Master of Science in Energy Management
EN 310E

Emission Trading Scheme: Risks & Strategies for the Norwegian Petroleum Industry

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Abstract

The issue of climate change has become one of the greatest challenges to our living pattern. There is huge pressure on the countries to cut their greenhouse gas emission that caused the climate change. Kyoto protocol is one of the international agreement that binds the developed countries to mitigate the greenhouse gas emissions for the certain amount. Protocol has recommended three mechanisms to achieve emissions reduction target cost effectively. One of them is emission trading scheme.

The purpose of this study to explore what opportunities and Risks have emerged for the Norwegian Petroleum with the implementation of the Emission trading scheme. Institutional theory and Domestic political model has used to analyze the risks from the environmental regulations. Furthermore, this study has also focused deeply on what strategic actions industry undertaking in order to undermine the risks and utilize the opportunities. We have used Steger model and corporate model to examine the industry response to the EU ETS (European Emission trading Scheme).

We have found that main risk for the industry is increase in operating cost that would create the financial problems, delay the projects and may restrain the upcoming projects on the Norwegian continental shelf. The decrease in the demand of the fossil fuel due to tight environment regulations is another challenges for the industry but it is unlikely in short term. Currently, industry is striving to increase the electrification of the shelf and deploy CCS technology in order to reduce the significant amount of emissions. Furthermore, industry is paying attention on the efficiency measures that can also limit emissions in short period of time without heavy investment. Industry is also participating in CDM and JI to offset carbon emission cost effectively. In order to develop sustainable technologies, industry and other stakeholder engage in Research and Development Activities.

SAMMENDRAG

Spørsmålet om klimaendringer har blitt en av de største utfordringene for vår levende mønster. Det er stort press på landene å kutte sine utslipp av klimagasser som har forårsaket klimaendringene. Kyoto-protokollen er en av den internasjonale avtalen som binder de utviklede landene for å redusere klimagassutslippene for visse beløp. Protokoll har anbefalt tre mekanismer for å oppnå utslippsreduksjoner målet kostnadseffektivt. En av dem er kvotehandel ordningen.

Hensikten med denne studien å undersøke hvilke muligheter og risikoer har kommet for Norsk Petroleumsforening med gjennomføringen av Emission Trading Scheme. Institusjonell teori og innenrikspolitiske modellen har brukt for å analysere risiko fra de miljøkrav. Videre har denne studien også fokusert på hvilke strategiske handlinger industri virksomhet for å undergrave risikoen og utnytte mulighetene. Vi har brukt Steger modell og bedrifts modell for å undersøke bransjen svar til EU ETS (European Emission Trading Scheme).

Vi har funnet at Hovedrisikoen for industrien er økningen i driftskostnader som vil skape de økonomiske problemene, forsinke prosjektene og kan begrense den kommende prosjekter på norsk sokkel. Nedgangen i etterspørselen av fossilt brensel grunnet trange miljølovgivning er en annen utfordringer for næringen, men det er usannsynlig på kort sikt. Foreløpig er industrien forsøker å øke elektrifisering av sokkelen og distribuere CCS-teknologi for å redusere den betydelige mengden av utslipp. Videre er industrien betaler oppmerksomhet på de effektiviseringstiltak som også kan begrense utslipp i løpet av kort tid uten store investeringer. Industrien er også deltar i CDM og JI for å oppveie utslipp av karbon kostnadseffektivt. For å utvikle bærekraftige teknologier, industri og andre interessenter drive forskning og utvikling.

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List of Abbreviations:

CDM	Clean Development Mechanism
JI	Joint Implementation
ETS	Emission Trading Scheme
EU	European Union
CO_2	Carbon Dioxide
CDP	Carbon Disclosure Project
GHG	Greenhouse Gas
CCS	Carbon Capture and Storage
OLF	Norwegian oil industry Association
NPD	Norwegian Directorate of Petroleum
NAP	National Allocation Plan
NCS	Norwegian Continental Shelf
KLIF	Climate and pollution Agency
R&D	Research and Development
UNFCCC	United National Framework convention on climate change
UN	United Nations

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Glossary:

Climate Change: A change in the Global climate that caused directly or indirectly by the human activities.

UNFCCC: it is international environmental agreement that signed at United Nation conference on Environment and Development in 1992. The objective is form international policies to limit the climate change.

Fossil Fuel: A hydrocarbon such Oil, Coal and gas that originated from ancient plants and animals.

Carbon Leakage: increase in the carbon emission in one country as result of reduction in another due to tight environment regulations.

Energy Intensity: The total consumption of Energy for one unit of GDP (gross domestic product.

Introduction:

1.1Background:

There is a significant increase in that natural disasters that caused by climate change over the last few decades around the globe, which has affected millions of people. As a result, there is growing consensus among the scientist about the existence of climate change phenomena and its relation with human activities (UNFCCC, 2006). The substantial use of fossil fuel for different purposes has profound effects on the climate of earth. It has been discussion on the international and national level how to combat effectively with climate change. It is obvious single country can neither stop the change in climate nor to tackle with its consequence alone. That's way world is looking for global solution to cut the GHG (greenhouse gas) emissions that are main driver of changing the climate of planet (Kim,2008).

1.2 Kyoto protocol:

In 1992, first international agreement was made with aim to find possible ways to mitigate GHG (greenhouse gases) emission that resulting in climate change. That agreement is called united nation framework convention on climate change. After that, negotiation among countries and international agencies initiated to formulate concrete plan to deal with the issue of climate change. Finally, protocol adopted in 1997 in Kyoto, Japan that binds the developed countries to reduce emission from 2008 to 2012 (UNFCC, 1998). The goal of emission reductions is average 5% on the level of 1990. The agreement also requires establishing an authority at national level regarding the compliance of protocol and clean development mechanism.

It was also recognized that developed countries are mainly responsible for the change in climate because they have produced emission in large amount since the industalization period. As a result, developing countries exempted from the binding targets of the Kyoto protocol. In 2001, rules regarding the implementation of protocol were adopted. There are three suggested mechanisms from UNFCC for developed countries for the compliance of Commitment. These mechanisms are discussed in detail below.

The protocol formally came in to force during 2005 when required number of countries ratified the treaty. Until now, 191 countries from developing and developed have become part of the agreement. The United State is one of the largest emission producers from developed countries who has not ratified the treaty so far. While, Canada refused to follow the agreement on December 2011. Both of them have serious concern on not including big polluters from

developing countries like India and china. During the Kyoto agreement, international community agreed to start work on treaty that would be effective after 2012. Following that many climate change conferences were arrange to take bold step which would have profound impact on stabilizing the climate but failed to give any concrete plan. In 2011, climate change conference arranged in Durban, South Africa where participants from the globe agreed to include developing and developed countries in next international binding treaty which would come into force 2020 (Oxfam,2011). But the framework is supposed to finalize until 2015. Meanwhile, developed countries would continue their efforts according to Kyoto protocol

1.3 Emission Trading:

The most significant mechanism of the Kyoto protocol to mitigate the emission is international emission trading. This mechanism is a kind of cap and trade scheme that allocate certain amount of emission to every installation or business. If anyone wants to emit more emission than allocated amount then must be purchased from any other business that has not used emission quota completely (Hansjürgens, 2005). In order to fully implement the policy, country has to allocate the allowances of emitting emission to installation. Governments have established carbon markets where companies those want to emit more can buy the permit of carbon. The prices of carbon permits are set by the market forces like other commodities. So far, many countries have formed own schemes in order to comply with Kyoto protocol such as European emission trading, Australian emission trading scheme and new Zealand emission trading. The largest scheme is European that covering thousands of installation in 27 countries and trading volume. Currently, there is a lot of discussion to integrate different carbon market around the world. This would help to create global price of the emission allowances instead of having high price in one system and low in other system that leads to limit carbon leakage among industrialized countries. Carbon leakage term refers to a situation when organization moves their businesses to other countries with the aim to avoid the cost of emitting emission (Brewer & Asselt, 2010).

1.4 Joint implementation:

The concept of joint implementation is that developed countries can make invest in any other developed country in emission reduction project with the aim to earn emission reduction points (Peters & Kuik, 2007). As a result, these points helped the investor to meet their Kyoto protocol commitment. On the other hand, host country get investment and transfer of

technology from partner country. In fact, it's a win-win deal for both of them. Currently, most of the joint implementation projects arranged in transition economies because there is still a lot of potential to bring the efficiency. The key idea of introducing this instrument is to achieve kyoto target in cost efficient way and transfer of clean technology.

1.5 Clean development mechanism.

Clean development mechanism is also one of the recommended instrument or policy in order to facilitate the countries to meet their commitment. It's quite similar with joint implementation. The main difference is that under this policy developed country can invest in developing countries in any environment friendly project (Olsen, 2007). As a result, host country gets sustainable development, investment and advance technology know- how. In addition, gained knowledge can promote further sustainable development in the country. While, investor earns emission reduction points. The whole mechanism of clean development regulated by the executive board which consists of members from developed countries and developing countries. It's mandatory for every project to get approval from the UNFCCC (united nation framework convention for climate change).

1.6 European emission trading:

The bold step from the European Union was undertaken in 2003 when member countries and European parliament approved the directives for establishing the emission trading. The aim while setting the directives was to mitigate the carbon emission with least possible cost for the member states. The trial phase of emission trading was started in 2005 in order to gain the experience for the commitment period (2008 to 2012). In the first phase, scheme just covered the co2 from the carbon intensive industries such as heating, electricity, refineries, steel and cement industries (europarl, 2011). In addition, 11,500 installations were covered and their total carbon emission accounted 45% of the total emission of the member countries. The structure of the Emission trading system is decentralized, which gives the freedom to member state to take decision about allocations. According to EU directives/2003, every country has to develop own national allocation plan in order to specify the allocated amount of emission for different sectors (Europa, 2006). Furthermore, the approval of the national allocation plan is necessary before the execution. Only 5% permits auctioned in the phase 1, rest of the allowances awarded free of cost. But most of members awarded the permits free of cost on the base of historical emission.

A carbon market was established just before the scheme launched with spot and future trading option. The trading amount of carbon in the first phase was quite small. In case of carbon market, demand and supply of the commodity exclusively dependent on the government decision that's different from normal market operations. While the prices of carbon allowances are affected by weather conditions, fuel prices and governments decisions. However, there was huge volatility in carbon price during the trial which caused by decentralization of the scheme. The volatility in the prices of carbon leads the system towards inefficiency, reduce confidence of the investor. In order to make market more efficient, there is growing consensus to set the minimum price for trading. It is evident that electricity sector actively participated in the trading of emission and additional cost of complying was shifted to consumer even though they got mostly allowances free of cost. As a result, they experienced the profit from the first phase.

In 2004, EU made the amendments in directives/2003 by linking the Joint implementation and clean development mechanism with the emission trading. As a result, installations have opportunity to get emission allowance through investing in low carbon projects in developing countries and also in other developed countries where cost mitigating the emission less as compare to home country. This was another move from commission to achieve environmental goals while having least adverse effects on the EU industry. However, these changes adopted for the second phase. After making the necessary amendments on the experience of trial phase, the second phase or commitment period started in 2008 which would last at the end of 2012. Instead of using own trading schemes, three EEA countries countries became part of the European emission trading scheme. The coverage of scheme extended to 50% of the co2 emission and 40% green house gases of the European Union. During this period, industrial countries have to achieve their emission cut targets in order to compliance Kyoto agreement. Almost 10% allowances of the European Union awarded through auction which is double figure than first phase.

The third phase of the trading scheme would be start from 2013 until 2020. In this next phase, EU has to achieve the internal goal of reducing emission up to 20%. Hence, emission trading would be even more significant to meet the target of 2020. The scope during next phase would be diverse in term of adding other green house gases than CO_2 and installation coverage. For instance, aviation sector would be covered by the trading scheme. As far as distribution of allowances is concerned, half of the allowances would be auctioned. Whereas, all allowances for the energy production companies would be auctioned. As a result, there

would be no chance for energy companies to enjoy windfall profit like trial phase. The newly establish companies from any sectors would have to buy all allowance through market mechanism.

