Universitetet
i Stavanger

Is the full electrification of oil and gas offshore fields with renewable energy feasible in order to eliminate all gas turbines from Norwegian Continental Shelf?

The Faculty of Social Sciences
University of Stavanger

Master in Energy, Environment and Society

By

Shinya Inui Waage

August 2020

UNIVERSITY OF STAVANGER

MASTER DEGREE IN
Energy, Environment and Society

MASTER THESIS

CANDIDATE NUMBER: 5624

SEMESTER: SPRING 2020

AUTHOR: SHINYA INUI WAAGE

SUPERVISOR: OLUF LANGHELLE

MASTER THESIS TITLE:

Is the full electrification of oil and gas offshore fields with renewable energy feasible in order to eliminate all gas turbines from Norwegian Continental Shelf?

SUBJECT WORDS/KEY WORDS: Offshore, Oil and Gas, Electrification, Wind Power Renewable, Hydrogen Storage**,** Reversible Fuel Cell

PAGE NUMBERS: 270 pages

STAVANGER: 30th August 2020
……………………………………………….
DATE/YEAR

Acknowledgement

Foremost, I would like to express my sincere gratitude to my previous supervisor Prof. Thomas Michael Sattich and current supervisor Prof. Oluf Langhelle for the support of my master thesis and for his incredible patience. His guidance helped me of research and writing of this thesis.

Besides my supervisor, I would like to express appreciation to Maria Varteressian, Liv Kari Eskeland, Liv Lønnum, Ingrid Tungen, Mailiss Solheim-Åkerblom and Kine Nossen for helping me and my study through answering survey.

I would like to also thank all family member, friends, colleagues, and everyone who participated the survey for my research.

Last but not the least, I would like to thank my husband: Jone Waage for supporting and encouraging me to get through tough time in the past two years.

Table of Contents

1 Abstract

In 2014, 16% of Norway's GDP came from oil and gas industry and 57% of export were oil and gas related products. (Hass, et al., 2017) At the same time, 27.6% of nationwide greenhouse gas emission in 2018 came from oil and gas production activities such as gas turbine and flaring. (Statistics Norway, 2020) Hence, the sustainable development for Norway may be continuing oil and gas extraction for its economy while reducing greenhouse gas emission from oil and gas extraction activities for Norway's and global environment. Electrification of offshore fields on Norwegian Continental Shelf with renewable energy can be a solution for Norway's sustainable development. The feasibility of electrification of offshore fields with shore power, wind power and hydrogen storage were examined through comprehensive analysis including technological, economic, political and social analysis.

Electrification with shore power is currently the most popular method since many fields are already electrified and planned to be electrified. Economically, the estimate cost of full electrification with shore power was 54.1 billion NOK. Politically, it was indicated that there is political consensus on this technology. Socially, 53% people can potentially support of full electrification project. Hence, it was concluded as the full electrification with shore power is feasible.

Secondly, offshore wind technology was assessed. Although floating offshore wind power is relatively newly developed, it could be said that technology is mature enough for large scale deployment. Economically, on the other hands, the cost of installation was estimated 118 to 152 billion NOK. Politically, 71% of representatives at parliament can be supportive. Potential social acceptance was estimated as 53%. However, despite its high feasibility, inflexibility of wind power can be a deal breaker for full electrification with just his technology.

Hydrogen production and storage can solve the inflexibility of offshore wind power. Electrification of offshore fields with wind power and hydrogen storage was assessed. Technologically, hydrogen can be generated with electricity and water by electrolyzer. In addition, hydrogen can generate electricity with fuel cell. These two technologies can be combined, called reversible fuel cell. Economically, the total estimated cost of wind turbines with hydrogen storage was 125 billion NOK to 178.6 billion NOK. Politically, the total 42 % of representatives at parliament can be supportive while 37% of representatives can be against. Rest of 21% of representatives remained as unclear. Socially, it is likely same or similar to electrification with wind power; hence, 53% of social support can be applied. It can be said that the full electrification of offshore fields with offshore wind and hydrogen storage is feasible; however, there are few 'if' exist.

To sum up, it can be said that is feasible that offshore fields on Norwegian Continental Shelf can be fully electrified with shore power and / or offshore wind power with hydrogen storage.

The author recommends utilizing all technologies; submarine cables, offshore wind and hydrogen storage for the risk hedge and further development of future export system.

