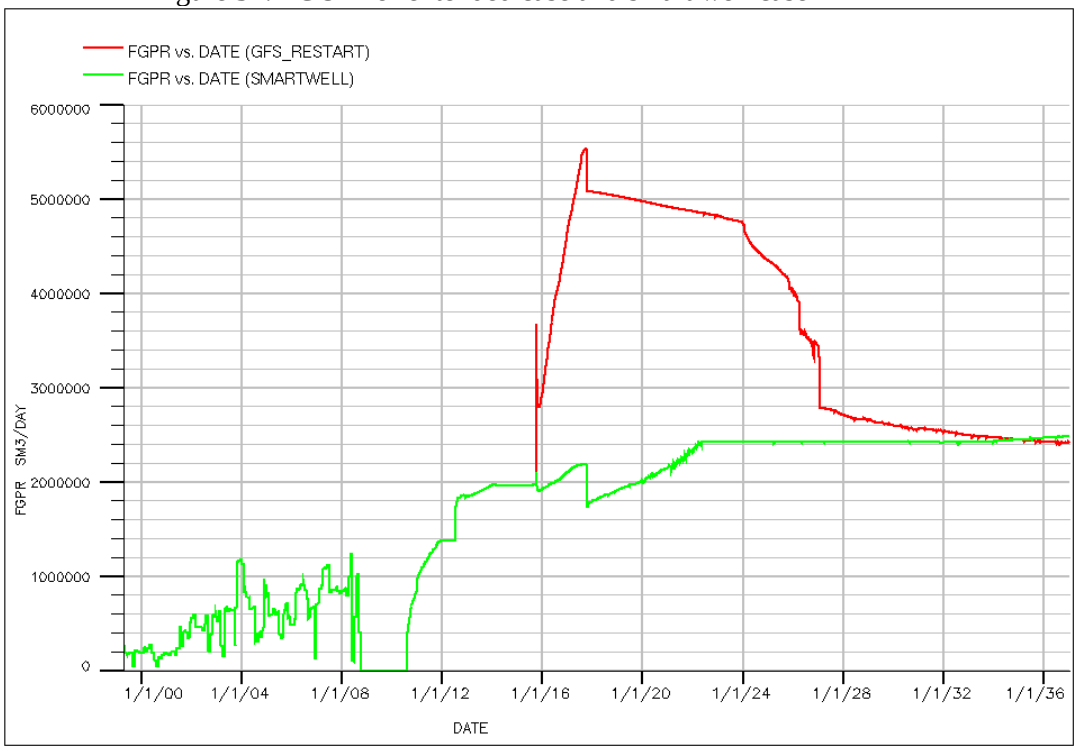


Figure 32: FGPR for extended case and smart well case

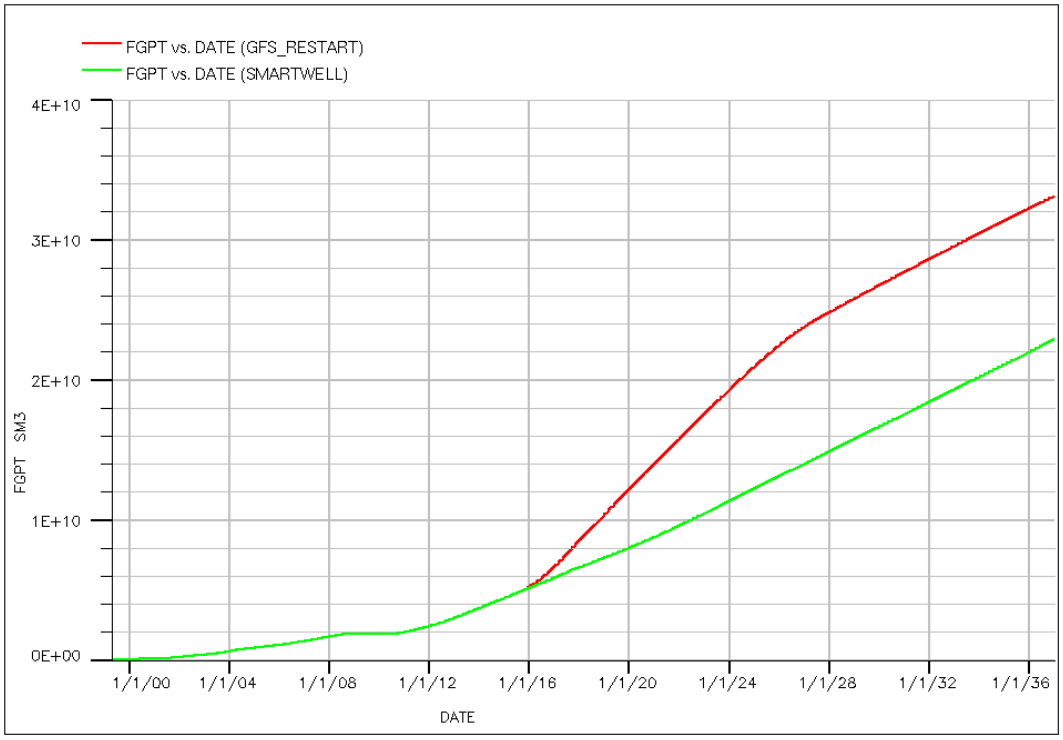


Figure 33: FGPT for extended case and smart well case

We can see from the gas production curve that the gas production is lower than the extended case since we control the gas oil ratio (GOR) in each segment. The GOR in the smart well case is approximately 3 times lower than the extended case at the end of simulation (2037).

3.4.2 The result in oil production

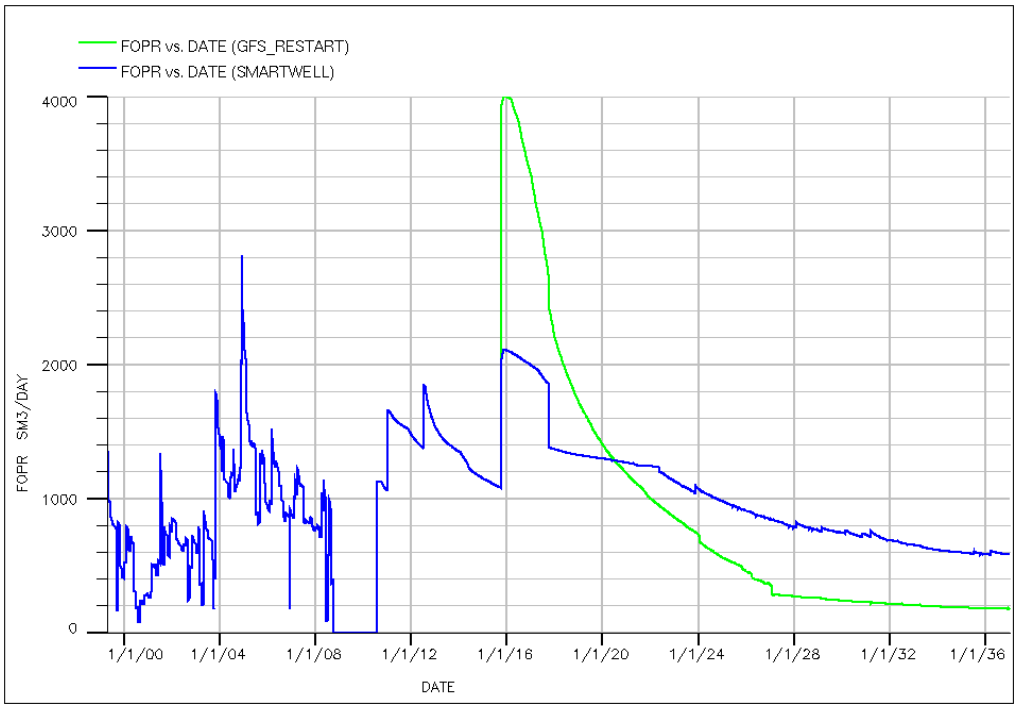


Figure 34: FOPR for extended case and smart well case

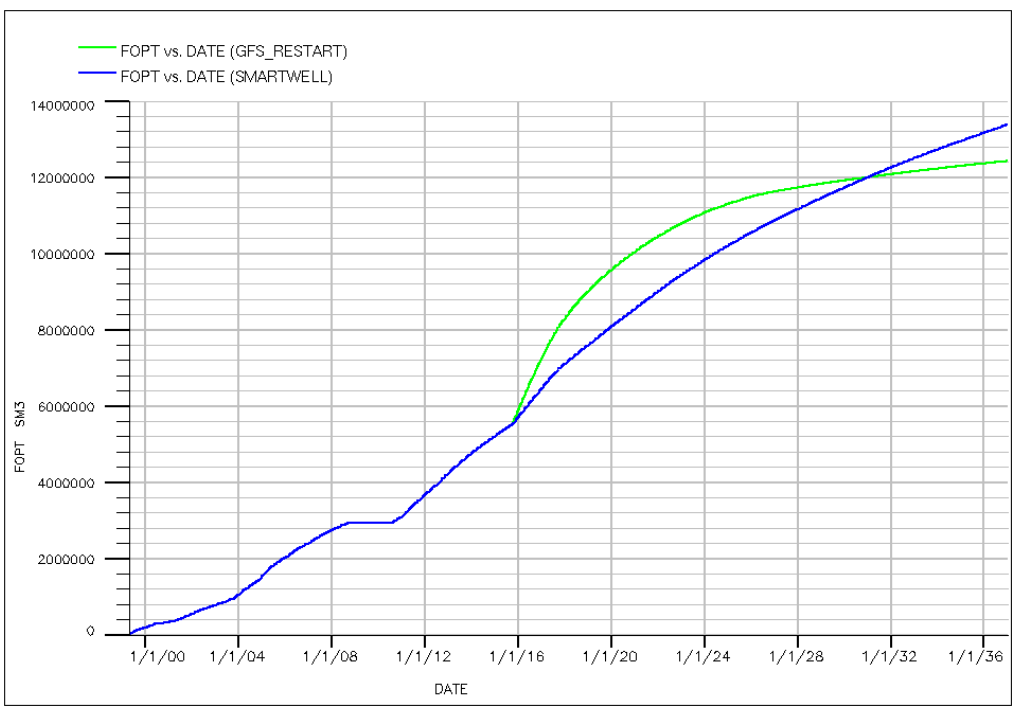


Figure 35: FOPT for extended case and smart well case

Though the oil production rate (and also cumulative oil production) in the extended case is higher than the smart well case at the beginning of the production as the

extended case which has more branches and has a higher drainage area. But then, the extended case's oil production cannot maintain the higher rate due to high gas production while the smart well case, oil production can maintain in the plateau rate and lead to higher cumulative oil production at the end of simulation than extended case.

3.4.3 The result in water production

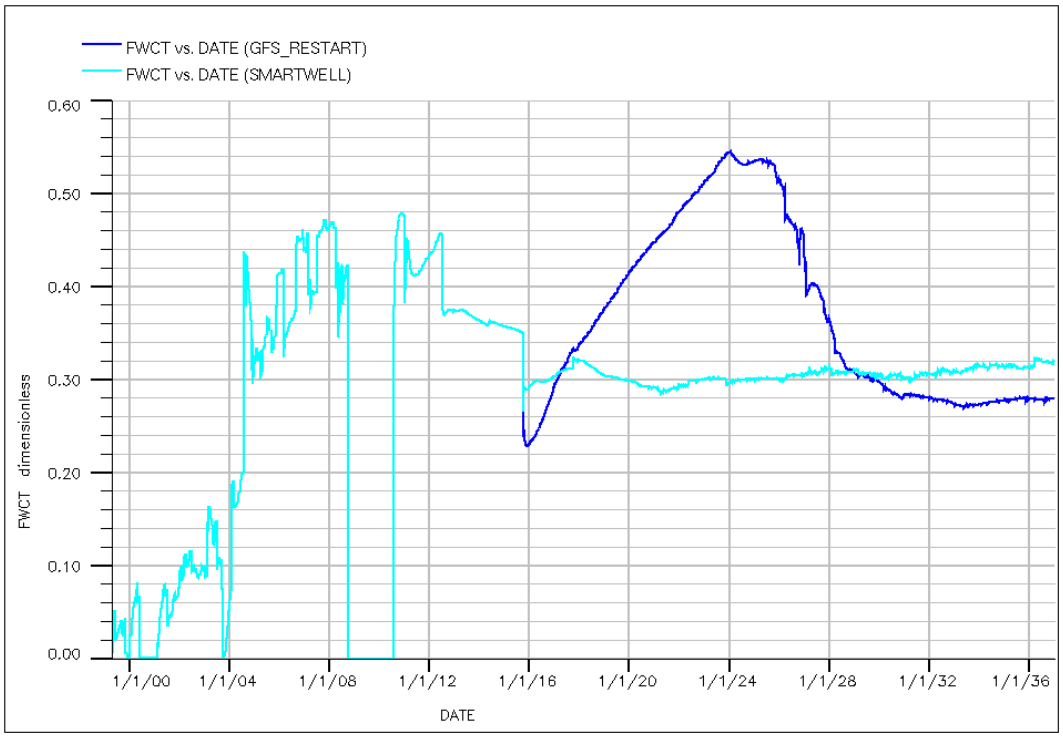


Figure 36: FWCT for extended case and smart well case

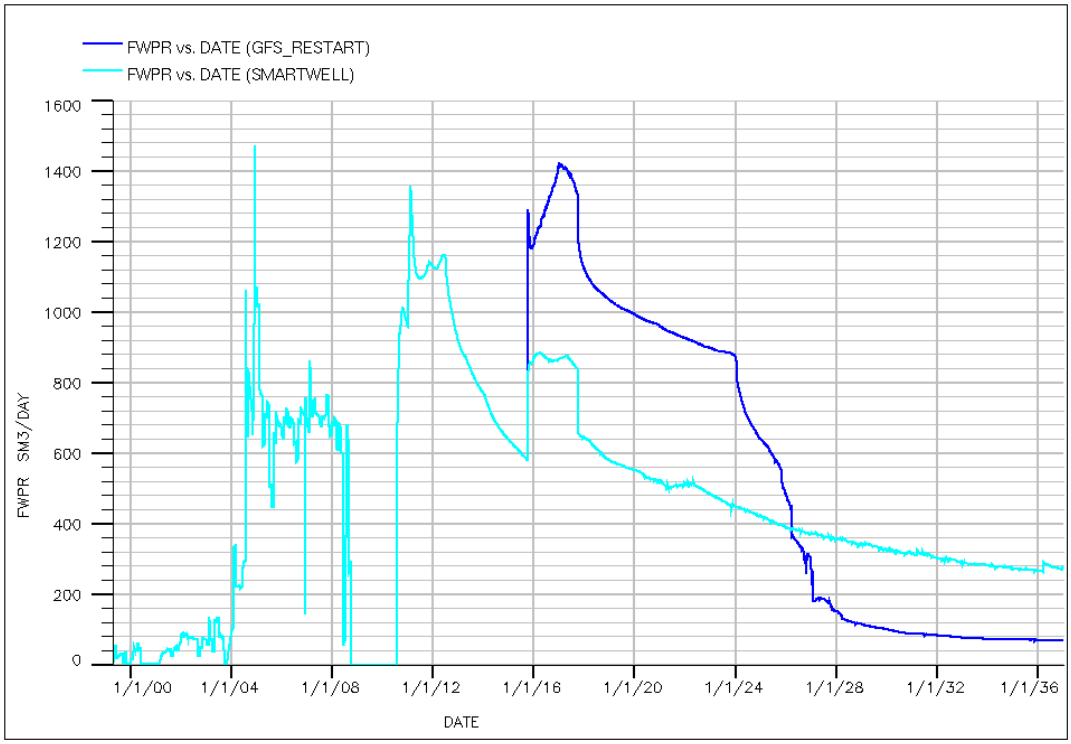


Figure 37: FWPR for extended case and smart well case

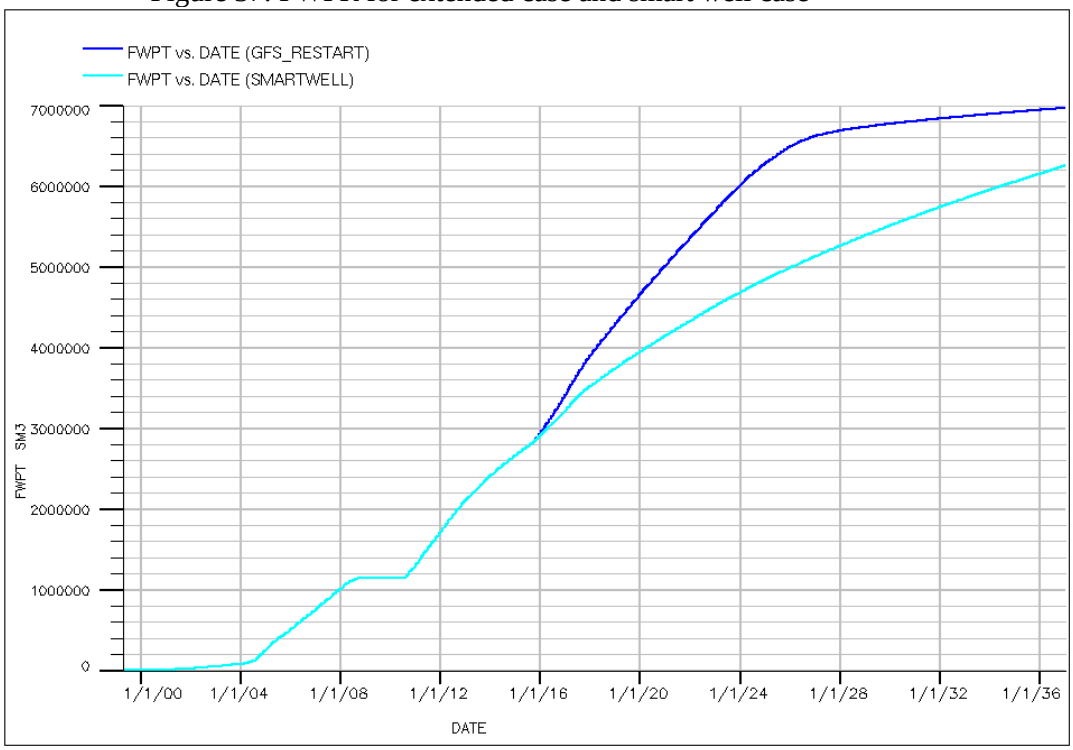


Figure 38: FWPT for extended case and smart well case

From the figures above, we can see that the water production in the smart well case is lower than the result in the extended case which is a positive result for the reservoir.

We can conclude from the results of simulation that smart well will make a better result to the whole system, higher oil production, lower water production, lower gas production which is a good idea to implement in field development. .

4. Inflow Control Device Simulation

4.1 The ICD Well Trajectory Segments and The ICD Segments

We also use the trajectory of 'RONALDO' to Infow Control Device (ICD) Scenario. In ICD scenario, the 'RONALDO' also have 5 branches:

1. branch 1 : from segment number 1 to 40
2. branch 2 : from segment number 41 to 84
3. branch 3 : from segment number 85 to 125
4. branch 4 : from segment number 126 to 162
5. branch 5 : from segment number 163 to 200

Each branch is connected to the first branch on segment number 1.

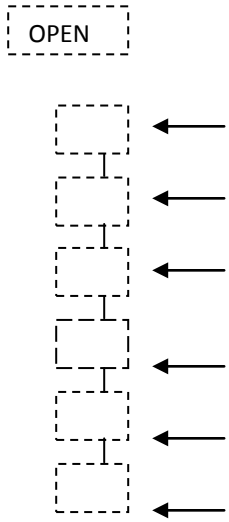
Then, ICD locations:

1. ICD of branch 1: from segment number 201 to 239
2. ICD of branch 2: from segment number 240 to 283
3. ICD of branch 3: from segment number 284 to 324
4. ICD of branch 4: from segment number 325 to 361
5. ICD of branch 5: from segment number 362 to 399

4.2 Procedure of making ICD

We will write briefly our process to get the final ICD Model in ECLIPSE 100.

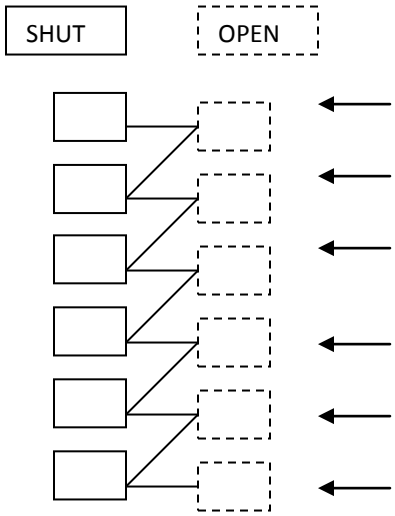
1. First Trial ICD Model



First, we try to use ICD using the above model, but ECLIPSE 100 can not calculate the solution and define the fluid properties in every segment. Then, we try to use Statoil's suggestion ICD model by adding another segment 'y + 1' beside 'y (actual)' segments.

2. Second Trial ICD Model

   Our first modified ICD model is shown in figure below. Actually, we want to make ICD Statoil's model, but we have no experience to make trajectory using WELSPECS, COMPDAT, COMPSEG, and WELSEG then we produce model as below. Reservoir fluid can only flow through ICD (dashed line).



The ECLIPSE 100 trajectory-model is shown below:

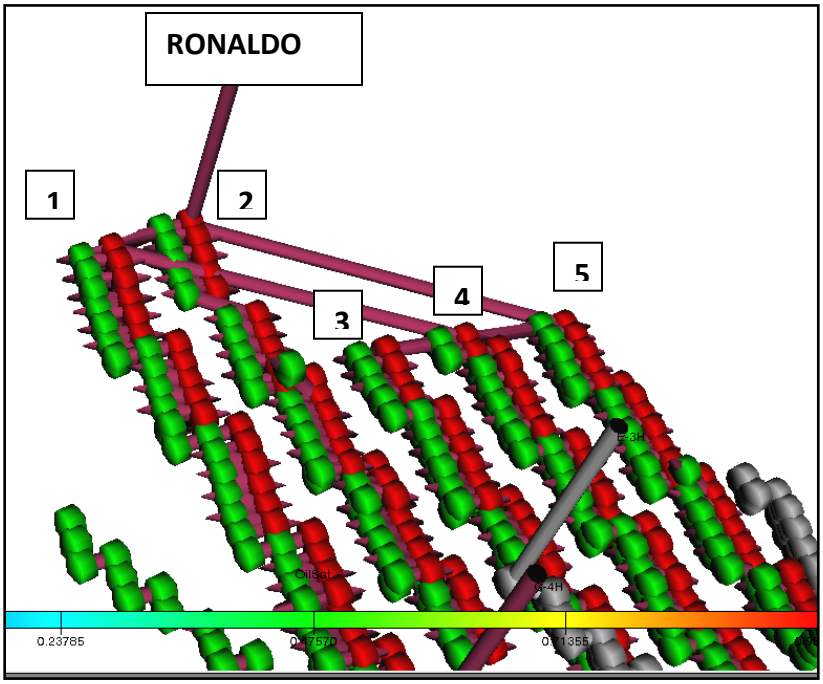
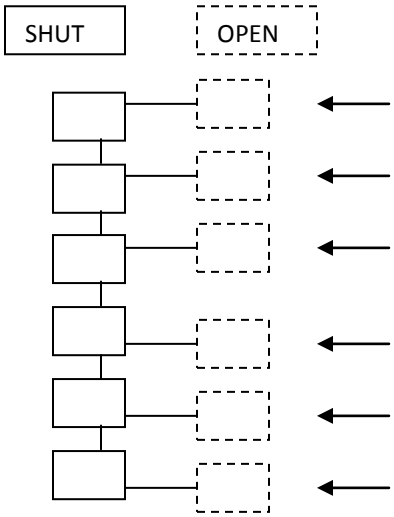


Figure 39: Second Trial : Multilateral-well with ICD

Because the trajectory is zigzag, we do not use this model and try other trials until we get the final ICD model below.

3. Final ICD Model

   We try to make ICD model like Statoil's model in Troll Field Presentation which is shared by our mentor. After several trial and error and read reference manual ECLIPSE 100, we get the final ICD model below.



The ECLIPSE 100 trajectory model is shown below:

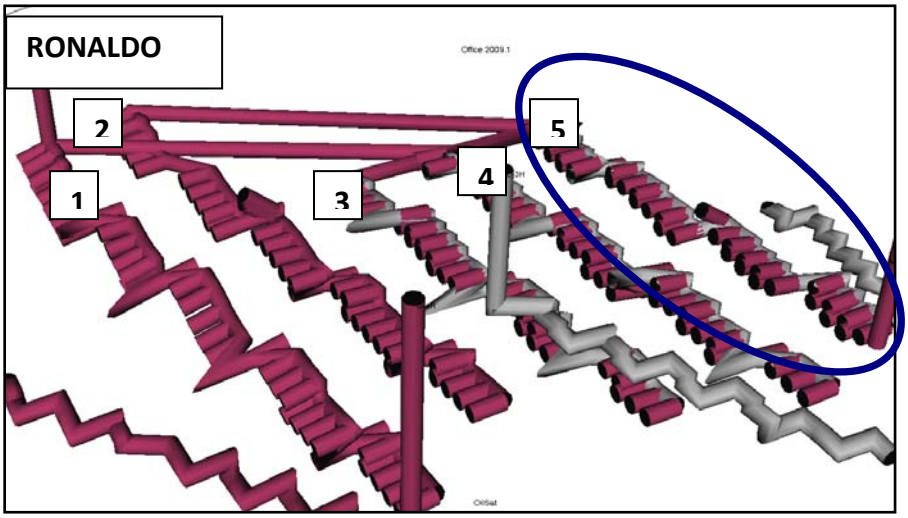


Figure 40: Final ICD

We worry about gray in branch 3, 4, and 5 in the simulation. Then, we make quality check (QC). To check (QC) the gray in branch no. 3, 4, and 5, we check branch no. 5 by plotting segment oil flow rate (SOFR) in branch 5 vs. branch 5's segment number (from segment 163 to 200). We can see from plot below that the branch 5 is working, although there is indication cross flow along branch no.5.

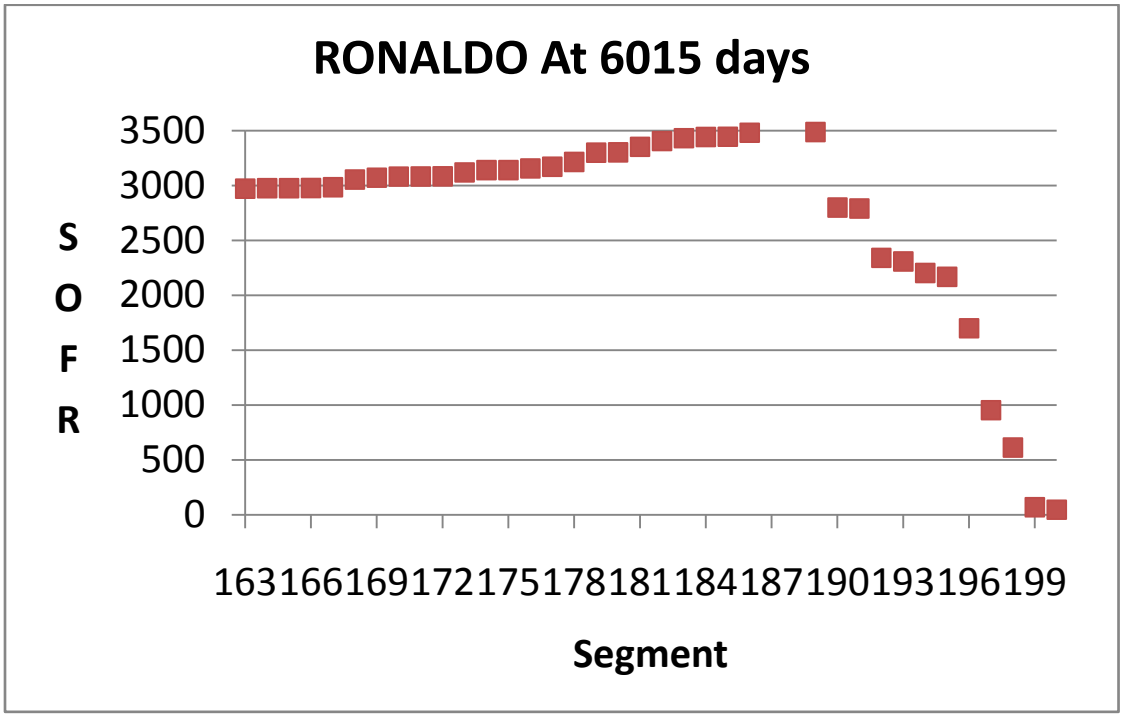


Figure 41: QC from branch no. 5: Segment no. 163 to 200

We may have uncertainty because we use 399 segments for 'RONALDO' which ECLIPSE 100 recommends user that there should be no more than 25 segments per well in order to ensure a reasonable level of performance.

The figure below illustrates our final model which looks like Troll's ICD model.

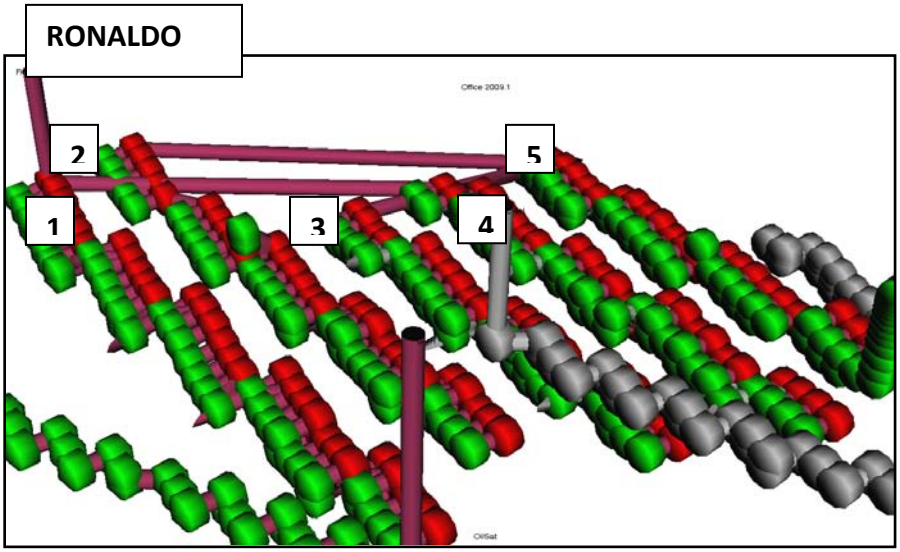


Figure 42: Five branches well with ICD model like in Troll's ICD model

We use similar ICD criteria for all segments:

1. spiral ICD

2. strength of ICD : 0.00021, we use this number as the strength of ICD in ECLIPSE 100 manual example
3. another parameters use defaults in ECLIPSE 100

$$\delta P = \left(\frac{\rho_{cal}}{\rho_{mix}} \cdot \frac{\mu_{mix}}{\mu_{cal}}\right)^{1/4} \cdot \frac{\rho_{mix}}{\rho_{cal}} \cdot a_{SICD} \cdot q^2$$

Source: ECLIPSE 100 reference manual, page 2538

4.3 The ICD Reservoir Simulation Result

4.3.1 Field Gas Oil Ratio (FGOR)

ICD scenario (red line) has lower GOR compare to extended case (green line). It is shown on below figure.

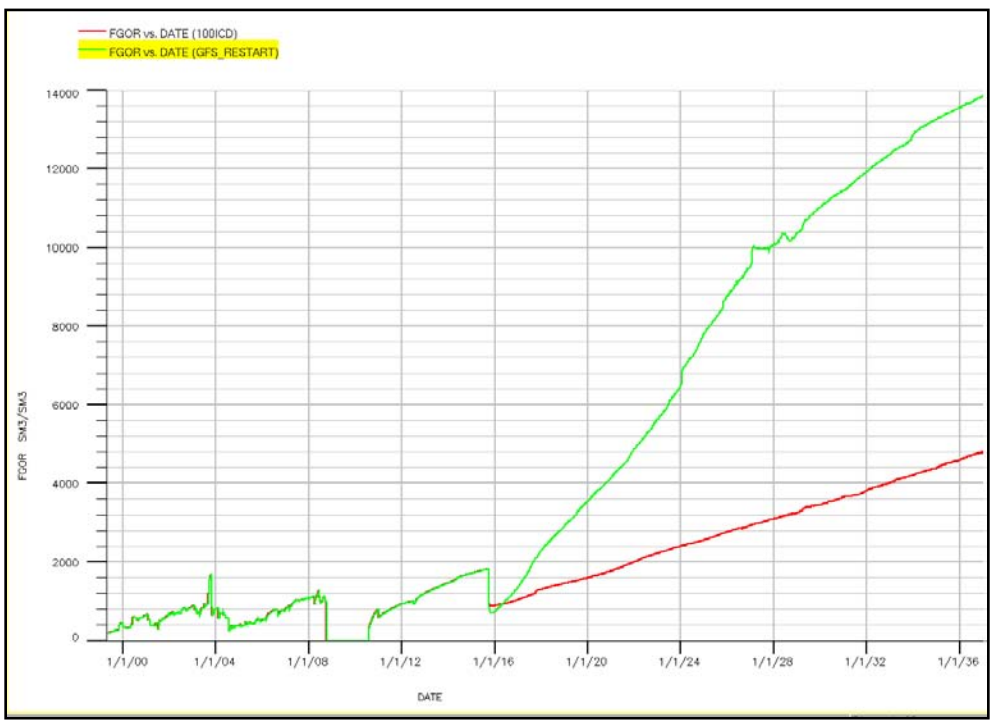


Figure 43: ICD FGOR vs Extended Case FGOR

4.3.2 Field Oil Production Rate (FOPR)

ICD profile rate (green line) is more stable than field oil flow rate of extended case (blue line).

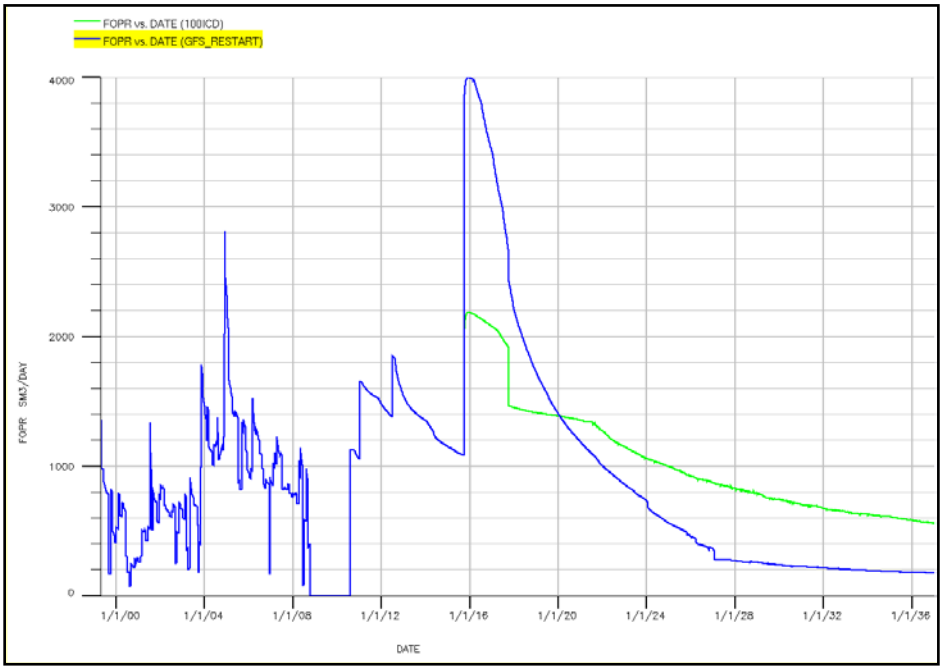


Figure 44: ICD FOPR vs Extended Case FOPR

4.3.3 Field Oil Production Total (FOPT)

ICD FOPT (green line) is lower than FOPT (blue line) of extended case before 2030, but ICD FOPT is higher than extended case after 2030.

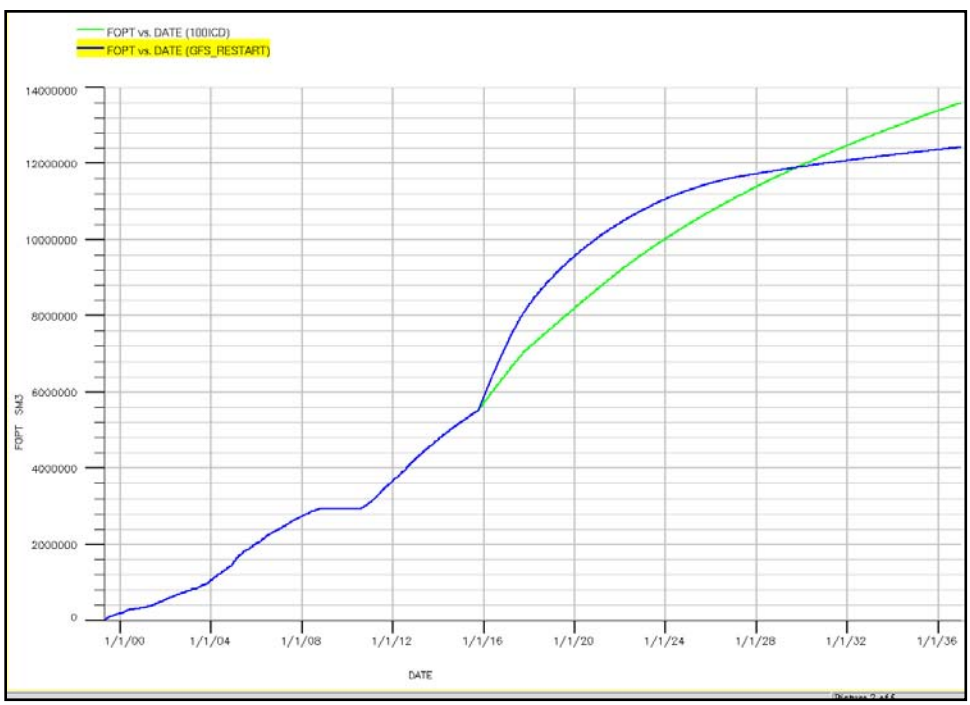


Figure 45: ICD FOPT vs Extended Case FOPT

4.3.4 Field Gas Production Rate (FGPR)

ICD FGPR (red line) is almost lower than FGPR extended case.