1.7 Norwegian Climate Policy:

Norway has been playing leading role on the international level in the fight against climate change since its relation is developed with human activities and threatening lives on the earth. Norway comes in the list of those few countries that are really committed to limit the change in temperature up to 2 degree Celsius. Despite the international binding agreements, Norway holds pioneer position in adopted economic instrument to reduce emission. For instance, Norway was the first country that implemented the Carbon tax for the energy intensive industry in 1991 that has helped to mitigate greenhouse gas emissions in millions of tons (Larsen & Bruvoll, 2003).

Norway ratified the Kyoto protocol in 2002 following the united nation framework convention on climate change in 1993. According to the Kyoto protocol, Norway average greenhouse gas emissions should not increase more than 1% as compare to 1990 emissions level during the first commitment period (2008-2012). Following Kyoto Protocol, Norwegian government took one step ahead and unilaterally set far big target of reducing emission up to 10% on 1990 level even though it's challenging. Meaning that, actual emissions reduction would be 9 % on 1990 level (NAP,2008). Later, Norway also defined long term ambitious targets for the reduction of emission at the national level that are 30% until 2020 and carbon neutral country by 2030 (norden,2011). In order to achieve the targets, combination of kyoto mechanism and domestic measures would be employed. Norwegian government committed to cut two third of emissions reduction at domestic level, whereas rest would be done through investment in developing countries especially China and India.

Following the Kyoto agreement, Norwegian government realized market based instruments are significant to meet climate commitment and formed a commission in 1998 for establishing the cap and trade system that help out the country to achieve the target at least possible cost. Eventually, Norwegian emission trading scheme implemented in 2005 for three years. In the first phase, scheme just accounted the 10% of the total emission of Norway. Only oil refineries and land based gas processing units were covered from the petroleum sector during the first phase of trading. Almost 95% emission allowances were allocated free of charge. That's way, it did not have significant impact in term of economic and promoting sustainable

development. In addition, offshore installations were not covered during the first phase of emission trading.

In 2007, a committee of EEA countries decided to follow European directives 2003 with the aim to integrate their national emission trading system with European emission trading scheme. It was necessary for Norway and other EEA countries to must approve their national allocation plans from EFTA surveillance authority in order to make their installation enable to trade allowance in other European countries. Amendments in the Norwegian emission trading act were made in 2007 to join together European Union system. In second phase, ETS covering 40% of the total emission of the Norway that is three times more as compare to trial phase. That's result of including more carbon intensive industries (NAP, 2008).

More than half of amount of allowances would be sold through market operations. The rest quantity of allowances would be awarded free of charge. The decisive factor to allocate free of charge would be historical emission level of the installation during 1998 to 2001, whereas new installations would buy emission allowances from the carbon market. Government has already decided that no emission allowance would be awarded free of charge in post 2012 period. This shows that government wants to expand the scope of the scheme in term of including other activities and green house gases rather than just CO_2.Later, amendments made in the scheme for implementing in the second phase (2008 to 2012) and integration with European union emission trading scheme.

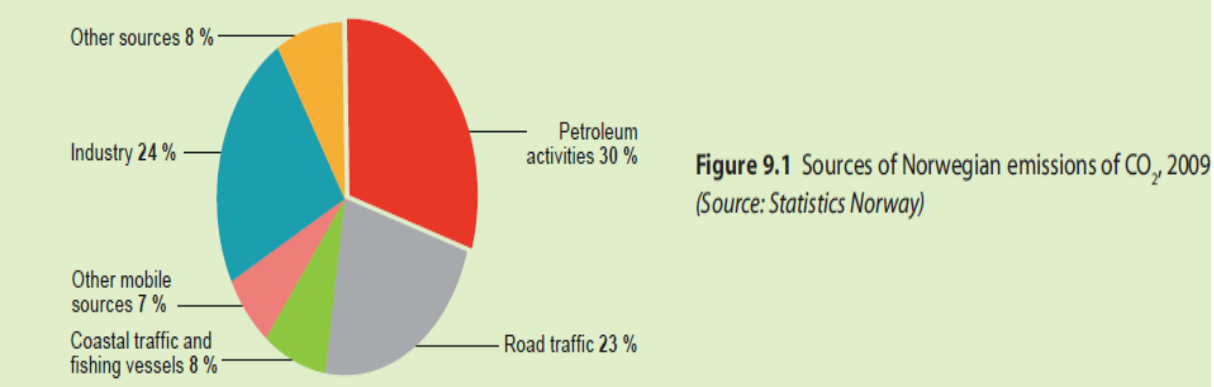


Figure 9.1 Sources of Norwegian emissions of CO_2, 2009 *(Source: Statistics Norway)*

Moreover, proportion of country GHG (Green house gases) under trading system increased from 10% to 35% in second phase. According to pollution control authority emission from the petroleum industry has increased by 80 from 1990 to 2005

This shows how much important is trading system tool for the compliance. According to statistical Norway, Norwegian petroleum sectors accounts 30% of the total CO2 emission of the country (Ministry of Petroleum & Energy, 2010). Furthermore, this emission quantity is 60% of the total coverage of emission trading. In order to trigger the innovation and making expensive low carbon technologies more economically viable, Norwegian petroleum sector is fully included in the emission trading system for the period (2008 to 2012) along the CO_2 tax that was implemented in 1991. In the second phase, no allowance would be allocated free of cost in petroleum industry, they have to buy from the carbon.

1.8 Existing Research:

Emission trading is quite new phenomena and currently operating in small number of countries, especially in European Countries. That's way, there is not much work done so far in this area. If we see the prior studies on emission trading, mostly were about were about history, implementation scope and economic impacts. In history and implementation related researches mostly discuss, what actually is emission trading, what it was necessary than other instrument, how does it work and what sectors are under scheme. On the other hand, effects related studies mostly conducted by the economists, they used the economic models and theories to figure out the financial burden and profitability issues under emission trading scheme.

The units of analysis in those studies were particular country, sectors. If we further look what sectors studied, most of the researches were about electricity generation, cement, steels and oil refineries. As far as Norway is concerned, most of the studies are about electricity sector or individual companies of that sector, rest of studies discussed the development of Norwegian emission trading scheme and integration with European Union system. This research is intended to study the implication of emission trading in Norwegian oil and gas extraction industry. We believe that this research is intended to fill the gap in literature about working of emission trading in Norwegian oil industry.

1.9 Problem statement:

"Implication of Emission Trading Scheme in Norwegian Petroleum Industry"

Research questions:

1. Opportunity and Challenges for Norwegian Petroleum Industry with the implementation of Emission Trading Scheme ?
2. What measures are undertaken by Industry in response to Emission trading scheme?

Purpose of Research:

The purpose of the research is figure out what are the risks emerged with the implementation of EU ETS for the Norwegian Petroleum industry. In addition, we will also have a look on the possible risks for the overall industry. In order to comply and undermine the impacts of EU ETS industry is adopting several strategic actions. This another aim of this research is identify what are the measures against the emission trading, how would they would help the organization to overcome cost that has arose from emission trading. Furthermore, this study would also see how much effective these measures have been ?

Summary:

In this chapter, firstly we described the issue of climate change and its possible consequences for our living pattern. Later, we explained the international efforts (Kyoto Protocol) to combat the challenges. There are three mechanisms suggested by the Kyoto Protocol that discussed in detail in order to understand how they work and interlinked with each other. Following the Kyoto, EU (European Union) formed trading scheme for the member states and further it expanded to EEA countries in 2008. Norway also became part of the scheme and domestic installation entitled to trade allowances in other European countries. Norwegian Petroleum Industry also included in the emission trading mechanism from 2008. The implementation of trading scheme would limit the industry emission that could result in certain opportunities and challenges. So, this study would analyze the opportunities and challenges along the response of the industry to the regulations.

Research Methods

In this section, we will discuss the methodology and scientific position which has taken to accomplish the research. In addition, argument would be given why we have preferred these approaches instead of others. The selection of the philosophical approach is significant, it leads us which method should be adopted. After that, data collection method and analyzing approach would be described. Reliability and validity

The Philosophy of the research:

The most important phase in carrying out the research scientifically is selection of research paradigm. According to Easterby-Smith, there are three main reasons to set any specific philosophical position for the research. Firstly, it explains the available research designs that could be used in the research. Meaning that, what kinds of data of would be required, what methods are appropriate for gathering the data and possible ways to analyze the data. Secondly, philosophical knowledge assists the research to know which designs would be suitable for the study instead of going blindly towards any approach. The third reason is that philosophical understanding support to research to bring creativity or innovation in adoption of methodologies according to the limitation of subject matter.

Selection of the philosophical approach depends on the nature of research, what questions are to be address and personal preference of the researcher. Mainly, there are two opposite view how social research should be carried out, those are positivism and social constructionist. The main thought of positivism approach is that social world exist externally and objectively, methods to measure the knowledge are objective rather than non- measureable means sensation and intuition. In addition, reality has nothing to do with the personal experience of the people. On the contrast, social constructionist is newly developed approach which asserts that reality does not exist externally but constructed socially and given meaning by people.

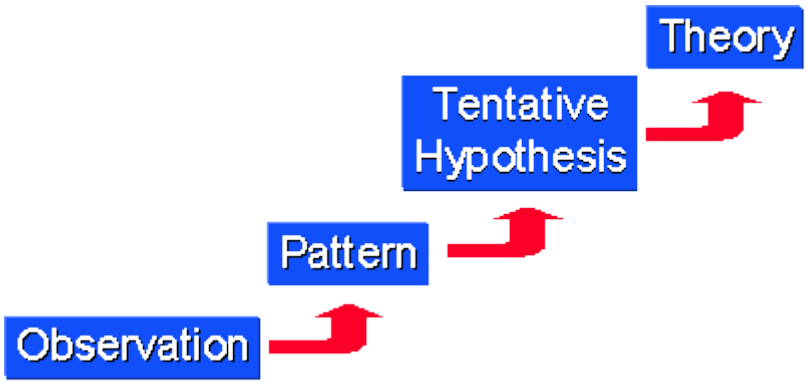
This proposed is based on social constructionist, which would facilitate us to have deep understanding about the issues or matter through having close contact with the people, those are close or have experience of the phenomena. There is a lot of debate about the impacts of emission trading scheme on the business organizations. Using social constructionist approach, we have true picture what changes have brought in the industry following the regulations with the interaction of people, those are part of implementing the regulations and observing the phenomena. Explore the affects of environmental regulations on the industry.

Research Approach:

Inductive and deductive:

Inductive and deductive are the two approaches to conduct the research. In deductive approach we move from general view towards more specific. Furthermore, we start working with thinking about the relevant theory which leads us to define hypothesis using specific variables. Later, data related to hypothesis gathered and analuzed in order to prove or reject the theory. This can be called also hypothesis testing and top to down approach. On the other hand, inductive approach moves from bottom to top. Meaning that, process moves from more specific towards generalization of the topic.

Firstly, specific phenomena is observed or measured then relationship between variable is established upon observation. Finally, it ended up with giving theory or generalizing the idea. The approach of this research is inductive because nature of the study is exploratory. We have collected the about the impacts of emission trading scheme and then analyzed using theories in the theoretical framework instead of setting the hypothesis for the study. Finding of the study are drawn via theoretical framework which has led us towards generalization of the view about the impacts of emission trading on the Norwegian petroleum industry.



Qualitative study:

In order to carry out the research, method of the study could be qualitative or quantitative. Both have own characteristics, those cannot be fit in every situation. It exclusively depends exclusive on the nature of the research, which method should be used to address the problem. According to Strauss and Corbin (1990:17) “qualitative is a research in which researcher proves findings without any statistical procedure or other means related to quantification”. Qualitative study considers the meaning of the people to interpret the phenomena and study is carry out in natural environment (Thomas, 2003).

In qualitative research, we have the opportunity to use several methods to gather the data such as open end, semi structure interview and observation. In addition, Respondents can answer in their own words of their experience or knowledge about the phenomena rather than restrict them to answer some particular questions like in quantitative research. Meaning that, produced finding would be dependent on respondent perception rather than determined before the results such as hypothesis is set in quantitative study.