2 *List of Abbreviation*

NCS = Norwegian Continental Shelf

MLP = Multi-Level Perspective

STH = Solar to Hydrogen

GDP = Gross Domestic Product

NOK = Norwegian kroner

EUR = Euro

USD = US dollars

PEM = Polymer Electrolyte Membrane

STCH = Solar Thermochemical Hydrogen

SMR = Steam-Methane Reformation

PEC = Photoelectrochemical

HVAC = High Voltage Alternating Current

HCDC = High Voltage Direct Current

MJ = Megajoule

KW = Kilowatt

MW = Megawatt

GW = Gigawatt

kWh = Kilowatt hour

MWh = Megawatt hour

GWh = Gigawatt hour

TWh = Terawatt hour

AP = Arbeiderpartiet : Labor Party

H = Høyre : Conservative Party

FrP = Fremskrittspartiet : Progress Pargy

Sp = Senterpartiet : Center Party

SV = Sosialistisk Venstreparti : Socialist Left party

V = Venstre : Liberal Party

Krf = Kristelig Folkeparti : Christian Democratic Party

MDG = Miljøpartiet De Grønne : Green Party

R = Rødt : Red Party

EU = European Union

CCS = Carbon Capture Storage

3 *Table of Figures*

4 *Introduction*

Climate change has been one of the major global issues in past few decades. Drought, more frequent heat waves, larger hurricanes, sea level rise, ice free arctic, change in precipitation pattern and among others are the potential effects of climate change. (NASA, n.d.) NASA (n.d.) continued that 97% or more of climate scientists, who publish actively, agree that it is likely that climate change and climate warming during a past century is caused by human activities. NASA (n.d.) also stated that human caused climate warming is supported by the most of leading scientific organizations in the world. Thus, it seems that there is global scientific consensus on human caused climate warming and climate change. In politics, through Kyoto Protocol and Doha Amendment, Paris Agreement was agreed in 2015. (United Nations Framework Convention on Climate Change, 2015) The agreement was signed and entered into force in a following year. (United Nations Framework Convention on Climate Change, n.d.) The main targets, Paris Agreement sets, were to maintain the global temperature rise within 2 °C and make efforts to keep the global temperature rise within 1.5 °C. (United Nations Framework Convention on Climate Change, 2015) The agreement includes crucial elements; mitigation, a transparency system and global stock, adaptation, loss and damage and support. (United Nations Framework Convention on Climate Change, 2015) The government of each nation, is signed Paris Agreement, is required to reduce greenhouse gas emission, improve resilience from climate impacts and ability to handle the climate change and support financially and politically. (United Nations Framework Convention on Climate Change, 2015) Hence, sustainable development has become significant in order to achieve the target of Paris Agreement while growing the economy of the country. Sustainable development means that "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (World Commission on Environment and Development, 1987) In 2014, 16% of Norway's GDP came from oil and gas industry and 57% of export were oil and gas related products. (Hass, et al., 2017) Oil and gas industry have contributed to country's economy extensively. Norwegian Petroleum (2020) showed historical and expected oil and gas production in Norway in Figure 1.

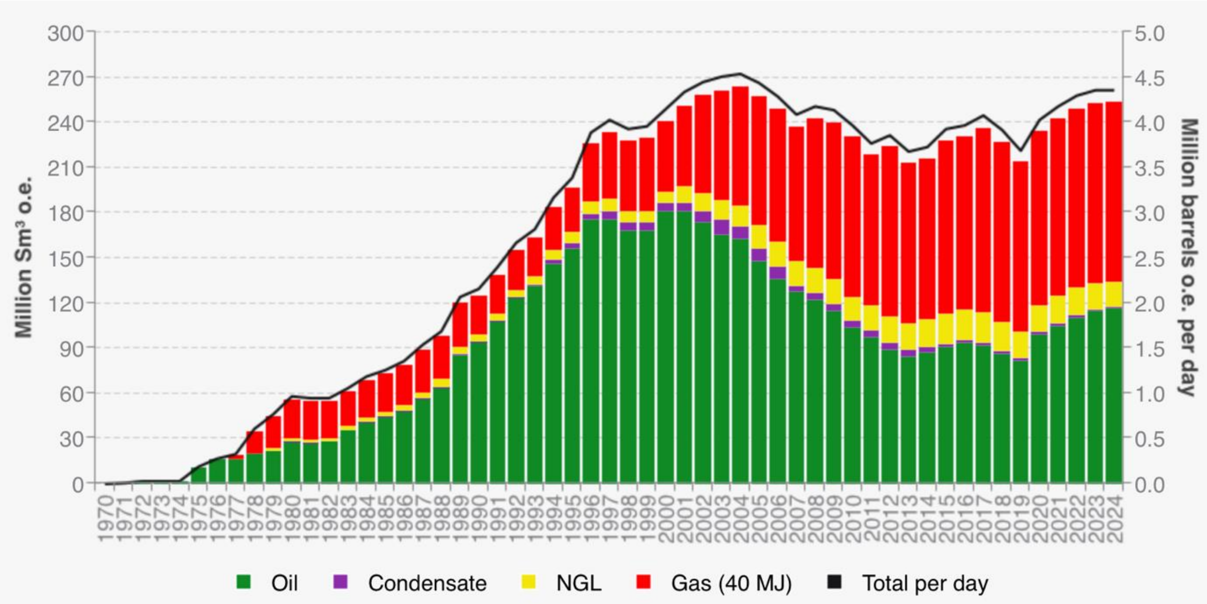


Figure 1: Historical and expected production in Norway, 1970-2024 (Norwegian Petroleum, 2020)