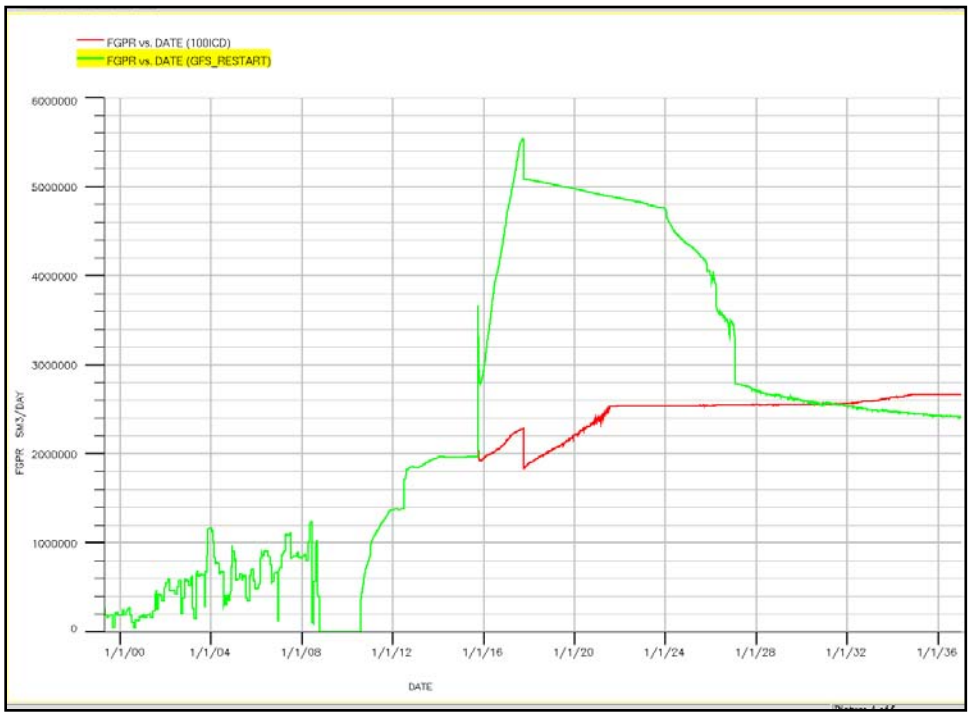


Figure 46: ICD FGPR vs Extended Case FGPR

4.3.5. Field Water Production Rate (FWPR)

ICD FWPR is almost lower than FWPR of extended case.

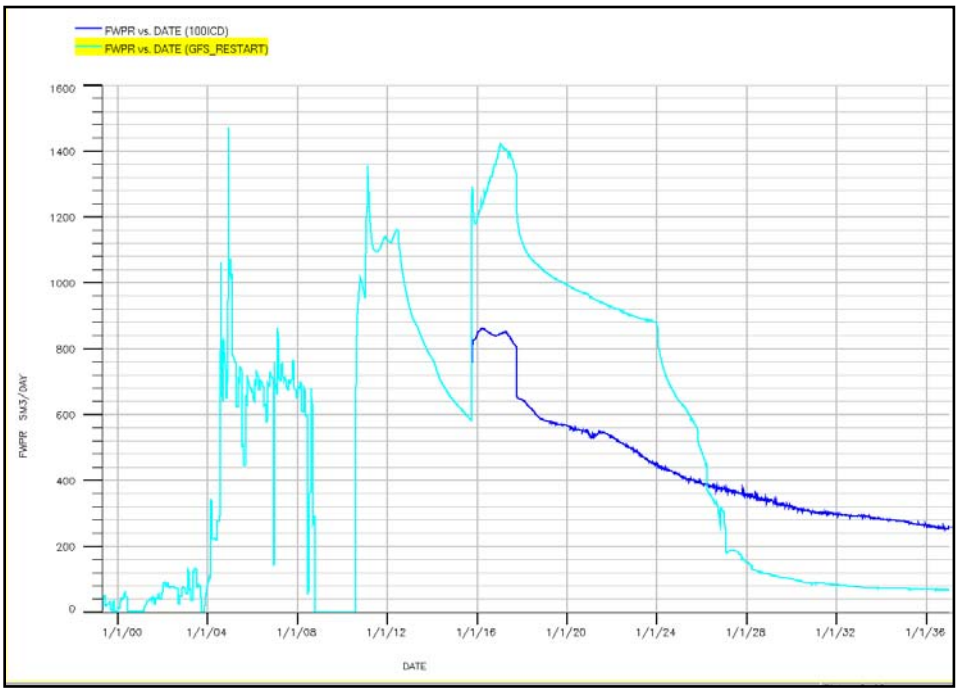


Figure 47: ICD FWPR vs Extended Case FWPR

4.3.6 Reservoir Pressure

ICD reservoir pressure is higher than reservoir pressure of extended case at the end of simulation in 2037.

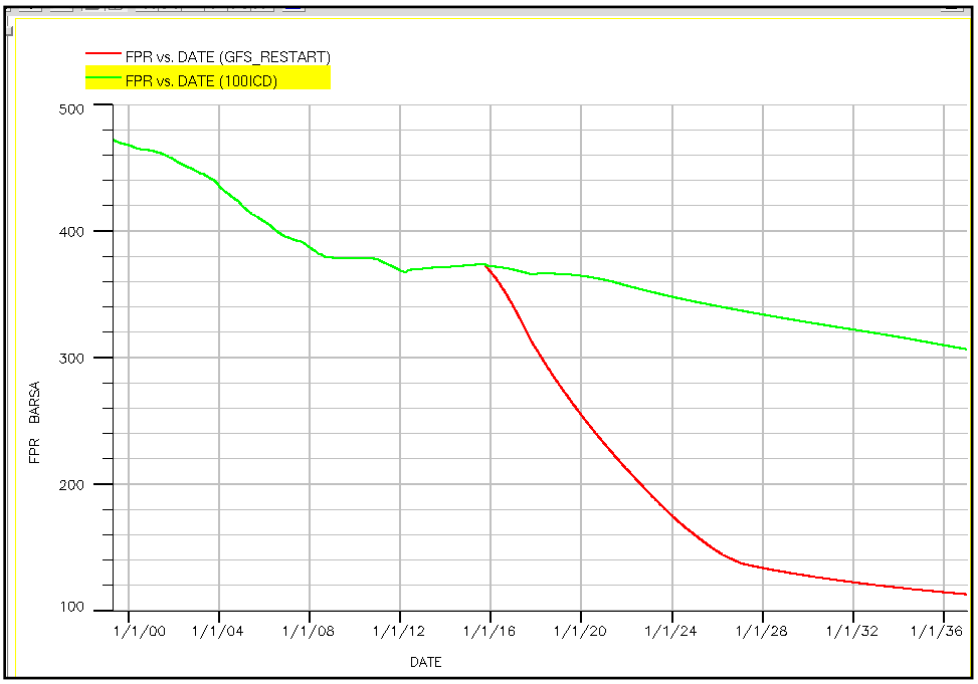


Figure 48: ICD reservoir pressure vs Extended Case reservoir pressure

Based upon figures above, we can see that ICD case has positive effects to reservoir management. It will make oil rate, gas rate, and water rate have better profile.

Since, GOR is managed, reservoir pressure can be maintained. As we know that gas is in reservoir has high compressibility which can maintain reservoir pressure still high until 2037.

5. Reservoir Simulation Comparision: Smart Well, ICD, And Extended Case

Smartwell and ICD have quite similar performance in our reservoir cases

1. higher FOPT than extended case after 2030
2. lower FGOR than extended case
3. lower FWPR and FGPR than extended case
4. maintain better reservoir pressure

We can see FOPT, FGOR, FWPR, FGPR on belowed figures.

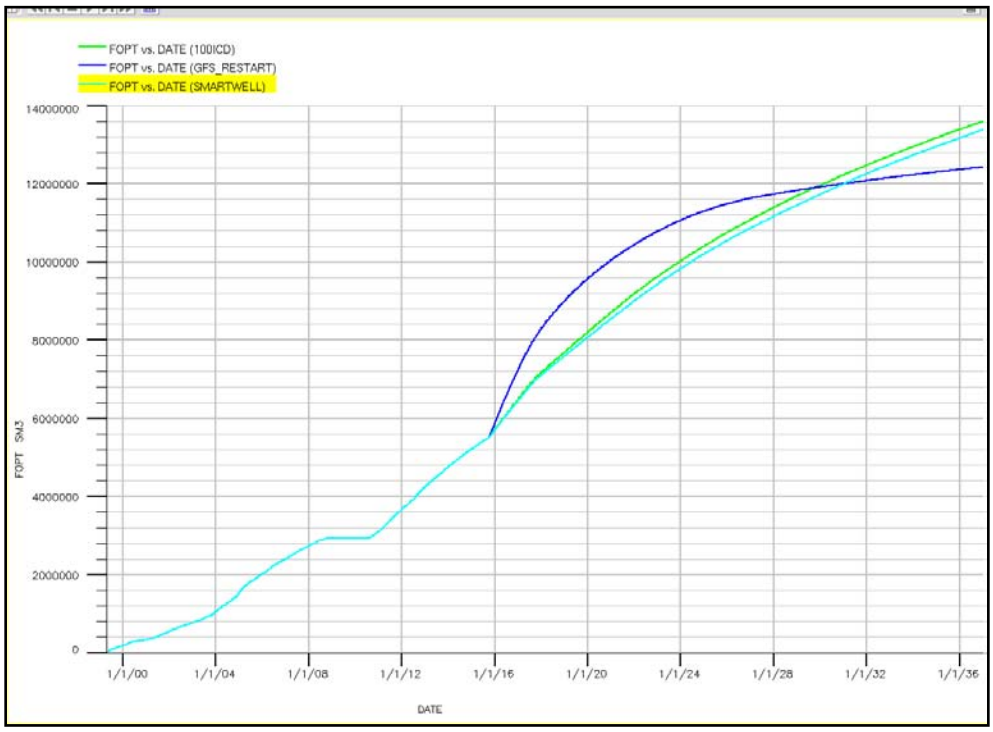


Figure 49: FOPT: Smartwell, ICD, and Extended Case

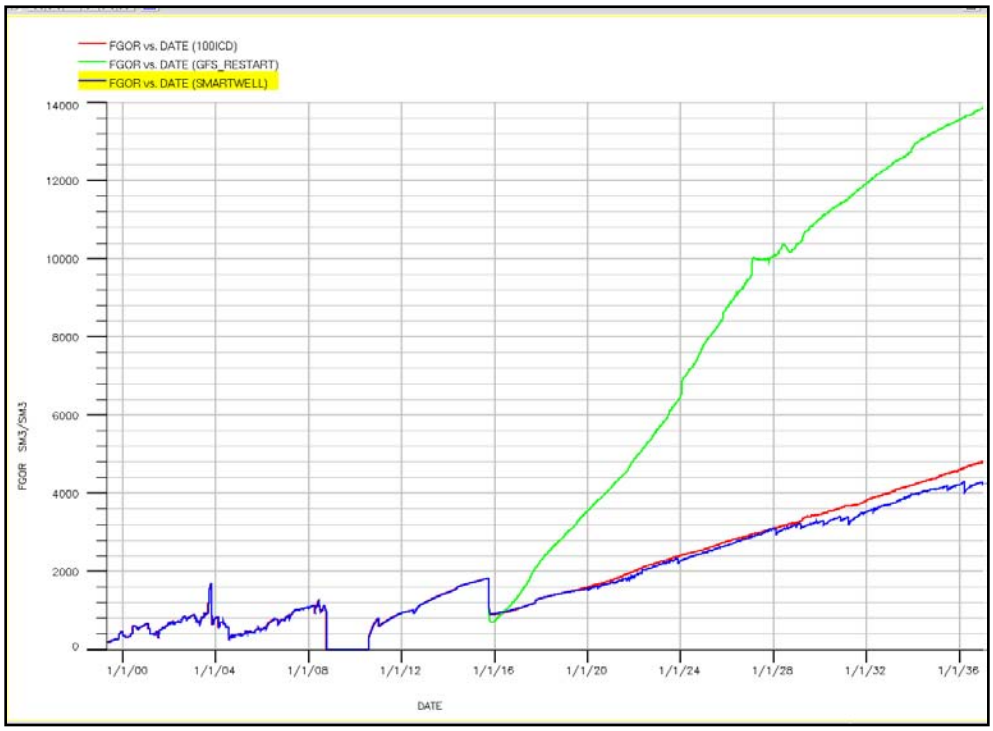


Figure 50: FGOR: Smartwell, ICD, and Extended Case

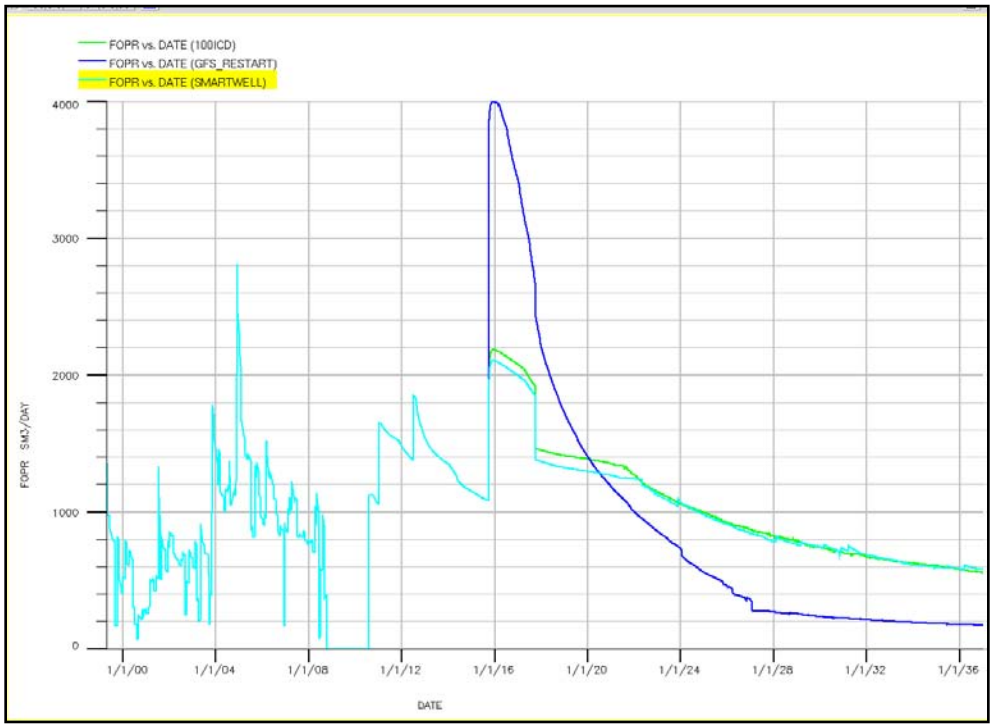


Figure 51: FOPR: Smartwell, ICD, and Extended Case

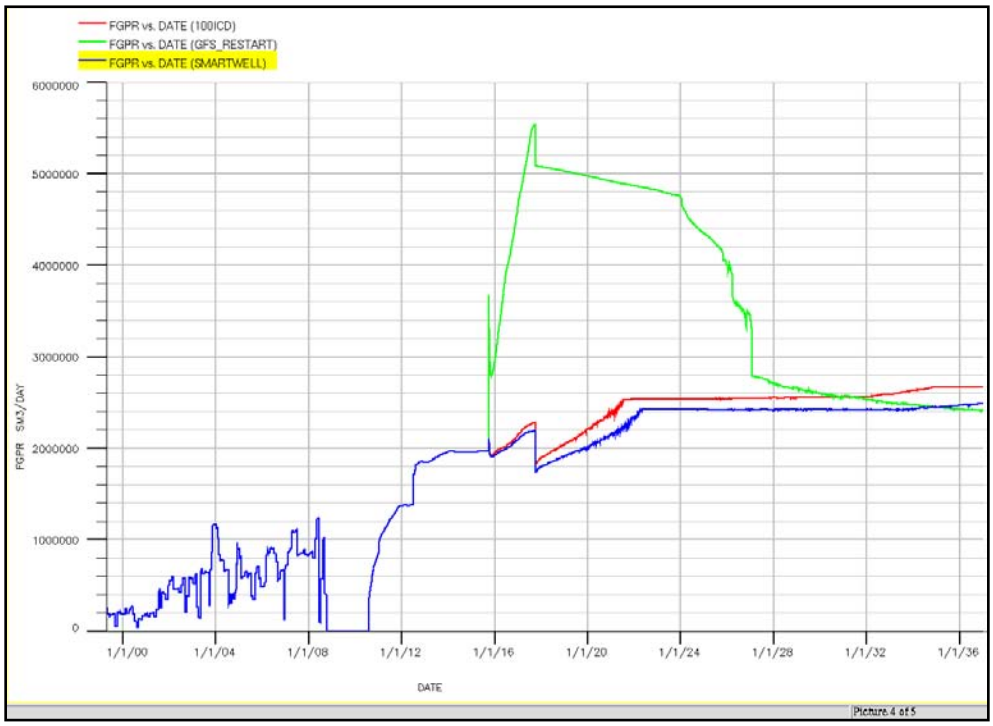


Figure 52: FGPR: Smartwell, ICD, and Extended Case

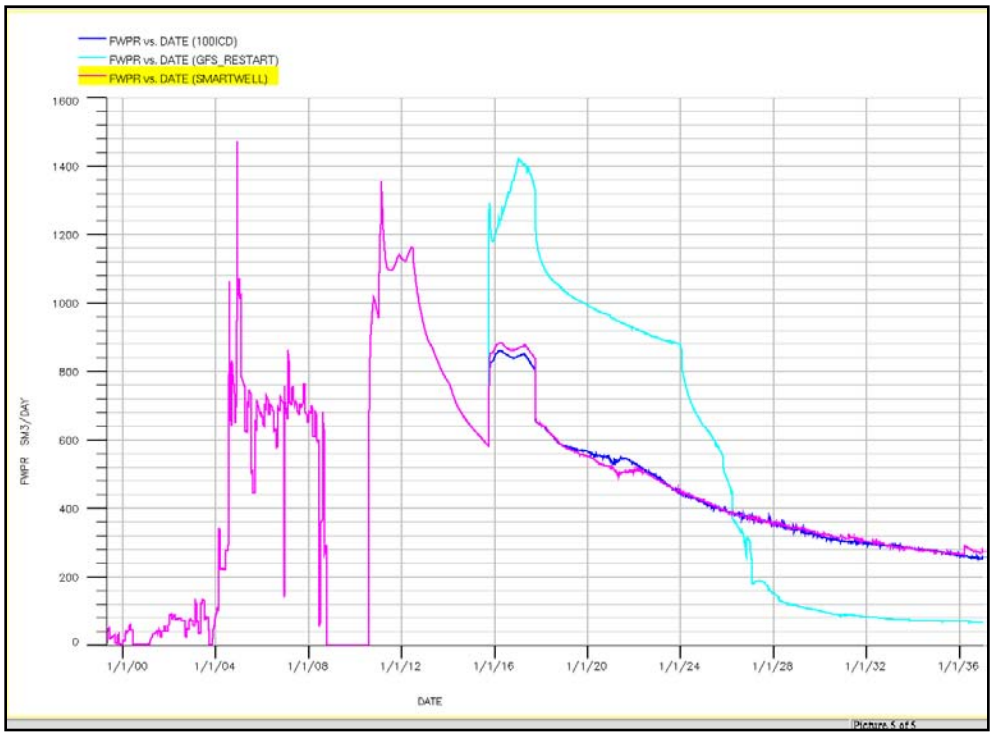


Figure 53: FWPR: Smartwell, ICD, and Extended Case

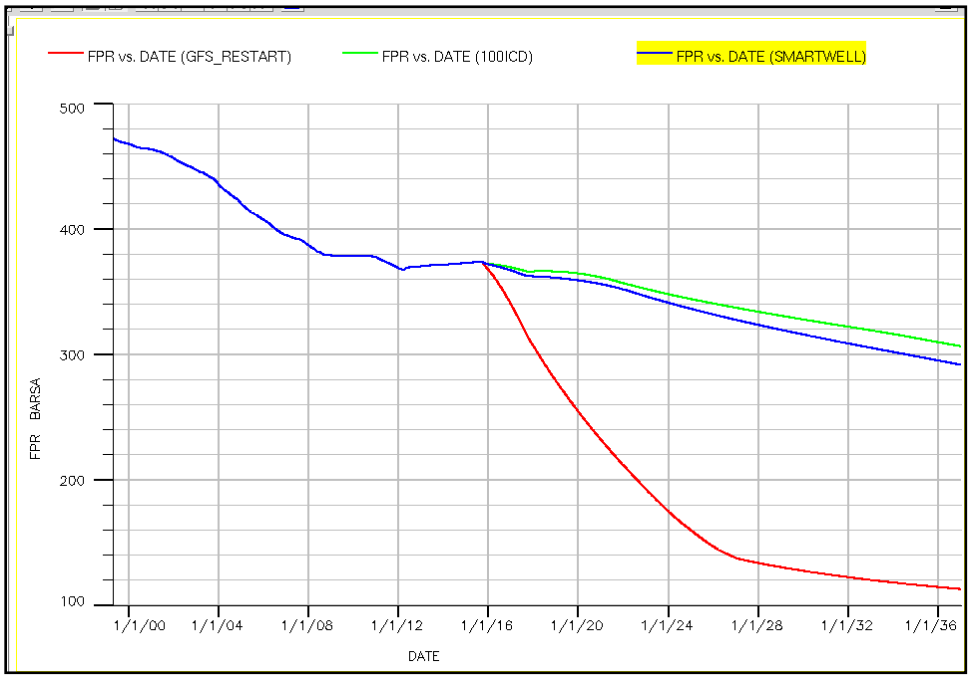


Figure 54: Reservoir Pressure: Smartwell, ICD, and Extended Case

If we compare the ICD case and smart well case, we find that ICD case has higher pressure, higher oil production total, higher GOR and approximately the same in water production compare to smart well case, and however, the difference between 2 cases is not significantly high and looks almost similar in the overall.

6. Economic Evaluation

In order to consider if the project should be done or not, we have to make economics evaluation to find the best alternative which will return the highest profit in the project.

6.1 Cost Data And Economic Assumptions

Cost data and economic assumptions are provided by Statoil. To calculate revenue, if the time is in the past we use oil and gas price from actual data and if the time is in the future we use Statoil's assumptions.

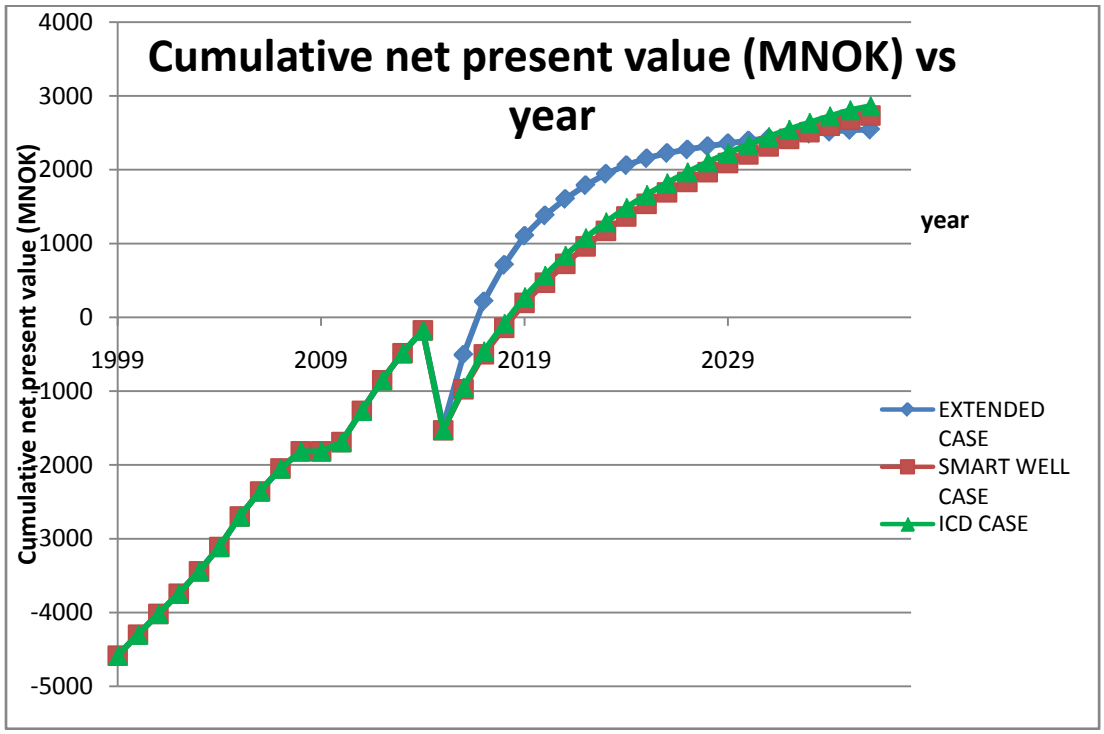
In this report, due to limited data of Smart Well and ICD well, we assume the two type wells cost have similar to conventional well ('normal' well) cost. We assume the extended case and 'RONALDO' can be compared as apple to apple since in extended case, we have 6 new wells cost (W1, W2W3, W4W5, W6W7, G1, G2) and in 'RONALDO' case, we have '3' new producer wells cost (W1, W2W3, W4W5 as a new well) and 2 gas injector wells cost (G1, G2). The used other assumptions are listed on below table.

Table 1: Cost Data and Economic Assumptions

COST DATA AND ECONOMIC ASSUMPTIONS	ASSUMPTIONS
Subsea Development	
One four slot template with all pipelines	1 500 MNOK
Two four slot template with all pipelines	2 500 MNOK
Three four slot template with all pipelines	3 500 MNOK
Drilling	
Semi-submercible	400 MNOK/well
Jack-up	300 MNOK/well
Own drilling rig	150 MNOK/well
Operation Cost	
Operations sub-sea	100 NOK/bbl oe
Plugging and abandonment	
Sub-sea	200 MNOK
Economics assumptions	
Gas price	200 NOK/bbl oe increasing 3 % p.a
Oil price	400 NOK/bbl increasing 3 % p.a.
Inflation	1%
Discount factor	5%
Sensitivities	
Oil and gas prices (OGP)	increasing 5% p. a./decreasing 2 % p. a.
Production	+/- 30 %
Investments	+/- 40 %

Actually, Smart well and ICD well CAPEX (Capital Expenditure) will be higher than 'normal' well. CAPEX will be higher because of more equipment in the two type wells, i.e. Smart Well and ICD Well. But we probably can reduce OPEX (Operation Expense), since we no need well intervention to open/close zone

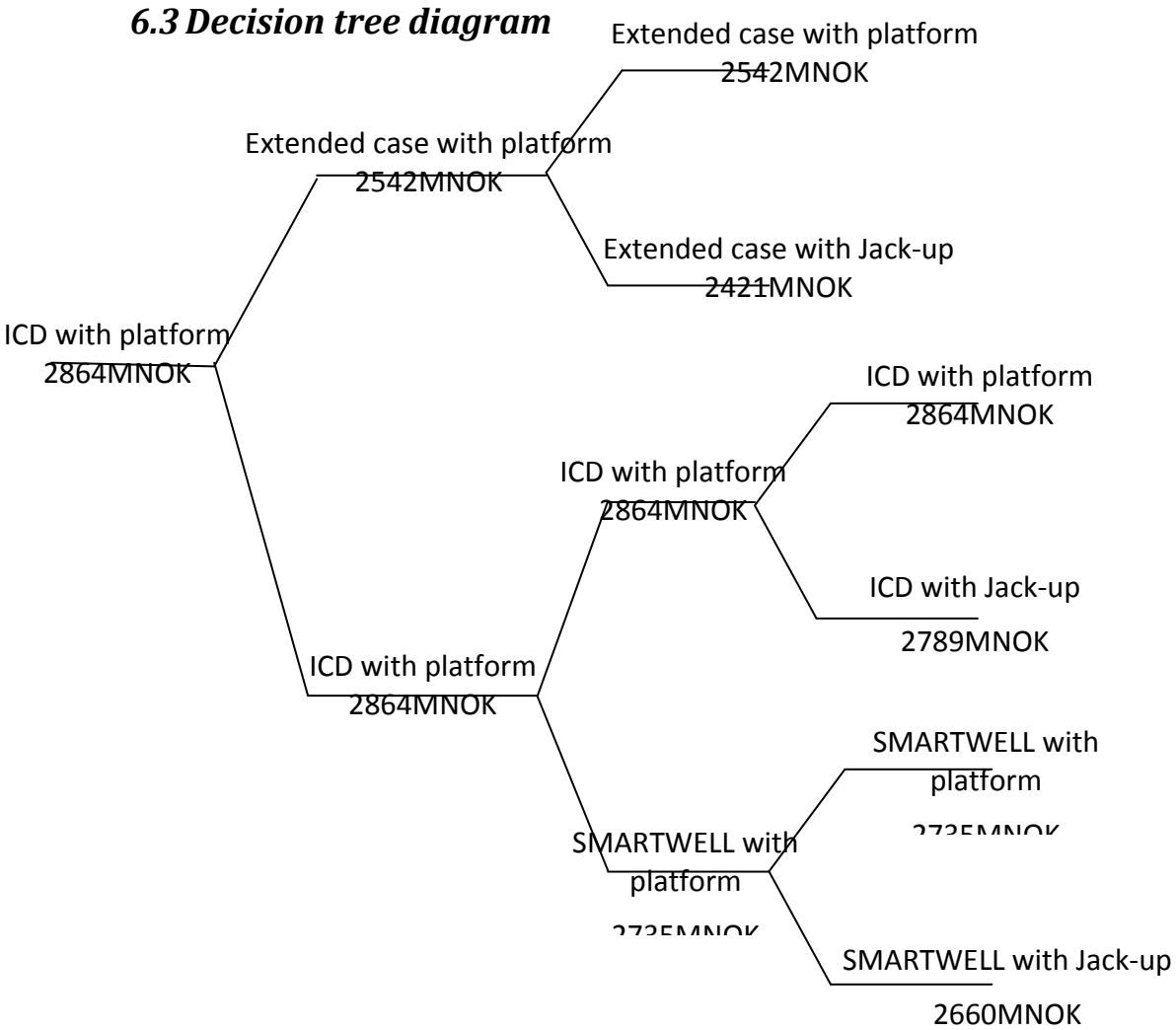
6.2 Result from economics evaluation



We can see from 2015-2030 the cumulative net present value of extended case is still higher than in the smart well case and ICD case (which result from the lower cumulative oil production). The payback period in the extended case which is in 2017 is also shorter than the other case which in 2019.

However in the end of simulation (2037) the graph that the cumulative net present value for the smart well and ICD is higher than extended case at the end of simulation (result from higher cumulative oil production). The ICD case has the highest cumulative NPV which is about 2864 MNOK as we can see in the decision tree diagram.

6.3 Decision tree diagram



The cumulative NPV of Smart well and ICD is higher than the extended case. Moreover if we look at the FOPT curve there is a tendency that the cumulative oil production will increase after 2037. So in the long term of investment, the smart well and ICD case is recommended to be used in this development. The ICD case is the best method for reservoir development in this case.

6.4 Sensitivity analysis

We get table below from sensitivity calculation which assumptions are given by Statoil, as we have stated above in

Table 2: Sensitivity Analysis Calculation of Extended Case, Smartwell and ICD Well

OIL AND GAS PRICE			
Case Name	5.00%	0.00%	-2.00%
RESTART	37.12%	0.00%	-67.71%
SMARTWELL RONALDO	47.49%	0.00%	-77.39%
ICD RONALDO	46.20%	0.00%	-75.53%
HYDROCARBON PRODUCTION			
Case Name	30.00%	0.00%	-30.00%
RESTART	94.97%	0.00%	-9.50%
SMARTWELL RONALDO	89.88%	0.00%	-8.99%
ICD RONALDO	87.20%	0.00%	-8.72%
INVESTMENT			
Case Name	40.00%	0.00%	-40.00%
RESTART	-86.44%	0.00%	86.44%
SMARTWELL RONALDO	-79.67%	0.00%	79.67%
ICD RONALDO	-76.09%	0.00%	76.09%

On figure below, we can see the sensitivity NPV Change (%) to three variables, i.e. oil and gas price (%), hydrocarbon production (%) and investment cost (%). The more sensitive NPV change to one of three variables above, the sharper gradient the variable.

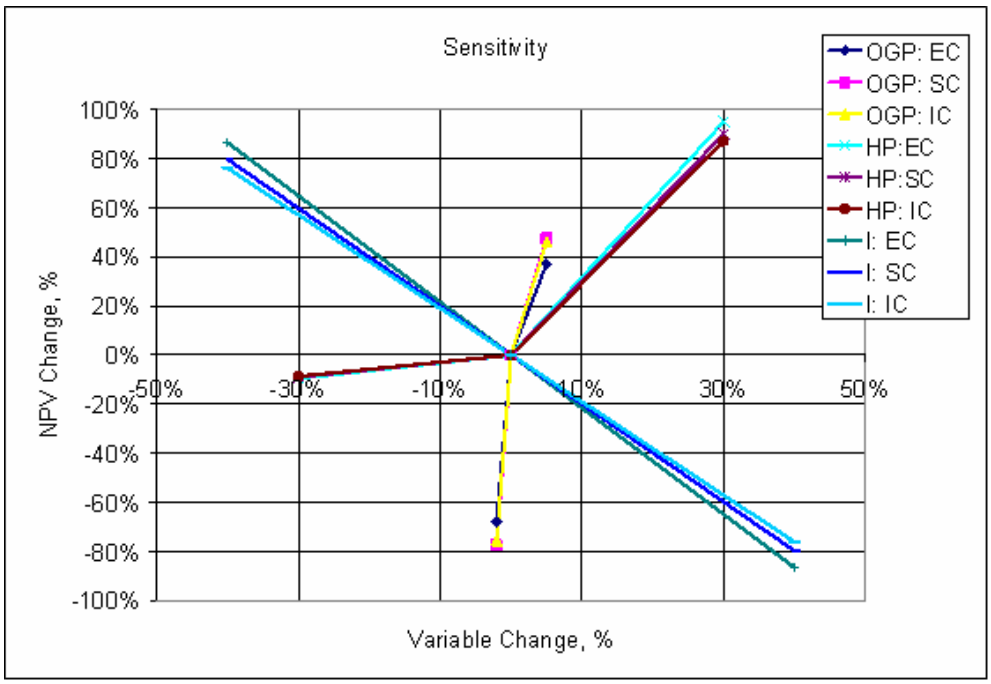


Figure 55: Sensitivity Analysis Curve

We can see that Oil and Gas Price (OGP) has the sharpest gradient than others. Then, if it will be followed by hydrocarbon production increasing, investment cost increasing/decreasing and last hydrocarbon production decreasing. It means the project has the highest sensitivity to oil and gas price, then it is followed by hydrocarbon production increasing, investment cost increasing/decreasing and last hydrocarbon production decreasing.

It is shown in above table, if oil and gas price change from assumption, the NPV change percentage will be 8-39 times of oil and gas change percentage. It is much more significant compare to other variable. So, these projects have high risk in uncertainty oil and gas price in the future.

Although the hydrocarbon production and investment cost have quite significant change, if the numbers in hydrocarbon production and investment cost change, the NPV change percentage will be affected twice from hydrocarbon production and investment cost change percentage.

7. Conclusion

1. Smart Well and ICD Case have better performance compared to extended case
2. ICD has the highest NPV considering our assumptions.
3. These Projects are very sensitive with changing oil and gas price, hydrocarbon production, and investment cost.

8. Recommendatios

1. In this smart well/ICD case, we want to compare the extended case and smart well case so we make the smart well in the same trajectory of extended case. However in order to optimize the oil production (or maximize the cumulative net present value), we may place the well in the other location so that the oil production is higher than this smart well case. Nevertheless, this process takes a lot of time to find the perfect location.

2. As we see from the simulation that the smart well case have 5 branches but the total production is still higher than extended case which has 7 branches. So if we increase the number of branches, it is possible to get higher recovery. However we should consider the economics evaluation with the new branches we add.

3. Reliability, although the smart well has a higher performance than a traditional well but there is a problem with the reliability which means that there are a higher cost for performance Even this problem is now less severe than the previous day but still the topic that need to be considered.

4. In this case the problem for our well is the higher GOR, so may be if we put water injection well instead of gas injection well.

5. Further checking in ICD model, especially in branch no.3, 4, and 5 which several segment have gray color. We recommend using Smart well and ICD economic data to get better representative economic evaluation.

9. Additional Work Report

9.1 Comparison ICD with different ICD strength

We run simulation for two cases. First, we run simulation with ICD strength 0,00021 bar/m6 (100ICD) as example in ECLIPSE 100. Then we run simulation with ICD strength 0,0032 bar/m6 (SICD) as Statoil suggestion for sensitivity ICD strength cases.

We plot Field Gas Oil Ratio (FGOR), Field Water Cut (FWCT), Field Oil Production Rate (FOPR) and Field Oil Production Total (FOPT).

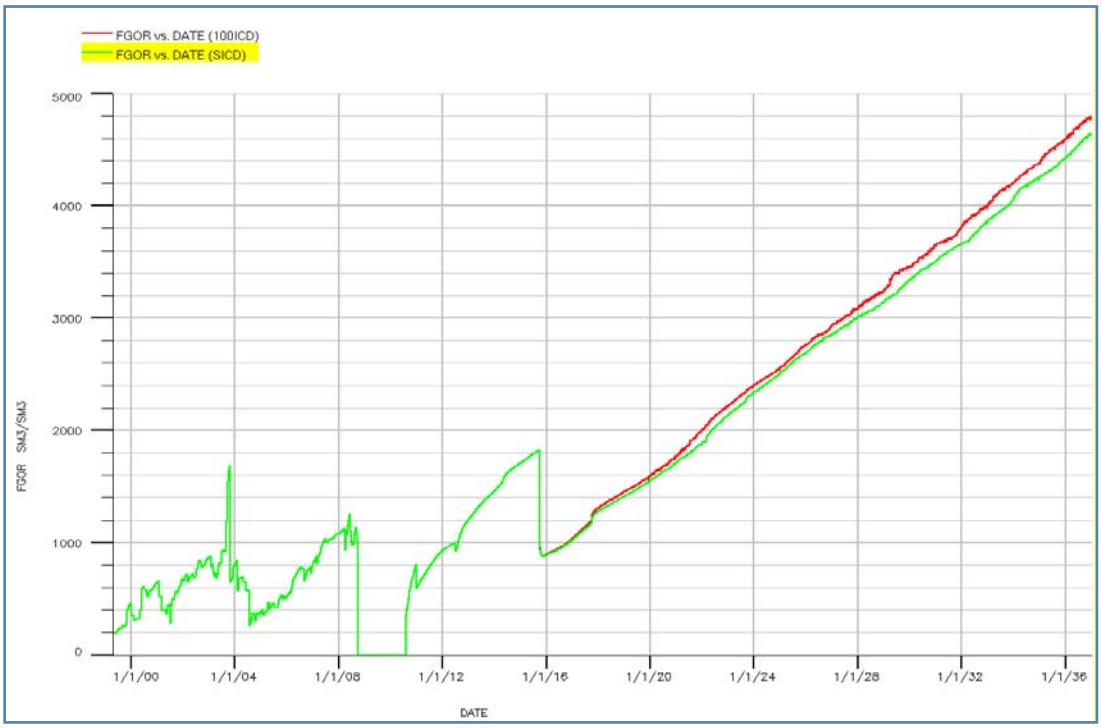


Figure 56: FGOR 100ICD and SICD

Based above picture, the stronger ICD will make lower GOR which means good.