On the other hand, quantitative study main concern with numbers and where cause and effect relation is to be studied. In addition, quantitative study avoid the personal involvement of the researcher in drawing the finding by giving the role of observing and measuring the data (Thomas, 2003). The topic of our research is how emission trading scheme has affected the Norwegian petroleum industry and what actions or strategies have been undertaken by the different actors in the society. In order to develop profound knowledge about the implication of emission trading scheme, we have selected qualitative method to conduct the research.

Research design:

Case study:

The definition of case study by Yin (2003: 13) is “empirical inquiry investigate the contemporary phenomenon with in real life context especially when boundaries between phenomena and context are not clearly evident”. In addition, case study method enables to use data from different sources like documents, interview and observations to conduct

comprehensive study. Case study is one approach that supports deeper and more detailed investigation of the type that is normally necessary to answer how and why questions.

There are are two main types of the case study research that are general conclusion and specific conclusion (Mannen,2000). In the general conclusion approach, we consider some cases of the industry but results represent the overall industry. The validity of the general conclusion might be at stake if there is huge is diversity among the population and sampling methods are inappropriate. Because of these issues, case study method is often criticized.
As far as specific conclusion is concerned, we just study single case that exclusively draw conclusion about one business. The method of this research would case study and its type exploratory and general conclusion. The reason of choosing general conclusion approach is that the numbers of firms are around 40 and there is huge similarity among the oil companies in adopting measures after the implementation of the emission trading scheme. In addition, there is also special forum where government, industry and other stakeholder discuss the potential challenges and appropriate measures to address the issues. Such kinds of features in the industry enabled us to generalize the conclusion with having information from few sources.

The Exploratory nature of case study is used when we intend to conduct comprehensive study of the concept and want to raise the understanding of the phenomena that is not discussed quite often before. We have chosen exploratory nature of the case study because the implementation of market based instrument such as emission tradition is quite new concept and prior studies related to this topic are very few. Furthermore, in order to contribute in the existing literature and developing own deep understanding we are going to study the implication of emission trading in the petroleum industry. The unit of analysis in our study is Norwegian petroleum sector, it could be interesting to compare another country how they are dealing with new climate change regulation but limitation of the time restrict us to just focus on one country.

Sample Selection:

We are carrying out study with social Constructionist approach, in which we select respondent with specific reason instead of random selection. The population in this research is Norwegian petroleum sector which comprised of large size, medium size and small

companies, Norwegian oil industry association, Climate & pollution agency and research institutes those carry out the research on environmental policies impacts on business sector.

Data collection:

Primary Data:

The selection of the appropriate data is highly important for the quality of research or to fulfill the aim of the research. Data collection can be done through primary and secondary source. The data which we have collected purely to address the problem of this study. This data could gather through surveys, structured interviews, semi structured interview and in-depth interview. As we mentioned above, our study based on qualitative data which bound us to use in-depth interview with the respondent. In-depth interview expand the dimension of the problem & help to find the new clues.

As far as selection of the respondent is concerned, we have chosen with specific reason instead of using any sampling technique to collect the data. We did this because our research depends on the philosophy of social constructionist where validity of research is enhanced if we select the respondent who has actually experienced the phenomena. Firstly, our intention was to approach several major oil companies in order to know how they are affected from the emission trading regulations. Due to some limitation, we could not manage to get data from them. After that, expert and Norwegian oil industry associated being contact. Firstly, we conducted telephonic interview with the Researcher of FNI institute who has been doing research on the topic “emission trading implication in the oil industry”. It was like one hour in depth interview. In order to represent the overall all experience of the industry, we engaged OLF that is joint organization of the industry. OLF has specific department to deals with the environmental challenges and government regulations. Norwegian petroleum directorate is a department that governs the petroleum sector through rules and regulations on the behalf of ministry and government.

Secondary Data:

On the contrast, a kind of data which was collected for different purpose but linked with our study is called secondary data. The good thing about secondary data is that it takes less time to gather the data. Furthermore, it gives a lot of help to the research to make the things clear in the early stages of the research. It can be collected using different sources such as books, articles, company reports, government agencies report about particular topic. In the case of this study, we paid much attention to the sustainability and CDP (Carbon Disclosure project) reports of the oil companies.

As far as sustainability reports are concerned, it published by the companies itself to show general public what special they are doing to deal with climate change and its regulation. On the other hand, CDP (Carbon disclosure project) is a organization that works with shareholders and corporations and gives comprehensive information about the emission emit by each organization, long term goals and range of measures to cut their emissions. We also consulted the Norwegian directorate of petroleum annual reports and bulletins to have a look about the industry performance in term of environment.

OLF (Norwegian oil industry association) is a formal platform for the oil companies operating on Norwegian continental shelf where they cooperate with each other to face the challenges ahead to the industry. In addition, reports are published by the OLF every to highlight the initiative took by the different companies, these reports were really helpful to see the measures and their potential to cut the future emission on the shelf. At the initial level, research databases such as Science direct, Springerlink, Proquest in order to retrieve articles about the emission trading, those were really useful to build general understanding and working of the phenomena in different industries and countries.

Data Analysis:

After having primary and second data from different sources, the most significant work is to draw out the result. There are number of methods those could be used to analyze the available information, but the selection is made on what is philosophical position and methodological assumptions in the research design. In addition, it’s hard in the case of qualitative study to make a story with complex and diverse information that could convince the people. In order to prove to research finding significant, it requires demonstration how analysis was

undertaken and how conclusion were withdrawn, also how unprocessed data transformed into meaningful conclusion(Easterby- smith et al., 2008).

The available methods for the analysis of qualitative data are content analysis, grounded analysis, discourse analysis, narrative analysis, conversation analysis and argument analysis. We have used narrative analysis method for analyzing the natural language data in our study. This method helps to the research to build a kind of picture of social phenomena or social situation with the intention to study the actions of different actors in that story, and explore their ideas and beliefs. In other words, it could say a way of telling a story telling. In addition, this approach keeps the interest of the reader up about the phenomena. At the same time, it's useful for analysis of the interview data as well as text based data.

Ethical considerations:

It is very important to take into account the ethical issues those are involved during the research process. Research is the one who collect the data and interpret in order to draw out the results, it is his ethical responsibility to do not manipulate the gathered data which could give misleading solution to the user of research. Meaning that, researcher should be neutral or unbiased. Some time, companies give access to valuable data with the condition of not exposing to other people. in that case, research should meet the commitment of keeping data secret. Furthermore, if interview would be recorded then respondent should be informed about the recording. Because, some time respondent do not want to give the recorded interview. While conducting this research, we paid the extraordinary attention on the ethical issues. We did not involve personal view during the interpreting and analysis that was necessary to show the clear picture of the results. Respondents were asked before recording their interviews and also about showing their documents in the appendixes.

Limitation of study:

This study was intended to highlight the impacts of emission trading scheme on petroleum industry. Because of time constraint, it was not possible to study the impacts from different aspects. We just managed to see how competitiveness of the industry has disturbed and what companies doing in response to this scheme. The most of the information about the industry is in Norwegian that was challenging to translate using different tools and understand them.

Because of this, we could not manage to consider all of the data. It was also hard to make an appointment with the relevant people for interviews. Due to their tough work routine, the numbers of interviews are not as many as considered in the start of research.

Validity:

According to Easterby-Smith, validity of research means true presentation of the reality and what experienced the people. The selection of the appropriate methods for collecting the data and analyzing the information is significant for the validity of the research. Another view about the validity is that, research should depict the correct interpretation of the phenomena (Silverman, 1993:149). In order to enhance the validity, it is important to avoid the factors that raise concerns over the accuracy of findings and their interpretations. The research should take into account these factors at the planning stage (Forzano-Gravetter, 2011).

Yin(1994) asserts that there are three main parts of the validity which are internal, external and construct. The external validity refers to what extent the finding of the study can be generalized. Meaning that, how much results would be consistent if we change the conditions, measurements, populations and experiments. The internal validity mainly deals with quantitative study that focuses on defining unambiguous relationship between two variables. The third dimension of validity is construct,

This study based on the triangulation methods that increase the validity of the research. Meaning that, data would come from several sources like documents, reports and interviews. Before having the interview, we sent the interview guide to the interviewee that described the study and mentioned what we specifically going to discuss about that. This study specifically deals with the Norwegian petroleum industry but it could be generalized to some extend because industry structure, resources location(offshore or onshore), carbon cap, trading regulations , flexible mechanism limit (CDM, JI) varies from country to country.

Reliability:

The meaning of reliability in the research is that if two researchers carry out the same study then they should come up with the identical results (Mannen,2000). There are three function

that does by the reliability which are, A police function (curb dishonest research)", An intelligent test(are the researchers clever enough to present their logic) and an alternative of validity when validity is hurt then part of a validity crutch(ibid). Because of subjectivity nature of qualitative study and the role of research as a research tool, there is least emphasis on the reliability. In addition, it would be unlike to have same results from identical studies even though under the similar conditions and circumstances (Dayman& Holloway, 2011).

The reliability of the study can be hurt if research misunderstood the information due to language issue between the participant of interview and other techniqual reasons. In order to enhance the reliability, interviews conducted in English in which participants were fluent. As mentioned above interviews conducted over telephone, we used the recording application of the phone to have clear understanding of information instead to make a guess about the information that missed during the interview. The most of the secondary data was in Norwegian and its correct translation was big challenging to maintain reliability of the research because sometime electronic translators change the meaning of actual information. To overcome this issue, we relied on multiple tools for translating the documents.

Summary:

In this section, philosophical position and methods are discussed to carry out the research. Social construction of reality is a philosophical position of the Research that enabled to study the phenomena in-depth. The nature of the study would be qualitative and method is case study. In addition, inductive approach is followed for the research process that moves from specific issue to general. In order to collect the primary data, we conducted in-depth interviews on phone whereas secondary data gathered from companies report, ministry website, oil industry association reports. Following, validity and reliability issues are discussed.

Theoretical framework

This chapter will attempt to discuss the theoretical frame work used in the study. Theoretical framework serves as sketch of the probable steps needs to be taken in order to present a selected approach by which study will attempt to find out solutions from problems. It will allow creating a connection between the tasks done in the study like; problem statement, what study wants to end up with, type of literature needs to be reviewed, methodology adopted in particular research, what type of data collection and how analysis will be done. It serves as plan that provides consistency to the study because the literature consulted has higher level of relevancy and closeness to the problem statement. We have used institutional theory and domestic political model to address the first research questions that is about the risks and opportunities from the institutional change. In addition, Steger model and corporate actor model in order to analyze the strategic actions of the organizations in response to the emission trading scheme.

Institutional theory:

According to the ingram and clay (2000), institutions are kind of rules that constraints in conducting normal operations of the organizations. Furthermore, level of constraint or pressure for changing the companies' structure and practices depends on the actor. Organizational behavior is a product of several norms, rules and regulations that emerged from the institutional context (Scott ,1983). CO_2 is one of the greenhouse gas that produced from the human activities (use of fossil fuel for different purposes) ultimately caused by the climate change. Institution or government regulatory measures to mitigate emissions pose different risks to the organizations that emitting carbon emission. In the perspective of this study, EU ETS (emission trading scheme) a kind of the institution that exert the pressure on the organizations to limit their greenhouse gas emissions. In addition, institution (EU ETS) posing risks to the industry. In order to comply, industry and companies adopting several strategies to undermine the pressure of Eu ETS (Emission trading scheme).

Institutional isomorphism:

According to dimaggio and powell assert that there are three kinds of institutional mechanism (coercive, mimetic and normative isomorphism) that change the organization behavior and practices. These mechanisms produce norms, values and rules that force them to adopt identical practices and structure for the organization that are operating in the same field.

Furthermore, organizational field is defined as set of organizations that have any kind of relation to each other such as competitor, supplier, and customer.

Coercive:

The term coercive refer to the external force that exerts pressure on the organization to achieve particular objective or results. This pressure could be formal and informal, a pressure from the government would be formal coercive and pressure from the general public or communities considered as informal. Government considered as main actor that influence the organizations through coercive pressure in term of rules and regulations. Furthermore, government create public institution that affect the diverse actors of the society and hard for them to be avoided. On the other hand, Local Communities build coercive pressure on organization and industries through participating in the election process, strengthening the role of the non-governmental organizations. Furthermore, general public or citizens can also exert coercive pressure through filing a suit in the court against any company practice or industry.