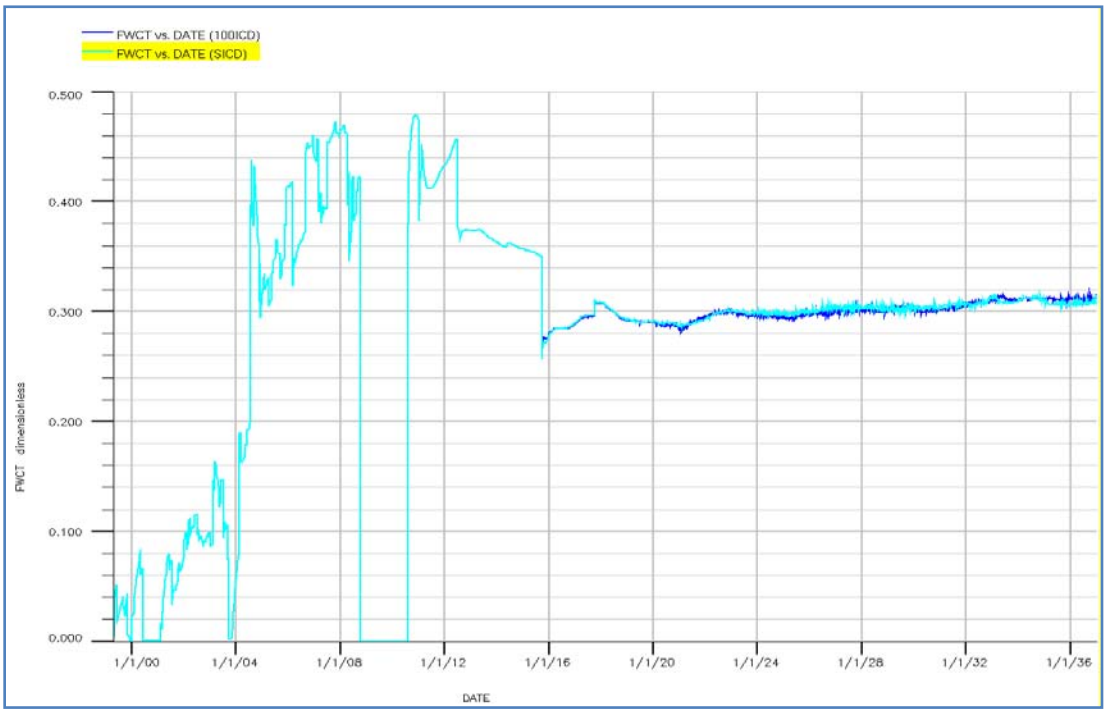


Figure 57: FWCT 100ICD and 100ICD

From FWCT plot, they are slightly different.

Figure 58: FOPR 100ICD and SICD

Stronger ICD will produce higher oil rate.

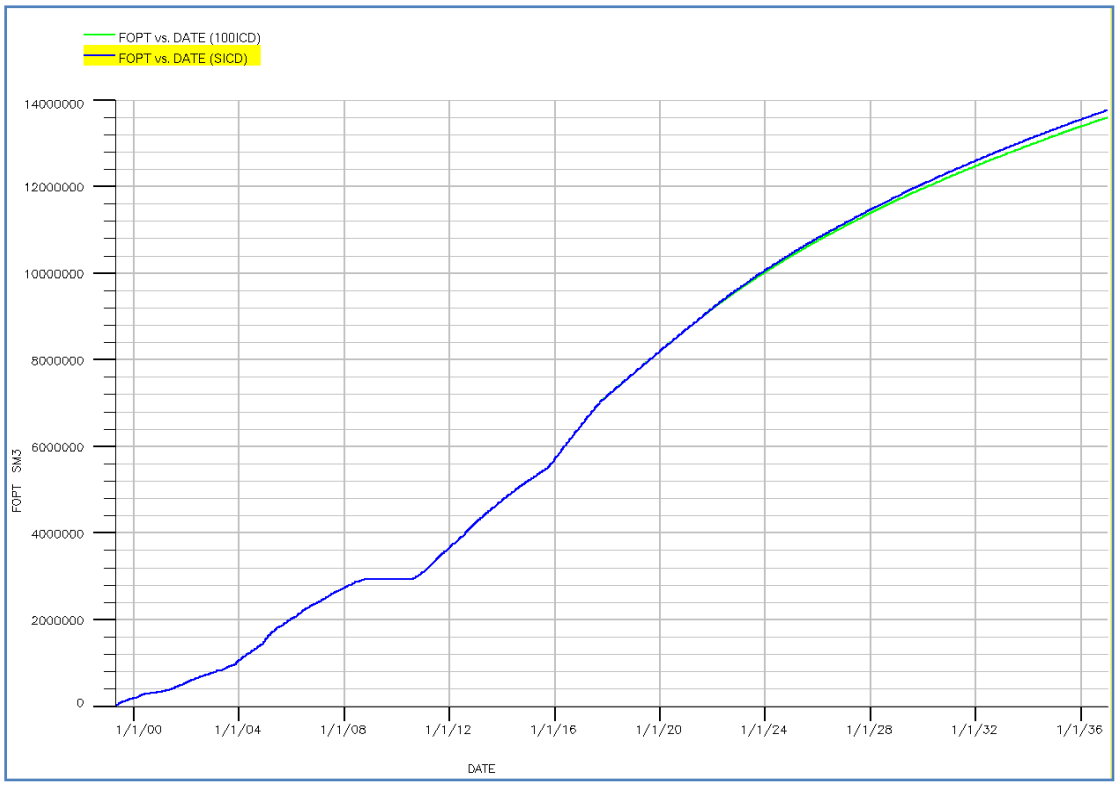


Figure 59: FOPT of 100ICD and SICD

FOPT of ICD with 0,0032 bar/m6 will produce slightly higher (13,8 MSm3) than the other (13,6 MSm3/day).

9.2 Comparison RONALDO with smart well ,ICD and RONALDO without smart well (RONALDO REFERENCE)

In order to see the effect of smart well, ICD, we will compare well RONALDO with smart well, ICD to the well RONALDO without smart well and ICD (RONALDO REFERENCE) and see the result.

Here is the figures of FGOR.

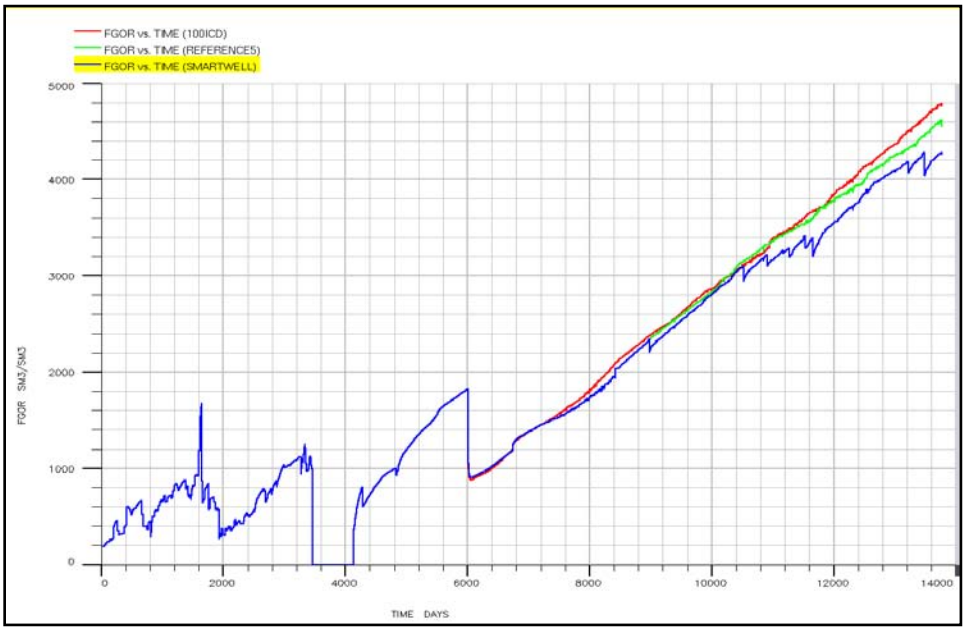


Figure 60: FGOR when RONALDO at 800 Sm3/day

However the effect of the smart well, ICD is not clearly seen in the simulation, so we try to increase the oil production rate from 800 Sm3/day to 2300 Sm3/day. Then we can see the difference more clarity in figure FGOR below.

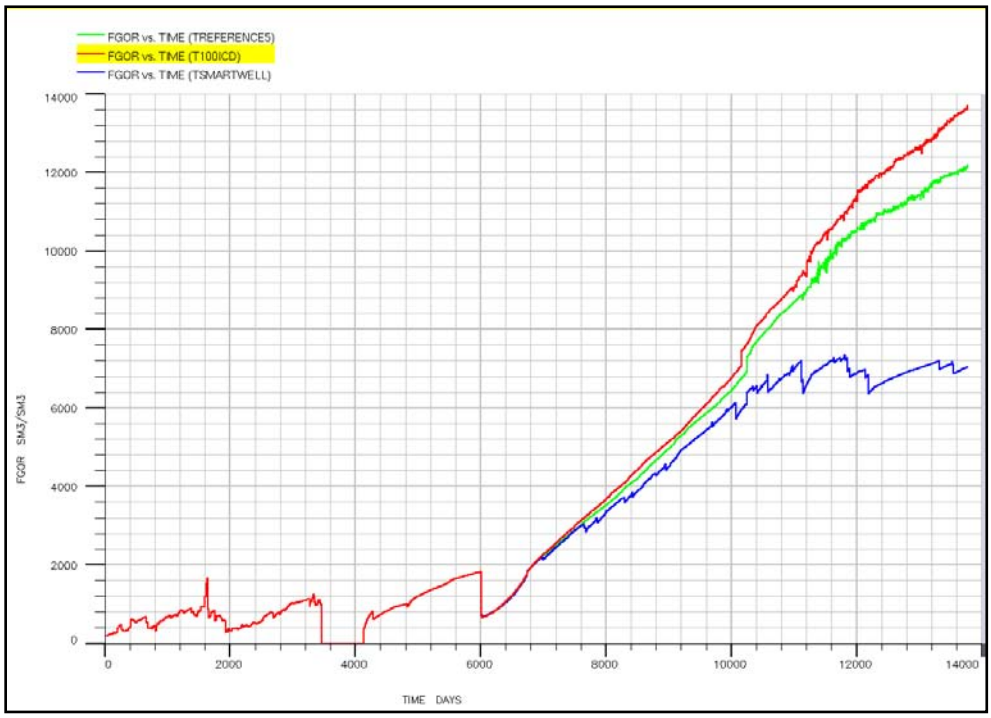


Figure 61: FGOR when RONALDO at 2300 Sm3/day

The smartwell is working, but we can not see the effect of ICD which is reduce gas rate compare to REFERENCE. Then we plot FOPR, FOPT, FWCT and FPR as belowed figures to see field performance.

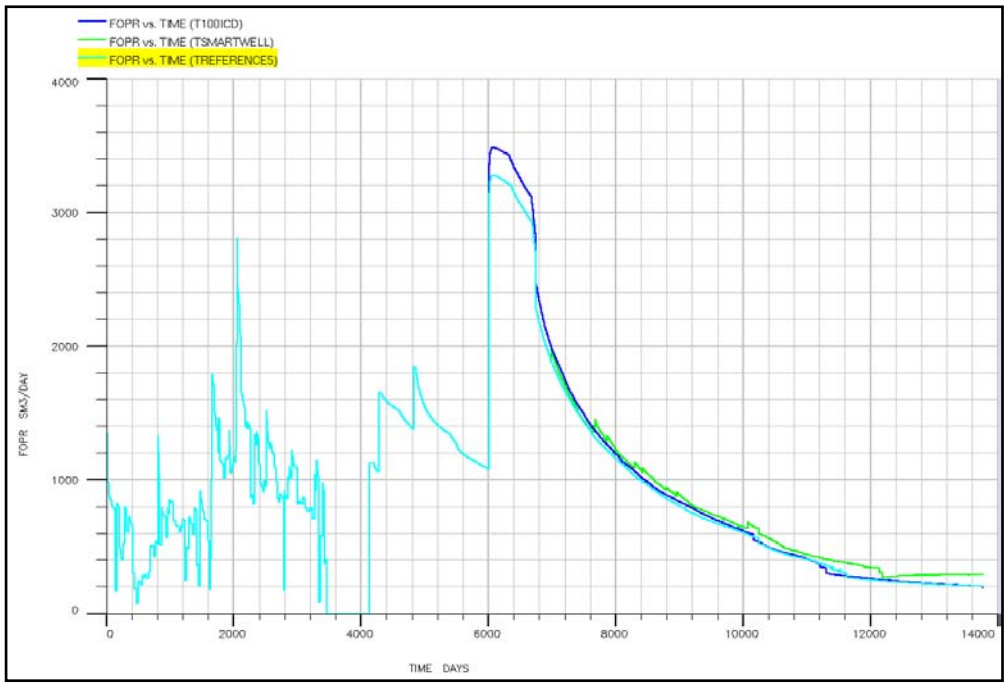


Figure 62: FOPR of RONALDO Smartwell, ICD and Reference

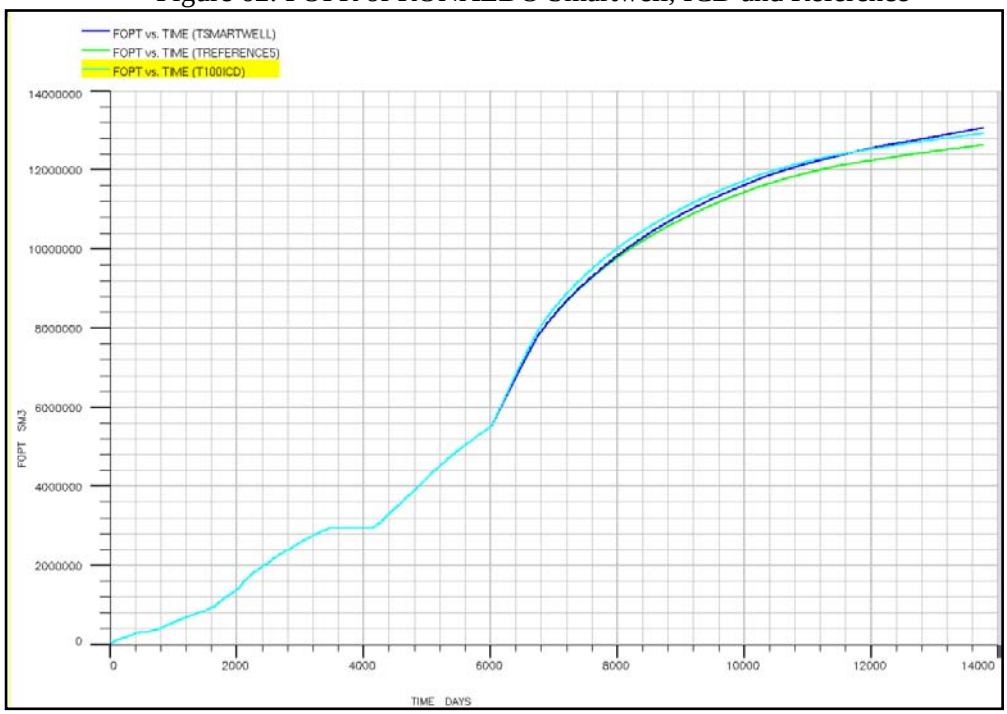


Figure 63: FOPT of RONALDO Smartwell, ICD and Reference

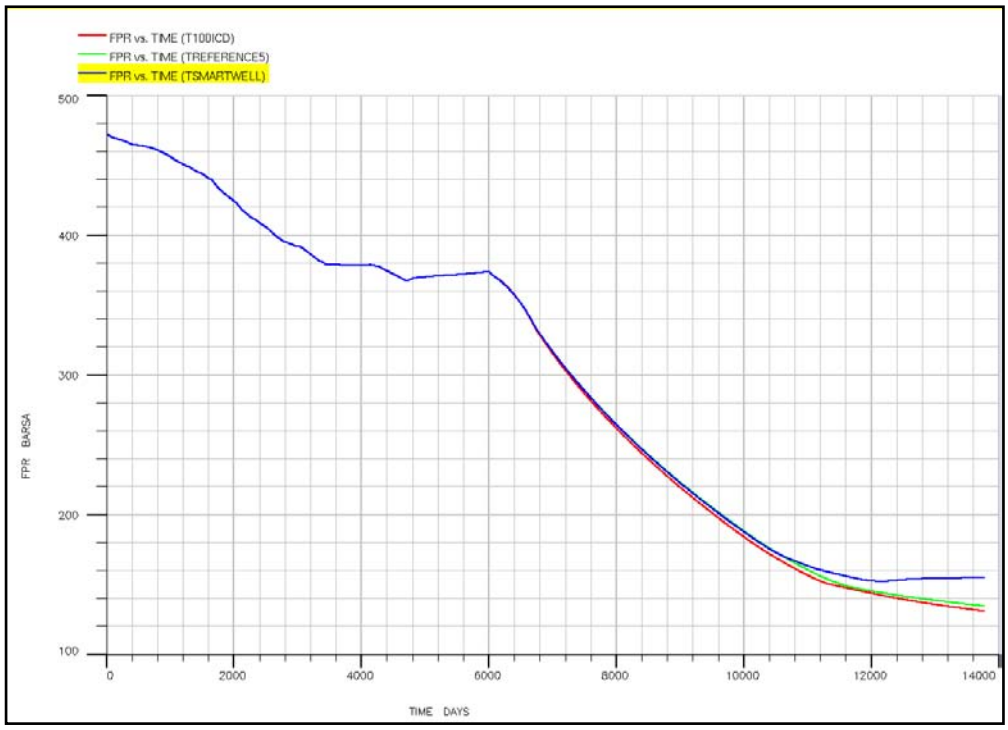


Figure 64: FPR of RONALDO Smartwell, ICD and Reference

9.3 Inconsistency ICD RONALDO

We found that there is inconsistency from WOPR 'RONALDO' and WOPT 'RONALDO'. WOPR and WOPT of RONALDO are shown below.

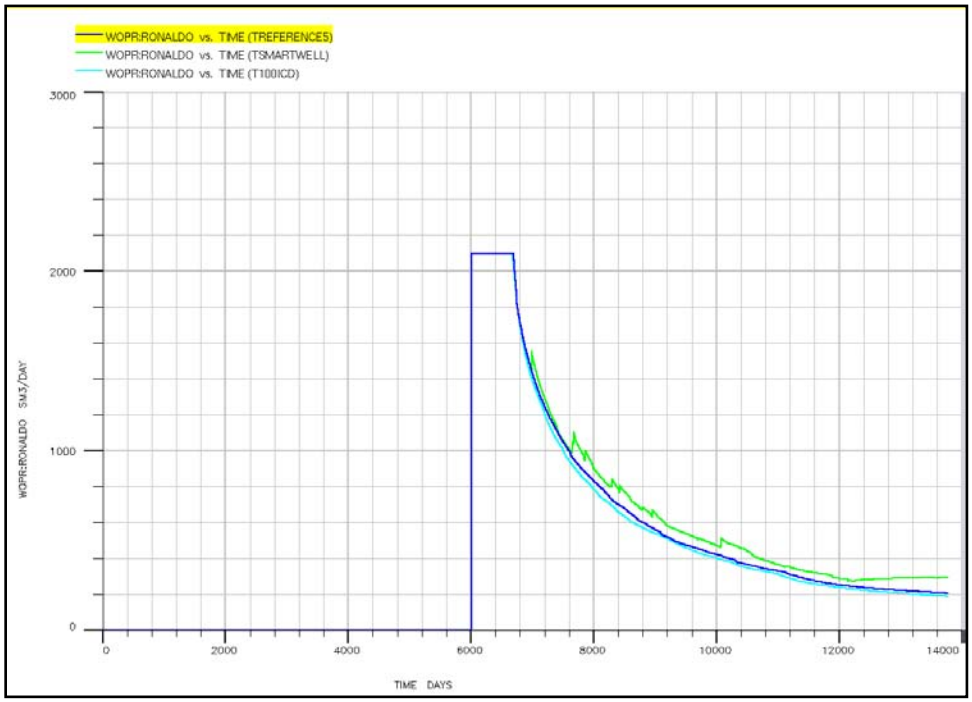


Figure 65: WOPR RONALDO

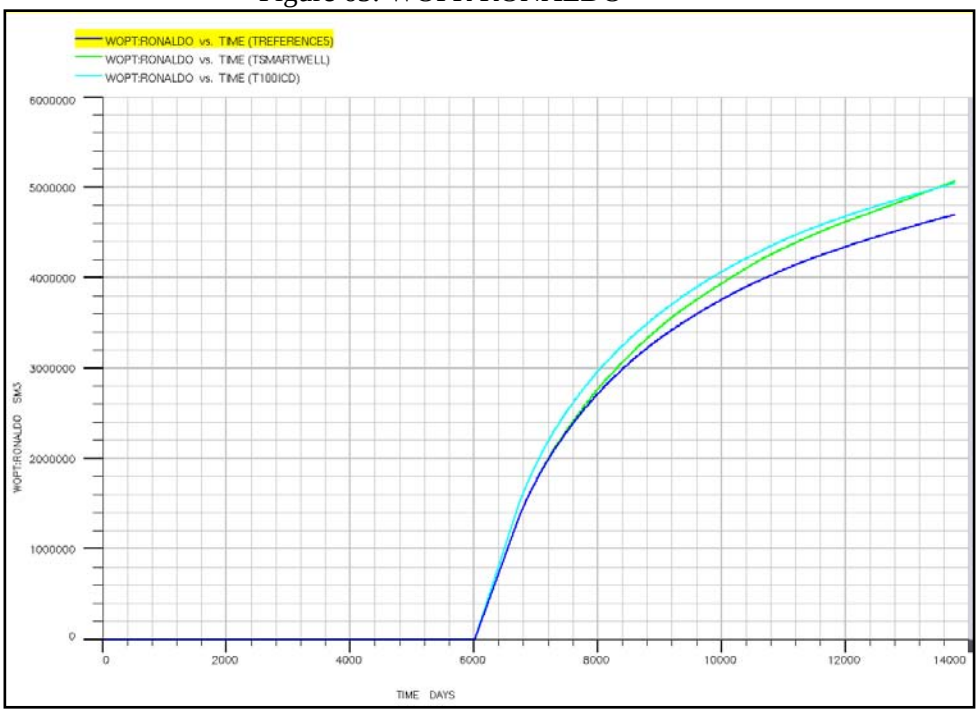


Figure 66: WOPT RONALDO

WOPR of smartwells is always higher than ICD well, but WOPT smartwell is almost lower than ICD until Smartwell WOPT is higher than ICD in the last stage. Our hypothesis, it happens because we have several segments which are gray as discussed before.

10. Bibliography

[1] Omar, A. A. (May 2007). Economic Evaluation Of Smart Well Technology. Texas A & M University .
[2] Changhong Gao, T. R. (April 2007). A Literature Review On Smart well Technology. Society of Petroleum Engineering .
[3] Denis J.Schiozer, J. P. (October,2009). Methodology to Compare Smart Well and Conventional Wells. Society of Petroleum Engineerings .
[4] S.Mahdia Motahhari, T. B. (n.d.). Smart Well Benefits, Types OF Sensors, Challenges, Economic Consideration, and Application in Fractured Reservoir. Society of Petroleum Engineerings .
[5] Burton, H. (2007). Developing Smart Well Technology for HPHT Enviroment. WD Well Dynamics.
[6] Eprasheed. (2007). Norway Oil& Gas and Saudi Arabia Oil& Gas
[7] E.A. Addiego guevara, S. M. (April 2008). Insurance Value Of Intelligent Well Technology Against Reservoir Uncertainty. USA.
[8] Imperial College London (2010), D. O. (n.d.). http://www.imperial.ac.uk.
[9] Svein Oddvar Netland, V. H. (September 2004). Smart Well Technology Apllied To a Horizontal Subsea Well at Gullfaks Satellites.
[10] Al-Mutairi, M. 2008. Effective Water Production Control Through Utilizing ECP and Passive ICD completion. [red.] SPE. SPE 120822. presented at the 2008 SPE Saudi Arabia Section Technical Symposium, 2008.
[11] Augustine, J. R. 2002. An Investigation of the Economic Benefit of Inflow Control Devices on Horizontal Well Completions Using a Reservoir-. SPE 78293. 2002.
[12] Davies, F. T. Al-Khelaiwi and D. R. 2007. Inflow Control Devices: Application and Value Quantification of a Developing Technology. SPE 108700. 2007.
[13] Garcia L., Coronado M., Russell R., Garcia G. 2009. The First Passive Inflow Control Device That Maximizes Productivity During Every Phase of a Wells Life. IPTC 13863. 2009.
[14] Garcia, G, Coronado, M. and Gavioli P. 2009. Identifying Well Completion Applications for Passive Inflow Control Devices. SPE 124349. 2009.
[15] Gule, E.I. 2009. Optimizing inflow by using passive inflow control with basis in the Troll Field, North Sea. 2009, SPE Work Shop 2009, Penang.
[16] Gule, Eli. 2009. Optimizing inflow by using passive inflow control with basis in the Troll Field, North Sea. Horizontal and Multilateral Wells. 2009, SPE Work Shop 2009.
[17] J. Augustine, S. Mathis, H. Nguyen, C. Gann, J. Gill. 2008. World's First Gravel-Packed Inflow-Control Completion. March 2008, ss. 61-67.
[18] K. H. Henriksen, E. I. Gule, J. Augustine. 2006. The Application of Inflow Control Devices in the Troll Oil Field. 2006.
[19] L.-B. Ouyang, W.S. Huang. 2006. Case Studies for Improving Completion Design through Comprehensive Well Performance Modeling. SPE 104078. 2006.
[20]Ouyang, L. 2009. Practical Consideration of an Inflow Control Device Application for Reducing Water. SPE 124154 . 2009.
[21] R. Freyer, M. Fejerskov, A. Huse. 2002. An Oil Selective Inflow Control System. SPE 78272. 2002.

[22] S.L. Crow, SPE, M.P. Coronado, SPE, and R.K. Mody. 2008. Means for Passive Inflow Control Upon Gas Breakthrough. 2008, SPE 102208.
[23] V.M. Birchenko, F.T. Al-Khelaiwi. 2008. Advanced Wells: How to Make a Choice between Passive and Active Inflow control completions. SPE 115742 . 2008.

11. Appendix A: Challenge no. 3 Description

Challenge 3. Improved oil recovery with smart wells

Gullfaks Sør Statfjord has used smart wells (Ref. 3), but has mixed experiences. It could however be possible to increase the oil recovery by using smart wells and/or Inflow Control Devices (ICD).

1. Explain smart wells and ICD.
2. Use the Gullfaks Sør Statfjord model with a five branch well with ICD in Gullfaks Sør Statfjord.
3. Make a recommendation if smart wells/ICD is a measure that Statoil should implement at Gullfaks Sør Statfjord.
4. Positive and negative comments about smart wells and ICD.

12. Appendix B: Economic Calculation

12.1 Base Case: Extended Case

						INCOME		EXPENDITURE																
								OPEX			CAPEX													
DATE	FOPT	vol oil per year	oil prize	Vol gas per year	Gas prize	oil income	Gas income	Field / offshore	CO2 - duty	Gas oil transportation	Subsea	Production unit	Drilling	abandon	Cap Allowance	royalty	Fiscal allowance	Taxable income	Tax	Net tax	cash flow	i	NPV	cum NPV
	(SM3)	Sm3	(UsD/BBL)	Sm3	(cents per gallon)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)		(MNOK)	(MNOK)
1999	182525,08	182525,08	21,39	45087848	110,8333333	147,3405078	0	11,48048214	1	1,148048214	3500		1650		1030	29,4681016	1073,096632	-925,7561241	-185,1512248	-185,1512248	-4860,6049	1	-4583,31438	-4583,31438
2000	330533,16	148008,08	34,29	62183542	138,4	191,5321749	0	9,309428157	1	0,930942816					1030	38,306435	1079,546806	-888,0146311	-177,6029262	-177,6029262	319,5882952	2	284,1643022	-4299,15008
2001	538899,12	208365,96	28,03	103837010	139,3333333	220,413758	0	13,10582459	1	1,310582459					1030	44,0827516	1089,499159	-869,0854006	-173,8170801	-173,8170801	334,7316795	3	280,6498394	-4018,50024
2002	773933,00	235033,88	27,33	174349490	136,5	242,4146889	0	14,7831863	1	1,47831863					1030	48,4829378	1095,744443	-853,3297538	-170,6659508	-170,6659508	347,336197	4	274,6043126	-3743,89593
2003	1050589,6	276656,6	32,47	231690460	156	339,009723	0	17,40117662	1	1,740117662					1030	67,8019446	1117,943239	-778,9335159	-155,7867032	-155,7867032	406,8531873	5	303,3083443	-3440,58758
2004	1529299,5	478709,9	42,97	246407810	180,3333333	776,2946497	0	30,10994685	1	3,010994685						155,25893	189,3798715	586,9147782	117,3829556	117,3829556	469,5318226	6	330,0661556	-3110,52143
2005	2016984,5	487685	55,21	213079440	231	1016,122283	0	30,67446366	1	3,067446366						203,224457	237,9663666	778,1559164	155,6311833	155,6311833	622,5247331	7	412,6500488	-2697,87138
2006	2392377	375392,5	62,36	247841245	270	883,447057	0	23,6114779	1	2,36114779						176,689411	203,6620371	679,7850199	135,957004	135,957004	543,8280159	8	339,9195899	-2357,95179
2007	2732394,5	340017,5	66,66	132349455	300	855,3727476	0	21,38645734	1	2,138645734						171,07455	195,5996526	659,773095	131,954619	131,954619	527,818476	9	311,0917778	-2046,86001
2008	2926702,5	194308	91,35	210171400	300	669,8661981	0	12,22160551	1	1,222160551						133,97324	148,4170057	521,4491924	104,2898385	104,2898385	417,1593539	10	231,8436779	-1815,01633
2009	2926702,5	0	60	0	300	0	0	0	1	0						0	1	-1	-0,2	0	-1	11	-0,52406191	-1815,54039
2010	3091608,2	164905,7	400	-51295890	300	414,8902592	0	10,37225648	1	1,037225648						82,9780518	95,38753396	319,5027252	63,90054504	63,90054504	255,6021802	12	126,3096348	-1689,23076
2011	3659698	568089,8	412	74040400	300	1472,149065	0	35,73177343	1	3,573177343						294,429813	334,7347638	1137,414301	227,4828603	227,4828603	909,9314411	13	424,0039715	-1265,22679
2012	4229853	570155	424,36	-235126510	300	1521,825854	0	35,8616706	1	3,58616706						304,365171	344,8130084	1177,012845	235,402569	235,402569	941,6102761	14	413,7345311	-851,492255
2013	4749729	519876	437,0908	-219673000	300	1429,252676	0	32,69921664	1	3,269921664						285,850535	322,8196735	1106,433003	221,2866005	221,2866005	885,1464021	15	366,7372428	-484,755012
2014	5199452	449723	450,203524	-197355000	300	1273,478359	0	28,28672569	1	2,828672569						254,695672	286,81107	986,6672888	197,3334578	197,3334578	789,3338311	16	308,382661	-176,372352
2015	5857101,5	657649,5	463,7096297	24858700	300	1918,130667	0	41,36490908	1	4,136490908	4000		900		980	383,626133	1410,127533	508,0031339	101,6006268	101,6006268	-3513,59749	17	-1294,40616	-1470,77851
2016	7238121,5	1381020	477,6209186	719654400	300	4148,784601	0	86,8635447	1	8,68635447					980	829,75692	1906,306819	2242,477782	448,4955564	448,4955564	2773,982226	18	963,6327747	-507,145734
2017	8285802	1047680,5	491,9495462	666976200	300	3241,805873	0	65,89712093	1	6,589712093					980	648,361175	1701,848008	1539,957866	307,9915732	307,9915732	2211,966293	19	724,5622785	217,4165447
2018	8993714	707912	506,7080326	528222200	300	2256,184665	0	44,52632522	1	4,452632522					980	451,236933	1481,215891	774,9687742	154,9937548	154,9937548	1599,975019	20	494,1965906	711,6131353
2019	9561861	568147	521,9092735	517110300	300	1865,062162	0	35,7353712	1	3,57353712					980	373,012432	1393,321341	471,7408214	94,34816428	94,34816428	1357,392657	21	395,3496563	1106,962792
2020	10036004	474143	537,5665517	508983800	300	1603,168465	0	29,82269748	1	2,982269748						320,633693	354,4386602	1248,729805	249,7459609	249,7459609	998,9838437	22	274,3618116	1381,324603
2021	10433785	397781	553,6935483	491506700	231	1385,323107	0	25,01967218	1	2,501967218						277,064621	305,5862607	1079,736846	215,9473692	215,9473692	863,7894768	23	223,698171	1605,022774
2022	10772715	338930	570,3043547	486772700	231	1215,777997	0	21,31805564	1	2,131805564						243,155599	267,6054606	948,1725363	189,6345073	189,6345073	758,538029	24	185,2342155	1790,25699
2023	11062583	289868	587,4134854	477554700	231	1070,981	0	18,23214868	1	1,823214868						214,1962	235,2515636	835,7294368	167,1458874	167,1458874	668,5835494	25	153,9532513	1944,210241
2024	11291221	228638	605,0358899	471223300	231	870,0959147	0	14,38089755	1	1,438089755						174,019183	190,8381702	679,2577444	135,8515489	135,8515489	543,4061956	26	117,9905136	2062,200755
2025	11477687	186466	623,1869666	455548600	231	730,8960189	0	11,72835855	1	1,172835855						146,179204	160,0803982	570,8156207	114,1631241	114,1631241	456,6524966	27	93,49699855	2155,697753
2026	11622705	145018	641,8825756	447699000	231	585,4840627	0	9,121357783	1	0,912135778						117,096813	128,1303061	457,3537566	91,47075132	91,47075132	365,8830053	28	70,6388138	2226,336567
2027	11725622	102917	661,1390529	439238000	231	427,9741217	0	6,473284551	1	0,647328455						85,5948243	93,71543735	334,2586844	66,85173687	66,85173687	267,4069475	29	48,68141282	2275,01798
2028	11821812	96190	680,9732245	430394000	231	412,0003079	0	6,05016898	1	0,605016898						82,4000616	90,05524746	321,9450605	64,38901209	64,38901209	257,5560484	30	44,21316119	2319,231141
2029	11910741	88929	701,4024212	390908000	231	392,3270469	0	5,59346582	1	0,559346582						78,4654094	85,61822179	306,7088251	61,34176503	61,34176503	245,3670601	31	39,71781979	2358,948961
2030	11994316	83575	722,4444939	5195000	231	379,7680727	0	5,256709351	1	0,525670935						75,9536145	82,73599482	297,0320779	59,40641557	59,40641557	237,6256623	32	36,27035523	2395,219316
2031	12074125	79809	744,1178287			373,5348778	0	5,019835078	1	0,501983508						74,7069756	81,22879415	292,3060837	58,46121674	58,46121674	233,844867	33	33,65701817	2428,876334
2032	12150283	76158	766,4413635			367,1402887	0	4,790194087	1	0,479019409						73,4280577	79,69727124	287,4430175	57,4886035	57,4886035	229,954414	34	31,20892958	2460,085264
2033	12221917	71634	789,4346045			355,6910537	0	4,505643047	1	0,450564305						71,1382107	77,09441809	278,5966356	55,71932712	55,71932712	222,8773085	35	28,52280972	2488,608074
2034	12290550	68633	813,1176426			351,0136026	0	4,316885826	1	0,431688583						70,2027205	75,95129493	275,0623077	55,01246154	55,01246154	220,0498461	36	26,55442162	2515,162495
2035	12356858	66308	837,5111719			349,2964064	0	4,170647726	1	0,417064773						69,8592813	75,44699378	273,8494126	54,76988253	54,76988253	219,0795301	37	24,92911754	2540,091613
2036	12421834	64976	862,636507			352,5481058	0	4,086867446	1	0,408686745				200		70,5096212	76,00517536	276,5429305	55,3085861	55,3085861	21,23434439	38	2,278417398	2542,37003
2037	12422357	523	888,5156022			2,922835187	0	0,03289571	1	0,003289571						0,58456704	1,620752319	1,302082869	0,260416574	0,260416574	1,041666295	39	0,105393147	
																						SUM	2542,37003	

12.2 Sensitivity Analysis: Extended Case

Sensitivity Analysis

As many assumptions were made, it is necessary to perform a sensitivity analysis which studies how the variation (uncertainty) in the input affects the output. In this case the *ceteris paribus* approach was used to observe how the effect of a single independent variable on a dependent variable can be isolated, for example if only the oil price changes how is the net present value affected.

Due to uncertainty, there are four variables here that might be varied between +/- 40% by assumed probability.

☐ Oil price ☐ Gas price ☐ CAPEX cost ☐ OPEX cost

These variables could effect on NPV, Sensitive analysis shows that how much the total NPV is sensitive by changing each these four variables.

The Sensitivity cases are described below.

12.2.1 Sensitivity Case: +5% of Oil and Gas Price

						INCOME		EXPENDITURE																
								OPEX			CAPEX													
DATE	FOPT	vol oil per year	oil prize	Vol gas per year	Gas prize	oil income	Gas income	Field / offshore	CO2 - duty	Gas oil transportation	Subsea	Production unit	Drilling	abandon	Cap Allowance	royalty	Fiscal allowance	Taxable income	Tax	Net tax	cash flow	i	NPV	cum NPV
	(SM3)	Sm3	(UsD/BBL)	Sm3	(cents per gallon)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)		(MNOK)	(MNOK)
1999	182525,08	182525,08	21,39	45087848	110,8333333	147,3405078	0	11,48048214	1	1,148048214	3500		1650		1030	29,4681016	1073,096632	-925,7561241	-185,1512248	-185,1512248	-4860,6049	1	-4583,31438	-4583,31438
2000	330533,16	148008,08	34,29	62183542	138,4	191,5321749	0	9,309428157	1	0,930942816					1030	38,306435	1079,546806	-888,0146311	-177,6029262	-177,6029262	319,5882952	2	284,1643022	-4299,15008
2001	538899,12	208365,96	28,03	103837010	139,3333333	220,413758	0	13,10582459	1	1,310582459					1030	44,0827516	1089,499159	-869,0854006	-173,8170801	-173,8170801	334,7316795	3	280,6498394	-4018,50024
2002	773933,00	235033,88	27,33	174349490	136,5	242,4146889	0	14,7831863	1	1,47831863					1030	48,4829378	1095,744443	-853,3297538	-170,6659508	-170,6659508	347,336197	4	274,6043126	-3743,89593
2003	1050589,6	276656,6	32,47	231690460	156	339,009723	0	17,40117662	1	1,740117662					1030	67,8019446	1117,943239	-778,9335159	-155,7867032	-155,7867032	406,8531873	5	303,3083443	-3440,58758
2004	1529299,5	478709,9	42,97	246407810	180,3333333	776,2946497	0	30,10994685	1	3,010994685						155,25893	189,3798715	586,9147782	117,3829556	117,3829556	469,5318226	6	330,0661556	-3110,52143
2005	2016984,5	487685	55,21	213079440	231	1016,122283	0	30,67446366	1	3,067446366						203,224457	237,9663666	778,1559164	155,6311833	155,6311833	622,5247331	7	412,6500488	-2697,87138
2006	2392377	375392,5	62,36	247841245	270	883,447057	0	23,6114779	1	2,36114779						176,689411	203,6620371	679,7850199	135,957004	135,957004	543,8280159	8	339,9195899	-2357,95179
2007	2732394,5	340017,5	66,66	132349455	300	855,3727476	0	21,38645734	1	2,138645734						171,07455	195,5996526	659,773095	131,954619	131,954619	527,818476	9	311,0917778	-2046,86001
2008	2926702,5	194308	91,35	210171400	300	669,8661981	0	12,22160551	1	1,222160551						133,97324	148,4170057	521,4491924	104,2898385	104,2898385	417,1593539	10	231,8436779	-1815,01633
2009	2926702,5	0	60	0	300	0	0	0	1	0						0	1	-1	-0,2	0	-1	11	-0,52406191	-1815,54039
2010	3091608,2	164905,7	400	-51295890	300	414,8902592	0	10,37225648	1	1,037225648						82,9780518	95,38753396	319,5027252	63,90054504	63,90054504	255,6021802	12	126,3096348	-1689,23076
2011	3659698	568089,8	420	74040400	300	1500,734484	0	35,73177343	1	3,573177343						300,146897	340,4518475	1160,282636	232,0565273	232,0565273	928,2261091	13	432,5288026	-1256,70196
2012	4229853	570155	441	-235126510	300	1581,499673	0	35,8616706	1	3,58616706						316,299935	356,7477723	1224,751901	244,9503802	244,9503802	979,8015208	14	430,5153981	-826,186557
2013	4749729	519876	463,05	-219673000	300	1514,137227	0	32,69921664	1	3,269921664						302,827445	339,7965836	1174,340643	234,8681286	234,8681286	939,4725144	15	389,2458455	-436,940712
2014	5199452	449723	486,2025	-197355000	300	1375,307675	0	28,28672569	1	2,828672569						275,061535	307,1769332	1068,130742	213,6261483	213,6261483	854,5045933	16	333,8440466	-103,096665
2015	5857101,5	657649,5	510,512625	24858700	300	2111,730832	0	41,36490908	1	4,136490908	4000		900		980	422,346166	1448,847566	662,8832655	132,5766531	132,5766531	-3389,69339	17	-1248,76	-1351,85666
2016	7238121,5	1381020	536,0382563	719654400	300	4656,218303	0	86,8635447	1	8,68635447					980	931,243661	2007,79356	2648,424744	529,6849487	529,6849487	3098,739795	18	1076,447859	-275,408803
2017	8285802	1047680,5	562,8401691	666976200	300	3708,954668	0	65,89712093	1	6,589712093					980	741,790934	1795,277767	1913,676902	382,7353803	382,7353803	2510,941521	19	822,4960371	547,0872345
2018	8993714	707912	590,9821775	528222200	300	2631,426464	0	44,52632522	1	4,452632522					980	526,285293	1556,26425	1075,162213	215,0324426	215,0324426	1840,129771	20	568,3750358	1115,46227
2019	9561861	568147	620,5312864	517110300	300	2217,491586	0	35,7353712	1	3,57353712					980	443,498317	1463,807225	753,6843604	150,7368721	150,7368721	1582,947488	21	461,0440039	1576,506274
2020	10036004	474143	651,5578507	508983800	300	1943,121267	0	29,82269748	1	2,982269748						388,624253	422,4292207	1520,692047	304,1384093	304,1384093	1216,553637	22	334,1153733	1910,621647
2021	10433785	397781	684,1357432	491506700	231	1711,685202	0	25,01967218	1	2,501967218						342,33704	370,8586799	1340,826522	268,1653045	268,1653045	1072,661218	23	277,790317	2188,411964
2022	10772715	338930	718,3425304	486772700	231	1531,366603	0	21,31805564	1	2,131805564						306,273321	330,7231819	1200,643422	240,1286843	240,1286843	960,5147373	24	234,5567223	2422,968687
2023	11062583	289868	754,2596569	477554700	231	1375,177421	0	18,23214868	1	1,823214868						275,035484	296,0908478	1079,086573	215,8173147	215,8173147	863,2692587	25	198,7830979	2621,751785
2024	11291221	228638	791,9726398	471223300	231	1138,927739	0	14,38089755	1	1,438089755						227,785548	244,6045352	894,3232043	178,8646409	178,8646409	715,4585634	26	155,3484742	2777,100259
2025	11477687	186466	831,5712718	455548600	231	975,2966036	0	11,72835855	1	1,172835855						195,059321	208,9605151	766,3360885	153,2672177	153,2672177	613,0688708	27	125,5223605	2902,622619
2026	11622705	145018	873,1498354	447699000	231	796,4312046	0	9,121357783	1	0,912135778						159,286241	170,3197345	626,1114702	125,222294	125,222294	500,8891761	28	96,70363678	2999,326256
2027	11725622	102917	916,8073271	439238000	231	593,4754707	0	6,473284551	1	0,647328455						118,695094	126,8157071	466,6597635	93,3319527	93,3319527	373,3278108	29	67,96429729	3067,290553
2028	11821812	96190	962,6476935	430394000	231	582,4181214	0	6,05016898	1	0,605016898						116,483624	124,1388102	458,2793112	91,65586225	91,65586225	366,623449	30	62,93613274	3130,226686
2029	11910741	88929	1010,780078	390908000	231	565,3763819	0	5,59346582	1	0,559346582						113,075276	120,2280888	445,1482931	89,02965862	89,02965862	356,1186345	31	57,64529168	3187,871978
2030	11994316	83575	1061,319082	5195000	231	557,9045943	0	5,256709351	1	0,525670935						111,580919	118,3632992	439,5412952	87,90825904	87,90825904	351,6330362	32	53,67204454	3241,544022
2031	12074125	79809	1114,385036			559,4029095	0	5,019835078	1	0,501983508						111,880582	118,4024005	441,000509	88,2001018	88,2001018	352,8004072	33	50,77814993	3292,322172
2032	12150283	76158	1170,104288			560,5026641	0	4,790194087	1	0,479019409						112,100533	118,3697463	442,1329178	88,42658355	88,42658355	353,7063342	34	48,00428001	3340,326452
2033	12221917	71634	1228,609502			553,5675862	0	4,505643047	1	0,450564305						110,713517	116,6697246	436,8978616	87,37957232	87,37957232	349,5182893	35	44,72973819	3385,056191
2034	12290550	68633	1290,039977			556,8955294	0	4,316885826	1	0,431688583						111,379106	117,1276803	439,7678491	87,95356982	87,95356982	351,8142793	36	42,45503857	3427,511229
2035	12356858	66308	1354,541976			564,9317413	0	4,170647726	1	0,417064773						112,986348	118,5740608	446,3576805	89,27153611	89,27153611	357,0861444	37	40,63292659	3468,144156
2036	12421834	64976	1422,269075			581,2625183	0	4,086867446	1	0,408686745				200		116,252504	121,7480579	459,5144605	91,90289209	91,90289209	167,6115684	38	17,98450221	3486,128658
2037	12422357	523	1493,382529			4,912587908	0	0,03289571	1	0,003289571						0,98251758	2,018702863	2,893885045	0,578777009	0,578777009	2,315108036	39	0,234236743	
																						SUM	3486,128658	

12.2.2 Sensitivity Case: -2% of Oil and Gas Price

						INCOME		EXPENDITURE																
								OPEX			CAPEX													
DATE	FOPT	vol oil per year	oil prize	Vol gas per year	Gas prize	oil income	Gas income	Field / offshore	CO2 - duty	Gas oil transportation	Subsea	Production unit	Drilling	abandon	Cap Allowance	royalty	Fiscal allowance	Taxable income	Tax	Net tax	cash flow	i	NPV	cum NPV
	(SM3)	Sm3	(UsD/BBL)	Sm3	(cents per gallon)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)		(MNOK)	(MNOK)
1999	182525,08	182525,08	21,39	45087848	110,8333333	147,3405078	0	11,48048214	1	1,148048214	3500		1650		1030	29,4681016	1073,096632	-925,7561241	-185,1512248	-185,1512248	-4860,6049	1	-4583,31438	-4583,31438
2000	330533,16	148008,08	34,29	62183542	138,4	191,5321749	0	9,309428157	1	0,930942816					1030	38,306435	1079,546806	-888,0146311	-177,6029262	-177,6029262	319,5882952	2	284,1643022	-4299,15008
2001	538899,12	208365,96	28,03	103837010	139,3333333	220,413758	0	13,10582459	1	1,310582459					1030	44,0827516	1089,499159	-869,0854006	-173,8170801	-173,8170801	334,7316795	3	280,6498394	-4018,50024
2002	773933,00	235033,88	27,33	174349490	136,5	242,4146889	0	14,7831863	1	1,47831863					1030	48,4829378	1095,744443	-853,3297538	-170,6659508	-170,6659508	347,336197	4	274,6043126	-3743,89593
2003	1050589,6	276656,6	32,47	231690460	156	339,009723	0	17,40117662	1	1,740117662					1030	67,8019446	1117,943239	-778,9335159	-155,7867032	-155,7867032	406,8531873	5	303,3083443	-3440,58758
2004	1529299,5	478709,9	42,97	246407810	180,3333333	776,2946497	0	30,10994685	1	3,010994685						155,25893	189,3798715	586,9147782	117,3829556	117,3829556	469,5318226	6	330,0661556	-3110,52143
2005	2016984,5	487685	55,21	213079440	231	1016,122283	0	30,67446366	1	3,067446366						203,224457	237,9663666	778,1559164	155,6311833	155,6311833	622,5247331	7	412,6500488	-2697,87138
2006	2392377	375392,5	62,36	247841245	270	883,447057	0	23,6114779	1	2,36114779						176,689411	203,6620371	679,7850199	135,957004	135,957004	543,8280159	8	339,9195899	-2357,95179
2007	2732394,5	340017,5	66,66	132349455	300	855,3727476	0	21,38645734	1	2,138645734						171,07455	195,5996526	659,773095	131,954619	131,954619	527,818476	9	311,0917778	-2046,86001
2008	2926702,5	194308	91,35	210171400	300	669,8661981	0	12,22160551	1	1,222160551						133,97324	148,4170057	521,4491924	104,2898385	104,2898385	417,1593539	10	231,8436779	-1815,01633
2009	2926702,5	0	60	0	300	0	0	0	1	0						0	1	-1	-0,2	0	-1	11	-0,52406191	-1815,54039
2010	3091608,2	164905,7	400	-51295890	300	414,8902592	0	10,37225648	1	1,037225648						82,9780518	95,38753396	319,5027252	63,90054504	63,90054504	255,6021802	12	126,3096348	-1689,23076
2011	3659698	568089,8	392	74040400	300	1400,685518	0	35,73177343	1	3,573177343						280,137104	320,4420544	1080,243464	216,0486928	216,0486928	864,1947711	13	402,6918936	-1286,53886
2012	4229853	570155	384,16	-235126510	300	1377,661938	0	35,8616706	1	3,58616706						275,532388	315,9802252	1061,681713	212,3363425	212,3363425	849,34537	14	373,1942156	-913,344649
2013	4749729	519876	376,4768	-219673000	300	1231,049644	0	32,69921664	1	3,269921664						246,209929	283,1790672	947,8705772	189,5741154	189,5741154	758,2964617	15	314,1802904	-599,164358
2014	5199452	449723	368,947264	-197355000	300	1043,631005	0	28,28672569	1	2,828672569						208,726201	240,8415993	802,7894058	160,5578812	160,5578812	642,2315247	16	250,9116659	-348,252692
2015	5857101,5	657649,5	361,5683187	24858700	300	1495,624063	0	41,36490908	1	4,136490908	4000		900		980	299,124813	1325,626213	169,9978505	33,9995701	33,9995701	-3784,00172	17	-1394,02283	-1742,27552
2016	7238121,5	1381020	354,3369523	719654400	300	3077,89637	0	86,8635447	1	8,68635447					980	615,579274	1692,129173	1385,767197	277,1534394	277,1534394	2088,613757	18	725,547789	-1016,72773
2017	8285802	1047680,5	347,2502133	666976200	300	2288,27893	0	65,89712093	1	6,589712093					980	457,655786	1511,142619	777,1363108	155,4272622	155,4272622	1601,709049	19	524,6634913	-492,064243
2018	8993714	707912	340,305209	528222200	300	1515,254041	0	44,52632522	1	4,452632522					980	303,050808	1333,029766	182,2242752	36,44485504	36,44485504	1125,77942	20	347,7281486	-144,336095
2019	9561861	568147	333,4991049	517110300	300	1191,771431	0	35,7353712	1	3,57353712					980	238,354286	1258,663194	-66,89176383	-13,37835277	-13,37835277	926,4865889	21	269,8453926	125,5092981
2020	10036004	474143	326,8291228	508983800	300	974,6926056	0	29,82269748	1	2,982269748						194,938521	228,7434883	745,9491172	149,1898234	149,1898234	596,7592938	22	163,8945034	289,4038015
2021	10433785	397781	320,2925403	491506700	231	801,361436	0	25,01967218	1	2,501967218						160,272287	188,7939266	612,5675094	122,5135019	122,5135019	490,0540075	23	126,9107672	416,3145687
2022	10772715	338930	313,8866895	486772700	231	669,1453913	0	21,31805564	1	2,131805564						133,829078	158,2789395	510,8664518	102,1732904	102,1732904	408,6931614	24	99,80245452	516,1170232
2023	11062583	289868	307,6089557	477554700	231	560,8372217	0	18,23214868	1	1,823214868						112,167444	133,2228079	427,6144138	85,52288276	85,52288276	342,091531	25	78,77265826	594,8896815
2024	11291221	228638	301,4567766	471223300	231	433,521902	0	14,38089755	1	1,438089755						86,7043804	103,5233677	329,9985343	65,99970685	65,99970685	263,9988274	26	57,32241827	652,2120997
2025	11477687	186466	295,4276411	455548600	231	346,48813	0	11,72835855	1	1,172835855						69,297626	83,19882041	263,2893096	52,65786192	52,65786192	210,6314477	27	43,1255896	695,3376894
2026	11622705	145018	289,5190882	447699000	231	264,0807189	0	9,121357783	1	0,912135778						52,8161438	63,84963734	200,2310815	40,04621631	40,04621631	160,1848652	28	30,92592087	726,2636102
2027	11725622	102917	283,7287065	439238000	231	183,6656652	0	6,473284551	1	0,647328455						36,733133	44,85374605	138,8119192	27,76238383	27,76238383	111,0495353	29	20,21655878	746,480169
2028	11821812	96190	278,0541323	430394000	231	168,2274486	0	6,05016898	1	0,605016898						33,6454897	41,3006756	126,926773	25,3853546	25,3853546	101,5414184	30	17,43102959	763,9111986
2029	11910741	88929	272,4930497	390908000	231	152,418056	0	5,59346582	1	0,559346582						30,4836112	37,6364236	114,7816324	22,95632647	22,95632647	91,8253059	31	14,86385724	778,7750558
2030	11994316	83575	267,0431887	5195000	231	140,3768427	0	5,25670935	1	0,525670935						28,0753685	34,85774883	105,5190939	21,10381878	21,10381878	84,41527512	32	12,88485421	791,65991
2031	12074125	79809	261,7023249			131,3702511	0	5,01983508	1	0,501983508						26,2740502	32,7958688	98,57438226	19,71487645	19,71487645	78,85950581	33	11,35015643	803,0100665
2032	12150283	76158	256,4682784			122,8532831	0	4,79019487	1	0,479019409						24,5706566	30,83987011	92,01341296	18,40268259	18,40268259	73,61073037	34	9,990293558	813,00036
2033	12221917	71634	251,3389129			113,2443425	0	4,50564304 7	1	0,450564305						22,6488685	28,60507586	84,63926667	16,92785333	16,92785333	67,71141333	35	8,665394298	821,6657543
2034	12290550	68633	246,3121346			106,3301363	0	4,31688582 6	1	0,431688583						21,2660273	27,01460166	79,3155346	15,86310692	15,86310692	63,45242768	36	7,657094732	829,3228491
2035	12356858	66308	241,3858919			100,6735521	0	4,170647726	1	0,417064773						20,1347104	25,72242292	74,95112919	14,99022584	14,99022584	59,96090335	37	6,822967013	836,1458161
2036	12421834	64976	236,5581741			96,67819008	0	4,086867446	1	0,408686745				200		19,335638	24,83119221	71,84699787	14,36939957	14,36939957	-142,522402	38	-15,2924674	820,8533487
2037	12422357	523	231,8270106			0,762611419	0	0,03289571	1	0,003289571						0,15252228	1,188707565	-0,426096146	-0,085219229	-0,085219229	-0,34087692	39	-0,03448906	
																						SUM	820,8533487	

12.2.3 Sensitivity Case: +30 % of Oil and Gas Production

						INCOME		EXPENDITURE																
								OPEX			CAPEX													
DATE	FOPT	vol oil per year	oil prize	Vol gas per year	Gas prize	oil income	Gas income	Field / offshore	CO2 - duty	Gas oil transportation	Subsea	Production unit	Drilling	abandon	Cap Allowance	royalty	Fiscal allowance	Taxable income	Tax	Net tax	cash flow	i	NPV	cum NPV
	(SM3)	Sm3	(UsD/BBL)	Sm3	(cents per gallon)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)		(MNOK)	(MNOK)
1999	237282,60	237282,604	21,39	45087848	110,8333333	191,5426601	0	14,92462678	1	1,492462678	3500		1650		1030	38,308532	1085,725621	-894,1829614	-178,8365923	-178,8365923	-4835,34637	1	-4559,49681	-4559,49681
2000	429693,11	192410,504	34,29	62183542	138,4	248,9918274	0	12,1022566	1	1,21022566					1030	49,7983655	1094,110848	-845,1190204	-169,0238041	-169,0238041	353,9047837	2	314,6770624	-4244,81975
2001	700568,86	270875,748	28,03	103837010	139,3333333	286,5378854	0	17,03757197	1	1,703757197					1030	57,3075771	1107,048906	-820,5110208	-164,1022042	-164,1022042	373,5911833	3	313,2309011	-3931,58885
2002	1006112,90	305544,044	27,33	174349490	136,5	315,1390956	0	19,21814219	1	1,921814219					1030	63,0278191	1115,167776	-800,0286799	-160,005736	-160,005736	389,9770561	4	308,3162145	-3623,27263
2003	1365766,48	359653,58	32,47	231690460	156	440,7126399	0	22,62152961	1	2,262152961					1030	88,142528	1144,026211	-703,3135707	-140,6627141	-140,6627141	467,3491435	5	348,4079745	-3274,86466
2004	1988089,35	622322,87	42,97	246407810	180,3333333	1009,183045	0	39,1429309	1	3,91429309						201,836609	245,8938329	763,2892117	152,6578423	152,6578423	610,6313693	6	429,2547148	-2845,60994
2005	2622079,85	633990,5	55,21	213079440	231	1320,958968	0	39,87680275	1	3,987680275						264,191794	309,0562766	1011,902691	202,3805383	202,3805383	809,5221531	7	536,6041511	-2309,00579
2006	3110090,10	488010,25	62,36	247841245	270	1148,481174	0	30,69492127	1	3,069492127						229,696235	264,4606482	884,0205259	176,8041052	176,8041052	707,2164207	8	442,0454789	-1866,96031
2007	3552112,85	442022,75	66,66	132349455	300	1111,984572	0	27,80239454	1	2,780239454						222,396914	253,9795484	858,0050235	171,6010047	171,6010047	686,4040188	9	404,5607651	-1462,39955
2008	3804713,25	252600,4	91,35	210171400	300	870,8260575	0	15,88808717	1	1,588808717						174,165212	192,6421074	678,1839501	135,63679	135,63679	542,5471601	10	301,5301655	-1160,86938
2009	3804713,25	0	60	0	300	0	0	0	1	0						0	1	-1	-0,2	0	-1	11	-0,52406191	-1161,39345
2010	4019090,66	214377,41	400	-51295890	300	539,3573369	0	13,48393342	1	1,348393342						107,871467	123,7037942	415,6535428	83,13070856	83,13070856	332,5228342	12	164,3211249	-997,072321
2011	4757607,40	738516,74	412	74040400	300	1913,793785	0	46,45130545	1	4,645130545						382,758757	434,8551929	1478,938592	295,7877184	295,7877184	1183,150873	13	551,3169966	-445,755325
2012	5498808,90	741201,5	424,36	-235126510	300	1978,37361	0	46,62017178	1	4,662017178						395,674722	447,9569109	1530,416699	306,0833397	306,0833397	1224,333359	14	537,9603442	92,20501968
2013	6174647,70	675838,8	437,0908	-219673000	300	1858,028479	0	42,50898163	1	4,250898163						371,605696	419,3655756	1438,662903	287,7325807	287,7325807	1150,930323	15	476,8578534	569,0628731
2014	6759287,60	584639,9	450,203524	-197355000	300	1655,521867	0	36,7727434	1	3,67727434						331,104373	372,554391	1282,967475	256,5934951	256,5934951	1026,37398	16	400,9912242	970,0540973
2015	7614231,95	854944,35	463,7096297	24858700	300	2493,569868	0	53,77438181	1	5,377438181	4000		900		980	498,713974	1538,865794	954,7040741	190,9408148	190,9408148	-3156,23674	17	-1162,75478	-192,70068
2016	9409557,95	1795326	477,6209186	719654400	300	5393,419982	0	112,9226081	1	11,29226081					980	1078,684	2183,898865	3209,521117	641,9042233	641,9042233	3547,616893	18	1232,37989	1039,67921
2017	10771542,60	1361984,65	491,9495462	666976200	300	4214,347636	0	85,66625721	1	8,566625721					980	842,869527	1918,10241	2296,245225	459,2490451	459,2490451	2816,99618	19	922,7487678	1962,427978
2018	11691828,20	920285,6	506,7080326	528222200	300	2933,040064	0	57,88422279	1	5,788422279					980	586,608013	1631,280658	1301,759407	260,3518813	260,3518813	2021,407525	20	624,3676902	2586,795668
2019	12430419,30	738591,1	521,9092735	517110300	300	2424,580811	0	46,45598256	1	4,645598256					980	484,916162	1517,017743	907,5630678	181,5126136	181,5126136	1706,050454	21	496,8985563	3083,694231
2020	13046805,20	616385,9	537,5665517	508983800	300	2084,119004	0	38,76950673	1	3,876950673						416,823801	460,4702583	1623,648746	324,7297492	324,7297492	1298,918997	22	356,7362689	3440,4305
2021	13563920,50	517115,3	553,6935483	491506700	231	1800,920039	0	32,52557383	1	3,252557383						360,184008	396,962139	1403,9579	280,7915799	280,7915799	1123,16632	23	290,8697759	3731,300276
2022	14004529,50	440609	570,3043547	486772700	231	1580,511396	0	27,71347234	1	2,771347234						316,102279	347,5870988	1232,924297	246,5848594	246,5848594	986,3394377	24	240,8630879	3972,163364
2023	14381357,90	376828,4	587,4134854	477554700	231	1392,275301	0	23,70179329	1	2,370179329						278,45506	305,5270327	1086,748268	217,3496536	217,3496536	869,3986143	25	200,194491	4172,357855
2024	14678587,30	297229,4	605,0358899	471223300	231	1131,124689	0	18,69516681	1	1,869516681						226,224938	247,7896213	883,3350678	176,6670136	176,6670136	706,6680542	26	153,4397792	4325,797634
2025	14920993,10	242405,8	623,1869666	455548600	231	950,1648246	0	15,24686612	1	1,524686612						190,032965	207,8045176	742,3603069	148,4720614	148,4720614	593,8882456	27	121,5952367	4447,392871
2026	15109516,50	188523,4	641,8825756	447699000	231	761,1292815	0	11,85776512	1	1,185776512						152,225856	166,2693979	594,8598836	118,9719767	118,9719767	475,8879069	28	91,87679329	4539,269664
2027	15243308,60	133792,1	661,1390529	439238000	231	556,3663582	0	8,415269916	1	0,841526992						111,273272	121,5300685	434,8362897	86,96725793	86,96725793	347,8690317	29	63,32952865	4602,599193
2028	15368355,60	125047	680,9732245	430394000	231	535,6004003	0	7,865219674	1	0,786521967						107,12008	116,7718217	418,8285786	83,76571572	83,76571572	335,0628629	30	57,51830896	4660,117502
2029	15483963,30	115607,7	701,4024212	390908000	231	510,025161	0	7,271505566	1	0,727150557						102,005032	111,0036883	399,0214727	79,80429454	79,80429454	319,2171781	31	51,67201477	4711,789516
2030	15592610,80	108647,5	722,4444939	5195000	231	493,6984945	0	6,833722157	1	0,683372216						98,7396989	107,2567933	386,4417012	77,28834024	77,28834024	309,153361	32	47,18809456	4758,977611
2031	15696362,50	103751,7	744,1178287			485,5953412	0	6,525785601	1	0,65257856						97,1190682	105,2974324	380,2979088	76,05958176	76,05958176	304,238327	33	43,78866654	4802,766278
2032	15795367,90	99005,4	766,4413635			477,2823754	0	6,227252313	1	0,622725231						95,4564751	103,3064526	373,9759227	74,79518455	74,79518455	299,1807382	34	40,60418075	4843,370458
2033	15888492,10	93124,2	789,4346045			462,3983698	0	5,857335961	1	0,585733596						92,479674	99,92274352	362,4756263	72,49512525	72,49512525	289,980501	35	37,11036672	4880,480825
2034	15977715,00	89222,9	813,1176426			456,3176834	0	5,611951574	1	0,561195157						91,2635367	98,43668341	357,881	71,5762	71,5762	286,3048	36	34,54971001	4915,030535
2035	16063915,40	86200,4	837,5111719			454,0853283	0	5,421842043	1	0,542184204						90,8170657	97,78109192	356,3042364	71,26084728	71,26084728	285,0433891	37	32,43516246	4947,465697
2036	16148384,20	84468,8	862,636507			458,3125376	0	5,31292768	1	0,531292768				200		91,6625075	98,50672797	359,8058096	71,96116193	71,96116193	87,8446477	38	9,42561588	4956,891313
2037	16149064,10	679,9	888,5156022			3,799685744	0	0,042764423	1	0,004276442						0,75993715	1,806978014	1,992707729	0,398541546	0,398541546	1,594166183	39	0,16129368	
																						SUM	4956,891313	

12.2.4 Sensitivity Case: -30 % of Oil and Gas Production

						INCOME		EXPENDITURE																
								OPEX			CAPEX													
DATE	FOPT	vol oil per year	oil prize	Vol gas per year	Gas prize	oil income	Gas income	Field / offshore	CO2 - duty	Gas oil transportation	Subsea	Production unit	Drilling	abandon	Cap Allowance	royalty	Fiscal allowance	Taxable income	Tax	Net tax	cash flow	i	NPV	cum NPV
	(SM3)	Sm3	(UsD/BBL)	Sm3	(cents per gallon)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)		(MNOK)	(MNOK)
1999	177049,33	177049,3276	21,39	45087848	110,8333333	142,9202926	0	11,13606768	1	1,113606768	3500		1650		1030	28,5840585	1071,833733	-928,9134404	-185,7826881	-185,7826881	-4863,13075	1	-4585,69614	-4585,69614
2000	320617,17	143567,8376	34,29	62183542	138,4	185,7862097	0	9,030145312	1	0,903014531					1030	37,1572419	1078,090402	-892,3041921	-178,4608384	-178,4608384	316,1566463	2	281,1130262	-4304,58311
2001	522732,15	202114,9812	28,03	103837010	139,3333333	213,8013453	0	12,71264986	1	1,271264986					1030	42,7602691	1087,744184	-873,9428386	-174,7885677	-174,7885677	330,8457291	3	277,3917332	-4027,19138
2002	750715,01	227982,8636	27,33	174349490	136,5	235,1422483	0	14,33969071	1	1,433969071					1030	47,0284497	1093,802109	-858,6598612	-171,7319722	-171,7319722	343,0721111	4	271,2331224	-3755,95825
2003	########	268356,902	32,47	231690460	156	328,8394313	0	16,87914133	1	1,687914133					1030	65,7678863	1115,334942	-786,4955104	-157,2991021	-157,2991021	400,8035917	5	298,7983813	-3457,15987
2004	########	464348,603	42,97	246407810	180,3333333	753,0058102	0	29,20664844	1	2,920664844						150,601162	183,7284753	569,2773349	113,855467	113,855467	455,4218679	6	320,1472997	-3137,01257
2005	########	473054,45	55,21	213079440	231	985,6386146	0	29,75422975	1	2,975422975						197,127723	230,8573756	754,7812389	150,9562478	150,9562478	603,8249911	7	400,2546386	-2736,75793
2006	########	364130,725	62,36	247841245	270	856,9436453	0	22,90313356	1	2,290313356						171,388729	197,582176	659,3614693	131,8722939	131,8722939	527,4891754	8	329,707001	-2407,05093
2007	########	329816,975	66,66	132349455	300	829,7115652	0	20,74486362	1	2,074486362						165,942313	189,761663	639,9499022	127,9899804	127,9899804	511,9599217	9	301,744879	-2105,30605
2008	########	188478,76	91,35	210171400	300	649,7702122	0	11,85495735	1	1,185495735						129,954042	143,9944955	505,7757166	101,1551433	101,1551433	404,6205733	10	224,8750291	-1880,43103
2009	########	0	60	0	300	0	0	0	1	0						0	1	-1	-0,2	0	-1	11	-0,52406191	-1880,95509
2010	########	159958,529	400	-51295890	300	402,4435514	0	10,06108879	1	1,006108879						80,4887103	92,55590795	309,8876435	61,97752869	61,97752869	247,9101148	12	122,5084858	-1758,4466
2011	########	551047,106	412	74040400	300	1427,984593	0	34,65982022	1	3,465982022						285,596919	324,7227209	1103,261872	220,6523745	220,6523745	882,6094979	13	411,272669	-1347,17393
2012	########	553050,35	424,36	-235126510	300	1476,171078	0	34,78582048	1	3,478582048						295,234216	334,4986181	1141,67246	228,334492	228,334492	913,3379678	14	401,3119498	-945,861983
2013	########	504279,72	437,0908	-219673000	300	1386,375096	0	31,71824014	1	3,171824014						277,275019	313,1650833	1073,210012	214,6420025	214,6420025	858,56801	15	355,7251818	-590,136801
2014	########	436231,31	450,203524	-197355000	300	1235,274008	0	27,43812392	1	2,743812392						247,054802	278,2367379	957,0372702	191,407454	191,407454	765,6298161	16	299,1218046	-291,014996
2015	########	637920,015	463,7096297	24858700	300	1860,586747	0	40,12396181	1	4,012396181	4000		900		980	372,117349	1397,253707	463,3330399	92,66660798	92,66660798	-3549,33357	17	-1307,57129	-1598,58629
2016	########	1339589,4	477,6209186	719654400	300	4024,321063	0	84,25763836	1	8,425763836					980	804,864213	1878,547615	2145,773449	429,1546897	429,1546897	2696,618759	18	936,7580632	-661,828228
2017	########	1016250,085	491,9495462	666976200	300	3144,551697	0	63,9202073	1	6,39202073					980	628,910339	1680,222567	1464,32913	292,865826	292,865826	2151,463304	19	704,7436295	42,91540133
2018	########	686674,64	506,7080326	528222200	300	2188,499125	0	43,19053546	1	4,319053546					980	437,699825	1466,209414	722,289711	144,4579422	144,4579422	1557,831769	20	481,1794807	524,094882
2019	########	551102,59	521,9092735	517110300	300	1809,110297	0	34,66331006	1	3,466331006					980	361,822059	1380,951701	428,1585967	85,63171935	85,63171935	1322,526877	21	385,1947657	909,2896477
2020	########	459918,71	537,5665517	508983800	300	1555,073411	0	28,92801656	1	2,892801656						311,014682	343,8355004	1211,237911	242,2475821	242,2475821	968,9903284	22	266,1243659	1175,414014
2021	########	385847,57	553,6935483	491506700	231	1343,763413	0	24,26908202	1	2,426908202						268,752683	296,4486729	1047,314741	209,4629481	209,4629481	837,8517925	23	216,9810105	1392,395024
2022	########	328762,1	570,3043547	486772700	231	1179,304657	0	20,67851397	1	2,067851397						235,860931	259,6072968	919,6973602	183,939472	183,939472	735,7578881	24	179,6713283	1572,066352
2023	########	281171,96	587,4134854	477554700	231	1038,85157	0	17,68518422	1	1,768518422						207,770314	228,2240167	810,6275537	162,1255107	162,1255107	648,502043	25	149,3291274	1721,39548
2024	########	221778,86	605,0358899	471223300	231	843,9930372	0	13,94947062	1	1,394947062						168,798607	185,1430251	658,8500121	131,7700024	131,7700024	527,0800097	26	114,445587	1835,841067
2025	########	180872,02	623,1869666	455548600	231	708,9691384	0	11,37650779	1	1,137650779						141,793828	155,3079862	553,6611521	110,7322304	110,7322304	442,9289217	27	90,68717473	1926,528241
2026	########	140667,46	641,8825756	447699000	231	567,9195408	0	8,847717051	1	0,884771705						113,583908	124,3163969	443,6031439	88,72062878	88,72062878	354,8825151	28	68,51501585	1995,043257
2027	########	99829,49	661,1390529	439238000	231	415,134898	0	6,279086014	1	0,627908601						83,0269796	90,93397423	324,2009238	64,84018476	64,84018476	259,3607391	29	47,21660124	2042,259859
2028	########	93304,3	680,9732245	430394000	231	399,6402987	0	5,868663911	1	0,586866391						79,9280597	87,38359004	312,2567086	62,45134173	62,45134173	249,8053669	30	42,88264641	2085,142505
2029	########	86261,13	701,4024212	390908000	231	380,5572355	0	5,425661845	1	0,542566185						76,1114471	83,07967513	297,4775604	59,49551208	59,49551208	237,9820483	31	38,52240029	2123,664905
2030	########	81067,75	722,4444939	5195000	231	368,3750305	0	5,099008071	1	0,509900807						73,6750061	80,28391498	288,0911155	57,6182231	57,6182231	230,4728924	32	35,17858129	2158,843487
2031	########	77414,73	744,1178287			362,3288315	0	4,869240025	1	0,486924003						72,4657663	78,82193033	283,5069012	56,70138024	56,70138024	226,8055209	33	32,64385333	2191,48734
2032	########	73873,26	766,4413635			356,1260801	0	4,646488264	1	0,464648826						71,225216	77,3363531	278,789727	55,75794539	55,75794539	223,0317816	34	30,26940447	2221,756744
2033	########	69484,98	789,4346045			345,0203221	0	4,370473756	1	0,437047376						69,0040644	74,81158555	270,2087365	54,04174731	54,04174731	216,1669892	35	27,66405401	2249,420798
2034	########	66574,01	813,1176426			340,4831945	0	4,187379251	1	0,418737925						68,0966389	73,70275608	266,7804385	53,35608769	53,35608769	213,4243508	36	25,75489278	2275,175691
2035	########	64318,76	837,5111719			338,8175142	0	4,045528294	1	0,404552829						67,7635028	73,21358397	265,6039303	53,12078605	53,12078605	212,4831442	37	24,17851304	2299,354204
2036	########	63026,72	862,636507			341,9716627	0	3,964261423	1	0,396426142				200		68,3943325	73,7550201	268,2166426	53,64332851	53,64332851	214,57331406	38	1,56369755	2300,917902
2037	########	507,31	888,5156022			2,835150132	0	0,031908839	1	0,003190884						0,56703003	1,602129749	1,233020382	0,246604076	0,246604076	0,986416306	39	0,099803093	
																						SUM	2300,917902	