Mimetic:

Companies can adopt strategies and actions that competitor are undertaking in order to avoid the potential uncertainty. The force or pressure to imitate other company strategies called Mimetic (DiMaggio and Powell, 1983). Some organizations copy the structure and practices because they do not have the ability to produce innovation and want to reduce the uncertainty (Ashworth *et al*., 2007). Another view is that economic loss is a reasons behind the mimic process, when organization facing a problem that could create financial trouble but does not have the concrete plan to avoid the cost (Cyert and March, 1963). In some studies, it is also revealed that industry associations encourage the organization to adopt particular policy and measures(Toffel and Delmas,2004).

Former employees of other organizations, consultancy firms, customer demand and associations of the industry could guide about the practices of the other organizations. In order to implement best practices, it is better to imitate from the industry leader. Usually industry

leader innovate the news measures and structures for competing in the market. In some cases, it has been seen that similar practices are adopted to address the customer concerns.

Normative:

The third pressure for changing the organization behavior is normative. This pressure referred to the professional bodies that affect the organization for change. DiMaggio & Powell (1983) claimed that two dimensions of the professionalization that are the main source of the normative isomorphism. The first one is the formal education that gained by the professionals from the specialize universities. Norms transferred in the form of educational training of the professionals to the organizations. Universities and educational institutes often have quite similar material for the teaching and learning. On the other hand, organizations hires the professionals from the same market where professionals belonged to same university or training institute or similar. As a result, professionals in different organizations tend to analyze the problem in the same direction and most probably respond adopting identical measures and structures (DiMaggio & Powell, 1991).

Hirsch and Whisler (1982), conducted the research to analyze the response of the professional that are engage with fortune 500 companies. The results show that there is much similarity in the behavior of the professionals towards particular situation. The second source is the professional networks that create hurdles to implement innovative in the organization. In addition, they undermine the organizational ability to behave proactively in the market to combat with the potential threats and uncertainties.

The domestic political model:

This model is mainly used in defining different political scenarios but here we are using to study the organization response to the opportunities challenges arose from the implementation of EU ETS(European emission trading scheme). According to model, government intention or social demand are the main drivers of the regulations and policies for the industries or activities. Furthermore, the core objective of the regulations is to bring the change in the practices those harmful for the society and system. These regulations could be resulted in opportunities and challenges for the targeted industries and activities.

Societal demand for environmental protection:

With the growing problem of climate change, companies are more concerned with public behavior and CSR (corporate social responsibility). The public response towards environmental shifted into political power. For instance, environmental groups and interested parties have a significant power to influence the companies strategies. These groups make the people aware about the environmental damages from the oil and gas activities.

Government supply of environmental policies:

Sometime government also introduces policies those not driven the public pressure. The organization and industry response depends on the strength of the environmental policy. In addition, the properly design policy or instrument may create pressure and provide opportunity and also eliminate uncertaintities. As a result, clear message is conveyed to the industry that adopts innovative and offensive strategies to respond the opportunities and pressures. Organizations adopt innovative and offensive strategies with the intentions to avoid the cost associated with complying the regulations. For instance, Norwegian government implemented the co2 tax for the energy intensive industry in 1991 even though there was strong opposition from the corporations. After that these policies turn the corporation attention towards seeking innovation. As a result, Norwegian energy intensive industries became leading in the world in term of sustainable operations and environmental friendly technologies.

Linkage of supply and demand:

Corporations are also one of the interest group of the society that can influence the government decisions rather to be targeted by public pressure and government policies. Decision maker have intensive talk with targeted industry in order to take into account their concerns the potential regime. The aim of such discuss is to build consensus among regulatory institution and affected industries. In addition, it also gives the sense of social responsibility to the industry. On the other hand, corporations expect that their interest must be considered while making the policies. Without cooperation, conflicted policy may oppose by the affected industry and give response to the regulation with reactive strategy. At the end, it is assume that three factors social demand, government policies and cooperation of political institute

motivate the organization to adopt innovative strategy to respond the environmental regulations.

Ulrich Steger typology:

Ulrich gave the typology about the climate strategies those can be adopted by the corporations in 1993. The available strategies for the business in order to respond the environmental regulation are defensive, indifferent, offensive and innovative. In addition, he asserts that business make the selection strategies or actions on the base of risk and opportunities associated with that regulation. Meaning that, effective regulations or market based instruments should have appropriate amount of risks and opportunities for the widespread adoption. Actually, Ulrich presented this idea in consideration of environmental regulation but we are going use this to study the organization strategies and actions with the aim to comply with emission trading scheme. In the case of this study, we are going to see how Norwegian industry is going to respond to the EU ETS. On the other hand, it als

Defensive:

Defensive strategy or actions are adopted by those organizations who do not believe climate change or environmental issue. In addition, some of them do not think, regulations are the solution of environmental problems. These kinds of organization just comply with mandatory regulations. Meaning that, survival in the market is the only priority. For instance, strategies and actions of the oil companies almost two decades when there was huge debate about the environmental regulations. Firstly, they opposed the phenomena of climate change and solutions to combat it. After that, they realized and become part of the efforts to mitigate the emission.

In-different:

According to indifferent strategy organization neither opposes nor supports in order to respond to the environmental legislation. So, organizations with indifferent strategies do not bring any change in actions or operations for the improvement of the environment.

Offensive:

Companies with offensive approach consider climate change or environmental issues as real threat to our society and fully comply with government policies to meet the challenges. These companies introduce limited changes in the organization structure, investment priorities and in R&D processes in order to exploit the opportunities associated in obeying the regulations. As a result, many organizations succeeded in developing competitive advantage and environmental friendly public image as compare to most of competitors.

	FEW OPPORTUNITIES	MANY OPPORTUNITIES
Small risks	Indifferent	Offensive
Large risks	Defensive	Innovative

(Source: Steger 1993)

Innovative:

Innovative companies also appreciate the measures those address the environmental. In addition, changes are implemented at large scale throughout the organization to become more innovative and environment friendly. These companies often incur huge cost despite exploiting the only opportunities of complying.

The corporate Actor Model:

According to Corporate Actor model, the choice of the measures and strategy depends on the internal factors of the organization. This model mainly deals to analyze the situation of the single company. But in this study we have use to see how internal factors of the Norwegian petroleum industry affecting the climate change strategies and actions.

Environmental risk:

The issues of climate change mainly connect with the significant use of the fossil fuel. Therefore, if the corporation is highly involve in the fossil fuel and operations are inefficient then it is likely that environmental regulations would have great threat from the strict environmental regulations. It is hard for every organization to increase the share of least carbon intensive businesses in their portfolio. Meaning that if organization have the most of the investment in coal projects, it would be impossible to shift investment towards Oil and gas. In order to undermine the impacts of the regulations, organization most probably intends to adopt the reactive approach.

The company's environmental reputation:

Environmental reputation of the company is another important factor for the selection of strategy. If the public consider the company environmentally unfriendly then it is likely that organization would adopt the proactive approach to change the general perception. This is because, market share cannot be maintained with poor reputation and dissatisfied customers.

The company capacity for organization learning:

Actually the ability of organization learning depends on two things. The first one is how much organization is active to analyze the external environment with the aim of screening potential trends of the market. After figuring out the opportunities and challenges for the organizations, the next factor is does organization have the structure or capacity to avail the future opportunities and avoid the challenges. If the organization has enough capability for learning, then organization can respond effectively to the institutional barrier.

Porter hypothesis of Environmental regulations:

Since the environment regulations are designed and adopted, the issue of impacts on the compliance industry is a hot debate. The traditional view about the environmental regime like ETS (Emission trading scheme) is that it's source of the challenges or risks for the complying organizations and industry. Meaning that, organization incur the additional cost to meet the terms of regulation which leads towards uncompetitive position as compare to other firms that are not operating in environmental constraint. On the other hand, Michel porter stood against the conventional notion by giving entirely unique idea about the impact of environment regulations on organization. According to him, properly designed environment regulations like ETS (Emission trading scheme) trigger the innovation in the firm or industry that help to overcome the cost of compliance partially or sometime full.

In addition, this view is based on the assumption that organizations in the non regulatory environment only pursue those policies that create value for them in the short term. With having effective environmental regulations, organizations become motivated to find the undiscovered opportunities regarding bringing efficiency in the system and to find new business opportunity. As a result, organizations approach shift towards long term investment for implementing innovation to gain first mover advantage. By having innovative technology, efficient process and new product, industry or organization under strict environmental regulations experience high level of competitiveness as compare to industry with flexible or no regulations. The porter hypothesis guide us, organizations and industry strive more aggressively for finding new opportunities and adopt offensive and innovative climate strategies after the introduction of EU ETS (Skjaerseth,2011).

He also asserts that innovation under regulation is result of giving awareness about the available opportunities. Furthermore, porter argued that direction of the innovation in the result of regulation either be favorable or unfavorable for the environment. That's way in order to generate the positive innovation regulation should be properly designed.
He also gave the six guidelines to develop the effective policy or regulation. The first point is that companies do not have the clear picture about the cost of wastage or inefficiencies, therefore regulation should identify the areas where the improvement is needed. Third, investment for bettering the environment often considered very risky, the uncertainty associated with potential should be reduced. The fourth point is that regulation creates pressure on organization that leads toward innovation. Fifth, regulations level the playing field.

Summary:

This section deals with defining theories in order to analyze the empirical finding in order to address the problem statement. Firstly, we have used Institutional theory that describe institution impact the complying industries and force them for change. Later, Domestic political model is discussed to see how environmental regulations formed and create risks for the businesses. After that, Steger model is used to see how organizations respond to the environmental regulations. The corporate model analyzes the organization related factors that affect the climate strategies adoption. At the end, Porter Hypothesis is explained for the competitive issues.

Empirical Findings:

This sections deals with the information that we have collected through primary and secondary source according to the problem statement. First, we have described the introduction of the Norwegian petroleum industry in term of emission sources and regulations to limit them. After that, risks and strategic actions or measures of the industry are explained. Actually, opportunities of the EU ETS are described with the measures industry is taking in response.

Norwegian Petroleum Industry:

The first Norwegian oil discovery was made in 1969 in the North Sea that followed the discoveries in large numbers. The most of the hydrocarbon resources are located in offshore areas. Even though, resources are located in the Norwegian and Barents Sea but so far main focus been in the north. Because of environmental concerns, North Norway has not been fully opened for the petroleum activities.

According to the Norwegian directorate of petroleum, CO_2 emissions from the petroleum operations account 29% in the total emission of the country. This is result of the quite large share of the petroleum sector in Norway and carbon intensive process of producing oil & gas. The main sources of the greenhouse gas emissions from the offshore installations are the combustions of the gas in the turbine, combustion of diesel and gas flaring. In addition, gas turbines are used to generate electricity to support different activities on the installations such pressure building for the injection, compression and transportation of the gas (Ministry of Petroleum & Energy, 2010). The green house gases emitted from installations are CO_2 (carbon dioxide), methane (CH4), Sulfur dioxide (SO_2) and nitrogen oxides (NO_x). It is also expected that this amount would further increase in coming years because many fields in the North Sea are on the maturity and oil recovery ehananced need to use in order to lift the remaining resources.

Norwegian authorities have been concerned so much about the climate change and environmental issues. That's way; Norway was the first country that implemented the CO_2 tax for the carbon intensive industries in 1991. Following, industry implemented a lot of measures that has made the Norwegian oil industry least carbon intensive among the other countries. In

order to meet to comply with Kyoto Protocol commitment and internal environmental goal, Norway adopted the ETS (Emission trading scheme) in 2005. Furthermore, petroleum industry started to participate in 2008 along the carbon tax. For the effective implementation of emission reduction measures, industry has developed the proper mechanism for measuring and reporting the emission.