12.2.5 Sensitivity Case: +40 % of Investment Cost

						INCOME		EXPENDITURE																
								OPEX			CAPEX													
DATE	FOPT	vol oil per year	oil prize	Vol gas per year	Gas prize	oil income	Gas income	Field / offshore	CO2 - duty	Gas oil transportation	Subsea	Production unit	Drilling	abandon	Cap Allowance	royalty	Fiscal allowance	Taxable income	Tax	Net tax	cash flow	i	NPV	cum NPV
	(SM3)	Sm3	(USD/BBL)	Sm3	(cents per gallon)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)		(MNOK)	(MNOK)
1999	182525,08	182525,08	21,39	45087848	110,8333333	147,3405078	0	11,48048214	1	1,148048214	4900		2310		1442	29,4681016	1485,096632	-1337,756124	-267,5512248	-267,5512248	-6838,2049	1	-6448,09514	-6448,09514
2000	330533,16	148008,08	34,29	62183542	138,4	191,5321749	0	9,309428157	1	0,930942816					1442	38,306435	1491,546806	-1300,014631	-260,0029262	-260,0029262	401,9882952	2	357,4308732	-6090,66427
2001	538899,12	208365,96	28,03	103837010	139,3333333	220,413758	0	13,10582459	1	1,310582459					1442	44,0827516	1501,499159	-1281,085401	-256,2170801	-256,2170801	417,1316795	3	349,7366578	-5740,92761
2002	773933,00	235033,88	27,33	174349490	136,5	242,4146889	0	14,7831863	1	1,47831863					1442	48,4829378	1507,744443	-1265,329754	-253,0659508	-253,0659508	429,736197	4	339,7498274	-5401,17778
2003	1050589,6	276656,6	32,47	231690460	156	339,009723	0	17,40117662	1	1,740117662					1442	67,8019446	1529,943239	-1190,933516	-238,1867032	-238,1867032	489,2531873	5	364,7374012	-5036,44038
2004	1529299,5	478709,9	42,97	246407810	180,3333333	776,2946497	0	30,10994685	1	3,010994685						155,25893	189,3798715	586,9147782	117,3829556	117,3829556	469,5318226	6	330,0661556	-4706,37423
2005	2016984,5	487685	55,21	213079440	231	1016,122283	0	30,67446366	1	3,067446366						203,224457	237,9663666	778,1559164	155,6311833	155,6311833	622,5247331	7	412,6500488	-4293,72418
2006	2392377	375392,5	62,36	247841245	270	883,447057	0	23,6114779	1	2,36114779						176,689411	203,6620371	679,7850199	135,957004	135,957004	543,8280159	8	339,9195899	-3953,80459
2007	2732394,5	340017,5	66,66	132349455	300	855,3727476	0	21,38645734	1	2,138645734						171,07455	195,5996526	659,773095	131,954619	131,954619	527,818476	9	311,0917778	-3642,71281
2008	2926702,5	194308	91,35	210171400	300	669,8661981	0	12,22160551	1	1,222160551						133,97324	148,4170057	521,4491924	104,2898385	104,2898385	417,1593539	10	231,8436779	-3410,86913
2009	2926702,5	0	60	0	300	0	0	0	1	0						0	1	-1	-0,2	0	-1	11	-0,52406191	-3411,3932
2010	3091608,2	164905,7	400	-51295890	300	414,8902592	0	10,37225648	1	1,037225648						82,9780518	95,38753396	319,5027252	63,90054504	63,90054504	255,6021802	12	126,3096348	-3285,08356
2011	3659698	568089,8	412	74040400	300	1472,149065	0	35,73177343	1	3,573177343						294,429813	334,7347638	1137,414301	227,4828603	227,4828603	909,9314411	13	424,0039715	-2861,07959
2012	4229853	570155	424,36	-235126510	300	1521,825854	0	35,8616706	1	3,58616706						304,365171	344,8130084	1177,012845	235,402569	235,402569	941,6102761	14	413,7345311	-2447,34506
2013	4749729	519876	437,0908	-219673000	300	1429,252676	0	32,69921664	1	3,269921664						285,850535	322,8196735	1106,433003	221,2866005	221,2866005	885,1464021	15	366,7372428	-2080,60782
2014	5199452	449723	450,203524	-197355000	300	1273,478359	0	28,28672569	1	2,828672569						254,695672	286,81107	986,6672888	197,3334578	197,3334578	789,3338311	16	308,382661	-1772,22515
2015	5857101,5	657649,5	463,7096297	24858700	300	1918,130667	0	41,36490908	1	4,136490908	5600		1260		1372	383,626133	1802,127533	116,0031339	23,20062679	23,20062679	-5395,19749	17	-1987,58591	-3759,81106
2016	7238121,5	1381020	477,6209186	719654400	300	4148,784601	0	86,8635447	1	8,68635447					1372	829,75692	2298,306819	1850,477782	370,0955564	370,0955564	2852,382226	18	990,8675597	-2768,9435
2017	8285802	1047680,5	491,9495462	666976200	300	3241,805873	0	65,89712093	1	6,589712093					1372	648,361175	2093,848008	1147,957866	229,5915732	229,5915732	2290,366293	19	750,2433581	-2018,70014
2018	8993714	707912	506,7080326	528222200	300	2256,184665	0	44,52632522	1	4,452632522					1372	451,236933	1873,215891	382,9687742	76,59375485	76,59375485	1678,375019	20	518,4126017	-1500,28754
2019	9561861	568147	521,9092735	517110300	300	1865,062162	0	35,7353712	1	3,57353712					1372	373,012432	1785,321341	79,74082138	15,94816428	15,94816428	1435,792657	21	418,1841788	-1082,10336
2020	10036004	474143	537,5665517	508983800	300	1603,168465	0	29,82269748	1	2,982269748						320,633693	354,4386602	1248,729805	249,7459609	249,7459609	998,9838437	22	274,3618116	-807,74155
2021	10433785	397781	553,6935483	491506700	231	1385,323107	0	25,01967218	1	2,501967218						277,064621	305,5862607	1079,736846	215,9473692	215,9473692	863,7894768	23	223,698171	-584,043378
2022	10772715	338930	570,3043547	486772700	231	1215,777997	0	21,31805564	1	2,131805564						243,155599	267,6054606	948,1725363	189,6345073	189,6345073	758,538029	24	185,2342155	-398,809163
2023	11062583	289868	587,4134854	477554700	231	1070,981	0	18,23214868	1	1,823214868						214,1962	235,2515636	835,7294368	167,1458874	167,1458874	668,5835494	25	153,9532513	-244,855912
2024	11291221	228638	605,0358899	471223300	231	870,0959147	0	14,38089755	1	1,438089755						174,019183	190,8381702	679,2577444	135,8515489	135,8515489	543,4061956	26	117,9905136	-126,865398
2025	11477687	186466	623,1869666	455548600	231	730,8960189	0	11,72835855	1	1,172835855						146,179204	160,0803982	570,8156207	114,1631241	114,1631241	456,6524966	27	93,49699855	-33,3683995
2026	11622705	145018	641,8825756	447699000	231	585,4840627	0	9,121357783	1	0,912135778						117,096813	128,1303061	457,3537566	91,47075132	91,47075132	365,8830053	28	70,6388138	37,2704143
2027	11725622	102917	661,1390529	439238000	231	427,9741217	0	6,473284551	1	0,647328455						85,5948243	93,71543735	334,2586844	66,85173687	66,85173687	267,4069475	29	48,68141282	85,95182711
2028	11821812	96190	680,9732245	430394000	231	412,0003079	0	6,05016898	1	0,605016898						82,4000616	90,05524746	321,9450605	64,38901209	64,38901209	257,5560484	30	44,21316119	130,1649883
2029	11910741	88929	701,4024212	390908000	231	392,3270469	0	5,59346582	1	0,559346582						78,4654094	85,61822179	306,7088251	61,34176503	61,34176503	245,3670601	31	39,71781979	169,8828081
2030	11994316	83575	722,4444939	5195000	231	379,7680727	0	5,256709351	1	0,525670935						75,9536145	82,73599482	297,0320779	59,40641557	59,40641557	237,6256623	32	36,27035523	206,1531633
2031	12074125	79809	744,1178287			373,5348778	0	5,019835078	1	0,501983508						74,7069756	81,22879415	292,3060837	58,46121674	58,46121674	233,844867	33	33,65701817	239,8101815
2032	12150283	76158	766,4413635			367,1402887	0	4,790194087	1	0,479019409						73,4280577	79,69727124	287,4430175	57,4886035	57,4886035	229,954414	34	31,20892958	271,0191111
2033	12221917	71634	789,4346045			355,6910537	0	4,505643047	1	0,450564305						71,1382107	77,09441809	278,5966356	55,71932712	55,71932712	222,8773085	35	28,52280972	299,5419208
2034	12290550	68633	813,1176426			351,0136026	0	4,316885826	1	0,431688583						70,2027205	75,95129493	275,0623077	55,01246154	55,01246154	220,0498461	36	26,55442162	326,0963424
2035	12356858	66308	837,5111719			349,2964064	0	4,170647726	1	0,417064773						69,8592813	75,44699378	273,8494126	54,76988253	54,76988253	219,0795301	37	24,92911754	351,0254599
2036	12421834	64976	862,636507			352,5481058	0	4,086867446	1	0,408686745				280		70,5096212	76,00517536	276,5429305	55,3085861	55,3085861	-58,7656556	38	-6,30547804	344,7199819
2037	12422357	523	888,5156022			2,922835187	0	0,03289571	1	0,003289571						0,58456704	1,620752319	1,302082869	0,260416574	0,260416574	1,041666295	39	0,105393147	
																						SUM	344,7199819	

12.2.6 Sensitivity Case: -40 % of Investment Cost

						INCOME		EXPENDITURE																
								OPEX			CAPEX													
DATE	FOPT	vol oil per year	oil prize	Vol gas per year	Gas prize	oil income	Gas income	Field / offshore	CO2 - duty	Gas oil transportation	Subsea	Production unit	Drilling	abandon	Cap Allowance	royalty	Fiscal allowance	Taxable income	Tax	Net tax	cash flow	i	NPV	cum NPV
	(SM3)	Sm3	(UsD/BBL)	Sm3	(cents per gallon)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)		(MNOK)	(MNOK)
1999	182525,08	182525,08	21,39	45087848	110,8333333	147,3405078	0	11,48048214	1	1,148048214	2100		990		618	29,4681016	661,0966319	-513,7561241	-102,7512248	-102,7512248	-2883,0049	1	-2718,53362	-2718,53362
2000	330533,16	148008,08	34,29	62183542	138,4	191,5321749	0	9,309428157	1	0,930942816					618	38,306435	667,546806	-476,0146311	-95,20292621	-95,20292621	237,1882952	2	210,8977313	-2507,63588
2001	538899,12	208365,96	28,03	103837010	139,3333333	220,413758	0	13,10582459	1	1,310582459					618	44,0827516	677,4991587	-457,0854006	-91,41708013	-91,41708013	252,3316795	3	211,5630209	-2296,07286
2002	773933,00	235033,88	27,33	174349490	136,5	242,4146889	0	14,7831863	1	1,47831863					618	48,4829378	683,7444427	-441,3297538	-88,26595076	-88,26595076	264,936197	4	209,4587978	-2086,61407
2003	1050589,6	276656,6	32,47	231690460	156	339,009723	0	17,40117662	1	1,740117662					618	67,8019446	705,9432389	-366,9335159	-73,38670318	-73,38670318	324,4531873	5	241,8792875	-1844,73478
2004	1529299,5	478709,9	42,97	246407810	180,3333333	776,2946497	0	30,10994685	1	3,010994685						155,25893	189,3798715	586,9147782	117,3829556	117,3829556	469,5318226	6	330,0661556	-1514,66862
2005	2016984,5	487685	55,21	213079440	231	1016,122283	0	30,67446366	1	3,067446366						203,224457	237,9663666	778,1559164	155,6311833	155,6311833	622,5247331	7	412,6500488	-1102,01857
2006	2392377	375392,5	62,36	247841245	270	883,447057	0	23,6114779	1	2,36114779						176,689411	203,6620371	679,7850199	135,957004	135,957004	543,8280159	8	339,9195899	-762,098984
2007	2732394,5	340017,5	66,66	132349455	300	855,3727476	0	21,38645734	1	2,138645734						171,07455	195,5996526	659,773095	131,954619	131,954619	527,818476	9	311,0917778	-451,007206
2008	2926702,5	194308	91,35	210171400	300	669,8661981	0	12,22160551	1	1,222160551						133,97324	148,4170057	521,4491924	104,2898385	104,2898385	417,1593539	10	231,8436779	-219,163528
2009	2926702,5	0	60	0	300	0	0	0	1	0						0	1	-1	-0,2	0	-1	11	-0,52406191	-219,68759
2010	3091608,2	164905,7	400	-51295890	300	414,8902592	0	10,37225648	1	1,037225648						82,9780518	95,38753396	319,5027252	63,90054504	63,90054504	255,6021802	12	126,3096348	-93,3779552
2011	3659698	568089,8	412	74040400	300	1472,149065	0	35,73177343	1	3,573177343						294,429813	334,7347638	1137,414301	227,4828603	227,4828603	909,9314411	13	424,0039715	330,6260163
2012	4229853	570155	424,36	-235126510	300	1521,825854	0	35,8616706	1	3,58616706						304,365171	344,8130084	1177,012845	235,402569	235,402569	941,6102761	14	413,7345311	744,3605475
2013	4749729	519876	437,0908	-219673000	300	1429,252676	0	32,69921664	1	3,269921664						285,850535	322,8196735	1106,433003	221,2866005	221,2866005	885,1464021	15	366,7372428	1111,09779
2014	5199452	449723	450,203524	-197355000	300	1273,478359	0	28,28672569	1	2,828672569						254,695672	286,81107	986,6672888	197,3334578	197,3334578	789,3338311	16	308,382661	1419,480451
2015	5857101,5	657649,5	463,7096297	24858700	300	1918,130667	0	41,36490908	1	4,136490908	2400		540		588	383,626133	1018,127533	900,0031339	180,0006268	180,0006268	-1631,99749	17	-601,226409	818,2540424
2016	7238121,5	1381020	477,6209186	719654400	300	4148,784601	0	86,8635447	1	8,68635447					588	829,75692	1514,306819	2634,477782	526,8955564	526,8955564	2695,582226	18	936,3979897	1754,652032
2017	8285802	1047680,5	491,9495462	666976200	300	3241,805873	0	65,89712093	1	6,589712093					588	648,361175	1309,848008	1931,957866	386,3915732	386,3915732	2133,566293	19	698,8811988	2453,533231
2018	8993714	707912	506,7080326	528222200	300	2256,184665	0	44,52632522	1	4,452632522					588	451,236933	1089,215891	1166,968774	233,3937548	233,3937548	1521,575019	20	469,9805796	2923,51381
2019	9561861	568147	521,9092735	517110300	300	1865,062162	0	35,7353712	1	3,57353712					588	373,012432	1001,321341	863,7408214	172,7481643	172,7481643	1278,992657	21	372,5151339	3296,028944
2020	10036004	474143	537,5665517	508983800	300	1603,168465	0	29,82269748	1	2,982269748						320,633693	354,4386602	1248,729805	249,7459609	249,7459609	998,9838437	22	274,3618116	3570,390756
2021	10433785	397781	553,6935483	491506700	231	1385,323107	0	25,01967218	1	2,501967218						277,064621	305,5862607	1079,736846	215,9473692	215,9473692	863,7894768	23	223,698171	3794,088927
2022	10772715	338930	570,3043547	486772700	231	1215,777997	0	21,31805564	1	2,131805564						243,155599	267,6054606	948,1725363	189,6345073	189,6345073	758,538029	24	185,2342155	3979,323142
2023	11062583	289868	587,4134854	477554700	231	1070,981	0	18,23214868	1	1,823214868						214,1962	235,2515636	835,7294368	167,1458874	167,1458874	668,5835494	25	153,9532513	4133,276394
2024	11291221	228638	605,0358899	471223300	231	870,0959147	0	14,38089755	1	1,438089755						174,019183	190,8381702	679,2577444	135,8515489	135,8515489	543,4061956	26	117,9905136	4251,266907
2025	11477687	186466	623,1869666	455548600	231	730,8960189	0	11,72835855	1	1,172835855						146,179204	160,0803982	570,8156207	114,1631241	114,1631241	456,6524966	27	93,49699855	4344,763906
2026	11622705	145018	641,8825756	447699000	231	585,4840627	0	9,121357783	1	0,912135778						117,096813	128,1303061	457,3537566	91,47075132	91,47075132	365,8830053	28	70,6388138	4415,40272
2027	11725622	102917	661,1390529	439238000	231	427,9741217	0	6,473284551	1	0,647328455						85,5948243	93,71543735	334,2586844	66,85173687	66,85173687	267,4069475	29	48,68141282	4464,084133
2028	11821812	96190	680,9732245	430394000	231	412,0003079	0	6,05016898	1	0,605016898						82,4000616	90,05524746	321,9450605	64,38901209	64,38901209	257,5560484	30	44,21316119	4508,297294
2029	11910741	88929	701,4024212	390908000	231	392,3270469	0	5,59346582	1	0,559346582						78,4654094	85,61822179	306,7088251	61,34176503	61,34176503	245,3670601	31	39,71781979	4548,015114
2030	11994316	83575	722,4444939	5195000	231	379,7680727	0	5,256709351	1	0,525670935						75,9536145	82,73599482	297,0320779	59,40641557	59,40641557	237,6256623	32	36,27035523	4584,285469
2031	12074125	79809	744,1178287			373,5348778	0	5,019835078	1	0,501983508						74,7069756	81,22879415	292,3060837	58,46121674	58,46121674	233,844867	33	33,65701817	4617,942487
2032	12150283	76158	766,4413635			367,1402887	0	4,790194087	1	0,479019409						73,4280577	79,69727124	287,4430175	57,4886035	57,4886035	229,954414	34	31,20892958	4649,151417
2033	12221917	71634	789,4346045			355,6910537	0	4,505643047	1	0,450564305						71,1382107	77,09441809	278,5966356	55,71932712	55,71932712	222,8773085	35	28,52280972	4677,674226
2034	12290550	68633	813,1176426			351,0136026	0	4,316885826	1	0,431688583						70,2027205	75,95129493	275,0623077	55,01246154	55,01246154	220,0498461	36	26,55442162	4704,228648
2035	12356858	66308	837,5111719			349,2964064	0	4,170647726	1	0,417064773						69,8592813	75,44699378	273,8494126	54,76988253	54,76988253	219,0795301	37	24,92911754	4729,157765
2036	12421834	64976	862,636507			352,5481058	0	4,086867446	1	0,408686745				120		70,5096212	76,00517536	276,5429305	55,3085861	55,3085861	101,2343444	38	10,86231283	4740,020078
2037	12422357	523	888,5156022			2,922835187	0	0,03289571	1	0,003289571						0,58456704	1,620752319	1,302082869	0,260416574	0,260416574	1,041666295	39	0,105393147	
																						SUM	4740,020078	

12.3 Base Case: Smartwell Case

						INCOME		EXPENDITURE																
								OPEX			CAPEX													
DATE	FOPT	vol oil per year	oil prize	Vol gas per year	Gas prize	oil income	Gas income	Field / offshore	CO2 - duty	Gas oil transportation	Subsea/platform	Production unit	Drilling	abandon	Cap Allowance	royalty	Fiscal allowance	Taxable income	Tax	Net tax	cash flow	i	NPV	cum NPV
	(SM3)	Sm3	(UsD/BBL)	Sm3	(cents per gallon)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)		(MNOK)	(MNOK)
1999	182525,08	182525,08	21,39	45087848	110,8333333	147,3405078	0	11,48048214	1	1,148048214	3500		1650		1030	29,4681016	1073,096632	-925,7561241	-185,1512248	-185,1512248	-4860,6049	1	-4583,31438	-4583,31438
2000	330533,16	148008,08	34,29	62183542	138,4	191,5321749	0	9,309428157	1	0,930942816					1030	38,306435	1079,546806	-888,0146311	-177,6029262	-177,6029262	319,5882952	2	284,1643022	-4299,15008
2001	538899,12	208365,96	28,03	103837010	139,3333333	220,413758	0	13,10582459	1	1,310582459					1030	44,0827516	1089,499159	-869,0854006	-173,8170801	-173,8170801	334,7316795	3	280,6498394	-4018,50024
2002	773933,00	235033,88	27,33	174349490	136,5	242,4146889	0	14,7831863	1	1,47831863					1030	48,4829378	1095,744443	-853,3297538	-170,6659508	-170,6659508	347,336197	4	274,6043126	-3743,89593
2003	1050589,6	276656,6	32,47	231690460	156	339,009723	0	17,40117662	1	1,740117662					1030	67,8019446	1117,943239	-778,9335159	-155,7867032	-155,7867032	406,8531873	5	303,3083443	-3440,58758
2004	1529299,5	478709,9	42,97	246407810	180,3333333	776,2946497	0	30,10994685	1	3,010994685						155,25893	189,3798715	586,9147782	117,3829556	117,3829556	469,5318226	6	330,0661556	-3110,52143
2005	2016984,5	487685	55,21	213079440	231	1016,122283	0	30,67446366	1	3,067446366						203,224457	237,9663666	778,1559164	155,6311833	155,6311833	622,5247331	7	412,6500488	-2697,87138
2006	2392377	375392,5	62,36	247841245	270	883,447057	0	23,6114779	1	2,36114779						176,689411	203,6620371	679,7850199	135,957004	135,957004	543,8280159	8	339,9195899	-2357,95179
2007	2732394,5	340017,5	66,66	132349455	300	855,3727476	0	21,38645734	1	2,138645734						171,07455	195,5996526	659,773095	131,954619	131,954619	527,818476	9	311,0917778	-2046,86001
2008	2926702,5	194308	91,35	210171400	300	669,8661981	0	12,22160551	1	1,222160551						133,97324	148,4170057	521,4491924	104,2898385	104,2898385	417,1593539	10	231,8436779	-1815,01633
2009	2926702,5	0	60	0	300	0	0	0	1	0						0	1	-1	-0,2	0	-1	11	-0,52406191	-1815,54039
2010	3091608,2	164905,7	400	-51295890	300	414,8902592	0	10,37225648	1	1,037225648						82,9780518	95,38753396	319,5027252	63,90054504	63,90054504	255,6021802	12	126,3096348	-1689,23076
2011	3659698	568089,8	412	74040400	300	1472,149065	0	35,73177343	1	3,573177343						294,429813	334,7347638	1137,414301	227,4828603	227,4828603	909,9314411	13	424,0039715	-1265,22679
2012	4229853	570155	424,36	-235126510	300	1521,825854	0	35,8616706	1	3,58616706						304,365171	344,8130084	1177,012845	235,402569	235,402569	941,6102761	14	413,7345311	-851,492255
2013	4749729	519876	437,0908	-219673000	300	1429,252676	0	32,69921664	1	3,269921664						285,850535	322,8196735	1106,433003	221,2866005	221,2866005	885,1464021	15	366,7372428	-484,755012
2014	5199452	449723	450,203524	-197355000	300	1273,478359	0	28,28672569	1	2,828672569						254,695672	286,81107	986,6672888	197,3334578	197,3334578	789,3338311	16	308,382661	-176,372352
2015	5689028	489576	463,7096297	24858700	300	1427,919796	0	30,79340398	1	3,079340398	4000		750		950	285,583959	1270,456703	157,4630921	31,49261842	31,49261842	-3674,02953	17	-1353,50917	-1529,88153
2016	6444182	755154	477,6209186	719654400	300	2268,592263	0	47,49775763	1	4,749775763					950	453,718453	1456,965986	811,6262769	162,3252554	162,3252554	1599,301022	18	555,5691261	-974,312399
2017	7098449,5	654267,5	491,9495462	666976200	300	2024,480005	0	41,15218768	1	4,115218768					950	404,896001	1401,163408	623,3165979	124,6633196	124,6633196	1448,653278	19	474,5278097	-499,78459
2018	7586291	487841,5	506,7080326	528222200	300	1554,798494	0	30,68430721	1	3,068430721					950	310,959699	1295,712437	259,086057	51,8172114	51,8172114	1157,268846	20	357,4545296	-142,33006
2019	8064097	477806	521,9092735	517110300	300	1568,498807	0	30,05309325	1	3,005309325					950	313,699761	1297,758164	270,7406427	54,14812853	54,14812853	1166,592514	21	339,7778433	197,4477834
2020	8535723	471626	537,5665517	508983800	300	1594,658005	0	29,66438294	1	2,966438294						318,931601	352,5624222	1242,095583	248,4191165	248,4191165	993,6764661	22	272,9041887	470,3519721
2021	8989277	453554	553,6935483	491506700	231	1579,559698	0	28,52768834	1	2,852768834						315,91194	348,2923968	1231,267301	246,2534603	246,2534603	985,0138411	23	255,092011	725,4439831
2022	9424002	434725	570,3043547	486772700	231	1559,404861	0	27,34337987	1	2,734337987						311,880972	342,9586901	1216,446171	243,2892343	243,2892343	973,156937	24	237,6439346	963,0879177
2023	9819693	395691	587,4134854	477554700	231	1461,96732	0	24,88821514	1	2,488821514						292,393464	320,7705006	1141,196819	228,2393638	228,2393638	912,9574553	25	210,2246888	1173,312606
2024	10195230	375537	605,0358899	471223300	231	1429,129058	0	23,62056667	1	2,362056667						285,825812	312,8084349	1116,320623	223,2641246	223,2641246	893,0564983	26	193,9105512	1367,223158
2025	10537150	341920	623,1869666	455548600	231	1340,23343	0	21,50612099	1	2,150612099						268,046686	292,7034191	1047,530011	209,5060022	209,5060022	838,0240088	27	171,5806442	1538,803802
2026	10856376	319226	641,8825756	447699000	231	1288,817494	0	20,07871133	1	2,007871133						257,763499	280,8500813	1007,967413	201,5934826	201,5934826	806,3739304	28	155,6817264	1694,485528
2027	11154096	297720	661,1390529	439238000	231	1238,050619	0	18,72602463	1	1,872602463						247,610124	269,2087508	968,8418678	193,7683736	193,7683736	775,0734942	29	141,1020659	1835,587594
2028	11443020	288924	680,9732245	430394000	231	1237,517174	0	18,17277287	1	1,817277287						247,503435	268,4934849	969,023689	193,8047378	193,8047378	775,2189512	30	133,0773657	1968,66496
2029	11717874	274854	701,4024212	390908000	231	1212,570232	0	17,28779649	1	1,728779649						242,514046	262,5306225	950,0396094	190,0079219	190,0079219	760,0316875	31	123,0271153	2091,692075
2030	11985437	267563	722,4444939	5195000	231	1215,816749	0	16,82920639	1	1,682920639						243,16335	262,6754769	953,1412725	190,6282545	190,6282545	762,513018	32	116,387337	2208,079412
2031	12246104	260667	744,1178287			1220,015487	0	16,39546104	1	1,639546104						244,003097	263,0381045	956,9773825	191,3954765	191,3954765	765,581906	33	110,1893082	2318,26872
2032	12492085	245981	766,4413635			1185,818107	0	15,47173943	1	1,547173943						237,163621	255,1825347	930,6355719	186,1271144	186,1271144	744,5084575	34	101,0431225	2419,311843
2033	12721195	229110	789,4346045			1137,621483	0	14,41058546	1	1,441058546						227,524297	244,3759406	893,2455424	178,6491085	178,6491085	714,5964339	35	91,45075488	2510,762598
2034	12941709	220514	813,1176426			1127,787122	0	13,86991332	1	1,386991332						225,557424	241,8143291	885,9727932	177,1945586	177,1945586	708,7782346	36	85,5315121	2596,29411
2035	13157516	215807	837,5111719			1136,825264	0	13,57385193	1	1,357385193						227,365053	243,2962898	893,5289738	178,7057948	178,7057948	714,823179	37	81,33991815	2677,634028
2036	13374376	216860	862,636507			1176,64341	0	13,64008364	1	1,364008364				200		235,328682	251,3327741	925,3106363	185,0621273	185,0621273	540,248509	38	57,96795888	2735,601987
2037	13376123	1747	888,5156022			9,763275473	0	0,109882994	1	0,010988299						1,95265509	3,073526388	6,689749085	1,337949817	1,337949817	5,351799268	39	0,541481439	
																						SUM	2735,601987	

12.4 Sensitivity Case: Smartwell Case

12.4.1 Sensitivity Case: +5% of Oil and Gas Price

						INCOME		EXPENDITURE																
								OPEX			CAPEX													
DATE	FOPT	vol oil per year	oil prize	Vol gas per year	Gas prize	oil income	Gas income	Field / offshore	CO2 - duty	Gas oil transportation	Subsea/platform	Production unit	Drilling	abandon	Cap Allowance	royalty	Fiscal allowance	Taxable income	Tax	Net tax	cash flow	i	NPV	cum NPV
	(SM3)	Sm3	(UsD/BBL)	Sm3	(cents per gallon)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)		(MNOK)	(MNOK)
1999	182525,08	182525,08	21,39	45087848	110,8333333	147,3405078	0	11,48048214	1	1,148048214	3500		1650		1030	29,4681016	1073,096632	-925,7561241	-185,1512248	-185,1512248	-4860,6049	1	-4583,31438	-4583,31438
2000	330533,16	148008,08	34,29	62183542	138,4	191,5321749	0	9,309428157	1	0,930942816					1030	38,306435	1079,546806	-888,0146311	-177,6029262	-177,6029262	319,5882952	2	284,1643022	-4299,15008
2001	538899,12	208365,96	28,03	103837010	139,3333333	220,413758	0	13,10582459	1	1,310582459					1030	44,0827516	1089,499159	-869,0854006	-173,8170801	-173,8170801	334,7316795	3	280,6498394	-4018,50024
2002	773933,00	235033,88	27,33	174349490	136,5	242,4146889	0	14,7831863	1	1,47831863					1030	48,4829378	1095,744443	-853,3297538	-170,6659508	-170,6659508	347,336197	4	274,6043126	-3743,89593
2003	1050589,6	276656,6	32,47	231690460	156	339,009723	0	17,40117662	1	1,740117662					1030	67,8019446	1117,943239	-778,9335159	-155,7867032	-155,7867032	406,8531873	5	303,3083443	-3440,58758
2004	1529299,5	478709,9	42,97	246407810	180,3333333	776,2946497	0	30,10994685	1	3,010994685						155,25893	189,3798715	586,9147782	117,3829556	117,3829556	469,5318226	6	330,0661556	-3110,52143
2005	2016984,5	487685	55,21	213079440	231	1016,122283	0	30,67446366	1	3,067446366						203,224457	237,9663666	778,1559164	155,6311833	155,6311833	622,5247331	7	412,6500488	-2697,87138
2006	2392377	375392,5	62,36	247841245	270	883,447057	0	23,6114779	1	2,36114779						176,689411	203,6620371	679,7850199	135,957004	135,957004	543,8280159	8	339,9195899	-2357,95179
2007	2732394,5	340017,5	66,66	132349455	300	855,3727476	0	21,38645734	1	2,138645734						171,07455	195,5996526	659,773095	131,954619	131,954619	527,818476	9	311,0917778	-2046,86001
2008	2926702,5	194308	91,35	210171400	300	669,8661981	0	12,22160551	1	1,222160551						133,97324	148,4170057	521,4491924	104,2898385	104,2898385	417,1593539	10	231,8436779	-1815,01633
2009	2926702,5	0	60	0	300	0	0	0	1	0						0	1	-1	-0,2	0	-1	11	-0,52406191	-1815,54039
2010	3091608,2	164905,7	400	-51295890	300	414,8902592	0	10,37225648	1	1,037225648						82,9780518	95,38753396	319,5027252	63,90054504	63,90054504	255,6021802	12	126,3096348	-1689,23076
2011	3659698	568089,8	420	74040400	300	1500,734484	0	35,73177343	1	3,573177343						300,146897	340,4518475	1160,282636	232,0565273	232,0565273	928,2261091	13	432,5288026	-1256,70196
2012	4229853	570155	441	-235126510	300	1581,499673	0	35,8616706	1	3,58616706						316,299935	356,7477723	1224,751901	244,9503802	244,9503802	979,8015208	14	430,5153981	-826,186557
2013	4749729	519876	463,05	-219673000	300	1514,137227	0	32,69921664	1	3,269921664						302,827445	339,7965836	1174,340643	234,8681286	234,8681286	939,4725144	15	389,2458455	-436,940712
2014	5199452	449723	486,2025	-197355000	300	1375,307675	0	28,28672569	1	2,828672569						275,061535	307,1769332	1068,130742	213,6261483	213,6261483	854,5045933	16	333,8440466	-103,096665
2015	5689028	489576	510,512625	24858700	300	1572,04215	0	30,79340398	1	3,079340398	4000		750		950	314,40843	1299,281174	272,7609754	54,55219508	54,55219508	-3581,79122	17	-1319,52866	-1422,62533
2016	6444182	755154	536,0382563	719654400	300	2546,061517	0	47,49775763	1	4,749775763					950	509,212303	1512,459837	1033,60168	206,7203361	206,7203361	1776,881344	18	617,2574159	-805,367914
2017	7098449,5	654267,5	562,8401691	666976200	300	2316,210427	0	41,15218768	1	4,115218768					950	463,242085	1459,509492	856,7009353	171,3401871	171,3401871	1635,360748	19	535,6866033	-269,681311
2018	7586291	487841,5	590,9821775	528222200	300	1813,387869	0	30,68430721	1	3,068430721					950	362,677574	1347,430312	465,9575573	93,19151146	93,19151146	1322,766046	20	408,5729228	138,8916121
2019	8064097	477806	620,5312864	517110300	300	1864,888461	0	30,05309325	1	3,005309325					950	372,977692	1357,036095	507,8523666	101,5704733	101,5704733	1356,281893	21	395,0261139	533,9177511
2020	8535723	471626	651,5578507	508983800	300	1932,806159	0	29,66438294	1	2,966438294						386,561232	420,1920531	1512,614106	302,5228213	302,5228213	1210,091285	22	332,3405471	866,2582981
2021	8989277	453554	684,1357432	491506700	231	1951,681127	0	28,52768834	1	2,852768834						390,336225	422,7166825	1528,964444	305,7928888	305,7928888	1223,171555	23	316,7684339	1183,026732
2022	9424002	434725	718,3425304	486772700	231	1964,191269	0	27,34337987	1	2,734337987						392,838254	423,9159716	1540,275297	308,0550594	308,0550594	1232,220238	24	300,9069293	1483,933661
2023	9819693	395691	754,2596569	477554700	231	1877,217661	0	24,88821514	1	2,488821514						375,443532	403,8205688	1473,397092	294,6794184	294,6794184	1178,717674	25	271,4207049	1755,354366
2024	10195230	375537	791,9726398	471223300	231	1870,684254	0	23,62056667	1	2,362056667						374,136851	401,1194742	1469,56478	293,912956	293,912956	1175,651824	26	255,2708519	2010,625218
2025	10537150	341920	831,5712718	455548600	231	1788,387238	0	21,50612099	1	2,150612099						357,677448	382,3341807	1406,053057	281,2106115	281,2106115	1124,842446	27	230,3050861	2240,930304
2026	10856376	319226	873,1498354	447699000	231	1753,172349	0	20,07871133	1	2,007871133						350,63447	373,7210523	1379,451297	275,8902594	275,8902594	1103,561038	28	213,0578396	2453,988144
2027	11154096	297720	916,8073271	439238000	231	1716,815658	0	18,72602463	1	1,872602463						343,363132	364,9617588	1351,8539	270,3707799	270,3707799	1081,48312	29	196,8839131	2650,872057
2028	11443020	288924	962,6476935	430394000	231	1749,397789	0	18,17277287	1	1,817277287						349,879558	370,8696079	1378,528181	275,7056362	275,7056362	1102,822545	30	189,3151185	2840,187242
2029	11717874	274854	1010,780078	390908000	231	1747,416029	0	17,28779649	1	1,728779649						349,483206	369,499782	1377,916247	275,5832494	275,5832494	1102,332998	31	178,4357824	3018,623024
2030	11985437	267563	1061,319082	5195000	231	1786,115788	0	16,82920639	1	1,682920639						357,223158	376,7352846	1409,380503	281,8761007	281,8761007	1127,504403	32	172,0983534	3190,721378
2031	12246104	260667	1114,385036			1827,085645	0	16,39546104	1	1,639546104						365,417129	384,452136	1442,633508	288,5267017	288,5267017	1154,106807	33	166,1092427	3356,83062
2032	12492085	245981	1170,104288			1810,354865	0	15,47173943	1	1,547173943						362,070973	380,0898864	1430,264979	286,0529957	286,0529957	1144,211983	34	155,2900446	3512,120665
2033	12721195	229110	1228,609502			1770,498223	0	14,41058546	1	1,441058546						354,099645	370,9512885	1399,546934	279,9093868	279,9093868	1119,637547	35	143,2860048	3655,406713
2034	12941709	220514	1290,039977			1789,274267	0	13,86991332	1	1,386991332						357,854853	374,1117581	1415,162509	283,0325018	283,0325018	1132,130007	36	136,6193073	3792,02602
2035	13157516	215807	1354,541976			1838,635222	0	13,57385193	1	1,357385193						367,727044	383,6582815	1454,97694	290,9953881	290,9953881	1163,981552	37	132,449768	3924,475788
2036	13374376	216860	1422,269075			1939,986914	0	13,64008364	1	1,364008364				200		387,997383	404,0014748	1535,985439	307,1970878	307,1970878	1028,788351	38	110,3876454	4034,863434
2037	13376123	1747	1493,382529			16,40973437	0	0,109882994	1	0,010988299						3,28194687	4,402818168	12,0069162	2,401383241	2,401383241	0,605532962	39	0,971863396	
																						SUM	4034,863434	

12.4.2 Sensitivity Case: -2% of Oil and Gas Price

						INCOME		EXPENDITURE																
								OPEX			CAPEX													
DATE	FOPT	vol oil per year	oil prize	Vol gas per year	Gas prize	oil income	Gas income	Field / offshore	CO2 - duty	Gas oil transportation	Subsea/platform	Production unit	Drilling	abandon	Cap Allowance	royalty	Fiscal allowance	Taxable income	Tax	Net tax	cash flow	i	NPV	cum NPV
	(SM3)	Sm3	(UsD/BBL)	Sm3	(cents per gallon)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)		(MNOK)	(MNOK)
1999	182525,08	182525,08	21,39	45087848	110,8333333	147,3405078	0	11,48048214	1	1,148048214	3500		1650		1030	29,4681016	1073,096632	-925,7561241	-185,1512248	-185,1512248	-4860,6049	1	-4583,31438	-4583,31438
2000	330533,16	148008,08	34,29	62183542	138,4	191,5321749	0	9,309428157	1	0,930942816					1030	38,306435	1079,546806	-888,0146311	-177,6029262	-177,6029262	319,5882952	2	284,1643022	-4299,15008
2001	538899,12	208365,96	28,03	103837010	139,3333333	220,413758	0	13,10582459	1	1,310582459					1030	44,0827516	1089,499159	-869,0854006	-173,8170801	-173,8170801	334,7316795	3	280,6498394	-4018,50024
2002	773933,00	235033,88	27,33	174349490	136,5	242,4146889	0	14,7831863	1	1,47831863					1030	48,4829378	1095,744443	-853,3297538	-170,6659508	-170,6659508	347,336197	4	274,6043126	-3743,89593
2003	1050589,6	276656,6	32,47	231690460	156	339,009723	0	17,40117662	1	1,740117662					1030	67,8019446	1117,943239	-778,9335159	-155,7867032	-155,7867032	406,8531873	5	303,3083443	-3440,58758
2004	1529299,5	478709,9	42,97	246407810	180,3333333	776,2946497	0	30,10994685	1	3,010994685						155,25893	189,3798715	586,9147782	117,3829556	117,3829556	469,5318226	6	330,0661556	-3110,52143
2005	2016984,5	487685	55,21	213079440	231	1016,122283	0	30,67446366	1	3,067446366						203,224457	237,9663666	778,1559164	155,6311833	155,6311833	622,5247331	7	412,6500488	-2697,87138
2006	2392377	375392,5	62,36	247841245	270	883,447057	0	23,6114779	1	2,36114779						176,689411	203,6620371	679,7850199	135,957004	135,957004	543,8280159	8	339,9195899	-2357,95179
2007	2732394,5	340017,5	66,66	132349455	300	855,3727476	0	21,38645734	1	2,138645734						171,07455	195,5996526	659,773095	131,954619	131,954619	527,818476	9	311,0917778	-2046,86001
2008	2926702,5	194308	91,35	210171400	300	669,8661981	0	12,22160551	1	1,222160551						133,97324	148,4170057	521,4491924	104,2898385	104,2898385	417,1593539	10	231,8436779	-1815,01633
2009	2926702,5	0	60	0	300	0	0	0	1	0						0	1	-1	-0,2	0	-1	11	-0,52406191	-1815,54039
2010	3091608,2	164905,7	400	-51295890	300	414,8902592	0	10,37225648	1	1,037225648						82,9780518	95,38753396	319,5027252	63,90054504	63,90054504	255,6021802	12	126,3096348	-1689,23076
2011	3659698	568089,8	392	74040400	300	1400,685518	0	35,73177343	1	3,573177343						280,137104	320,4420544	1080,243464	216,0486928	216,0486928	864,1947711	13	402,6918936	-1286,53886
2012	4229853	570155	384,16	-235126510	300	1377,661938	0	35,8616706	1	3,58616706						275,532388	315,9802252	1061,681713	212,3363425	212,3363425	849,34537	14	373,1942156	-913,344649
2013	4749729	519876	376,4768	-219673000	300	1231,049644	0	32,69921664	1	3,269921664						246,209929	283,1790672	947,8705772	189,5741154	189,5741154	758,2964617	15	314,1802904	-599,164358
2014	5199452	449723	368,947264	-197355000	300	1043,631005	0	28,28672569	1	2,828672569						208,726201	240,8415993	802,7894058	160,5578812	160,5578812	642,2315247	16	250,9116659	-348,252692
2015	5689028	489576	361,5683187	24858700	300	1113,39193	0	30,79340398	1	3,079340398	4000		750		950	222,678386	1207,55113	-94,15920007	-18,83184001	-18,83184001	-3875,32736	17	-1427,66711	-1775,91981
2016	6444182	755154	354,3369523	719654400	300	1683,021068	0	47,49775763	1	4,749775763					950	336,604214	1339,851747	343,169321	68,63386421	68,63386421	1224,535457	18	425,3821416	-1350,53767
2017	7098449,5	654267,5	347,2502133	666976200	300	1429,010595	0	41,15218768	1	4,115218768					950	285,802119	1282,069525	146,9410696	29,38821392	29,38821392	1067,552856	19	349,6927291	-1000,84494
2018	7586291	487841,5	340,305209	528222200	300	1044,202958	0	30,68430721	1	3,068430721					950	208,840592	1193,59333	-149,3903716	-29,87807432	-29,87807432	830,4877027	20	256,5191245	-744,325812
2019	8064097	477806	333,4991049	517110300	300	1002,26797	0	30,05309325	1	3,005309325					950	200,453594	1184,511997	-182,2440268	-36,44880537	-36,44880537	804,2047785	21	234,2300005	-510,095811
2020	8535723	471626	326,8291228	508983800	300	969,5184255	0	29,66438294	1	2,966438294						193,903685	227,5345063	741,9839191	148,3967838	148,3967838	593,5871353	22	163,0232989	-347,072512
2021	8989277	453554	320,2925403	491506700	231	913,7205768	0	28,52768834	1	2,852768834						182,744115	215,1245725	698,5960043	139,7192009	139,7192009	558,8768034	23	144,7340146	-202,338498
2022	9424002	434725	313,8866895	486772700	231	858,2722988	0	27,34337987	1	2,734337987						171,65446	202,7321776	655,5401211	131,1080242	131,1080242	524,4320969	24	128,0657849	-74,2727129
2023	9819693	395691	307,6089557	477554700	231	765,5837867	0	24,88821514	1	2,488821514						153,116757	181,493794	584,0899927	116,8179985	116,8179985	467,2719942	25	107,5976859	33,32497299
2024	10195230	375537	301,4567766	471223300	231	712,057989	0	23,62056667	1	2,362056667						142,411598	169,3942211	542,6637679	108,5327536	108,5327536	434,1310143	26	94,26344741	127,5884204
2025	10537150	341920	295,4276411	455548600	231	635,3502591	0	21,50612099	1	2,150612099						127,070052	151,7267849	483,6234742	96,72469484	96,72469484	386,8987794	27	79,21532212	206,8037425
2026	10856376	319226	289,5190882	447699000	231	581,3170197	0	20,07871133	1	2,007871133						116,263404	139,3499864	441,9670333	88,39340666	88,39340666	353,5736267	28	68,26231669	275,0660592
2027	11154096	297720	283,7287065	439238000	231	531,3110744	0	18,72602463	1	1,872602463						106,262215	127,860842	403,4502325	80,69004649	80,69004649	322,760186	29	58,75846534	333,8245245
2028	11443020	288924	278,0541323	430394000	231	505,3014593	0	18,17277287	1	1,817277287						101,060292	122,050342	383,2511173	76,65022345	76,65022345	306,6008938	30	52,63240691	386,4569315
2029	11717874	274854	272,4930497	390908000	231	471,0804389	0	17,28779649	1	1,728779649						94,2160878	114,2326639	356,847775	71,369555	71,369555	285,47822	31	46,21065473	432,6675862
2030	11985437	267563	267,0431887	5195000	231	449,4124938	0	16,82920639	1	1,682920639						89,8824988	109,3946258	340,017868	68,0035736	68,0035736	272,0142944	32	41,51931652	474,1869027
2031	12246104	260667	261,7023249			429,0730273	0	16,39546104	1	1,639546104						85,8146055	104,8496126	324,2234147	64,84468293	64,84468293	259,3787317	33	37,33207746	511,5189802
2032	12492085	245981	256,4682784			396,8010376	0	15,47173943	1	1,547173943						79,3602075	97,3791209	299,4219167	59,88438334	59,88438334	239,5375334	34	32,5095304	544,0285106
2033	12721195	229110	251,3389129			362,1940882	0	14,41058546	1	1,441058546						72,4388176	89,29046165	272,9036266	54,58072532	54,58072532	218,3229013	35	27,93995769	571,9684682
2034	12941709	220514	246,3121346			341,6327957	0	13,86991332	1	1,386991332						68,3265591	84,5834638	257,0493319	51,40986638	51,40986638	205,6394655	36	24,81545507	596,7839233
2035	13157516	215807	241,3858919			327,6536355	0	13,57385193	1	1,357385193						65,5307271	81,46196422	246,1916712	49,23833425	49,23833425	196,953337	37	22,41137218	619,1952955
2036	13374376	216860	236,5581741			322,6673279	0	13,64008364	1	1,364008364				200		64,5334656	80,53755759	242,1297703	48,42595407	48,42595407	-6,29618372	38	-0,67557228	618,5197232
2037	13376123	1747	231,8270106			2,547384605	0	0,109882994	1	0,010988299						0,50947692	1,630348215	0,91703639	0,183407278	0,183407278	0,733629112	39	0,074226728	
																						SUM	618,5197232	

12.4.3 Sensitivity Case: +30 % of Oil and Gas Production

						INCOME		EXPENDITURE																
								OPEX			CAPEX													
DATE	FOPT	vol oil per year	oil prize	Vol gas per year	Gas prize	oil income	Gas income	Field / offshore	CO2 - duty	Gas oil transportation	Subsea/platform	Production unit	Drilling	abandon	Cap Allowance	royalty	Fiscal allowance	Taxable income	Tax	Net tax	cash flow	i	NPV	cum NPV
	(SM3)	Sm3	(UsD/BBL)	Sm3	(cents per gallon)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)		(MNOK)	(MNOK)
1999	237282,60	237282,604	21,39	45087848	110,8333333	191,5426601	0	14,92462678	1	1,492462678	3500		1650		1030	38,308532	1085,725621	-894,1829614	-178,8365923	-178,8365923	-4835,34637	1	-4559,49681	-4559,49681
2000	429693,11	192410,504	34,29	62183542	138,4	248,9918274	0	12,1022566	1	1,21022566					1030	49,7983655	1094,110848	-845,1190204	-169,0238041	-169,0238041	353,9047837	2	314,6770624	-4244,81975
2001	700568,86	270875,748	28,03	103837010	139,3333333	286,5378854	0	17,03757197	1	1,703757197					1030	57,3075771	1107,048906	-820,5110208	-164,1022042	-164,1022042	373,5911833	3	313,2309011	-3931,58885
2002	1006112,90	305544,044	27,33	174349490	136,5	315,1390956	0	19,21814219	1	1,921814219					1030	63,0278191	1115,167776	-800,0286799	-160,005736	-160,005736	389,9770561	4	308,3162145	-3623,27263
2003	1365766,48	359653,58	32,47	231690460	156	440,7126399	0	22,62152961	1	2,262152961					1030	88,142528	1144,026211	-703,3135707	-140,6627141	-140,6627141	467,3491435	5	348,4079745	-3274,86466
2004	1988089,35	622322,87	42,97	246407810	180,3333333	1009,183045	0	39,1429309	1	3,91429309						201,836609	245,8938329	763,2892117	152,6578423	152,6578423	610,6313693	6	429,2547148	-2845,60994
2005	2622079,85	633990,5	55,21	213079440	231	1320,958968	0	39,87680275	1	3,987680275						264,191794	309,0562766	1011,902691	202,3805383	202,3805383	809,5221531	7	536,6041511	-2309,00579
2006	3110090,10	488010,25	62,36	247841245	270	1148,481174	0	30,69492127	1	3,069492127						229,696235	264,4606482	884,0205259	176,8041052	176,8041052	707,2164207	8	442,0454789	-1866,96031
2007	3552112,85	442022,75	66,66	132349455	300	1111,984572	0	27,80239454	1	2,780239454						222,396914	253,9795484	858,0050235	171,6010047	171,6010047	686,4040188	9	404,5607651	-1462,39955
2008	3804713,25	252600,4	91,35	210171400	300	870,8260575	0	15,88808717	1	1,588808717						174,165212	192,6421074	678,1839501	135,63679	135,63679	542,5471601	10	301,5301655	-1160,86938
2009	3804713,25	0	60	0	300	0	0	0	1	0						0	1	-1	-0,2	0	-1	11	-0,52406191	-1161,39345
2010	4019090,66	214377,41	400	-51295890	300	539,3573369	0	13,48393342	1	1,348393342						107,871467	123,7037942	415,6535428	83,13070856	83,13070856	332,5228342	12	164,3211249	-997,072321
2011	4757607,40	738516,74	412	74040400	300	1913,793785	0	46,45130545	1	4,645130545						382,758757	434,8551929	1478,938592	295,7877184	295,7877184	1183,150873	13	551,3169966	-445,755325
2012	5498808,90	741201,5	424,36	-235126510	300	1978,37361	0	46,62017178	1	4,662017178						395,674722	447,9569109	1530,416699	306,0833397	306,0833397	1224,333359	14	537,9603442	92,20501968
2013	6174647,70	675838,8	437,0908	-219673000	300	1858,028479	0	42,50898163	1	4,250898163						371,605696	419,3655756	1438,662903	287,7325807	287,7325807	1150,930323	15	476,8578534	569,0628731
2014	6759287,60	584639,9	450,203524	-197355000	300	1655,521867	0	36,7727434	1	3,67727434						331,104373	372,554391	1282,967475	256,5934951	256,5934951	1026,37398	16	400,9912242	970,0540973
2015	7395736,40	636448,8	463,7096297	24858700	300	1856,295734	0	40,03142517	1	4,003142517	4000		750		950	371,259147	1366,293715	490,0020198	98,00040395	98,00040395	-3407,99838	17	-1255,50354	-285,449443
2016	8377436,60	981700,2	477,6209186	719654400	300	2949,169942	0	61,74708491	1	6,174708491					950	589,833988	1608,755782	1340,41416	268,082832	268,082832	2022,331328	18	702,5224354	417,0729924
2017	9227984,35	850547,75	491,9495462	666976200	300	2631,824007	0	53,49784399	1	5,349784399					950	526,364801	1536,21243	1095,611577	219,1223155	219,1223155	1826,489262	19	598,2935751	1015,366567
2018	9862178,30	634193,95	506,7080326	528222200	300	2021,238042	0	39,88959937	1	3,988959937					950	404,247608	1399,126168	622,1118741	124,4223748	124,4223748	1447,689499	20	447,1589907	1462,525558
2019	10483326,10	621147,8	521,9092735	517110300	300	2039,048448	0	39,06902122	1	3,906902122					950	407,80969	1401,785613	637,2628355	127,4525671	127,4525671	1459,810268	21	425,1794681	1887,705026
2020	11096439,90	613113,8	537,5665517	508983800	300	2073,055406	0	38,56369783	1	3,856369783						414,611081	458,0311489	1615,024257	323,0048515	323,0048515	1292,019406	22	354,8413591	2242,546385
2021	11686060,10	589620,2	553,6935483	491506700	231	2053,427608	0	37,08599484	1	3,708599484						410,685522	452,4801159	1600,947492	320,1894984	320,1894984	1280,757993	23	331,6817678	2574,228153
2022	12251202,60	565142,5	570,3043547	486772700	231	2027,22632	0	35,54639383	1	3,554639383						405,445264	445,5462972	1581,680023	316,3360045	316,3360045	1265,344018	24	308,9957228	2883,223876
2023	12765600,90	514398,3	587,4134854	477554700	231	1900,557516	0	32,35467968	1	3,235467968						380,111503	416,7016508	1483,855865	296,771173	296,771173	1187,084692	25	273,3473596	3156,571236
2024	13253799,00	488198,1	605,0358899	471223300	231	1857,867775	0	30,70673667	1	3,070673667						371,573555	406,3509654	1451,51681	290,303362	290,303362	1161,213448	26	252,135828	3408,707064
2025	13698295,00	444496	623,1869666	455548600	231	1742,303459	0	27,95795728	1	2,795795728						348,460692	380,2144449	1362,089014	272,4178029	272,4178029	1089,671211	27	223,1039761	3631,81104
2026	14113288,80	414993,8	641,8825756	447699000	231	1675,462743	0	26,10232473	1	2,610232473						335,092549	364,8051057	1310,657637	262,1315274	262,1315274	1048,52611	28	202,4325797	3834,243619
2027	14500324,80	387036	661,1390529	439238000	231	1609,465804	0	24,34383201	1	2,434383201						321,893161	349,671376	1259,794428	251,9588856	251,9588856	1007,835542	29	183,4763777	4017,719997
2028	14875926,00	375601,2	680,9732245	430394000	231	1608,772326	0	23,62460473	1	2,362460473						321,754465	348,7415304	1260,030796	252,0061591	252,0061591	1008,024637	30	173,0417749	4190,761772
2029	15233236,20	357310,2	701,4024212	390908000	231	1576,341302	0	22,47413544	1	2,247413544						315,26826	340,9898093	1235,351492	247,0702984	247,0702984	988,2811938	31	159,974099	4350,735871
2030	15581068,10	347831,9	722,4444939	5195000	231	1580,561774	0	21,87796831	1	2,187796831						316,112355	341,17812	1239,383654	247,8767308	247,8767308	991,5069234	32	151,3401708	4502,076042
2031	15919935,20	338867,1	744,1178287			1586,020133	0	21,31409935	1	2,131409935						317,204027	341,6495359	1244,370597	248,8741194	248,8741194	995,4964778	33	143,2806436	4645,356685
2032	16239710,50	319775,3	766,4413635			1541,563539	0	20,11326126	1	2,011326126						308,312708	331,4372951	1210,126243	242,0252487	242,0252487	968,1009948	34	131,3886316	4776,745317
2033	16537553,50	297843	789,4346045			1478,907928	0	18,73376109	1	1,873376109						295,781586	317,3887228	1161,519205	232,303841	232,303841	929,215364	35	118,9166954	4895,662012
2034	16824221,70	286668,2	813,1176426			1466,123259	0	18,03088732	1	1,803088732						293,224652	314,0586279	1152,064631	230,4129262	230,4129262	921,651705	36	111,2199276	5006,88194
2035	17104770,80	280549,1	837,5111719			1477,872843	0	17,64600751	1	1,764600751						295,574569	315,9851768	1161,887666	232,3775332	232,3775332	929,5101327	37	105,7692033	5112,651143
2036	17386688,80	281918	862,636507			1529,636433	0	17,73210873	1	1,773210873				200		305,927287	326,4326063	1203,203827	240,6407654	240,6407654	762,5630618	38	81,8220198	5194,473163
2037	17388959,90	2271,1	888,5156022			12,69225811	0	0,142847892	1	0,014284789						2,53845162	3,695584305	8,99667381	1,799334762	1,799334762	7,197339048	39	0,728208461	
																						SUM	5194,473163	

12.4.4 Sensitivity Case: -30 % of Oil and Gas Production

						INCOME		EXPENDITURE																
								OPEX			CAPEX													
DATE	FOPT	vol oil per year	oil prize	Vol gas per year	Gas prize	oil income	Gas income	Field / offshore	CO2 - duty	Gas oil transportation	Subsea/platform	Production unit	Drilling	abandon	Cap Allowance	royalty	Fiscal allowance	Taxable income	Tax	Net tax	cash flow	i	NPV	cum NPV
	(SM3)	Sm3	(UsD/BBL)	Sm3	(cents per gallon)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)		(MNOK)	(MNOK)
1999	177049,33	177049,3276	21,39	45087848	110,8333333	142,9202926	0	11,13606768	1	1,113606768	3500		1650		1030	28,5840585	1071,833733	-928,9134404	-185,7826881	-185,7826881	-4863,13075	1	-4585,69614	-4585,69614
2000	320617,17	143567,8376	34,29	62183542	138,4	185,7862097	0	9,030145312	1	0,903014531					1030	37,1572419	1078,090402	-892,3041921	-178,4608384	-178,4608384	316,1566463	2	281,1130262	-4304,58311
2001	522732,15	202114,9812	28,03	103837010	139,3333333	213,8013453	0	12,71264986	1	1,271264986					1030	42,7602691	1087,744184	-873,9428386	-174,7885677	-174,7885677	330,8457291	3	277,3917332	-4027,19138
2002	750715,01	227982,8636	27,33	174349490	136,5	235,1422483	0	14,33969071	1	1,433969071					1030	47,0284497	1093,802109	-858,6598612	-171,7319722	-171,7319722	343,0721111	4	271,2331224	-3755,95825
2003	1019071,91	268356,902	32,47	231690460	156	328,8394313	0	16,87914133	1	1,687914133					1030	65,7678863	1115,334942	-786,4955104	-157,2991021	-157,2991021	400,8035917	5	298,7983813	-3457,15987
2004	1483420,52	464348,603	42,97	246407810	180,3333333	753,0058102	0	29,20664844	1	2,920664844						150,601162	183,7284753	569,2773349	113,855467	113,855467	455,4218679	6	320,1472997	-3137,01257
2005	1956474,97	473054,45	55,21	213079440	231	985,6386146	0	29,75422975	1	2,975422975						197,127723	230,8573756	754,7812389	150,9562478	150,9562478	603,8249911	7	400,2546386	-2736,75793
2006	2320605,69	364130,725	62,36	247841245	270	856,9436453	0	22,90313356	1	2,290313356						171,388729	197,582176	659,3614693	131,8722939	131,8722939	527,4891754	8	329,707001	-2407,05093
2007	2650422,67	329816,975	66,66	132349455	300	829,7115652	0	20,74486362	1	2,074486362						165,942313	189,761663	639,9499022	127,9899804	127,9899804	511,9599217	9	301,744879	-2105,30605
2008	2838901,43	188478,76	91,35	210171400	300	649,7702122	0	11,85495735	1	1,185495735						129,954042	143,9944955	505,7757166	101,1551433	101,1551433	404,6205733	10	224,8750291	-1880,43103
2009	2838901,43	0	60	0	300	0	0	0	1	0						0	1	-1	-0,2	0	-1	11	-0,52406191	-1880,95509
2010	2998859,95	159958,529	400	-51295890	300	402,4435514	0	10,06108879	1	1,006108879						80,4887103	92,55590795	309,8876435	61,97752869	61,97752869	247,9101148	12	122,5084858	-1758,4466
2011	3549907,06	551047,106	412	74040400	300	1427,984593	0	34,65982022	1	3,465982022						285,596919	324,7227209	1103,261872	220,6523745	220,6523745	882,6094979	13	411,2726669	-1347,17393
2012	4102957,41	553050,35	424,36	-235126510	300	1476,171078	0	34,78582048	1	3,478582048						295,234216	334,4986181	1141,67246	228,334492	228,334492	913,3379678	14	401,3119498	-945,861983
2013	4607237,13	504279,72	437,0908	-219673000	300	1386,375096	0	31,71824014	1	3,171824014						277,275019	313,1650833	1073,210012	214,6420025	214,6420025	858,56801	15	355,7251818	-590,136801
2014	5043468,44	436231,31	450,203524	-197355000	300	1235,274008	0	27,43812392	1	2,743812392						247,054802	278,2367379	957,0372702	191,407454	191,407454	765,6298161	16	299,1218046	-291,014996
2015	5518357,16	474888,72	463,7096297	24858700	300	1385,082202	0	29,86960186	1	2,986960186	4000		750		950	277,01644	1260,873002	124,2091994	24,84183987	24,84183987	-3700,63264	17	-1363,30974	-1654,32473
2016	6250856,54	732499,38	477,6209186	719654400	300	2200,534495	0	46,0728249	1	4,60728249					950	440,106899	1441,787006	758,7474886	151,7494977	151,7494977	1556,997991	18	540,8737952	-1113,45094
2017	6885496,02	634639,475	491,9495462	666976200	300	1963,745605	0	39,91762205	1	3,991762205					950	392,749121	1387,658505	576,0871	115,21742	115,21742	1410,86968	19	462,1512332	-651,299705
2018	7358702,27	473206,255	506,7080326	528222200	300	1508,154539	0	29,76377799	1	2,976377799					950	301,630908	1285,371064	222,7834753	44,55669506	44,55669506	1128,22678	20	348,4840835	-302,815622
2019	7822174,09	463471,82	521,9092735	517110300	300	1521,443842	0	29,15150045	1	2,915150045					950	304,288768	1287,355419	234,0884234	46,81768468	46,81768468	1137,270739	21	331,2376808	28,42205912
2020	8279651,31	457477,22	537,5665517	508983800	300	1546,818265	0	28,77445146	1	2,877445146						309,363653	342,0155495	1204,802715	240,960543	240,960543	963,8421721	22	264,7104716	293,1325308
2021	8719598,69	439947,38	553,6935483	491506700	231	1532,172907	0	27,67185769	1	2,767185769						306,434581	337,8736249	1194,299282	238,8598565	238,8598565	955,4394259	23	247,4330353	540,5655661
2022	9141281,94	421683,25	570,3043547	486772700	231	1512,622716	0	26,52307848	1	2,652307848						302,524543	332,6999294	1179,922786	235,9845572	235,9845572	943,9382289	24	230,5087558	771,0743219
2023	9525102,21	383820,27	587,4134854	477554700	231	1418,1083	0	24,14156868	1	2,414156868						283,62166	311,1773856	1106,930915	221,3861829	221,3861829	885,5447317	25	203,9124217	974,9867436
2024	9889373,10	364270,89	605,0358899	471223300	231	1386,255186	0	22,91194967	1	2,291194967						277,251037	303,4541819	1082,801004	216,5602008	216,5602008	866,2408034	26	188,0880235	1163,0747767
2025	10221035,50	331662,4	623,1869666	455548600	231	1300,026427	0	20,86093736	1	2,086093736						260,005285	283,9523165	1016,074111	203,2148221	203,2148221	812,8592886	27	166,428311	1329,503078
2026	10530684,72	309649,22	641,8825756	447699000	231	1250,15297	0	19,47634999	1	1,947634999						250,030594	272,4545789	977,6983907	195,5396781	195,5396781	782,1587125	28	151,0066411	1480,509719
2027	10819473,12	288788,4	661,1390529	439238000	231	1200,9091	0	18,16424389	1	1,816424389						240,18182	261,1624883	939,7466117	187,9493223	187,9493223	751,7972894	29	136,8646348	1617,374354
2028	11099729,40	280256,28	680,9732245	430394000	231	1200,391659	0	17,62758968	1	1,762758968						240,078332	260,4686804	939,9229783	187,9845957	187,9845957	751,9383827	30	129,0809248	1746,455279
2029	11366337,78	266608,38	701,4024212	390908000	231	1176,193125	0	16,7691626	1	1,67691626						235,238625	254,6847039	921,5084211	184,3016842	184,3016842	737,2067369	31	119,332417	1865,787696
2030	11625873,89	259536,11	722,4444939	5195000	231	1179,342247	0	16,3243302	1	1,63243302						235,868449	254,8252126	924,5170343	184,9034069	184,9034069	739,6136274	32	112,8920536	1978,679749
2031	11878720,88	252846,99	744,1178287			1183,415022	0	15,90359721	1	1,590359721						236,683004	255,1769614	928,238061	185,6476122	185,6476122	742,5904488	33	106,8801747	2085,559924
2032	12117322,45	238601,57	766,4413635			1150,243563	0	15,00758725	1	1,500758725						230,048713	247,5570587	902,6865048	180,537301	180,537301	722,1492038	34	98,00857161	2183,568496
2033	12339559,15	222236,7	789,4346045			1103,492838	0	13,97826789	1	1,397826789						220,698568	237,0746624	866,4181761	173,2836352	173,2836352	693,1345409	35	88,70416083	2272,272656
2034	12553457,73	213898,58	813,1176426			1093,953509	0	13,45381592	1	1,345381592						218,790702	234,5898993	859,3636094	171,8727219	171,8727219	687,4908875	36	82,96267054	2355,235327
2035	12762790,52	209332,79	837,5111719			1102,720506	0	13,16663637	1	1,316663637						220,544101	236,0274011	866,6931045	173,3386209	173,3386209	693,3544836	37	78,89698964	2434,132317
2036	12973144,72	210354,2	862,636507			1141,344108	0	13,23088113	1	1,323088113				200		228,268822	243,8227909	897,5213172	179,5042634	179,5042634	518,0170538	38	55,58255279	2489,714869
2037	12974839,31	1694,59	888,5156022			9,470377209	0	0,106586504	1	0,01065865						1,89407544	3,011320597	6,459056612	1,291811322	1,291811322	5,16724529	39	0,522808737	
																						SUM	2489,714869	

12.4.5 Sensitivity Case: +40 % of Investment Cost

						INCOME		EXPENDITURE																
								OPEX			CAPEX													
DATE	FOPT	vol oil per year	oil prize	Vol gas per year	Gas prize	oil income	Gas income	Field / offshore	CO2 - duty	Gas oil transportation	Subsea/platform	Production unit	Drilling	abandon	Cap Allowance	royalty	Fiscal allowance	Taxable income	Tax	Net tax	cash flow	i	NPV	cum NPV
	(SM3)	Sm3	(UsD/BBL)	Sm3	(cents per gallon)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)		(MNOK)	(MNOK)
1999	182525,08	182525,08	21,39	45087848	110,8333333	147,3405078	0	11,48048214	1	1,148048214	4900		2310		1442	29,4681016	1485,096632	-1337,756124	-267,5512248	-267,5512248	-6838,2049	1	-6448,09514	-6448,09514
2000	330533,16	148008,08	34,29	62183542	138,4	191,5321749	0	9,309428157	1	0,930942816					1442	38,306435	1491,546806	-1300,014631	-260,0029262	-260,0029262	401,9882952	2	357,4308732	-6090,66427
2001	538899,12	208365,96	28,03	103837010	139,3333333	220,413758	0	13,10582459	1	1,310582459					1442	44,0827516	1501,499159	-1281,085401	-256,2170801	-256,2170801	417,1316795	3	349,7366578	-5740,92761
2002	773933,00	235033,88	27,33	174349490	136,5	242,4146889	0	14,7831863	1	1,47831863					1442	48,4829378	1507,744443	-1265,329754	-253,0659508	-253,0659508	429,736197	4	339,7498274	-5401,17778
2003	1050589,6	276656,6	32,47	231690460	156	339,009723	0	17,40117662	1	1,740117662					1442	67,8019446	1529,943239	-1190,933516	-238,1867032	-238,1867032	489,2531873	5	364,7374012	-5036,44038
2004	1529299,5	478709,9	42,97	246407810	180,3333333	776,2946497	0	30,10994685	1	3,010994685						155,25893	189,3798715	586,9147782	117,3829556	117,3829556	469,5318226	6	330,0661556	-4706,37423
2005	2016984,5	487685	55,21	213079440	231	1016,122283	0	30,67446366	1	3,067446366						203,224457	237,9663666	778,1559164	155,6311833	155,6311833	622,5247331	7	412,6500488	-4293,72418
2006	2392377	375392,5	62,36	247841245	270	883,447057	0	23,6114779	1	2,36114779						176,689411	203,6620371	679,7850199	135,957004	135,957004	543,8280159	8	339,9195899	-3953,80459
2007	2732394,5	340017,5	66,66	132349455	300	855,3727476	0	21,38645734	1	2,138645734						171,07455	195,5996526	659,773095	131,954619	131,954619	527,818476	9	311,0917778	-3642,71281
2008	2926702,5	194308	91,35	210171400	300	669,8661981	0	12,22160551	1	1,222160551						133,97324	148,4170057	521,4491924	104,2898385	104,2898385	417,1593539	10	231,8436779	-3410,86913
2009	2926702,5	0	60	0	300	0	0	0	1	0						0	1	-1	-0,2	0	-1	11	-0,52406191	-3411,3932
2010	3091608,2	164905,7	400	-51295890	300	414,8902592	0	10,37225648	1	1,037225648						82,9780518	95,38753396	319,5027252	63,90054504	63,90054504	255,6021802	12	126,3096348	-3285,08356
2011	3659698	568089,8	412	74040400	300	1472,149065	0	35,73177343	1	3,573177343						294,429813	334,7347638	1137,414301	227,4828603	227,4828603	909,9314411	13	424,0039715	-2861,07959
2012	4229853	570155	424,36	-235126510	300	1521,825854	0	35,8616706	1	3,58616706						304,365171	344,8130084	1177,012845	235,402569	235,402569	941,6102761	14	413,7345311	-2447,34506
2013	4749729	519876	437,0908	-219673000	300	1429,252676	0	32,69921664	1	3,269921664						285,850535	322,8196735	1106,433003	221,2866005	221,2866005	885,1464021	15	366,7372428	-2080,60782
2014	5199452	449723	450,203524	-197355000	300	1273,478359	0	28,28672569	1	2,828672569						254,695672	286,81107	986,6672888	197,3334578	197,3334578	789,3338311	16	308,382661	-1772,22515
2015	5689028	489576	463,7096297	24858700	300	1427,919796	0	30,79340398	1	3,079340398	5600		1050		1330	285,583959	1650,456703	-222,5369079	-44,50738158	-44,50738158	-5498,02953	17	-2025,46913	-3797,69429
2016	6444182	755154	477,6209186	719654400	300	2268,592263	0	47,49775763	1	4,749775763					1330	453,718453	1836,965986	431,6262769	86,32525539	86,32525539	1675,301022	18	581,9701932	-3215,72409
2017	7098449,5	654267,5	491,9495462	666976200	300	2024,480005	0	41,15218768	1	4,115218768					1330	404,896001	1781,163408	243,3165979	48,66331958	48,66331958	1524,653278	19	499,4227339	-2716,30136
2018	7586291	487841,5	506,7080326	528222200	300	1554,798494	0	30,68430721	1	3,068430721					1330	310,959699	1675,712437	-120,913943	-24,1827886	-24,1827886	1233,268846	20	380,9292342	-2335,37213
2019	8064097	477806	521,9092735	517110300	300	1568,498807	0	30,05309325	1	3,005309325					1330	313,699761	1677,758164	-109,2593573	-21,85187147	-21,85187147	1242,592514	21	361,9133497	-1973,45878
2020	8535723	471626	537,5665517	508983800	300	1594,658005	0	29,66438294	1	2,966438294						318,931601	352,5624222	1242,095583	248,4191165	248,4191165	993,6764661	22	272,9041887	-1700,55459
2021	8989277	453554	553,6935483	491506700	231	1579,559698	0	28,52768834	1	2,852768834						315,91194	348,2923968	1231,267301	246,2534603	246,2534603	985,0138411	23	255,092011	-1445,46258
2022	9424002	434725	570,3043547	486772700	231	1559,404861	0	27,34337987	1	2,734337987						311,880972	342,9586901	1216,446171	243,2892343	243,2892343	973,156937	24	237,6439346	-1207,81864
2023	9819693	395691	587,4134854	477554700	231	1461,96732	0	24,88821514	1	2,488821514						292,393464	320,7705006	1141,196819	228,2393638	228,2393638	912,9574553	25	210,2246888	-997,593954
2024	10195230	375537	605,0358899	471223300	231	1429,129058	0	23,62056667	1	2,362056667						285,825812	312,8084349	1116,320623	223,2641246	223,2641246	893,0564983	26	193,9105512	-803,683403
2025	10537150	341920	623,1869666	455548600	231	1340,23343	0	21,50612099	1	2,150612099						268,046686	292,7034191	1047,530011	209,5060022	209,5060022	838,0240088	27	171,5806442	-632,102759
2026	10856376	319226	641,8825756	447699000	231	1288,817494	0	20,07871133	1	2,007871133						257,763499	280,8500813	1007,967413	201,5934826	201,5934826	806,3739304	28	155,6817264	-476,421032
2027	11154096	297720	661,1390529	439238000	231	1238,050619	0	18,72602463	1	1,872602463						247,610124	269,2087508	968,8418678	193,7683736	193,7683736	775,0734942	29	141,1020659	-335,318966
2028	11443020	288924	680,9732245	430394000	231	1237,517174	0	18,17277287	1	1,817277287						247,503435	268,4934849	969,023689	193,8047378	193,8047378	775,2189512	30	133,0773657	-202,2416
2029	11717874	274854	701,4024212	390908000	231	1212,570232	0	17,28779649	1	1,728779649						242,514046	262,5306225	950,0396094	190,0079219	190,0079219	760,0316875	31	123,0271153	-79,2144851
2030	11985437	267563	722,4444939	5195000	231	1215,816749	0	16,82920639	1	1,682920639						243,16335	262,6754769	953,1412725	190,6282545	190,6282545	762,513018	32	116,387337	37,17285184
2031	12246104	260667	744,1178287			1220,015487	0	16,39546104	1	1,639546104						244,003097	263,0381045	956,9773825	191,3954765	191,3954765	765,581906	33	110,1893082	147,36216
2032	12492085	245981	766,4413635			1185,818107	0	15,47173943	1	1,547173943						237,163621	255,1825347	930,6355719	186,1271144	186,1271144	744,5084575	34	101,0431225	248,4052826
2033	12721195	229110	789,4346045			1137,621483	0	14,41058546	1	1,441058546						227,524297	244,3759406	893,2455424	178,6491085	178,6491085	714,5964339	35	91,45075488	339,8560374
2034	12941709	220514	813,1176426			1127,787122	0	13,86991332	1	1,386991332						225,557424	241,8143291	885,9727932	177,1945586	177,1945586	708,7782346	36	85,5315121	425,3875495
2035	13157516	215807	837,5111719			1136,825264	0	13,57385193	1	1,357385193						227,365053	243,2962898	893,5289738	178,7057948	178,7057948	714,823179	37	81,33991815	506,7274677
2036	13374376	216860	862,636507			1176,643411	0	13,64008364	1	1,364008364				280		235,328682	251,3327741	925,3106363	185,0621273	185,0621273	460,248509	38	49,38406344	556,1115311
2037	13376123	1747	888,5156022			9,763275473	0	0,109882994	1	0,010988299						1,95265509	3,073526388	6,689749085	1,337949817	1,337949817	5,351799268	39	0,541481439	
																						SUM	556,1115311	