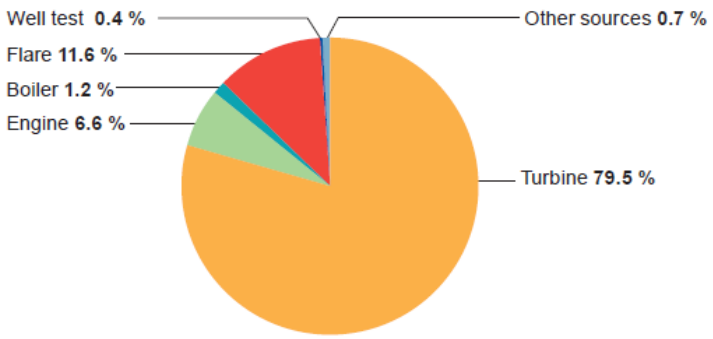


Figure 9.2 CO_2 emissions from petroleum activities 2008, by source
(Source: Norwegian Petroleum Directorate)

There are three kinds of the emissions of the Norwegian continental shelf emissions or discharge to sea, emissions to air and acute emission (Ministry of Petroleum & Energy, 2010). The scope of the emission trading is just to cover emission to air. In addition, there are several greenhouse gas emissions that contribute in the climate change but CO_2 is traded according to emission trading rules. Norwegian government also has introduced tax for the nitrogen oxides (NO_x) from 2007. At the international level, discussion is going on to include methane and other greenhouse gases in trading mechanism.

Risk Emerged from the EU ETS:

Increase in Operating Cost:

As we discussed earlier, installations covered by the EU ETS have to buy emission allowances against the quantity of carbon emissions that is emitted into air. The price of the emission allowance is depends on the market fundamentals such as demand and supply.

Moreover, additional cost of buying Emission allowances increase the total operating cost that leads the industry towards unprofitability. It has seen that industries like power and others that mainly operate to serve the European market have benefits from the Emission trading so far. Because, their product market is domestic and they raise the price in order to pass on the marginal cost to the consumer even though some portion of the allowances were allocated free of charge (chen & Neuhof, 2006).

As far as, petroleum products are concerned, that are international commodities and have almost single price around the globe. That's mean, market structure of the global oil industry does not allow to any single firm or industry to pass on CO_2 cost to the customer by raising the price of the crude in the market. Because of the absence of the international climate regime, only companies in the Norway and other European countries have to pay the price of the carbon. On the other hand, oil industries outside the Europe are best off and operating without carbon constraint and strict environment regulations. The increase in the operating cost due to carbon price is a serious risk for the profitability of the industry and competitiveness. Almost every oil and gas company on the Norwegian continental shelf has rated this risk on the top in their CDP (climate disclosure project) reports. When we see the price of the emission allowance in the European carbon market since 2008, it has been too low against the forecasted (Parkinson, 2012). This is because of economic downturn in EU member states where economic activities have contracted significantly that ultimately leads towards low emission. As a result, Norwegian petroleum industry has benefited in term of low carbon cost.

The low carbon price made the industry reluctant to invest in low carbon technologies and enhance innovation. In order to enhance the motivation and diminish the benefit in the result of economic crisis, Norwegian government has doubled carbon tax for the offshore installations in April, 2012. According to government, this would help to increase the adoption of the cost intensive measures that are significant to realize long term environment goals (emisje, 2012). Moreover, oil industry feared that this risk would increase further during the third period of the EU ETS. The third phase is suppose to start in 2013 in which more industries would be covered by the EU ETS and free allocation for the many industries would be abandon (Decc,2012). As a result, carbon price would be significantly high and may hurt the profitability of the industry even more.

Future investment:

Long term investment decision is one of the crucial stages for the organization because it has significant impact on the future profitability and survival in the market. In the case of oil industry, this decision could be development of new field or redevelopment of the existing field. Before making the investment decision, future costs and revenue are calculated in order to see whether it would create the value for the company. With the growing uncertainty of environmental policies and implementation of the market based instrument, new risks have emerged that must be taken into account. For instance, EU ETS has created additional cost of buying allowances for the industry that would have significant impact on the future cash flows.

As a result, industries covered under EU ETS have started to take into account carbon price for the future project evaluation. As we mentioned above price of the carbon has not been as high as it expected, that's way it has not affected the future development plan of the industry. In order to prevent the organization from future risk, companies in the Norwegian petroleum industry have set $40 internal price of the carbon that is considered while evaluating investment evaluation (CDP). On the other hand, capital expenditures have also increased for the oil companies because they have implement the best available technology and several other steps that ensure the lower emission from the operations. If we compare with other countries, companies avoid deploying innovative technology because carbon price is irrelevant in that case.

Carbon leakage:

According to IEA (2008) term carbon leakage refers to the increase in emission outside a region as a direct result of ETS (emission trading scheme) in another region. Meaning that, firms of one country or regions that has carbon constraint environment moved to another place with the aim to avoid the co2 cost for the operations. For instance, one steel manufacture relocates their business from any member state of European Union to china. Such kinds of situation often happened due to some flaws in the regulations and distrust among the corporate sector and legislations bodies or governing institutions.

In the case of petroleum industry, there is no possibility of carbon leakage during the short run. Because operations of the industry based on the sub surface resources that takes long time to be depleted and mobility of the developments is also impossible. Therefore, it is very unlikely in the short term.

Uncertainty of demand:

The concerns over the issue of climate change increasing with the passage of time that would result in international agreements and more tight environmental regulations for the industry. For instance, last COP (conference of the parties) 17 arranged in Durban, South Africa that suggest to the Developed countries to cut 25% to 40% emission until 2020. After that, there is huge talk within the European Union member states to raise the emission reduction targets from 20% to 30% for the 2020 goal (Guardian, 2012). In addition, EU also has the goal cut the emission by 50% until 2050. On the other hand, largest polluter China and India also agreed to be part of the post Kyoto binding agreement to cut the emission like developed countries (hindustantimes, 2011). In order to realize the emission reduction commitments, ETS (Emission trading Scheme) would be significant mechanism for them too.

The growing adoption of the cap & trade has also made expensive for the industry to use hydrocarbons to run their operations. That means, cap and trade result of international of international agreements would have significant impact on the demand of the hydrocarbons. It is not possible for the industry to shift their operations over the night on low carbon technologies. In the short term, industrial consumer would implement the energy efficiency measures that would bring the minor change in use of the demand. For the long term, developed and developing countries have ambitious goals to cut their emissions. To realize these goals, carbon trading mechanism would expand to many other countries such as China and India and price would be much stable in Europe to encourage the businesses for cost intensive clean technologies.

As a result, demand would be diminished of the carbon intensive fuel especially for the oil and coal, whereas demand of the gas would grow because clean in burning and has least impact on the environment. In addition, the role of the renewable energy in the global energy mix would be expanded too. According to the CDP (carbon disclosure project) and conducted

interviews, possible decrease in the demand of the hydrocarbons is one the risk that also has emerged with the implementation of cap & trade. The nature of the risk is indirect and could affect the oil industry in the long term.

Response to the EU ETS

Cooperation for the common challenge:

Even though competition brings the efficiency but Norwegian authority following the approach of cooperation and competition in the development of resources and meeting the emerging challenges to the industry. That's way, most of the licenses for the blocks given to a group of companies instead of single entity. As a result, knowledge and capital is combined from different parties that have more chance to develop the resources in the sustainable and efficient manner. On the other hand, communication and cooperation of the oil industry with other stakeholders also contribute for the effective value creation. In order to have proper platform of discussion, one special forum formed in 2000 called "The Senior Management forum" that comprised of 30 senior managers from oil companies, authorities, supply industry, research institute (Facts, 2005).

The main idea behind the formation of forum is to discuss the industry challenges and their possible solutions. This forum chaired by the minister of the petroleum and energy who take into account the point of views of the member parties and represent the government priorities about the issues. Like the safety of the offshore rig, Emission reduction, is also one of the debated issues on this forum these days.
Because of cooperation approach, there is much uniformity among the oil companies' strategies to cut the emission in order to have profitable operation in the carbon constraint environment.

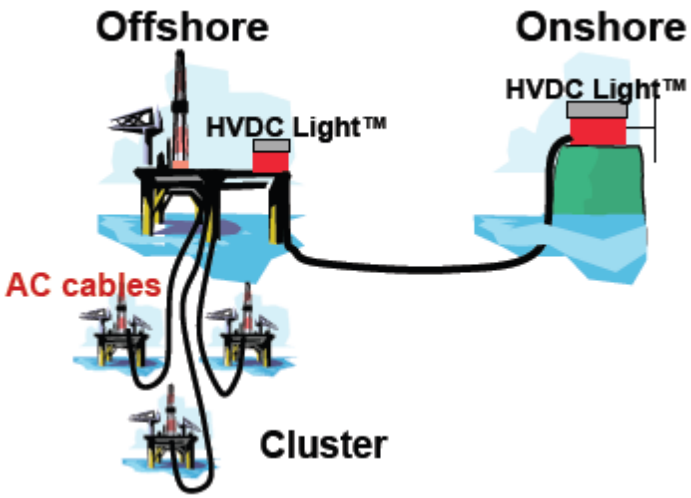
Measures in response to Emission trading:

According to Norwegian oil industry report, Emission from the oil and gas activities is expected to increase til 2020 per unit of energy produced. The measures that industry is undertaking to cut the emission are energy efficiency, carbon capture and storage,

electrification and renewable energy development. In addition, we have also discussed the use of CDM and JI mechanism to offset the emission for short term.

Electrification of offshore installation from Land

The largest source of Co2 emission in the Norwegian petroleum industry is offshore power production with gas turbine. The main uses of the electricity are compressing gas for transportation, building pressure for pumping the oil. There is a huge potential to cut the emission by connecting the offshore installation with onshore electric grid. The idea of Electrification firstly came on discussion in 1997 and different stakeholder started work to make it happen. In the early studies, it has been considered commercially unviable in many studies conducted by Government agencies and petroleum companies. However, with growing carbon constraint environment in term of CO2 cost of and technological advancement has motivated the industry to find the possibilities to connect the installations with onshore grid even though a lot of challenges still ahead for the widespread adoption. As a result, some projects have already realized and several others are underway.



Troll A was the first installation on Norwegian continental shelf that started to get power from land based grid. Following Troll, several other installations became part of the land based grid. Most notably are Ormen Lange, Vallhall, Gjøa and Snøhvit. Whereas, Vallhall is one of the operating field of the BP that has redeveloped with the aim to make it ready for another 40 years. The new installation is connected with the land through 290 km long subsea cables that would provide the full required power for the field (BP, 2012). As a result, millions of tones

carbon emission would be avoided only with this single project. In addition, BP claims that new installed system is reliable, required less maintenance and convenient for day to day operation.

In order to provide the complete power from land to old fields, large scale modifications is necessary in the existing structure of the facilities. That would be costly and resulted in the temporary disruption of production (Konkraft, 2009). Without modification there is also potential of partial electrification that means shift some components on electricity and keep boiler and compressor remain on oil. According to some reports, such kind of electrification could reduce emission upto to 45%. Furthermore, it would help to avoid the cost that incurred in case of stopping production from the field. This is especially suitable for those fields that are going develop first time or redevelopment of field due to some other reasons. For instance, Vallhall field that redeveloped due to production concerns. On the other hand, the design of the recently developed field feasible for the electrification with minor changes.

For the further Electrification, there is substantial need to develop new power production facilities that must be environmentally sustainable. There are three possible ways that could supply electricity to the offshore installations (Ministry of Petroleum & Energy, 2011). One of them is to build gas fired power on land with CCS (carbon capture and storage) technologies. The deployment of CCS would help to utilize hydrocarbon without emitting emission into air. This source is highly reliable and locations of the plants can be designed according to the flexibility. On the other hand, CCS (carbon capture and Storage) technology for the power production is immature and economically unavailable (NPD,2008). The development of the wind farms in North Sea could be another choice to generate power for the industry. But there would be need of backup system that provides the supply when the wind is not blowing. Another issue with wind energy is that its takes a lot of time to came into online because approval from the authorities and consultation with communities is time consuming (Konkraft,2009). The development of the hydropower could also increase the supply with renewable source. Even though, it's economically viable but political conflicts and lengthy administrative work are the main hurdles.