12.4.6 Sensitivity Case: -40 % of Investment Cost

						INCOME		EXPENDITURE																
								OPEX			CAPEX													
DATE	FOPT	vol oil per year	oil prize	Vol gas per year	Gas prize	oil income	Gas income	Field / offshore	CO2 - duty	Gas oil transportation	Subsea/platform	Production unit	Drilling	abandon	Cap Allowance	royalty	Fiscal allowance	Taxable income	Tax	Net tax	cash flow	i	NPV	cum NPV
	(SM3)	Sm3	(UsD/BBL)	Sm3	(cents per gallon)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)		(MNOK)	(MNOK)
1999	182525,08	182525,08	21,39	45087848	110,8333333	147,3405078	0	11,48048214	1	1,148048214	2100		990		618	29,4681016	661,0966319	-513,7561241	-102,7512248	-102,7512248	-2883,0049	1	-2718,53362	-2718,53362
2000	330533,16	148008,08	34,29	62183542	138,4	191,5321749	0	9,309428157	1	0,930942816					618	38,306435	667,546806	-476,0146311	-95,20292621	-95,20292621	237,1882952	2	210,8977313	-2507,63588
2001	538899,12	208365,96	28,03	103837010	139,3333333	220,413758	0	13,10582459	1	1,310582459					618	44,0827516	677,4991587	-457,0854006	-91,41708013	-91,41708013	252,3316795	3	211,5630209	-2296,07286
2002	773933,00	235033,88	27,33	174349490	136,5	242,4146889	0	14,7831863	1	1,47831863					618	48,4829378	683,7444427	-441,3297538	-88,26595076	-88,26595076	264,936197	4	209,4587978	-2086,61407
2003	1050589,6	276656,6	32,47	231690460	156	339,009723	0	17,40117662	1	1,740117662					618	67,8019446	705,9432389	-366,9335159	-73,38670318	-73,38670318	324,4531873	5	241,8792875	-1844,73478
2004	1529299,5	478709,9	42,97	246407810	180,3333333	776,2946497	0	30,10994685	1	3,010994685						155,25893	189,3798715	586,9147782	117,3829556	117,3829556	469,5318226	6	330,0661556	-1514,66862
2005	2016984,5	487685	55,21	213079440	231	1016,122283	0	30,67446366	1	3,067446366						203,224457	237,9663666	778,1559164	155,6311833	155,6311833	622,5247331	7	412,6500488	-1102,01857
2006	2392377	375392,5	62,36	247841245	270	883,447057	0	23,6114779	1	2,36114779						176,689411	203,6620371	679,7850199	135,957004	135,957004	543,8280159	8	339,9195899	-762,098984
2007	2732394,5	340017,5	66,66	132349455	300	855,3727476	0	21,38645734	1	2,138645734						171,07455	195,5996526	659,773095	131,954619	131,954619	527,818476	9	311,0917778	-451,007206
2008	2926702,5	194308	91,35	210171400	300	669,8661981	0	12,22160551	1	1,222160551						133,97324	148,4170057	521,4491924	104,2898385	104,2898385	417,1593539	10	231,8436779	-219,163528
2009	2926702,5	0	60	0	300	0	0	0	1	0						0	1	-1	-0,2	0	-1	11	-0,52406191	-219,68759
2010	3091608,2	164905,7	400	-51295890	300	414,8902592	0	10,37225648	1	1,037225648						82,9780518	95,38753396	319,5027252	63,90054504	63,90054504	255,6021802	12	126,3096348	-93,3779552
2011	3659698	568089,8	412	74040400	300	1472,149065	0	35,73177343	1	3,573177343						294,429813	334,7347638	1137,414301	227,4828603	227,4828603	909,9314411	13	424,0039715	330,6260163
2012	4229853	570155	424,36	-235126510	300	1521,825854	0	35,8616706	1	3,58616706						304,365171	344,8130084	1177,012845	235,402569	235,402569	941,6102761	14	413,7345311	744,3605475
2013	4749729	519876	437,0908	-219673000	300	1429,252676	0	32,69921664	1	3,269921664						285,850535	322,8196735	1106,433003	221,2866005	221,2866005	885,1464021	15	366,7372428	1111,09779
2014	5199452	449723	450,203524	-197355000	300	1273,478359	0	28,28672569	1	2,828672569						254,695672	286,81107	986,6672888	197,3334578	197,3334578	789,3338311	16	308,382661	1419,480451
2015	5689028	489576	463,7096297	24858700	300	1427,919796	0	30,79340398	1	3,079340398	2400		450		570	285,583959	890,4567035	537,4630921	107,4926184	107,4926184	-1850,02953	17	-681,549214	737,9312373
2016	6444182	755154	477,6209186	719654400	300	2268,592263	0	47,49775763	1	4,749775763					570	453,718453	1076,965986	1191,626277	238,3252554	238,3252554	1523,301022	18	529,168059	1267,099296
2017	7098449,5	654267,5	491,9495462	666976200	300	2024,480005	0	41,15218768	1	4,115218768					570	404,896001	1021,163408	1003,316598	200,6633196	200,6633196	1372,653278	19	449,6328855	1716,732182
2018	7586291	487841,5	506,7080326	528222200	300	1554,798494	0	30,68430721	1	3,068430721					570	310,959699	915,7124367	639,086057	127,8172114	127,8172114	1081,268846	20	333,979825	2050,712007
2019	8064097	477806	521,9092735	517110300	300	1568,498807	0	30,05309325	1	3,005309325					570	313,699761	917,7581639	650,7406427	130,1481285	130,1481285	1090,592514	21	317,6423369	2368,354344
2020	8535723	471626	537,5665517	508983800	300	1594,658005	0	29,66438294	1	2,966438294						318,931601	352,5624222	1242,095583	248,4191165	248,4191165	993,6764661	22	272,9041887	2641,258532
2021	8989277	453554	553,6935483	491506700	231	1579,559698	0	28,52768834	1	2,852768834						315,91194	348,2923968	1231,267301	246,2534603	246,2534603	985,0138411	23	255,092011	2896,350543
2022	9424002	434725	570,3043547	486772700	231	1559,404861	0	27,34337987	1	2,734337987						311,880972	342,9586901	1216,446171	243,2892343	243,2892343	973,156937	24	237,6439346	3133,994478
2023	9819693	395691	587,4134854	477554700	231	1461,96732	0	24,88821514	1	2,488821514						292,393464	320,7705006	1141,196819	228,2393638	228,2393638	912,9574553	25	210,2246888	3344,219167
2024	10195230	375537	605,0358899	471223300	231	1429,129058	0	23,62056667	1	2,362056667						285,825812	312,8084349	1116,320623	223,2641246	223,2641246	893,0564983	26	193,9105512	3538,129718
2025	10537150	341920	623,1869666	455548600	231	1340,23343	0	21,50612099	1	2,150612099						268,046686	292,7034191	1047,530011	209,5060022	209,5060022	838,0240088	27	171,5806442	3709,710362
2026	10856376	319226	641,8825756	447699000	231	1288,817494	0	20,07871133	1	2,007871133						257,763499	280,8500813	1007,967413	201,5934826	201,5934826	806,3739304	28	155,6817264	3865,392089
2027	11154096	297720	661,1390529	439238000	231	1238,050619	0	18,72602463	1	1,872602463						247,610124	269,2087508	968,8418678	193,7683736	193,7683736	775,0734942	29	141,1020659	4006,494155
2028	11443020	288924	680,9732245	430394000	231	1237,517174	0	18,17277287	1	1,817277287						247,503435	268,4934849	969,023689	193,8047378	193,8047378	775,2189512	30	133,0773657	4139,57152
2029	11717874	274854	701,4024212	390908000	231	1212,570232	0	17,28779649	1	1,728779649						242,514046	262,5306225	950,0396094	190,0079219	190,0079219	760,0316875	31	123,0271153	4262,598636
2030	11985437	267563	722,4444939	5195000	231	1215,816749	0	16,82920639	1	1,682920639						243,16335	262,6754769	953,1412725	190,6282545	190,6282545	762,513018	32	116,387337	4378,985973
2031	12246104	260667	744,1178287			1220,015487	0	16,39546104	1	1,639546104						244,003097	263,0381045	956,9773825	191,3954765	191,3954765	765,581906	33	110,1893082	4489,175281
2032	12492085	245981	766,4413635			1185,818107	0	15,47173943	1	1,547173943						237,163621	255,1825347	930,6355719	186,1271144	186,1271144	744,5084575	34	101,0431225	4590,218403
2033	12721195	229110	789,4346045			1137,621483	0	14,41058546	1	1,441058546						227,524297	244,3759406	893,2455424	178,6491085	178,6491085	714,5964339	35	91,45075488	4681,669158
2034	12941709	220514	813,1176426			1127,787122	0	13,86991332	1	1,386991332						225,557424	241,8143291	885,9727932	177,1945586	177,1945586	708,7782346	36	85,5315121	4767,20067
2035	13157516	215807	837,5111719			1136,825264	0	13,57385193	1	1,357385193						227,365053	243,2962898	893,5289738	178,7057948	178,7057948	714,823179	37	81,33991815	4848,540588
2036	13374376	216860	862,636507			1176,64341	0	13,64008364	1	1,364008364				120		235,328682	251,3327741	925,3106363	185,0621273	185,0621273	620,248509	38	66,55185431	4915,092443
2037	13376123	1747	888,5156022			9,763275473	0	0,109882994	1	0,010988299						1,95265509	3,073526388	6,689749085	1,337949817	1,337949817	5,351799268	39	0,541481439	
																						SUM	4915,092443	

12.5 Base Case: ICD Case

						INCOME		EXPENDITURE																
								OPEX			CAPEX													
DATE	FOPT	vol oil per year	oil prize	Vol gas per year	Gas prize	oil income	Gas income	Field / offshore	CO2 - duty	Gas oil transportation	Subsea/platform	Production unit	Drilling	abandon	Cap Allowance	royalty	Fiscal allowance	Taxable income	Tax	Net tax	cash flow	i	NPV	cum NPV
	(SM3)	Sm3	(UsD/BBL)	Sm3	(cents per gallon)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)		(MNOK)	(MNOK)
1999	182525,08	182525,08	21,39	45087848	110,8333333	147,3405078	0	11,48048214	1	1,148048214	3500		1650		1030	29,4681016	1073,096632	-925,7561241	-185,1512248	-185,1512248	-4860,6049	1	-4583,31438	-4583,31438
2000	330533,16	148008,08	34,29	62183542	138,4	191,5321749	0	9,309428157	1	0,930942816					1030	38,306435	1079,546806	-888,0146311	-177,6029262	-177,6029262	319,5882952	2	284,1643022	-4299,15008
2001	538899,12	208365,96	28,03	103837010	139,3333333	220,413758	0	13,10582459	1	1,310582459					1030	44,0827516	1089,499159	-869,0854006	-173,8170801	-173,8170801	334,7316795	3	280,6498394	-4018,50024
2002	773933,00	235033,88	27,33	174349490	136,5	242,4146889	0	14,7831863	1	1,47831863					1030	48,4829378	1095,744443	-853,3297538	-170,6659508	-170,6659508	347,336197	4	274,6043126	-3743,89593
2003	1050589,6	276656,6	32,47	231690460	156	339,009723	0	17,40117662	1	1,740117662					1030	67,8019446	1117,943239	-778,9335159	-155,7867032	-155,7867032	406,8531873	5	303,3083443	-3440,58758
2004	1529299,5	478709,9	42,97	246407810	180,3333333	776,2946497	0	30,10994685	1	3,010994685						155,25893	189,3798715	586,9147782	117,3829556	117,3829556	469,5318226	6	330,0661556	-3110,52143
2005	2016984,5	487685	55,21	213079440	231	1016,122283	0	30,67446366	1	3,067446366						203,224457	237,9663666	778,1559164	155,6311833	155,6311833	622,5247331	7	412,6500488	-2697,87138
2006	2392377	375392,5	62,36	247841245	270	883,447057	0	23,6114779	1	2,36114779						176,689411	203,6620371	679,7850199	135,957004	135,957004	543,8280159	8	339,9195899	-2357,95179
2007	2732394,5	340017,5	66,66	132349455	300	855,3727476	0	21,38645734	1	2,138645734						171,07455	195,5996526	659,773095	131,954619	131,954619	527,818476	9	311,0917778	-2046,86001
2008	2926702,5	194308	91,35	210171400	300	669,8661981	0	12,22160551	1	1,222160551						133,97324	148,4170057	521,4491924	104,2898385	104,2898385	417,1593539	10	231,8436779	-1815,01633
2009	2926702,5	0	60	0	300	0	0	0	1	0						0	1	-1	-0,2	0	-1	11	-0,52406191	-1815,54039
2010	3091608,2	164905,7	400	-51295890	300	414,8902592	0	10,37225648	1	1,037225648						82,9780518	95,38753396	319,5027252	63,90054504	63,90054504	255,6021802	12	126,3096348	-1689,23076
2011	3659698	568089,8	412	74040400	300	1472,149065	0	35,73177343	1	3,573177343						294,429813	334,7347638	1137,414301	227,4828603	227,4828603	909,9314411	13	424,0039715	-1265,22679
2012	4229853	570155	424,36	-235126510	300	1521,825854	0	35,8616706	1	3,58616706						304,365171	344,8130084	1177,012845	235,402569	235,402569	941,6102761	14	413,7345311	-851,492255
2013	4749729	519876	437,0908	-219673000	300	1429,252676	0	32,69921664	1	3,269921664						285,850535	322,8196735	1106,433003	221,2866005	221,2866005	885,1464021	15	366,7372428	-484,755012
2014	5199452	449723	450,203524	-197355000	300	1273,478359	0	28,28672569	1	2,828672569						254,695672	286,81107	986,6672888	197,3334578	197,3334578	789,3338311	16	308,382661	-176,372352
2015	5697914,5	498462,5	463,7096297	24858700	300	1453,838569	0	31,35234801	1	3,135234801	4000		750		950	290,767714	1276,255297	177,5832722	35,51665443	35,51665443	-3657,93338	17	-1347,57937	-1523,95172
2016	6480866	782951,5	477,6209186	719654400	300	2352,099989	0	49,24616777	1	4,924616777					950	470,419998	1475,590782	876,5092067	175,3018413	175,3018413	1651,207365	18	573,6004796	-950,351241
2017	7163098	682232	491,9495462	666976200	300	2111,009706	0	42,91110182	1	4,291110182					950	422,201941	1420,404153	690,6055531	138,1211106	138,1211106	1502,484442	19	492,1610038	-458,190237
2018	7682229,5	519131,5	506,7080326	528222200	300	1654,522779	0	32,652389	1	3,2652389					950	330,904556	1317,822184	336,7005952	67,34011903	67,34011903	1219,360476	20	376,6332491	-81,5569878
2019	8192207,5	509978	521,9092735	517110300	300	1674,110171	0	32,07665117	1	3,207665117					950	334,822034	1321,10635	353,0038205	70,6007641	70,6007641	1232,403056	21	358,9456023	277,3886145
2020	8696013	503805,5	537,5665517	508983800	300	1703,463069	0	31,6884126	1	3,16884126						340,692614	376,5498677	1326,913201	265,3826403	265,3826403	1061,530561	22	291,5396977	568,9283122
2021	9176470	480457	553,6935483	491506700	231	1673,25283	0	30,21983613	1	3,021983613						334,650566	368,8923857	1304,360444	260,8720888	260,8720888	1043,488355	23	270,2353326	839,1636448
2022	9614766	438296	570,3043547	486772700	231	1572,214419	0	27,56798901	1	2,756798901						314,442884	345,7676716	1226,446747	245,2893494	245,2893494	981,1573976	24	239,5976639	1078,761284
2023	10016939	402173	587,4134854	477554700	231	1485,916493	0	25,29592067	1	2,529592067						297,183299	326,0088113	1159,907681	231,9815363	231,9815363	927,9261451	25	213,6714958	1292,43278
2024	10394906	377967	605,0358899	471223300	231	1438,376572	0	23,77340907	1	2,377340907						287,675314	314,8260643	1123,550507	224,7101015	224,7101015	898,8404059	26	195,1664187	1487,599198
2025	10742690	347784	623,1869666	455548600	231	1363,218716	0	21,87495549	1	2,187495549						272,643743	297,7061942	1065,512522	213,1025043	213,1025043	852,4100172	27	174,5260975	1662,125296
2026	11069757	327067	641,8825756	447699000	231	1320,47412	0	20,57189539	1	2,057189539						264,094824	287,7239089	1032,750211	206,5500422	206,5500422	826,2001689	28	159,5094581	1821,634754
2027	11379174	309417	661,1390529	439238000	231	1286,691886	0	19,46174379	1	1,946174379						257,338377	279,7462953	1006,94559	201,3891181	201,3891181	805,5564724	29	146,6514896	1968,286243
2028	11675520	296346	680,9732245	430394000	231	1269,30703	0	18,63960263	1	1,863960263						253,861406	275,364969	993,9420614	198,7884123	198,7884123	795,1536491	30	136,4994404	2104,785684
2029	11950347	274827	701,4024212	390908000	231	1212,451116	0	17,28609825	1	1,728609825						242,490223	262,5049313	949,946185	189,989237	189,989237	759,956948	31	123,0150172	2227,800701
2030	12213791	263444	722,4444939	5195000	231	1197,099852	0	16,57012909	1	1,657012909						239,41997	258,6471124	938,4527397	187,6905479	187,6905479	750,7621917	32	114,5937317	2342,394433
2031	12465869	252078	744,1178287			1179,815872	0	15,85522919	1	1,585522919						235,963174	254,4039265	925,4119456	185,0823891	185,0823891	740,3295565	33	106,5547671	2448,9492
2032	12708213	242344	766,4413635			1168,284962	0	15,24297901	1	1,524297901						233,656992	251,4242693	916,8606927	183,3721385	183,3721385	733,4885541	34	99,54752439	2548,496724
2033	12938343	230130	789,4346045			1142,686185	0	14,47474153	1	1,447474153						228,537237	245,4594527	897,2267324	179,4453465	179,4453465	717,7813859	35	91,85835035	2640,355074
2034	13163144	224801	813,1176426			1149,712367	0	14,13955751	1	1,413955751						229,942473	246,4959867	903,2163803	180,6432761	180,6432761	722,5731043	36	87,19620213	2727,551277
2035	13379649	216505	837,5111719			1140,502179	0	13,61775481	1	1,361775481						228,100436	244,079966	896,4222127	179,2844425	179,2844425	717,1377702	37	81,60329609	2809,154573
2036	13588541	208892	862,636507			1133,410473	0	13,13891151	1	1,313891151				200		226,682095	242,1348974	891,2755761	178,2551152	178,2551152	513,0204609	38	55,0464249	2864,200998
2037	13590219	1678	888,5156022			9,377662418	0	0,105543025	1	0,010554302						1,87553248	2,991629811	6,386032607	1,277206521	1,277206521	5,108826086	39	0,516898031	
																						SUM	2864,200998	

12.6 Sensitivity Case: ICD Case

12.6.1 Sensitivity Case: +5% of Oil and Gas Price

						INCOME		EXPENDITURE																
								OPEX			CAPEX													
DATE	FOPT	vol oil per year	oil prize	Vol gas per year	Gas prize	oil income	Gas income	Field / offshore	CO2 - duty	Gas oil transportation	Subsea/platform	Production unit	Drilling	abandon	Cap Allowance	royalty	Fiscal allowance	Taxable income	Tax	Net tax	cash flow	i	NPV	cum NPV
	(SM3)	Sm3	(UsD/BBL)	Sm3	(cents per gallon)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)		(MNOK)	(MNOK)
1999	182525,08	182525,08	21,39	45087848	110,8333333	147,3405078	0	11,48048214	1	1,148048214	3500		1650		1030	29,4681016	1073,096632	-925,7561241	-185,1512248	-185,1512248	-4860,6049	1	-4583,31438	-4583,31438
2000	330533,16	148008,08	34,29	62183542	138,4	191,5321749	0	9,309428157	1	0,930942816					1030	38,306435	1079,546806	-888,0146311	-177,6029262	-177,6029262	319,5882952	2	284,1643022	-4299,15008
2001	538899,12	208365,96	28,03	108837010	139,3333333	220,413758	0	13,10582459	1	1,310582459					1030	44,0827516	1089,499159	-869,0854006	-173,8170801	-173,8170801	334,7316795	3	280,6498394	-4018,50024
2002	773933,00	235033,88	27,33	174349490	136,5	242,4146889	0	14,7831863	1	1,47831863					1030	48,4829378	1095,744443	-853,3297538	-170,6659508	-170,6659508	347,336197	4	274,6043126	-3743,89593
2003	1050589,6	276656,6	32,47	231690460	156	339,009723	0	17,40117662	1	1,740117662					1030	67,8019446	1117,943239	-778,9335159	-155,7867032	-155,7867032	406,8531873	5	303,3083443	-3440,58758
2004	1529299,5	478709,9	42,97	246407810	180,3333333	776,2946497	0	30,10994685	1	3,010994685						155,25893	189,3798715	586,9147782	117,3829556	117,3829556	469,5318226	6	330,0661556	-3110,52143
2005	2016984,5	487685	55,21	213079440	231	1016,122283	0	30,67446366	1	3,067446366						203,224457	237,9663666	778,1559164	155,6311833	155,6311833	622,5247331	7	412,6500488	-2697,87138
2006	2392377	375392,5	62,36	247841245	270	883,447057	0	23,6114779	1	2,36114779						176,689411	203,6620371	679,7850199	135,957004	135,957004	543,8280159	8	339,9195899	-2357,95179
2007	2732394,5	340017,5	66,66	132349455	300	855,3727476	0	21,38645734	1	2,138645734						171,07455	195,5996526	659,773095	131,954619	131,954619	527,818476	9	311,0917778	-2046,86001
2008	2926702,5	194308	91,35	210171400	300	669,8661981	0	12,22160551	1	1,222160551						133,97324	148,4170057	521,4491924	104,2898385	104,2898385	417,1593539	10	231,8436779	-1815,01633
2009	2926702,5	0	60	0	300	0	0	0	1	0						0	1	-1	-0,2	0	-1	11	-0,52406191	-1815,54039
2010	3091608,2	164905,7	400	-51295890	300	414,8902592	0	10,37225648	1	1,037225648						82,9780518	95,38753396	319,5027252	63,90054504	63,90054504	255,6021802	12	126,3096348	-1689,23076
2011	3659698	568089,8	420	74040400	300	1500,734484	0	35,73177343	1	3,573177343						300,146897	340,4518475	1160,282636	232,0565273	232,0565273	928,2261091	13	432,5288026	-1256,70196
2012	4229853	570155	441	-235126510	300	1581,499673	0	35,8616706	1	3,58616706						316,299935	356,7477723	1224,751901	244,9503802	244,9503802	979,8015208	14	430,5153981	-826,186557
2013	4749729	519876	463,05	-219673000	300	1514,137227	0	32,69921664	1	3,269921664						302,827445	339,7965836	1174,340643	234,8681286	234,8681286	939,4725144	15	389,2458455	-436,940712
2014	5199452	449723	486,2025	-197355000	300	1375,307675	0	28,28672569	1	2,828672569						275,061535	307,1769332	1068,130742	213,6261483	213,6261483	854,5045933	16	333,8440466	-103,096665
2015	5697914,5	498462,5	510,512625	24858700	300	1600,576948	0	31,35234801	1	3,135234801	4000		750		950	320,11539	1305,602972	294,9739759	58,99479517	58,99479517	-3564,02082	17	-1312,98207	-1416,07873
2016	6480866	782951,5	536,0382563	719654400	300	2639,78299	0	49,24616777	1	4,924616777					950	527,956598	1533,127383	1106,655608	221,3311215	221,3311215	1835,324486	18	637,5595383	-778,519192
2017	7163098	682232	562,8401691	666976200	300	2415,20918	0	42,91110182	1	4,291110182					950	483,041836	1481,244048	933,965132	186,7930264	186,7930264	1697,172106	19	555,9338277	-222,585364
2018	7682229,5	519131,5	590,9821775	528222200	300	1929,697995	0	32,652389	1	3,2652389					950	385,939599	1372,857227	556,8407683	111,3681537	111,3681537	1395,472615	20	431,0303599	208,4449956
2019	8192207,5	509978	620,5312864	517110300	300	1990,456561	0	32,07665117	1	3,207665117					950	398,091312	1384,375629	606,0809328	121,2161866	121,2161866	1434,864746	21	417,9139185	626,3589141
2020	8696013	503805,5	651,5578507	508983800	300	2064,683401	0	31,6884126	1	3,16884126						412,93668	448,793934	1615,889467	323,1778933	323,1778933	1292,711573	22	355,0314566	981,3903707
2021	9176470	480457	684,1357432	491506700	231	2067,447005	0	30,21983613	1	3,021983613						413,489401	447,7312208	1619,715785	323,9431569	323,9431569	1295,772628	23	335,570153	1316,960524
2022	9614766	438296	718,3425304	486772700	231	1980,325899	0	27,56798901	1	2,756798901						396,06518	427,3899677	1552,935931	310,5871862	310,5871862	1242,348745	24	303,3803004	1620,340824
2023	10016939	402173	754,2596569	477554700	231	1907,969245	0	25,29592067	1	2,529592067						381,593849	410,4193617	1497,549883	299,5099766	299,5099766	1198,039906	25	275,8699926	1896,210817
2024	10394906	377967	791,9726398	471223300	231	1882,788954	0	23,77340907	1	2,377340907						376,557791	403,7085408	1479,080413	295,8160827	295,8160827	1183,264331	26	256,9237657	2153,134582
2025	10742690	347784	831,5712718	455548600	231	1819,058456	0	21,87495549	1	2,187495549						363,811691	388,8741422	1430,184313	286,0368627	286,0368627	1144,147451	27	234,2576759	2387,392258
2026	11069757	327067	873,1498354	447699000	231	1796,234707	0	20,57189539	1	2,057189539						359,246941	382,8760264	1413,358681	282,6717362	282,6717362	1130,686945	28	218,2948741	2605,687132
2027	11379174	309417	916,8073271	439238000	231	1784,266931	0	19,46174379	1	1,946174379						356,853386	379,2613043	1405,005626	281,0011253	281,0011253	1124,004501	29	204,6249271	2810,312059
2028	11675520	296346	962,6476935	430394000	231	1794,337047	0	18,63960263	1	1,863960263						358,867409	380,3709724	1413,966075	282,793215	282,793215	1131,17286	30	194,1819201	3004,49398
2029	11950347	274827	1010,780078	390908000	231	1747,244374	0	17,28609825	1	1,728609825						349,448875	369,4635828	1377,780791	275,5561582	275,5561582	1102,224633	31	178,4182413	3182,912221
2030	12213791	263444	1061,319082	5195000	231	1758,619419	0	16,57012909	1	1,657012909						351,723884	370,9510258	1387,668393	277,5336787	277,5336787	1110,134715	32	169,4471046	3352,359325
2031	12465869	252078	1114,385036			1766,883016	0	15,85522919	1	1,585522919						353,376603	371,8173553	1395,065661	279,0131321	279,0131321	1116,052528	33	160,632135	3512,99146
2032	12708213	242344	1170,104288			1783,587511	0	15,24297901	1	1,524297901						356,717502	374,484779	1409,102731	281,8205463	281,8205463	1127,282185	34	152,992368	3665,983828
2033	12938343	230130	1228,609502			1778,380498	0	14,47474153	1	1,447474153						355,6761	372,5983153	1405,782183	281,1564366	281,1564366	1124,625746	35	143,9244147	3809,908243
2034	13163144	224801	1290,039977			1824,059445	0	14,13955751	1	1,413955751						364,811889	381,3654023	1442,694043	288,5388086	288,5388086	1154,155234	36	139,2771922	3949,185435
2035	13379649	216505	1354,541976			1844,582051	0	13,61775481	1	1,361775481						368,91641	384,8959405	1459,686111	291,9372221	291,9372221	1167,748889	37	132,8784541	4082,063889
2036	13588541	208892	1422,269075			1868,706753	0	13,13891151	1	1,313891151				200		373,741351	389,1941532	1479,5126	295,9025199	295,9025199	983,6100797	38	105,5400759	4187,603965
2037	13590219	1678	1493,382529			15,76161092	0	0,105543025	1	0,010554302						3,15232218	4,268419511	11,49319141	2,298638281	2,298638281	9,194553126	39	0,930281502	
																						SUM	4187,603965	

Sensitivity Case: -2% of Oil and Gas Price

						INCOME		EXPENDITURE																
								OPEX			CAPEX													
DATE	FOPT	vol oil per year	oil prize	Vol gas per year	Gas prize	oil income	Gas income	Field / offshore	CO2 - duty	Gas oil transportation	Subsea/platform	Production unit	Drilling	abandon	Cap Allowance	royalty	Fiscal allowance	Taxable income	Tax	Net tax	cash flow	i	NPV	cum NPV
	(SM3)	Sm3	(UsD/BBL)	Sm3	(cents per gallon)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)		(MNOK)	(MNOK)
1999	182525,08	182525,08	21,39	45087848	110,8333333	147,3405078	0	11,48048214	1	1,148048214	3500		1650		1030	29,4681016	1073,096632	-925,7561241	-185,1512248	-185,1512248	-4860,6049	1	-4583,31438	-4583,31438
2000	330533,16	148008,08	34,29	62183542	138,4	191,5321749	0	9,309428157	1	0,930942816					1030	38,306435	1079,546806	-888,0146311	-177,6029262	-177,6029262	319,5882952	2	284,1643022	-4299,15008
2001	538899,12	208365,96	28,03	103837010	139,3333333	220,413758	0	13,10582459	1	1,310582459					1030	44,0827516	1089,499159	-869,0854006	-173,8170801	-173,8170801	334,7316795	3	280,6498394	-4018,50024
2002	773933,00	235033,88	27,33	174349490	136,5	242,4146889	0	14,7831863	1	1,47831863					1030	48,4829378	1095,744443	-853,3297538	-170,6659508	-170,6659508	347,336197	4	274,6043126	-3743,89593
2003	1050589,6	276656,6	32,47	231690460	156	339,009723	0	17,40117662	1	1,740117662					1030	67,8019446	1117,943239	-778,9335159	-155,7867032	-155,7867032	406,8531873	5	303,3083443	-3440,58758
2004	1529299,5	478709,9	42,97	246407810	180,3333333	776,2946497	0	30,10994685	1	3,010994685						155,25893	189,3798715	586,9147782	117,3829556	117,3829556	469,5318226	6	330,0661556	-3110,52143
2005	2016984,5	487685	55,21	213079440	231	1016,122283	0	30,67446366	1	3,067446366						203,224457	237,9663666	778,1559164	155,6311833	155,6311833	622,5247331	7	412,6500488	-2697,87138
2006	2392377	375392,5	62,36	247841245	270	883,447057	0	23,6114779	1	2,36114779						176,689411	203,6620371	679,7850199	135,957004	135,957004	543,8280159	8	339,9195899	-2357,95179
2007	2732394,5	340017,5	66,66	132349455	300	855,3727476	0	21,38645734	1	2,138645734						171,07455	195,5996526	659,773095	131,954619	131,954619	527,818476	9	311,0917778	-2046,86001
2008	2926702,5	194308	91,35	210171400	300	669,8661981	0	12,22160551	1	1,222160551						133,97324	148,4170057	521,4491924	104,2898385	104,2898385	417,1593539	10	231,8436779	-1815,01633
2009	2926702,5	0	60	0	300	0	0	0	1	0						0	1	-1	-0,2	0	-1	11	-0,52406191	-1815,54039
2010	3091608,2	164905,7	400	-51295890	300	414,8902592	0	10,37225648	1	1,037225648						82,9780518	95,38753396	319,5027252	63,90054504	63,90054504	255,6021802	12	126,3096348	-1689,23076
2011	3659698	568089,8	392	74040400	300	1400,685518	0	35,73177343	1	3,573177343						280,137104	320,4420544	1080,243464	216,0486928	216,0486928	864,1947711	13	402,6918936	-1286,53886
2012	4229853	570155	384,16	-235126510	300	1377,661938	0	35,8616706	1	3,58616706						275,532388	315,9802252	1061,681713	212,3363425	212,3363425	849,34537	14	373,1942156	-913,344649
2013	4749729	519876	376,4768	-219673000	300	1231,049644	0	32,69921664	1	3,269921664						246,209929	283,1790672	947,8705772	189,5741154	189,5741154	758,2964617	15	314,1802904	-599,164358
2014	5199452	449723	368,947264	-197355000	300	1043,631005	0	28,28672569	1	2,828672569						208,726201	240,8415993	802,7894058	160,5578812	160,5578812	642,2315247	16	250,9116659	-348,252692
2015	5697914,5	498462,5	361,5683187	24858700	300	1133,601576	0	31,35234801	1	3,135234801	4000		750		950	226,720315	1212,207898	-78,60632214	-15,72126443	-15,72126443	-3862,88506	17	-1423,08338	-1771,33607
2016	6480866	782951,5	354,3369523	719654400	300	1744,9737	0	49,24616777	1	4,924616777					950	348,99474	1354,165525	390,8081758	78,16163515	78,16163515	1262,646541	18	438,6212638	-1332,71481
2017	7163098	682232	347,2502133	666976200	300	1490,088926	0	42,91110182	1	4,291110182					950	298,017785	1296,219997	193,8689287	38,77378573	38,77378573	1105,095143	19	361,9902606	-970,72455
2018	7682229,5	519131,5	340,305209	528222200	300	1111,177806	0	32,652389	1	3,2652389					950	222,235561	1209,153189	-97,97538278	-19,59507656	-19,59507656	871,6196938	20	269,223879	-701,500671
2019	8192207,5	509978	333,4991049	517110300	300	1069,753445	0	32,07665117	1	3,207665117					950	213,950689	1200,235005	-130,4815601	-26,09631202	-26,09631202	845,6147519	21	246,2909312	-455,20974
2020	8696013	503805,5	326,8291228	508983800	300	1035,669609	0	31,6884126	1	3,16884126						207,133922	242,9911757	792,6784335	158,5356867	158,5356867	634,1427468	22	174,1615281	-281,048211
2021	9176470	480457	320,2925403	491506700	231	967,9188083	0	30,21983613	1	3,021983613						193,583762	227,8255814	740,0932269	148,0186454	148,0186454	592,0745815	23	153,3313435	-127,716868
2022	9614766	438296	313,8866895	486772700	231	865,3224808	0	27,56798901	1	2,756798901						173,064496	204,3892841	660,9331967	132,1866393	132,1866393	528,7465574	24	129,1193718	1,402503797
2023	10016939	402173	307,6089557	477554700	231	778,1251741	0	25,29592067	1	2,529592067						155,625035	184,4505476	593,6746265	118,7349253	118,7349253	474,9397012	25	109,3633118	110,7658156
2024	10394906	377967	301,4567766	471223300	231	716,6655268	0	23,77340907	1	2,377340907						143,333105	170,4838553	546,1816715	109,2363343	109,2363343	436,9453372	26	94,8745251	205,6403407
2025	10742690	347784	295,4276411	455548600	231	646,2466499	0	21,87495549	1	2,187495549						129,24933	154,311781	491,9348689	98,38697377	98,38697377	393,5478951	27	80,5766907	286,2170314
2026	11069757	327067	289,5190882	447699000	231	595,5956397	0	20,57189539	1	2,057189539						119,119128	142,7482129	452,8474269	90,56948537	90,56948537	362,2779415	28	69,94280599	356,1598374
2027	11379174	309417	283,7287065	439238000	231	552,1855392	0	19,46174379	1	1,946174379						110,437108	132,845026	419,3405132	83,86810263	83,86810263	335,4724105	29	61,07272478	417,2325622
2028	11675520	296346	278,0541323	430394000	231	518,2818535	0	18,63960263	1	1,863960263						103,656371	125,1599336	393,1219199	78,62438399	78,62438399	314,4975359	30	53,98797792	471,2205401
2029	11950347	274827	272,4930497	390908000	231	471,0341628	0	17,28609825	1	1,728609825						94,2068326	114,2215406	356,8126222	71,36252444	71,36252444	285,4500978	31	46,20610255	517,4266426
2030	12213791	263444	267,0431887	5195000	231	442,4940108	0	16,57012909	1	1,657012909						88,4988022	107,7259442	334,7680667	66,95361333	66,95361333	267,8144533	32	40,87826737	558,30491
2031	12465869	252078	261,7023249			414,9350342	0	15,85522919	1	1,585522919						82,9870068	101,427759	313,5072753	62,70145505	62,70145505	250,8058202	33	36,09818833	594,4030983
2032	12708213	242344	256,4682784			390,9340586	0	15,24297901	1	1,524297901						78,1868117	95,95408863	294,9799699	58,99599399	58,99599399	235,983976	34	32,02724906	626,4303474
2033	12938343	230130	251,3389129			363,8065799	0	14,47474153	1	1,447474153						72,761316	89,68353166	274,1230482	54,82460965	54,82460965	219,2984386	35	28,06480246	654,4951499
2034	13163144	224801	246,3121346			348,2744593	0	14,13955751	1	1,413955751						69,6548919	86,20840511	262,0660542	52,41321083	52,41321083	209,6528433	36	25,29976773	679,7949176
2035	13379649	216505	241,3858919			328,713389	0	13,61775481	1	1,361775481						65,7426778	81,7222081	246,9911809	49,39823619	49,39823619	197,5929447	37	22,48415332	702,2790709
2036	13588541	208892	236,5581741			310,8116917	0	13,13891151	1	1,313891151				200		62,1623383	77,61514101	233,1965507	46,63931014	46,63931014	-13,4427594	38	-1,44239052	700,8366804
2037	13590219	1678	231,8270106			2,446772391	0	0,105543025	1	0,010554302						0,48935448	1,605451805	0,841320586	0,168264117	0,168264117	0,673056469	39	0,068098142	
																						SUM	700,8366804	