The reliance on the market for the electricity is another option for the electrification of the shelf. Meaning that connect the installations with the land based power grid without adding power in system from new developments. This looks feasible but In order to realize this

choice, there are several factors must be taken into account such as production surplus and transmission infrastructure. For instance, if the system does not have the sufficient supply for the industry, then it would increase the import of the electricity from other countries. Most probably, that would be based on hydrocarbons. As a result, there would be no emission reduction in total. On the other hand, it would also increase the electricity prices in the domestic market. The current power system consists of small power plants that are geographically scattered. In order to realize the dream of electrification, improved electric grid and transmission system is significant. According to the study, it is economically viable to shift LNG (Liquefied natural Gas) plant at Melkøya on electricity from land but insufficient transmission capacity and shortage of electricity supply are the barriers to realize this plan (Klif,2011). Statnett(Norwegian electric transmission System operator) has developed the plan to substantially increase the capacity of national grid by 2020 with NOK 40 billion investment(Statnett, 2012).

According to NPD (Norwegian Directorate of Petroleum) and NVE (Norwegian Water Resources and Energy Directorate) 2010 analysis, it's becoming challenging to supply the electricity to more and more installation. The approval of authorities has become mandatory to connect their installations with aim of to figure out impact on the power balance and take into account for further power developments. On the other hand, there is also suggestions for industry to conduct analysis about the possibility of power from land for new fields and those that going to redevelop.

Carbon capturing and storage:

The one of the greatest challenge of our age is climate change which caused by the human activities of using fossil fuel substantially. However, dependence on fossil fuel is significant for the sustainable economic growth and maintaining the current living standard. According to international energy agency, world energy demand is expected to rise by 50% until 2030 and fossil fuel would remain significant part of the world energy mix. There is no short term solution to completely decarbonizes the global economy even though strong commitment have been shown on the international level in term of increasing the role of renewable energy and alternative fuels in the world energy mix. On the other hand, there is also focus to develop and deploy technologies that enabled us to exploit enormous fossil fuel resources while

having least impact on the environment. The one of the technology is Carbon Capture and storage (CSS) which has potential and getting great attention from the policy makers for the widespread adoption to limit the amount of green house gases in the environment.

Carbon capture and storage is an innovative technology that can store and capture co2 up to 90 from different activities such as electricity generation, industrial processes and etc. after that, captured co2 is transferred by pipeline and special tankers to the safe place where it has to store below the earth surface. Currently, technology is in the phase of development which has high cost implement and many other uncertainties. According to UN intergovernmental panel on climate change, half of the century emission could be prevented through carbon capture and storage. However, technological and economical challenges need to be addressed for the widespread adoption of technology.

Norwegian government believes that Carbon Capture and Storage (CSS) is important tool to meet the 2020 emission reduction target and others environmental commitments. Therefore, authorities have set goals for the widespread adoption and infrastructure development also underway at large scale to facilitate the transportation and injection of co2. It has become great opportunity for Norway to get competitive advantage of CCS technology over many other countries. In future, carbon capture and storage competencies and technology could be exported when there would be strict or binding environmental agreement on the international level.

Currently, there are two gas fields in the Norwegian oil industry that are facilities to capture co_2 from their operations. One of them is Sleipner and other one is Snøhvit. Sleipner is world largest project that is in offshore with CCS (carbon capture and storage facilities). Almost 10 millions tones emission just has been avoid with only this project (Statoil, 2008). Snøhvit is a LNG (Liquified Natural Gas) project in the Barents Sea where CCS technology is also fully installed to remove the co_2 before the liquefaction of Gas. There is a great potential to reduce co_2 from the land based gas processing unit. In addition, Norwegian petroleum directorate and industry has initiated work to see whether co_2 can be avoided from the offshore installations. But it would be viable for those fields that are far from the coast and remaining reserves are substantial. Like electrification, lack of space and limitation of weight on the offshore installation are big challenges for the deployment of the technology. There is also possibility to combine power production facilities of several installations that are close to each other and

capture the co2 from single place. Furthermore, it would save the cost of transportation of co2 for the storage because of the short distance of storage location from the installations. On the other hand, co2 transportation cost of the land based gas fired power plant would be higher.

There are several oil and gas fields in Norway that have entered into mature stage. Meaning that they need water and gas combination in large amount to inject into reservoir with the aim to increase recovery rate. As a result, water and gas are wasted in large amount. There is a possibility to use captured co2 for enhance oil recovery. Many studies have been conducted to figure out the cost and benefit and associated technological challenges. The required amount of the co2 is considerable and the main issue is developing comprehensive value chain for the transportation. This plan could be realize if the use of CCS(carbon capture and storage) technology increased within the country and other European States. (Ministry of Petroleum and Energy, 2008) .

In order to enhance the knowledge and widespread adoption of the CCS(Carbon Capture and Storage) technology, Oil companies and Norwegian government has established a research and test center at Mongstad, Norway. The major shareholders in this project are Statoil , Shell and Gassnova. The scope of the project is to capture the co_2 from the gas fired power plant and refinery operations. It is believed that it would contribute to find the solution of technology risks and economical issues that are associated with the technology. If it gets successful, it could help to mitigate the significant amount of emission from the refinery sector of the Norway. In addition, it would make the economically viable to produce power on land for the further electrification of the shelf.

After capturing the co_2, the next step is storage below the surface for a long time. In some reports, it is reviled that there is huge potential for the co_2 storage in the reservoirs located in the North Sea. The safety in the storage capacity is a big challenge for this CCS (carbon capture and storage) technology. Norway and UK firstly collaborated with each other to develop strict rules and regulation to make storage safe. Later, Germany and Netherland started to collaborate with Norway and UK for the CO_2 in North Sea. After that, EEA directives issues regarding the storage that also apply on the Norwegian activities of storage. It is expected that storage of the co_2 is a potential business opportunity for the Norwegian oil companies. Their experience of the North Sea would give edge to participate in storing activities that has captured by the other industries and countries.

Energy Efficiency:

Norway was the first country that introduced the carbon tax in 1991 for the petroleum industry in order to trigger the conservation and efficiency in the energy production process. Following carbon tax, substantial measures took by the industry to have least impact on the environment such as reducing gas flaring, installation of efficient turbines. There has been 135000 tones reduction in emission per year from the Norwegian continental shelf since 1991 However, there is still substantial opportunity to reduce emission through efficiency and deploying new developed technology. According to the study of NPD studies, this reduction could be 4.6 millions tones until 2020. These measures could be to replace equipments like compressor and pumps with new one that are energy efficient.

Lower the use of energy led to reduction in energy production on the offshore installations. However, it also provides economic benefit along the reduction in the co2 emission. Renovation and redesigning of the processes could reduce the energy consumption. As we mentioned earlier, the main user of electricity on offshore installation are pumps and compressor that create pressure to lift the oil from the reservoir. The efficiency of compressor and pumps tend to reduced with passage of time if production and pressure circumstances changed quite often. The time to time follow up of the components necessary to keep them energy efficient. Such kind of measures depends operational situation, technical design and reservoir infrastructure. Furthermore, newly built infrastructure has overall higher possibility to achieve efficiency .

There are many energy intensive activities involved for the production of the oil and gas from the offshore area such as compression of gas for transport, injection of water and gas for building pressure and to pump oil from the reservoir. The power to support these activities is produced on the platform through gas turbines. The potential for the energy efficiency for the production of power is related to the optimal use the power production instrument such as gas turbines. For instance, turbines should fluctuate the power productions according to the changing demand. The newly built installations equip with the turbines that change the production level but there is a need to install efficient turbines even on old fields to bring the efficiency and avoid the emissions into air.

Gas flaring is a burning of gas that produced along the oil production and accounts 10% of the carbon emissions on the Norwegian continental shelf. Due to unavailability of supply infrastructure and safety reasons, this gas is flared continuously and produce significant amount of the emission. The major causes of gas flaring on Norwegian continental shelf are process interruption, equipment failure, human error, alteration of existing field and introducing new field. There is a still potential in Norwegian petroleum industry to cut further flaring through operational measures even a lot of measures have been implemented. The one of the measure is to increasing the regularity of the plant that could reduce the unintended shutdowns of the plant. Furthermore, human errors can be reduced through strong focus on planning and preparation of work and procedures.

Statoil has developed energy management process in order to promote the energy efficiency in the operations. This is continuous process that led by the energy manager who coordinates with the responsible persons for the offshore installations on the Norwegian continental shelf. In addition, plan evaluates the performance of already adopted measures and figure out the measures that could increase the efficiency. Only in 2010, this process suggested strategic energy modifications in the system that could reduce 37,500 tones emission per year.

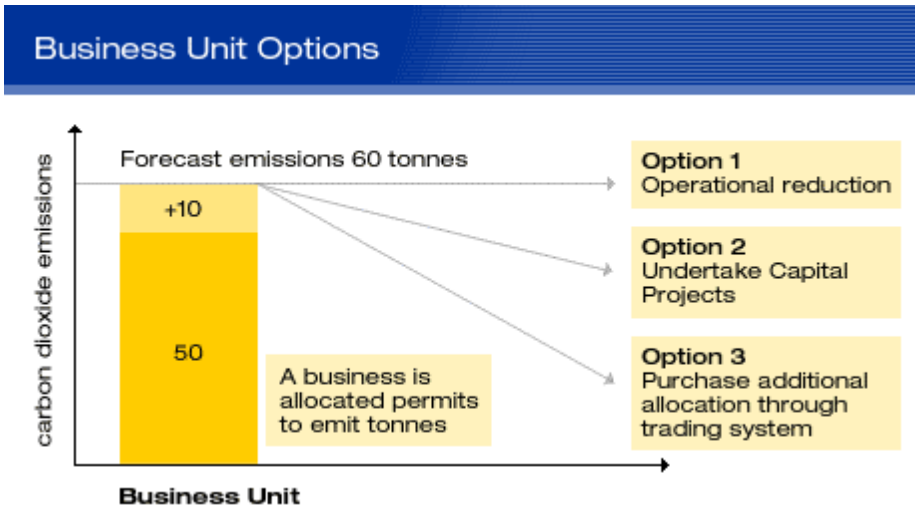
Proposed measured for Norwegian continental shelf are economical viable in this circumstances. The investment cost for implementing the measures is far less as compare to electrification and carbon capture and storage. This is because measures consists of small modification

Investment through clean development mechanism and Joint implementation:

CDM (Clean Development mechanism) is a project based mechanism of kyoto protocol that allows to companies and agencies from industrialized countries to invest in emission reduction projects in developing countries against emission credits. In addition, gained carbon credits or emission credits through CDM can be used to meet own target and can be sold in the carbon market (G.Singh, 2009). However, if company invest in any green project within industrialized counties along the same then its called Joint Implementation. The involvement

of the companies growing in CDM to earn carbon credits is growing because it's hard for any business to cut emission in short term with internal measures and carbon allowance price in the market is relatively high.

According to the EEA joint committee decision, emitter in Norway can raise up to 10% of their emission target through investment in Joint implementation and clean development mechanism (Bellona,2007) . This limitation is imposed with aim to keep emitter on the track of low carbon technologies and efficiency measures rather to rely completely meet commitment cost effectively through CDM. To elaborate, cheap emission credits against investment in developing countries could incentive to operate with carbon extensive system which would result in slow down the process of cutting emission. Statoil is a largest producer of oil on Norwegian continental shelf that financing and providing techniques in several emission reduction projects in developing countries to earn carbon credits that help in complying EU ETS cost effectively while contributing in sustainable development.



The main priority of Statoil is to engage national oil companies for initiating projects about reducing gas flaring. One of the example of such project is statoil collaborating with Mexican oil company "Pemex" to reduce the gas flaring from Tres Hermanos oil field that is UNFCCC(United National Framework convention on climate change) recognized project(Statoil, 2009). It is expected that this project would reduce 83000 tones emission annually for ten years. Against this reduction, UNFCCC would issue the carbon credits of the same quantity annually until reduction continue.

These carbon credits could be used to comply with regulations or to sold in market with the profit intentions. Even though, United States has not ratified the Kyoto protocol but their corporations engaged in Kyoto protocol mechanisms to meet environmental obligations especially in Europe. For instance, ConocoPhillips participating in Vietnam's Rang dang projects that is about reducing gas flaring and further avoided gas would be supplied to industrial user. The total emission reduction potential from the project is around 6.77 million metric tons during the period of ten years. BP that is one of the significant producers on Norwegian continental shelf also supporting several projects of sustainable development with the aim to respond EU ETS cost effectively.

Prodeem programme is a prominent project of BP that is with cooperation of Brazil government to provide electricity in the northeast areas of Brazil where people are with no electricity or using diesel based generator. The source of the electricity would be solar that would cut the use of diesel or other means of energy. This project would help the BP to emission quote requirement in Norway and other operations around Europe.

On the other hand, market based environmental instruments have emerged as a business opportunity for the oil companies. Instead of participating in CDM and JI for own requirement, Shell has develop a kind of consultancy firm that assist to other firm in managing projects. In addition, Shell has own large portfolio of CDM and JI projects include wind farm, hydro power, solar panel, energy efficiency and gas flaring where interested parties can invest in order to get carbon credits rather than expensive emission allowance.

Trading of emission Allowances:

As we discussed before, there is no free emission allowance for the Norwegian Petroleum industry. That's way oil & gas companies operating in Norway are obliged to report complete emission quantity to pollution and climate agency and buy allowance though carbon market. In addition, the third possibility could be to gain emission credits through participating in clean development mechanism. Climate and pollution control agency (SFT) is a department under the ministry of environment that deals with the implementation EU ETS and other regulations regarding emission into air. The deadline for reporting the emission in Norway is 1st march every year that should be measured and presented according to the determined standards of SFT(climate and pollution agency).

As far petroleum industry is concerned, their report should include annual emission to air, production of oil and gas, consumption of energy. After that, report is sent to climate and pollution agency that hires independent consultant who evaluates the provided data and decides the exact amount of emission for the particular installation. In order to buy and sell allowances, Oil companies have established emission trading units within the trading department that use different market strategies to arrange allowance for the market. For instance, ENI oil company using hedging techniques to diversify the risk of future increase in the carbon price. Statoil is one of the largest traders of allowances in Norway and that has traded more than 8 million tones carbon from 2008 to 2012 through Stavanger based office.

However, other international oil companies have trading office either in London or in home country that arrange allowances for their European based subsidiaries. For instance, Shell, Bp, ConocoPhillips and Total petroleum are running their offices in London. Like petroleum and stock trading, companies buying and selling allowances more than their need with intention of making profit. in addition, they are are dealing with future contracts and using hedging practices in order to avoid the potential increase and generate revenues.

Following the Kyoto protocol, BP and Shell and realized their future activities in the industrialized would be covered by the emission trade that could affect the organization significantly. They developed the internal trading scheme in order to gain knowledge to operating under the constraint of carbon emission. The experience of implementing emission trading gave them competitive edge over other market players and started new business of consultancy for meeting emission targets and trading of environment commodities such as emission allowances, emission credits, emission units and renewable energy certificates.

Investment in Renewable Energy:

Since the power production installations covered by the EU ETS, it has become more expensive to produce energy with conventional resources like coal and diesel. This is because, production from these sources are highly carbon intensive that requires buying allowances in large amount in order to comply with EU ETS regulations. As a result, prices of energy increased significantly and producer transfer extra cost to the final consumer. If we see the European electricity production apart from Nordic countries still heavily based on the Coal.

On the other hand, Electricity market in the Europe is becoming integrated, that would allow the producer to sell their power anywhere within the system. So far, power markets of the Nordic region (Norway, Sweden, Denmark, Finland), Baltic countries and some parts of the Germany are integrated under the Nordpool and its largest power market in the world (Nordpool,2012). It is also expected that rest parts of the Germany, Belgium, Nederland would become the part of the nordpool. EU also has issued the directives to the member state concerning the integration of power market.

As we mentioned above, the third phase of the EU ETS (Emission trading scheme) is going to in 2013 when more installations would be part of the scheme and no free allowance would be given to most of the industries especially for the electricity sector. As a result, pressure on the electricity sector in term of cost would grow in future. The market integration would enable the low price producer (Renewable energy & Hydro) to have better competitive position in the market as compare to the coal or diesel based power production.

On the other hand, EU 2020 targets also require 20% electricity must be produced through renewable energy. In order to realize these targets, European Union member's states are adopting aggressive measures to enhance the commercial viability of the renewable energy. In addition, special fund to encourage the investment in renewable energy sector is also established. Such kinds of policies have created investment climate for the renewable energy sector. There is a lot of potential of wind energy on the Norwegian continental shelf; some reports even reveal Norway could be green battery of the Europe (ENN, 2008).

The potential role of renewable energy due to carbon price and market integration has emerged new business opportunity for the oil and gas industry. In order to capitalize these opportunities and to minimize the risk of reducing demand of hydrocarbons, oil and gas companies are diversifying their business portfolio from fossil to clean energy. Even though, EU ETS does not directly encourage investing in renewable energy but creating a kind of favorable environment to participate. Most of the Norwegian petroleum industry operations are offshore in Norwegian Sea where there is also significant potential of wind energy. The experience of operating in offshore areas would be edge for the petroleum industry to develop wind farm. As we discussed above, there is a lot of plans to provide electricity from land where the source of energy is renewable. In that scenario, offshore wind farm could be

potential supplier of the energy. It would help the industry to meet their demands without putting pressure on the Norwegian grid.

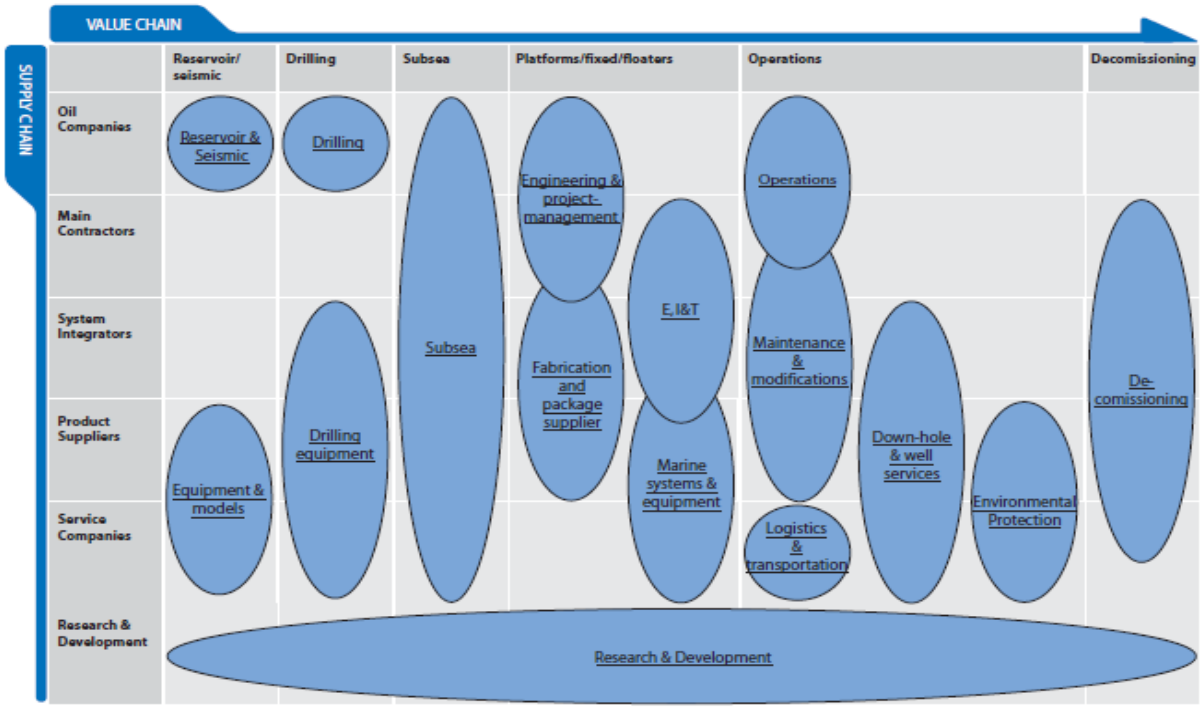
In order to obtain competency in the renewable energy technologies, Statoil is engaged in several projects to produce clean energy with different sources like wind power, wave power and tidal power. In addition, Statoil has developed world largest floating wind turbine in the North Sea (Statoil, 2012). On the other hand, international oil companies giving priority to their home countries for investing in the renewable energy. Dong energy investing in the wind energy projects along the Danish coast in the North Sea. Whereas, BP mostly engaged on the UK continental shelf for implementing clean energy projects.

Research & Development:

Research and development activities contribute to innovate new technologies and process that eventually promote sustainable development. The growing numbers of environmental regulations has motivated the industries to invest more in research and development activities to find more solutions to meet the challenges of climate change. As discussed early, carbon trading provide incentive to develop low carbon technology, while increase burden in term of emission allowance cost that does not focus on research & development and wants to stick with existing carbon intensive operations. Even though, research & development in the result of carbon tax has played significant role in making operations environmentally sustainable but there is a still possibilities to develop new competencies that ensure competitiveness of the industry under highly constraint environment for co_2.The increase in research and development activities is one of the responses of the oil industry to combat with the emerging challenges of the greenhouse gases regulations.

Along the industry, government itself is giving strong focus on the research and activities related to the petroleum industry. The Norwegian government has took initiative by forming research agency called OG21 (Oil and Gas in 21th century) that mainly responsible to carry out research to address the challenges of petroleum industry. This agency governed by a board that constitute of ministry of petroleum and several Sectaries. The major stakeholders are Government, supply industry, petroleum industry, universities and research institute. In addition, two research programs PETROMKS and DEMO2000 have launched specifically to conduct research specifically about the emission to air and discharge (Ministry of the

Petorleum and Energy, 2011, p116). In order to support these activities, NOK 230 millions have allocated by the Ministry of petroleum and energy.



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Because of tight regulations and cooperative environment, Norwegian continental shelf considered as a laboratory for the national and international oil companies. Through participating in different research projects in Norway, once they develop new technology or competency here then further implemented in other countries where operations also going on. ENI is one of the largest company on the Norwegian continental shelf that is participating in 38 projects with Statoil concerning environment, subsea technologies, oil spill and etc. The worth of the allocated budget is 60 million to support research & development activities in Norway (ENI Norge, 2012). On the other hand, shell is participating in the world largest project of developing CCS (Carbon capture and storage) technologies with the cooperation of Statoil, Gassnova and Sosal (tcmda, 2012). After working on this project with other partners, shell can make their developments more sustainable in Norway and use acquired competency in other countries.

Summary:

In this chapter, we have discussed the findings from different sources. At the start, introduction, emission from different activities and regulations to limit the emissions are discussed. After that, we have discussed the direct or indirect risks in complying EU ETS. There are three main risks that are increase in operating cost or decrease in profitability, delay in projects and possible reduction in the European demand for the hydrocarbons. After that, we presented the strategies and measures industry is undertaking to undermine the effects of the environmental regulations. Furthermore, we explained the potential and challenges involve in implementing different measures.

Analysis:

In this section, we will analyze the empirical findings according to the theortical framework in order to properly

5.1 Risks from the institutional constraint:

Institutions are the rules and regulations that create constraint for the organization to carry their activities in the normal routine (ingram and clay, 2000). EU ETS is a kind of institution that has strong impact on the working of the organization. It is mandatory for the organization to comply with the rules and regulation in order to survive in the market. In the case of this study, institution is a formal law that is coercive pressure on the organizations and industry to cut their emission and buy the emission allowances according to the quantity of emission that emitted into the air. As a result, regulatory institution poses several risks for the complying organizations and industry.

The main risk for the Norwegian oil industry is increase in the operating cost in the form of buying allowances from the market. The influence of the institution on the organizations and industry change with the increase or decrease of carbon price in the market. The higher price leads towards more risks to the working of the industry. According to the empirical finding, price of the carbon has not been as high as it was expected before launching trading scheme in the European union. That's shows that coercive pressure been not so much for the Norwegian petroleum industry.