12.6.2 Sensitivity Case: +30 % of Oil and Gas Production

						INCOME		EXPENDITURE																
								OPEX			CAPEX													
DATE	FOPT	vol oil per year	oil prize	Vol gas per year	Gas prize	oil income	Gas income	Field / offshore	CO2 - duty	Gas oil transportation	Subsea/platform	Production unit	Drilling	abandon	Cap Allowance	royalty	Fiscal allowance	Taxable income	Tax	Net tax	cash flow	i	NPV	cum NPV
	(SM3)	Sm3	(UsD/BBL)	Sm3	(cents per gallon)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)		(MNOK)	(MNOK)
1999	237282,60	237282,604	21,39	45087848	110,8333333	191,5426601	0	14,92462678	1	1,492462678	3500		1650		1030	38,308532	1085,725621	-894,1829614	-178,8365923	-178,8365923	-4835,34637	1	-4559,49681	-4559,49681
2000	429693,11	192410,504	34,29	62183542	138,4	248,9918274	0	12,1022566	1	1,21022566					1030	49,7983655	1094,110848	-845,1190204	-169,0238041	-169,0238041	353,9047837	2	314,6770624	-4244,81975
2001	700568,86	270875,748	28,03	103837010	139,3333333	286,5378854	0	17,03757197	1	1,703757197					1030	57,3075771	1107,048906	-820,5110208	-164,1022042	-164,1022042	373,5911833	3	313,2309011	-3931,58885
2002	1006112,90	305544,044	27,33	174349490	136,5	315,1390956	0	19,21814219	1	1,921814219					1030	63,0278191	1115,167776	-800,0286799	-160,005736	-160,005736	389,9770561	4	308,3162145	-3623,27263
2003	1365766,48	359653,58	32,47	231690460	156	440,7126399	0	22,62152961	1	2,262152961					1030	88,142528	1144,026211	-703,3135707	-140,6627141	-140,6627141	467,3491435	5	348,4079745	-3274,86466
2004	1988089,35	622322,87	42,97	246407810	180,3333333	1009,183045	0	39,1429309	1	3,91429309						201,836609	245,8938329	763,2892117	152,6578423	152,6578423	610,6313693	6	429,2547148	-2845,60994
2005	2622079,85	633990,5	55,21	213079440	231	1320,958968	0	39,87680275	1	3,987680275						264,191794	309,0562766	1011,902691	202,3805383	202,3805383	809,5221531	7	536,6041511	-2309,00579
2006	3110090,10	488010,25	62,36	247841245	270	1148,481174	0	30,69492127	1	3,069492127						229,696235	264,4606482	884,0205259	176,8041052	176,8041052	707,2164207	8	442,0454789	-1866,96031
2007	3552112,85	442022,75	66,66	132349455	300	1111,984572	0	27,80239454	1	2,780239454						222,396914	253,9795484	858,0050235	171,6010047	171,6010047	686,4040188	9	404,5607651	-1462,39955
2008	3804713,25	252600,4	91,35	210171400	300	870,8260575	0	15,88808717	1	1,588808717						174,165212	192,6421074	678,1839501	135,63679	135,63679	542,5471601	10	301,5301655	-1160,86938
2009	3804713,25	0	60	0	300	0	0	0	1	0						0	1	-1	-0,2	0	-1	11	-0,52406191	-1161,39345
2010	4019090,66	214377,41	400	-51295890	300	539,3573369	0	13,48393342	1	1,348393342						107,871467	123,7037942	415,6535428	83,13070856	83,13070856	332,5228342	12	164,3211249	-997,072321
2011	4757607,40	738516,74	412	74040400	300	1913,793785	0	46,45130545	1	4,645130545						382,758757	434,8551929	1478,938592	295,7877184	295,7877184	1183,150873	13	551,3169966	-445,755325
2012	5498808,90	741201,5	424,36	-235126510	300	1978,37361	0	46,62017178	1	4,662017178						395,674722	447,9569109	1530,416699	306,0833397	306,0833397	1224,333359	14	537,9603442	92,20501968
2013	6174647,70	675838,8	437,0908	-219673000	300	1858,028479	0	42,50898163	1	4,250898163						371,605696	419,3655756	1438,662903	287,7325807	287,7325807	1150,930323	15	476,8578534	569,0628731
2014	6759287,60	584639,9	450,203524	-197355000	300	1655,521867	0	36,7727434	1	3,67727434						331,104373	372,554391	1282,967475	256,5934951	256,5934951	1026,37398	16	400,9912242	970,0540973
2015	7407288,85	648001,25	463,7096297	24858700	300	1889,990139	0	40,75805242	1	4,075805242	4000		750		950	377,998028	1373,831886	516,1582538	103,2316508	103,2316508	-3387,0734	17	-1247,79479	-277,740697
2016	8425125,80	1017836,95	477,6209186	719654400	300	3057,729986	0	64,02001811	1	6,402001811					950	611,545997	1632,968017	1424,761969	284,9523937	284,9523937	2089,809575	18	725,963195	448,2224984
2017	9312027,40	886901,6	491,9495462	666976200	300	2744,312618	0	55,78443236	1	5,578443236					950	548,862524	1561,225399	1183,087219	236,6174438	236,6174438	1896,469775	19	621,2167274	1069,439226
2018	9986898,35	674870,95	506,7080326	528222200	300	2150,879612	0	42,4481057	1	4,24481057					950	430,175922	1427,868839	723,0107737	144,6021547	144,6021547	1528,408619	20	472,0913261	1541,530552
2019	#########	662971,4	521,9092735	517110300	300	2176,343222	0	41,69964652	1	4,169964652					950	435,268644	1432,138256	744,2049667	148,8409933	148,8409933	1545,363973	21	450,0975547	1991,628107
2020	#########	654947,15	537,5665517	508983800	300	2214,50199	0	41,19493638	1	4,119493638						442,900398	489,214828	1725,287162	345,0574324	345,0574324	1380,22973	22	379,0675209	2370,695627
2021	#########	624594,1	553,6935483	491506700	231	2175,228679	0	39,28578697	1	3,928578697						435,045736	479,2601014	1695,968577	339,1937155	339,1937155	1356,774862	23	351,3680859	2722,063713
2022	#########	569784,8	570,3043547	486772700	231	2043,878744	0	35,83838572	1	3,583838572						408,775749	449,1979731	1594,680771	318,9361542	318,9361542	1275,744617	24	311,5355384	3033,599252
2023	#########	522824,9	587,4134854	477554700	231	1931,69144	0	32,88469687	1	3,288469687						386,338288	423,5114546	1508,179986	301,6359972	301,6359972	1206,543989	25	277,8282088	3311,427461
2024	#########	491357,1	605,0358899	471223300	231	1869,889543	0	30,9054318	1	3,09054318						373,977909	408,9738836	1460,91566	292,1831319	292,1831319	1168,732528	26	253,7684559	3565,195916
2025	#########	452119,2	623,1869666	455548600	231	1772,18433	0	28,43744214	1	2,843744214						354,436866	386,7180524	1385,466278	277,0932556	277,0932556	1108,373022	27	226,9330654	3792,128982
2026	#########	425187,1	641,8825756	447699000	231	1716,616356	0	26,74346401	1	2,674346401						343,323271	373,7410816	1342,875274	268,5750549	268,5750549	1074,30022	28	207,4086308	3999,537613
2027	#########	402242,1	661,1390529	439238000	231	1672,699452	0	25,30026693	1	2,530026693						334,53989	363,3701839	1309,329268	261,8658535	261,8658535	1047,463414	29	190,6906285	4190,228241
2028	#########	385249,8	680,9732245	430394000	231	1650,099139	0	24,23148341	1	2,423148341						330,019828	357,6744596	1292,42468	258,484936	258,484936	1033,939744	30	177,4904719	4367,718713
2029	#########	357275,1	701,4024212	390908000	231	1576,186451	0	22,47192772	1	2,247192772						315,23729	340,9564107	1235,230041	247,0460081	247,0460081	988,1840324	31	159,9583713	4527,677084
2030	#########	342477,2	722,4444939	5195000	231	1556,229808	0	21,54116781	1	2,154116781						311,245962	335,9412461	1220,288562	244,0577123	244,0577123	976,2308493	32	149,008484	4676,685568
2031	#########	327701,4	744,1178287			1533,760634	0	20,61179795	1	2,061179795						306,752127	330,4251045	1203,335529	240,6671058	240,6671058	962,6684234	33	138,5557401	4815,241308
2032	#########	315047,2	766,4413635			1518,770451	0	19,81587272	1	1,981587272						303,75409	326,5515501	1192,2189	238,4437801	238,4437801	953,7751204	34	129,4443354	4944,685662
2033	#########	299169	789,4346045			1485,492041	0	18,81716398	1	1,881716398						297,098408	318,7972885	1166,694752	233,3389504	233,3389504	933,3558017	35	119,4465696	5064,132232
2034	#########	292241,3	813,1176426			1494,626077	0	18,38142476	1	1,838142476						298,925215	320,1447827	1174,481294	234,8962589	234,8962589	939,5850355	36	113,3840247	5177,516257
2035	#########	281456,5	837,5111719			1482,652832	0	17,70308125	1	1,770308125						296,530566	317,0039559	1165,648877	233,1297753	233,1297753	932,5191012	37	106,1115946	5283,627851
2036	#########	271559,6	862,636507			1473,433616	0	17,08058497	1	1,708058497				200		294,686723	314,4753666	1158,958249	231,7916498	231,7916498	727,1665992	38	78,02402563	5361,651877
2037	#########	2181,4	888,5156022			12,19096114	0	0,137205932	1	0,013720593						2,43819223	3,589118754	8,601842389	1,720368478	1,720368478	6,881473911	39	0,696250029	
																						SUM	5361,651877	

12.6.3 ensitivity Case: -30 % of Oil and Gas Production

						INCOME		EXPENDITURE															
								OPEX			CAPEX												
DATE	FOPT	vol oil per year	oil prize	Vol gas per year	Gas prize	oil income	Gas income	Field / offshore	CO2 - duty	Gas oil transportation	Subsea/platform	Production unit	Drilling	abandon	Cap Allowance	royalty	Fiscal allowance	Taxable income	Tax	Net tax	cash flow	i	NPV	cum NPV
	(SM3)	Sm3	(UsD/BBL)	Sm3	(cents per gallon)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)		(MNOK)	(MNOK)
1999	177049,33	177049,3276	21,39	45087848	110,8333333	142,9202926	0	11,13606768	1	1,113606768	3500		1650		1030	28,5840585	1071,833733	-928,9134404	-185,7826881	-185,7826881	-4863,13075	1	-4585,69614	-4585,69614
2000	320617,17	143567,8376	34,29	62183542	138,4	185,7862097	0	9,030145312	1	0,903014531					1030	37,1572419	1078,090402	-892,3041921	-178,4608384	-178,4608384	316,1566463	2	281,1130262	-4304,58311
2001	522732,15	202114,9812	28,03	103837010	139,3333333	213,8013453	0	12,71264986	1	1,271264986					1030	42,7602691	1087,744184	-873,9428386	-174,7885677	-174,7885677	330,8457291	3	277,3917332	-4027,19138
2002	750715,01	227982,8636	27,33	174349490	136,5	235,1422483	0	14,33969071	1	1,433969071					1030	47,0284497	1093,802109	-858,6598612	-171,7319722	-171,7319722	343,0721111	4	271,2331224	-3755,95825
2003	1019071,91	268356,902	32,47	231690460	156	328,8394313	0	16,87914133	1	1,687914133					1030	65,7678863	1115,334942	-786,4955104	-157,2991021	-157,2991021	400,8035917	5	298,7983813	-3457,15987
2004	1483420,52	464348,603	42,97	246407810	180,3333333	753,0058102	0	29,20664844	1	2,920664844						150,601162	183,7284753	569,2773349	113,855467	113,855467	455,4218679	6	320,1472997	-3137,01257
2005	1956474,97	473054,45	55,21	213079440	231	985,6386146	0	29,75422975	1	2,975422975						197,127723	230,8573756	754,7812389	150,9562478	150,9562478	603,8249911	7	400,2546386	-2736,75793
2006	2320605,69	364130,725	62,36	247841245	270	856,9436453	0	22,90313356	1	2,290313356						171,388729	197,582176	659,3614693	131,8722939	131,8722939	527,4891754	8	329,707001	-2407,05093
2007	2650422,67	329816,975	66,66	132349455	300	829,7115652	0	20,74486362	1	2,074486362						165,942313	189,761663	639,9499022	127,9899804	127,9899804	511,9599217	9	301,744879	-2105,30605
2008	2838901,43	188478,76	91,35	210171400	300	649,7702122	0	11,85495735	1	1,185495735						129,954042	143,9944955	505,7757166	101,1551433	101,1551433	404,6205733	10	224,8750291	-1880,43103
2009	2838901,43	0	60	0	300	0	0	0	1	0						0	1	-1	-0,2	0	-1	11	-0,52406191	-1880,95509
2010	2998859,95	159958,529	400	-51295890	300	402,4435514	0	10,06108879	1	1,006108879						80,4887103	92,55590795	309,8876435	61,97752869	61,97752869	247,9101148	12	122,5084858	-1758,4466
2011	3549907,06	551047,106	412	74040400	300	1427,984593	0	34,65982022	1	3,465982022						285,596919	324,7227209	1103,261872	220,6523745	220,6523745	882,6094979	13	411,272669	-1347,17393
2012	4102957,41	553050,35	424,36	-235126510	300	1476,171078	0	34,78582048	1	3,478582048						295,234216	334,4986181	1141,67246	228,334492	228,334492	913,3379678	14	401,3119498	-945,861983
2013	4607237,13	504279,72	437,0908	-219673000	300	1386,375096	0	31,71824014	1	3,171824014						277,275019	313,1650833	1073,210012	214,6420025	214,6420025	858,56801	15	355,7251818	-590,136801
2014	5043468,44	436231,31	450,203524	-197355000	300	1235,274008	0	27,43812392	1	2,743812392						247,054802	278,2367379	957,0372702	191,407454	191,407454	765,6298161	16	299,1218046	-291,014996
2015	5526977,07	483508,625	463,7096297	24858700	300	1410,223412	0	30,41777757	1	3,041777757	4000		750		950	282,044682	1266,497638	143,725774	28,7451548	28,7451548	-3685,01938	17	-1357,55783	-1648,57282
2016	6286440,02	759462,955	477,6209186	719654400	300	2281,536989	0	47,76878274	1	4,776878274					950	456,307398	1459,853059	821,6839305	164,3367861	164,3367861	1607,347144	18	558,3642081	-1090,20861
2017	6948205,06	661765,04	491,9495462	666976200	300	2047,679415	0	41,62376876	1	4,162376876					950	409,535883	1406,322029	641,3573865	128,2714773	128,2714773	1463,085909	19	479,2554315	-610,953183
2018	7451762,62	503557,555	506,7080326	528222200	300	1604,887095	0	31,67281733	1	3,167281733					950	320,977419	1306,817518	298,0695773	59,61391546	59,61391546	1188,455662	20	367,0874414	-243,865742
2019	7946441,28	494678,66	521,9092735	517110300	300	1623,886866	0	31,11435164	1	3,111435164					950	324,777373	1310,00316	313,8837059	62,77674118	62,77674118	1201,106965	21	349,830407	105,9646652
2020	8435132,61	488691,335	537,5665517	508983800	300	1652,359177	0	30,73776022	1	3,073776022						330,471835	365,2833717	1287,075805	257,4151611	257,4151611	1029,660644	22	282,7869154	388,7515806
2021	8901175,90	466043,29	553,6935483	491506700	231	1623,055245	0	29,31324105	1	2,931324105						324,611049	357,8556141	1265,199631	253,0399261	253,0399261	1012,159705	23	262,1220573	650,8736379
2022	9326323,02	425147,12	570,3043547	486772700	231	1525,047986	0	26,74094934	1	2,674094934						305,009597	335,4246415	1189,623345	237,9246689	237,9246689	951,6986757	24	232,403849	883,277487
2023	9716430,83	390107,81	587,4134854	477554700	231	1441,338998	0	24,53704305	1	2,453704305						288,2678	316,2585469	1125,080451	225,0160902	225,0160902	900,0643608	25	207,2558245	1090,533311
2024	10083058,82	366627,99	605,0358899	471223300	231	1395,225274	0	23,06020068	1	2,30602068						279,045055	305,4112824	1089,813992	217,9627984	217,9627984	871,8511937	26	189,306215	1279,839526
2025	10420409,30	337350,48	623,1869666	455548600	231	1322,322154	0	21,21870683	1	2,121870683						264,464431	288,8050084	1033,517146	206,7034292	206,7034292	826,8137167	27	169,2854007	1449,124927
2026	10737664,29	317254,99	641,8825756	447699000	231	1280,859896	0	19,95473853	1	1,995473853						256,171979	279,1221917	1001,737705	200,347541	200,347541	801,3901638	28	154,7195408	1603,844468
2027	11037798,78	300134,49	661,1390529	439238000	231	1248,091129	0	18,87789148	1	1,887789148						249,618226	271,3839065	976,7072228	195,3414446	195,3414446	781,3657782	29	142,2475757	1746,092044
2028	11325254,40	287455,62	680,9732245	430394000	231	1231,227819	0	18,08041455	1	1,808041455						246,245564	267,1340199	964,0937995	192,8187599	192,8187599	771,2750396	30	132,4003372	1878,492381
2029	11591836,59	266582,19	701,4024212	390908000	231	1176,077583	0	16,7675153	1	1,67675153						235,215517	254,6597834	921,4177995	184,2835599	184,2835599	737,1342396	31	119,3206817	1997,813063
2030	11847377,27	255540,68	722,4444939	5195000	231	1161,186857	0	16,07302521	1	1,607302521						232,237371	250,917699	910,2691575	182,0538315	182,0538315	728,215326	32	111,1522565	2108,965319
2031	12091892,93	244515,66	744,1178287			1144,421396	0	15,37957232	1	1,537957232						228,884279	246,8018087	897,6195872	179,5239174	179,5239174	718,0956698	33	103,3546698	2212,319989
2032	12326966,61	235073,68	766,4413635			1133,236413	0	14,78568964	1	1,478568964						226,647283	243,9115412	889,3248719	177,8649744	177,8649744	711,4598975	34	96,55784143	2308,87783
2033	12550192,71	223226,1	789,4346045			1108,4056	0	14,04049928	1	1,404049928						221,68112	238,1256691	870,2799304	174,0559861	174,0559861	696,2239443	35	89,09952843	2397,977359
2034	12768249,68	218056,97	813,1176426			1115,220996	0	13,71537078	1	1,371537078						223,044199	239,1311071	876,0898889	175,2179778	175,2179778	700,8719111	36	84,57741988	2482,554779
2035	12978259,53	210009,85	837,5111719			1106,287113	0	13,20922216	1	1,320922216						221,257423	236,7875671	869,4995464	173,8999093	173,8999093	695,5996371	37	79,15246624	2561,707245
2036	13180884,77	202625,24	862,636507			1099,408159	0	12,74474417	1	1,274474417				200		219,881632	234,9008504	864,5073088	172,9014618	172,9014618	491,6058471	38	52,74866483	2614,45591
2037	13182512,43	1627,66	888,5156022			9,096332545	0	0,102376734	1	0,010237673						1,81926651	2,931880916	6,164451629	1,232890326	1,232890326	4,931561303	39	0,498962831	
																						SUM	2614,45591	

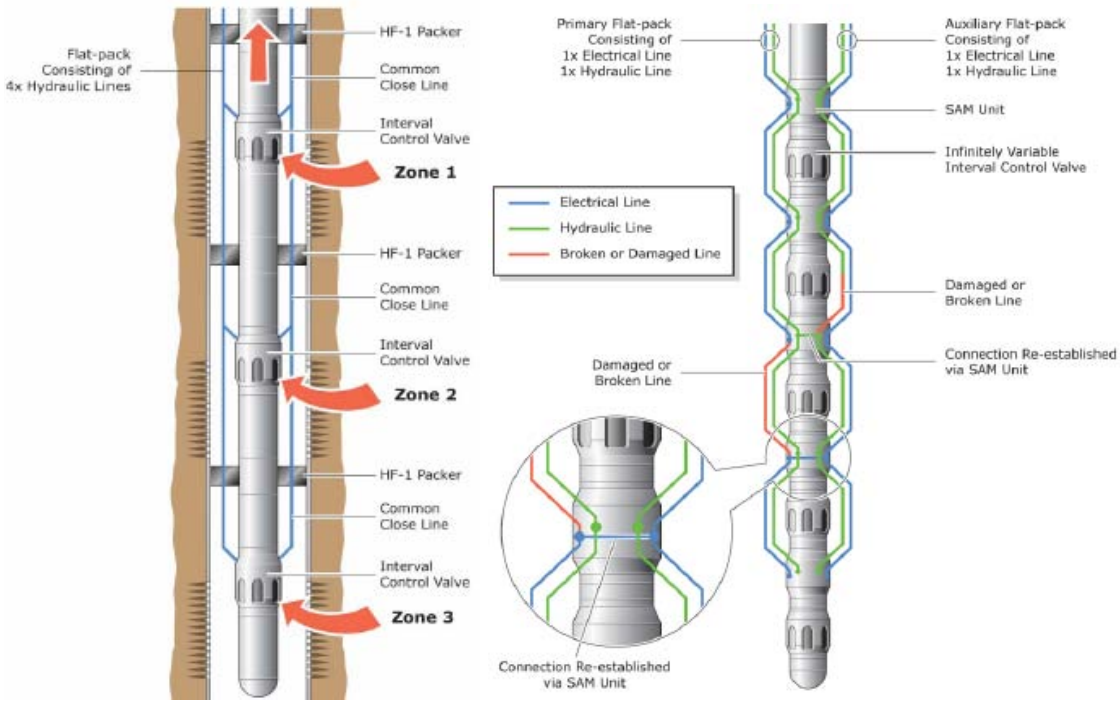
12.6.4 Sensitivity Case: +40 % of Investment Cost

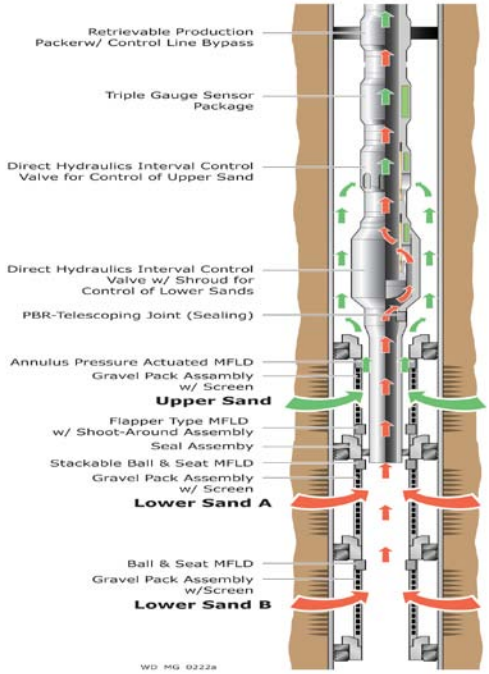
						INCOME		EXPENDITURE																
								OPEX			CAPEX													
DATE	FOPT	vol oil per year	oil prize	Vol gas per year	Gas prize	oil income	Gas income	Field / offshore	CO2 - duty	Gas oil transportation	Subsea/platform	Production unit	Drilling	abandon	Cap Allowance	royalty	Fiscal allowance	Taxable income	Tax	Net tax	cash flow	i	NPV	cum NPV
	(SM3)	Sm3	(UsD/BBL)	Sm3	(cents per gallon)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)		(MNOK)	(MNOK)
1999	182525,08	182525,08	21,39	45087848	110,8333333	147,3405078	0	11,48048214	1	1,148048214	4900		2310		1442	29,4681016	1485,096632	-1337,756124	-267,5512248	-267,5512248	-6838,2049	1	-6448,09514	-6448,09514
2000	330533,16	148008,08	34,29	62183542	138,4	191,5321749	0	9,309428157	1	0,930942816					1442	38,306435	1491,546806	-1300,014631	-260,0029262	-260,0029262	401,9882952	2	357,4308732	-6090,66427
2001	538899,12	208365,96	28,03	103837010	139,3333333	220,413758	0	13,10582459	1	1,310582459					1442	44,0827516	1501,499159	-1281,085401	-256,2170801	-256,2170801	417,1316795	3	349,7366578	-5740,92761
2002	773933,00	235033,88	27,33	174349490	136,5	242,4146889	0	14,7831863	1	1,47831863					1442	48,4829378	1507,744443	-1265,329754	-253,0659508	-253,0659508	429,7361197	4	339,7498274	-5401,17778
2003	1050589,6	276656,6	32,47	231690460	156	339,009723	0	17,40117662	1	1,740117662					1442	67,8019446	1529,943239	-1190,933516	-238,1867032	-238,1867032	489,2531873	5	364,7374012	-5036,44038
2004	1529299,5	478709,9	42,97	246407810	180,3333333	776,2946497	0	30,10994685	1	3,010994685						155,25893	189,3798715	586,9147782	117,3829556	117,3829556	469,5318226	6	330,0661556	-4706,37423
2005	2016984,5	487685	55,21	213079440	231	1016,122283	0	30,67446366	1	3,067446366						203,224457	237,9663666	778,1559164	155,6311833	155,6311833	622,5247331	7	412,6500488	-4293,72418
2006	2392377	375392,5	62,36	247841245	270	883,447057	0	23,6114779	1	2,36114779						176,689411	203,6620371	679,7850199	135,957004	135,957004	543,8280159	8	339,9195899	-3953,80459
2007	2732394,5	340017,5	66,66	132349455	300	855,3727476	0	21,38645734	1	2,138645734						171,07455	195,5996526	659,773095	131,954619	131,954619	527,818476	9	311,0917778	-3642,71281
2008	2926702,5	194308	91,35	210171400	300	669,8661981	0	12,22160551	1	1,222160551						133,97324	148,4170057	521,4491924	104,2898385	104,2898385	417,1593539	10	231,8436779	-3410,86913
2009	2926702,5	0	60	0	300	0	0	0	1	0						0	1	-1	-0,2	0	-1	11	-0,52406191	-3411,3932
2010	3091608,2	164905,7	400	-51295890	300	414,8902592	0	10,37225648	1	1,037225648						82,9780518	95,38753396	319,5027252	63,90054504	63,90054504	255,6021802	12	126,3096348	-3285,08356
2011	3659698	568089,8	412	74040400	300	1472,149065	0	35,73177343	1	3,573177343						294,429813	334,7347638	1137,414301	227,4828603	227,4828603	909,9314411	13	424,0039715	-2861,07959
2012	4229853	570155	424,36	-235126510	300	1521,825854	0	35,8616706	1	3,58616706						304,365171	344,8130084	1177,012845	235,402569	235,402569	941,6102761	14	413,7345311	-2447,34506
2013	4749729	519876	437,0908	-219673000	300	1429,252676	0	32,69921664	1	3,269921664						285,850535	322,8196735	1106,433003	221,2866005	221,2866005	885,1464021	15	366,7372428	-2080,60782
2014	5199452	449723	450,203524	-197355000	300	1273,478359	0	28,28672569	1	2,828672569						254,695672	286,81107	986,6672888	197,3334578	197,3334578	789,3338311	16	308,382661	-1772,22515
2015	5697914,5	498462,5	463,7096297	24858700	300	1453,838569	0	31,35234801	1	3,135234801	5600		1050		1330	290,767714	1656,255297	-202,4167278	-40,48334557	-40,48334557	-5481,93338	17	-2019,53933	-3791,76448
2016	6480866	782951,5	477,6209186	719654400	300	2352,099989	0	49,24616777	1	4,924616777					1330	470,419998	1855,590782	496,5092067	99,301814134	99,301814134	1727,207365	18	600,0015467	-3191,76294
2017	7163098	682232	491,9495462	666976200	300	2111,009706	0	42,91110182	1	4,291110182					1330	422,201941	1800,404153	310,6055531	62,12111062	62,12111062	1578,484442	19	517,055928	-2674,70701
2018	7682229,5	519131,5	506,7080326	528222200	300	1654,522779	0	32,652389	1	3,2652389					1330	330,904556	1697,822184	-43,29940484	-8,659880968	-8,659880968	1295,360476	20	400,1079537	-2274,59905
2019	8192207,5	509978	521,9092735	517110300	300	1674,110171	0	32,07665117	1	3,207665117					1330	334,822034	1701,10635	-26,9961795	-5,399235899	-5,399235899	1308,403056	21	381,0811087	-1893,51795
2020	8696013	503805,5	537,5665517	508983800	300	1703,463069	0	31,6884126	1	3,16884126						340,692614	376,5498677	1326,913201	265,3826403	265,3826403	1061,530561	22	291,5396977	-1601,97825
2021	9176470	480457	553,6935483	491506700	231	1673,25283	0	30,21983613	1	3,021983613						334,650566	368,8923857	1304,360444	260,8720888	260,8720888	1043,488355	23	270,2353326	-1331,74292
2022	9614766	438296	570,3043547	486772700	231	1572,214419	0	27,56798901	1	2,756798901						314,442884	345,7676716	1226,446747	245,2893494	245,2893494	981,1573976	24	239,597639	-1092,14528
2023	10016939	402173	587,4134854	477554700	231	1485,916493	0	25,29592067	1	2,529592067						297,183299	326,0088113	1159,907681	231,9815363	231,9815363	927,9261451	25	213,6714958	-878,4737781
2024	10394906	377967	605,0358899	471223300	231	1438,376572	0	23,77340907	1	2,377340907						287,675314	314,8260643	1123,550507	224,7101015	224,7101015	898,8404059	26	195,1664187	-683,307362
2025	10742690	347784	623,1869666	455548600	231	1363,218716	0	21,87495549	1	2,187495549						272,643743	297,7061942	1065,512522	213,1025043	213,1025043	852,4100172	27	174,5260975	-508,781265
2026	11069757	327067	641,8825756	447699000	231	1320,47412	0	20,57189539	1	2,057189539						264,094824	287,7239089	1032,750211	206,5500422	206,5500422	826,2001689	28	159,5094581	-349,271807
2027	11379174	309417	661,1390529	439238000	231	1286,691886	0	19,46174379	1	1,946174379						257,338377	279,7462953	1006,94559	201,3891181	201,3891181	805,5564724	29	146,6514896	-202,620317
2028	11675520	296346	680,9732245	430394000	231	1269,30703	0	18,63960263	1	1,863960263						253,861406	275,364969	993,9420614	198,7884123	198,7884123	795,1536491	30	136,4994404	-66,1208766
2029	11950347	274827	701,4024212	390908000	231	1212,451116	0	17,28609825	1	1,728609825						242,490223	262,5049313	949,946185	189,989237	189,989237	759,956948	31	123,0150172	56,89414058
2030	12213791	263444	722,4444939	5195000	231	1197,099852	0	16,57012909	1	1,657012909						239,41997	258,6471124	938,4527397	187,6905479	187,6905479	750,7621917	32	114,5937317	171,4878723
2031	12465869	252078	744,1178287			1179,815872	0	15,85522919	1	1,585522919						235,963174	254,4039265	925,4119456	185,0823891	185,0823891	740,3295565	33	106,5547671	278,0426393
2032	12708213	242344	766,4413635			1168,284962	0	15,24297901	1	1,524297901						233,656992	251,4242693	916,8606927	183,3721385	183,3721385	733,4885541	34	99,54752439	377,5901637
2033	12938343	230130	789,4346045			1142,686185	0	14,47474153	1	1,447474153						228,537237	245,4594527	897,2267324	179,4453465	179,4453465	717,7813859	35	91,85835035	469,4485141
2034	13163144	224801	813,1176426			1149,712367	0	14,13955751	1	1,413955751						229,942473	246,4959867	903,2163803	180,6432761	180,6432761	722,5731043	36	87,19620213	556,6447162
2035	13379649	216505	837,5111719			1140,502179	0	13,61775481	1	1,361775481						228,100436	244,079966	896,4222127	179,2844425	179,2844425	717,1377702	37	81,60329609	638,2480123
2036	13588541	208892	862,6365507			1133,410473	0	13,13891151	1	1,313891151				280		226,682095	242,1348974	891,2755761	178,2551152	178,2551152	433,0204609	38	46,46252947	684,7105418
2037	13590219	1678	888,5156022			9,377662418	0	0,105543025	1	0,010554302						1,87553248	2,991629811	6,386032607	1,277206521	1,277206521	5,108826086	39	0,516898031	
																						SUM	684,7105418	

12.6.5 Sensitivity Case: -40 % of Investment Cost

						INCOME		EXPENDITURE																
								OPEX			CAPEX													
DATE	FOPT	vol oil per year	oil prize	Vol gas per year	Gas prize	oil income	Gas income	Field / offshore	CO2 - duty	Gas oil transportation	Subsea/platform	Production unit	Drilling	abandon	Cap Allowance	royalty	Fiscal allowance	Taxable income	Tax	Net tax	cash flow	i	NPV	cum NPV
	(SM3)	Sm3	(UsD/BBL)	Sm3	(cents per gallon)	(MNOK)	(MNOK)	(MNOK)		(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)	(MNOK)		(MNOK)	(MNOK)
1999	182525,08	182525,08	21,39	45087848	110,8333333	147,3405078	0	11,48048214	1	1,148048214	2100		990		618	29,4681016	661,0966319	-513,7561241	-102,7512248	-102,7512248	-2883,0049	1	-2718,53362	-2718,53362
2000	330533,16	148008,08	34,29	62183542	138,4	191,5321749	0	9,309428157	1	0,930942816					618	38,306435	667,546806	-476,0146311	-95,20292621	-95,20292621	237,1882952	2	210,8977313	-2507,63588
2001	538899,12	208365,96	28,03	103837010	139,3333333	220,413758	0	13,10582459	1	1,310582459					618	44,0827516	677,4991587	-457,0854006	-91,41708013	-91,41708013	252,3316795	3	211,5630209	-2296,07286
2002	773933,00	235033,88	27,33	174349490	136,5	242,4146889	0	14,7831863	1	1,47831863					618	48,4829378	683,7444427	-441,3297538	-88,26595076	-88,26595076	264,936197	4	209,4587978	-2086,61407
2003	1050589,6	276656,6	32,47	231690460	156	339,009723	0	17,40117662	1	1,740117662					618	67,8019446	705,9432389	-366,9335159	-73,38670318	-73,38670318	324,4531873	5	241,8792875	-1844,73478
2004	1529299,5	478709,9	42,97	246407810	180,3333333	776,2946497	0	30,10994685	1	3,010994685						155,25893	189,3798715	586,9147782	117,3829556	117,3829556	469,5318226	6	330,0661556	-1514,66862
2005	2016984,5	487685	55,21	213079440	231	1016,122283	0	30,67446366	1	3,067446366						203,224457	237,9663666	778,1559164	155,6311833	155,6311833	622,5247331	7	412,6500488	-1102,01857
2006	2392377	375392,5	62,36	247841245	270	883,447057	0	23,6114779	1	2,36114779						176,689411	203,6620371	679,7850199	135,957004	135,957004	543,8280159	8	339,9195899	-762,098984
2007	2732394,5	340017,5	66,66	132349455	300	855,3727476	0	21,38645734	1	2,138645734						171,07455	195,5996526	659,773095	131,954619	131,954619	527,818476	9	311,0917778	-451,007206
2008	2926702,5	194308	91,35	210171400	300	669,8661981	0	12,22160551	1	1,222160551						133,97324	148,4170057	521,4491924	104,2898385	104,2898385	417,1593539	10	231,8436779	-219,163528
2009	2926702,5	0	60	0	300	0	0	0	1	0						0	1	-1	-0,2	0	-1	11	-0,52406191	-219,68759
2010	3091608,2	164905,7	400	-51295890	300	414,8902592	0	10,37225648	1	1,037225648						82,9780518	95,38753396	319,5027252	63,90054504	63,90054504	255,6021802	12	126,3096348	-93,3779552
2011	3659698	568089,8	412	74040400	300	1472,149065	0	35,73177343	1	3,573177343						294,429813	334,7347638	1137,414301	227,4828603	227,4828603	909,9314411	13	424,0039715	330,6260163
2012	4229853	570155	424,36	-235126510	300	1521,825854	0	35,8616706	1	3,58616706						304,365171	344,8130084	1177,012845	235,402569	235,402569	941,6102761	14	413,7345311	744,3605475
2013	4749729	519876	437,0908	-219673000	300	1429,252676	0	32,69921664	1	3,269921664						285,850535	322,8196735	1106,433003	221,2866005	221,2866005	885,1464021	15	366,7372428	1111,09779
2014	5199452	449723	450,203524	-197355000	300	1273,478359	0	28,28672569	1	2,828672569						254,695672	286,81107	986,6672888	197,3334578	197,3334578	789,3338311	16	308,382661	1419,480451
2015	5697914,5	498462,5	463,7096297	24858700	300	1453,838569	0	31,35234801	1	3,135234801	2400		450		570	290,767714	896,2552966	557,5832722	111,5166544	111,5166544	-1833,93338	17	-675,619409	743,8610423
2016	6480866	782951,5	477,6209186	719654400	300	2352,099989	0	49,24616777	1	4,924616777					570	470,419998	1095,590782	1256,509207	251,3018413	251,3018413	1575,207365	18	547,1994125	1291,060455
2017	7163098	682232	491,9495462	666976200	300	2111,009706	0	42,91110182	1	4,291110182					570	422,201941	1040,404153	1070,605553	214,1211106	214,1211106	1426,484442	19	467,2660796	1758,326534
2018	7682229,5	519131,5	506,7080326	528222200	300	1654,522779	0	32,652389	1	3,2652389					570	330,904556	937,8221837	716,7005952	143,340119	143,340119	1143,360476	20	353,1585446	2111,485079
2019	8192207,5	509978	521,9092735	517110300	300	1674,110171	0	32,07665117	1	3,207665117					570	334,822034	941,1063505	733,0038205	146,6007641	146,6007641	1156,403056	21	336,8100958	2448,295175
2020	8696013	503805,5	537,5665517	508983800	300	1703,463069	0	31,6884126	1	3,16884126						340,692614	376,5498677	1326,913201	265,3826403	265,3826403	1061,530561	22	291,5396977	2739,834873
2021	9176470	480457	553,6935483	491506700	231	1673,25283	0	30,21983613	1	3,021983613						334,650566	368,8923857	1304,360444	260,8720888	260,8720888	1043,488355	23	270,2353326	3010,070205
2022	9614766	438296	570,3043547	486772700	231	1572,214419	0	27,56798901	1	2,756798901						314,442884	345,7676716	1226,446747	245,2893494	245,2893494	981,1573976	24	239,597639	3249,667844
2023	10016939	402173	587,4134854	477554700	231	1485,916493	0	25,29592067	1	2,529592067						297,183299	326,0088113	1159,907681	231,9815363	231,9815363	927,9261451	25	213,6714958	3463,33934
2024	10394906	377967	605,0358899	471223300	231	1438,376572	0	23,77340907	1	2,377340907						287,675314	314,8260643	1123,550507	224,7101015	224,7101015	898,8404059	26	195,1664187	3658,505759
2025	10742690	347784	623,1869666	455548600	231	1363,218716	0	21,87495549	1	2,187495549						272,643743	297,7061942	1065,512522	213,1025043	213,1025043	852,4100172	27	174,5260975	3833,031856
2026	11069757	327067	641,8825756	447699000	231	1320,47412	0	20,57189539	1	2,057189539						264,094824	287,7239089	1032,750211	206,5500422	206,5500422	826,2001689	28	159,5094581	3992,541314
2027	11379174	309417	661,1390529	439238000	231	1286,691886	0	19,46174379	1	1,946174379						257,338377	279,7462953	1006,94559	201,3891181	201,3891181	805,5564724	29	146,6514896	4139,192804
2028	11675520	296346	680,9732245	430394000	231	1269,30703	0	18,63960263	1	1,863960263						253,861406	275,364969	993,9420614	198,7884123	198,7884123	795,1536491	30	136,4994404	4275,692244
2029	11950347	274827	701,4024212	390908000	231	1212,451116	0	17,28609825	1	1,728609825						242,490223	262,5049313	949,946185	189,989237	189,989237	759,956948	31	123,0150172	4398,707261
2030	12213791	263444	722,4444939	5195000	231	1197,099852	0	16,57012909	1	1,657012909						239,41997	258,6471124	938,4527397	187,6905479	187,6905479	750,7621917	32	114,5937317	4513,300993
2031	12465869	252078	744,1178287			1179,815872	0	15,85522919	1	1,585522919						235,963174	254,4039265	925,4119456	185,0823891	185,0823891	740,3295565	33	106,5547671	4619,85576
2032	12708213	242344	766,4413635			1168,284962	0	15,24297901	1	1,524297901						233,656992	251,4242693	916,8606927	183,3721385	183,3721385	733,4885541	34	99,54752439	4719,403284
2033	12938343	230130	789,4346045			1142,686185	0	14,47474153	1	1,447474153						228,537237	245,4594527	897,2267324	179,4453465	179,4453465	717,7813859	35	91,85835035	4811,261635
2034	13163144	224801	813,1176426			1149,712367	0	14,13955751	1	1,413955751						229,942473	246,4959867	903,2163803	180,6432761	180,6432761	722,5731043	36	87,19620213	4898,457837
2035	13379649	216505	837,5111719			1140,502179	0	13,61775481	1	1,361775481						228,100436	244,079966	896,4222127	179,2844425	179,2844425	717,1377702	37	81,60329609	4980,061133
2036	13588541	208892	862,636507			1133,410473	0	13,13891151	1	1,313891151				120		226,682095	242,1348974	891,2755761	178,2551152	178,2551152	593,0204609	38	63,63032034	5043,691453
2037	13590219	1678	888,5156022			9,377662418	0	0,105543025	1	0,010554302						1,87553248	2,991629811	6,386032607	1,277206521	1,277206521	5,108826086	39	0,516898031	
																						SUM	5043,691453	

13. Appendix C: HPHT Packer





HPHT Production Packer [5]

- Compatible element package
- Feed-through capability
- Retrievable
- High-tubing tension / compression loads
- Compatible elastomers

Elements for a packer to be used in an HPHT smart completion are as below:

- Compatible element package
  - HPHT wells require heavy completion brines such as zinc bromide or cesium format primarily for well control purposes. Such brines are corrosive in nature. Conventional packing elastomers such as nitrile or HNBR are not suitable for these environments. Fluroelastomers or perfluroelastomers will be the material of choice to combat the high corrosive nature of these completion fluids as well as the high temperature.
- Feedthough Capability
  - To bypass hydraulic or electrical lines from surface to downhole valves or gauges.
- Retrievable
  - The ability to retrieve the packer in any eventuality without having to resort to fishing or milling operations.
- High tubing loads
  - The operating envelope of these packers would have to be able to handle high tension and compression loads created due to significant pipe movement during the life of the well. These loads tend to be excessive particularly when high temperatures are combined with high operating pressures
- Compatible Elastomers
  - Surface pressure tests prove difficult since high temperature elastomers may not seal at ambient temperatures.