Decrease in the demand of fossil fuel in the long term is another risk to the Norwegian oil industry from the institutional constraint (EU ETS). This is indirect risk for the Norwegian oil industry. Meaning that institution also affects the industries and consumer on which Norwegian oil industry is dependent. EU ETS influence the other carbon industries to reduce their emission in the form of setting price of the carbon. In order to avoid the complying cost, industries reduce the emission by adopting alternative measures. As a result, demand for the fossil fuel may be reduced. The lower demand means decrease in the organization power to influence the price in the market. In such conditions, price of the commodity decrease in the market and hurt the profitability of the organization.

5.2 Strategies of the Norwegian oil industry:

Steger gave the model that describes how companies respond to the environmental regulations. According to him, there are four kinds of the strategies (defensive, indifferent, offensive and innovative) that organizations or industry could adopt to undermine the impact of the environmental regulations. Furthermore, he described the adoption of the strategy depends on the intensity of the risk and associated opportunities for the organization. The main risk in the case of this study is increase in the price of the emission allowances that ultimately increase the operating cost, delay the projects and decrease the demand of hydrocarbons. In addition, climate change is happening and would remain dependent on the use of fossil fuel. That's way, this risk would continue for the long term instead of any limited time period. The intensity of the risk depends on the carbon market which means impact could be higher or lower but not static.

On the other hand, opportunities for the industry to could be technological development, green reputation among general public, decrease in operating cost and portfolio diversification. According to the empirical data, the price of the carbon has not been high since EU ETS (emission trading scheme) started to cover the Norwegian petroleum industry. That's way; impact on the industry has been limited on the industry. The EU ETS (Emission trading Scheme) trading scheme is at the early stages of development, the next period of the scheme would diversify the scope in term of adding more industries under the cap of emission and diminish the allocation of free allowances to the existing industries. As a result, price of the carbon would be much higher compare to the previous periods. Norwegian oil industries has realized the potential impacts and acting by adopting long term and short term objectives.

The measures that industry is undertaking in response to the emission trading are mostly associated with innovation strategy. For instance, industry is focusing on Electrification of shelf, carbon capture and storage, research & development activities and renewable energy. According to the model Steger, both of them are part of the innovative strategy. Moreover, innovation strategy is adopted when there are a lot of risks and opportunities and a lot of uncertainties associated with deploying technologies. The main opportunity is to complete mitigate the emissions from the operations through electrification and CCS (carbon capture and storage), that would help to avoid the emission allowances cost and carbon tax.

As a result, company or industry brings the major structural changing in their operations and structure. In order to implement large scale structural changes industry needs to concentrate on the research activities and allocation of substantial financial resources. Research & development is also one of the priority areas for the industry that shows response to the institutional constraint or risk is innovation. They are striving to develop something new that make the industry operations more sustainable. The same response was given to the carbon tax regulation that implemented in 1991.

That resulted in many technological breakthroughs in the oil and gas industry. The developed technologies helped the industry to export the technology along the oil products. The same is the case of carbon capture and technology and electrification. Currently, Norwegian industry is the only industry that has started to connect the offshore installations with the electricity from the land. This could help to industry in future to export competency to other countries. on the other hand, oil companies from the Norwegian oil industry have developed the world largest research center for the in order to enhance the knowhow of the technology and remove the economical and technological barrier for the widespread use. Since it has launched, European countries hoping bigger breakthrough in the technology. European and other developed countries have ambitious goals for cutting the emission, so this technology would help the industry to take capitalize the market opportunities and avoid further risks from the environmental regulations.

The third bold initiative of the industry in response to emission trading is to efficiency measures. Meaning that trying to deploy the existing best technologies and procedure with the intention to reduce the emission in the short run. According to the Steger model, this response is associated with the defensive strategy. This strategy is adopted when opportunities are very limited in pursuing innovation strategy.

It takes time to innovate and deploy the innovative technology that ensures the emission free operations. But under the EU ETS (emission trading Scheme) requires to buy carbon allowance in order to meet the requirement of the regulations. Clean development mechanism and joint implementation gives the opportunity to arrange the carbon credits effectively by investing in green projects. Furthermore, Industry is also involved in the hedging activities in order to minimize the cost of complying regulations. According to Steger model, these actions of the industry also lie in the defensive strategy.

5.3 Individual factors for strategy selection:

The Steger model defines the company or industry strategies mainly depend on two external factors risks and opportunities. On the other hand, Corporate Actor model argued that there are three internal factors that influence the company decision to implement certain measures and strategies. One of them is capacity of learning that is consists of two points potential to look the future trends and organization structure to capitalize the future opportunities. Norwegian petroleum industry is considered trend setter in the world for introducing efficient technologies for carrying out the petroleum activities. That's way Norway has the lowest emission rate in the world against the production of each unit of oil and gas.

The unique cooperation model in the Norwegian petroleum industry enabled them to look at current and potential challenges and respond them through collective effort. Norway petroleum industry realized the future trend in clean technologies and became the first country that initiated the project for the advancement of the technology. In order to make it happen different stakeholder are cooperating to each others such as akersolution provided the required instrument while Statoil and some other companies actually carrying out the project. That's shows the cooperation mode has strengthen the industry capacity to learn and implement new innovative technologies.

The nature of the portfolio is also decisive factor for choosing the climate change strategy. If the industry operations are highly carbon intensive or coal investment significant part of the industry portfolio, it is likely the strategy would be reactive. If we see the production of fossil fuel on the Norwegian continental shelf, the share of gas production is increasing while oil reserves and producing declining. This is another favorable element for the industry to adopt innovative strategy to respond the climate change regulations.

The reputation of the industry also influences the company decision regarding pursuing climate change initiative. The main success of the company or product depends on the perception in the market. If the general perception about the business is negative, it would lead the industry to worse market position. The Norwegian petroleum sector is leading in country in term of emitting carbon emissions. It is often considered hurdle to achieve the future Norwegian position of carbon neutrality.

Conclusion:

The issue of climate change has become one of the greatest challenges for the globe over the last few decades. There is a lot of debate to cut the greenhouse gas emissions that is main driver of the problem. In order to combat this issue, the approach has change from domestic effort to the global collective efforts. Kyoto protocol was the first international agreement that binds the developed nations to cut their greenhouse gas emissions on the emissions level of 1990. Protocol agreed in 1997 but period for meeting the commitment is from 2008 to 2012. Later, three mechanisms suggested in order realizing the emission reduction goals cost effectively. The one of them is ETS (Emission trading scheme) or carbon trading that limit the emissions of the country and its businesses.

After that, importance of ETS realized and countries started efforts to make domestic emission trading system in order mitigate greenhouse gas emissions. European Union designed the trading for implementing in the all member states but EEA (European Economic Agreement) countries formed individually like Norway and Switzerland. The first phase of the carbon trading initiated in 2005 and lasted in 2008 to gain experience for fully implementing for meeting the commitment. During the first phase, Norway did not include in petroleum industry apart from the refineries and few gas processing units. The main reason of excluding the oil industry was high level of carbon tax. After that, Norway decided to integrate the carbon market with European Union in order to stabiles the price of carbon and give access to the local businesses to European market for buying and selling the emission allowances.

Norway made the changed in the scheme and decided to cover the Norwegian petroleum industry that is largest emissions producer in the Norway. It was also decided, no free allowance would be given to the petroleum industry against their emissions. This factor raised the serious challenges for the competitiveness of the Norwegian petroleum industry with the rest of the world, where industries do not pay the cost to emit the emissions into air. We intended the study to explore what risks and opportunities have emerged for the Norwegian petroleum industry. In addition, this study also focused to see what measures and strategic actions industry is adopting in order to minimize the impact of regulations and promoting sustainable development in the industry.

According to collected data through documents and interviews, increase in the operating cost in the form of buying allowance is the main challenge or risk for the industry. In addition, low profitability of the companies increases the cost of raising money for the future developments.

As a result, Industry has perceived the potential hike in the price of emission allowances and taking into account while making the future investment decisions. According to industry, significant increase in the price of allowances could delay or stop the investment on the shelf. The high operating cost on the Norwegian continental shelf also make vulnerable for the investment. On the other hand, the impact on the industry has been too low, because carbon price lost stability due to economic downturn in the Europe. Moreover, the existing efficiency level of the industry and solidity of the crude price also played significant role to limit the adverse effects. The decrease in fossil fuel demand is another indirect risk for the industry from the widespread adoption of EU ETS (Emission trading Scheme). Even though, European nations have ambitious goals to cut their greenhouse gas emissions but the likelihoods of this risk is minimal during short and medium term.

There is high level of similarity in Norwegian petroleum industry in adopting strategies and actions for complying with environmental regulations and addressing the issue of climate change. There is one special forum within the industry where different stakeholders interact in order to discuss the future challenges and their possible solutions. The overall strategic response of the industry is to innovate technologies and processes that could help to industry to avoid the significant amount of emissions. There are two main measures electrification of the shelf and carbon capture and storage technology where industry is focusing. The idea of electrification is to consume electricity from clean sources on the offshore installations instead power generation with carbon intensive turbines. Currently, there are some installations in the North Sea that have started to get

We have come to know that there are three main challenges to trigger the connectivity of installations. The first one is lack of space on the old platform that necessary to make the installation ready to accept the electricity from land. In addition, replacement of the infrastructure or partial electrification on the existing installations considered economically unviable in most of cases. The supply of electricity from renewable source is also one of the challenges because existing production capacity does not have the significant surplus supply for the offshore installations. In order to address these issues, planning is underway whether gas fired power plants to be built with CCS (carbon capture and storage) technology or offshore wind farms. The distance of the installations from the shore is another challenge. if politician take the decision early about increasing the electricity production capacity, it would leads many more fields to get connected with the grid those are not far from the shore. On the

other hand, there is also possibility of using CCS (carbon capture and storage) technology to avoid the emissions from the offshore installations where technology and cost are the barrier for the installations. This technology is quite expensive, that's way plan is to integrate the power production facilities of different fields and installation those are close to each other's and then deploy the carbon capture technology. Further, captured co_2 would be stored in the geological formation of the North Sea. So far, only few land based gas processing units have deployed the CSS technology.

There is also strong focus in the industry on the energy efficiency measures to bring down the emissions level without large modification of existing infrastructure. These measures can be implemented in the short period of time with little investment. The most of the power that produced offshore are consumed by the pumps, compressors. Companies are working to install best available technology and keep them in maintained position in order to achieve the higher efficiency level. On the other hand, efficiency can be gained on the production site as well. The outdated turbines are not flexible to produce power according to changing demand. So, there is also possibility to replace old turbine with the new one that are capable of changing production with consumption pattern. Gas flaring accounted 10% of the emissions of the shelf and most of flaring resulted by the human error, equipment failure, process interruption and alteration on the field. The one of the measure is to increasing the regularity of the plant that could reduce the unintended shutdowns of the plant. Furthermore, human errors can be reduced through strong focus on planning and preparation of work and procedures.

In order to minimize the cost of buying allowances, companies in the Norwegian petroleum industry investing in developing and developed countries for promoting sustainable development where cost of cutting emission is lower as compare to Norway. Most of the projects are concerned in reducing gas flaring in the developing countries. Against the investments, companies get carbon credits equal to the emissions avoided through projects. Carbon credits could be used to meet their requirement of allowances and rest sold in the carbon market. The limit to use CDM and JI carbon credits is 10% in Norway whereas remaining are bought through market operations. With the aim of avoiding volatility in price of carbon, companies are engage in hedging of emission allowances.

Further Research:

in this research, we have just focused on the upstream sector(exploration and production) of Norway to see what industry is planning to do to combat with current and coming strict environment regulations. This study just defines the risks and strategies and their potential for the reduction of the greenhouse gas emissions. Because of time limitation and nature of study, we could not measure the impact of the EU ETS quantitatively. There is a possibility for the further to carry a study to see what does EU ETS has affect on the industry in term of additional cost and to what level of carbon price would encourage the companies to invest in other countries where ETS (emission trading Scheme) is not already implemented.

Refinery sector is also intensive carbon intensive industry that is going to be heavily affected by the EU ETS. There is possibility to study what would happen with the refinery industry when free allocation of the allowances would be stopped. Whether it would be able to compete with petroleum products that are coming to Europe especially from Russia and United State where sill there is not cost of emitting emission.

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