Sales of oil and gas can correspond with global economy; hence, it fluctuates over periods of years. According to this graph, it can be said that the oil and gas production in Norway may continue as similar level as now, and the industry will continue being one of the most important industries for Norway. However, at the same time, oil and gas extraction emitted 13.9 million tons of CO_2 equivalent greenhouse gas, which is 27.6% of domestic greenhouse gas emission. (Statistics Norway, 2020) If the oil and gas production continue as it is now, the emission from the activities also remains at the same level as today. Oil and gas industry support the economy in Norway, but the industry is also emitting greenhouse gas the most within the country. Today, the sustainable development for Norway may be continuing oil and gas extraction for its economy while reducing greenhouse gas emission from oil and gas extraction activities for global environment. For Norway to accomplish the target of Paris Agreement, drastic change in oil and gas activities may be crucial. In 2019, 84.6% of greenhouse gas emission at offshore fields on Norwegian Continental Shelf came from gas turbines, which supply power to machineries, equipment and accommodations for workers at offshore fields. (Norwegian Petroleum Directorate, 2019) Therefore, reducing the use of gas turbines or even eliminating gas turbines at offshore fields can be one of the most effective approaches to meet the target of Paris Agreement for Norway. Electrification of offshore fields with renewable energy can lead gas turbines to be reduced or eliminated from Norwegian Continental Shelf. If the power for oil and gas extraction are supplied by renewable energy, and all gas turbines are removed from offshore fields, 23.3% of greenhouse gas emission of Norway can theoretically disappear. Transforming current offshore fields to green offshore fields can be one of the main goals for Norway's sustainable development. Therefore, in this thesis, the feasibility of electrification of offshore fields with renewable energy, particularly hydro power-based shore power, offshore wind power and offshore wind with hydrogen storage, will be assessed.

5 Literature Review

Reduction of greenhouse gas emission on Norwegian Continental Shelf has been discussed in various platforms and institutions. Technological possibilities may be one of the areas most discussed. Ballari & Østensen (2013) studied the "electrification of the Utsira formation". They researched on technical requirements for an electrical power distribution system for the installations of electrification including voltage source converter, transformer, circuit breaker and HVAC transmission cable. (Ballari & Østensen, 2013) Tangerås and Tveiten (2018) studied on Hywind Tampen project in technological and economic perspectives. They researched on profitability of the project and concluded that they recommend canceling Hywind Tampen project due to lower profitability than using gas turbines at offshore fields. (Tangerås & Tveiten, 2018) Riboldi, Völler, Korpås & Nord (2019) investigated environmental impact of electrification of offshore fields in North Sea. Their research was conducted based on a process model of the offshore electricity generation units and European power system. They concluded that the total CO_2 emission is strongly affected due to its increase in power demand through electrification of offshore fields. (Riboldi, Völler, Korpås, & Nord, 2019) They added that the lifetime CO_2 emission increased 40% because coal plants needed to be operated to meet the power demand although 48 to 90% of CO_2 emission can be reduced at the offshore fields. (Riboldi, Völler, Korpås, & Nord, 2019) In addition to the researches above, there is a number of researches on electrification of offshore fields on Norwegian Continental Shelf and offshore renewable energy in technological, economic, political and social perspectives.

6 Problem Statement

Through literature review, it could be seen that specific technology, projects and issues were studied in either technological, economic or environmental perspectives. For example, the research of Ballari and Østensen (2013) focuses on the power transmission in technological perspective. Tangerås and Tveiten (2018) investigated the profitability of Hywind Tampen project. Riboldi, Völler, Korpås & Nord (2019) studied the environmental impact on electrification of offshore fields with shore power. In addition, there is a number of study of submarine cables, offshore wind power and hydrogen storage; however, each research was studied in technological perspective or/and economic perspective. In order to identify the feasibility of electrification of offshore fields with renewable energy, political and social factors can be as important as technological and economic factors. Technological, economic, political and social factors may be interconnected and influence each other. For example, if the new innovative technology can solve the environmental issue of Norway; however, the cost of such technology is high since it has not been able to be mass produced. It may also face the barrier of entry to the industry. Politics can support this new innovative technology with financial support such as subsidy. In that case, political factors intervene in economic factors. The research on each technology and solution in either of technological, economic, political or social perspective may be insufficient in order to assess the feasibility of electrification of offshore fields with renewable energy on Norwegian Continental Shelf. Therefore, comprehensive analysis including technological, economic, political and social analysis, is essential.

7 Research Question

Is the full electrification of oil and gas offshore fields with renewable energy feasible in order to eliminate all gas turbines from Norwegian Continental Shelf?

8 Theories to be used: Multi Level Perspective – Transition Pathways

8.1 Multi-Level Perspective

Transition may require long term perspective. Especially socio-technical transition can be complicated; thus, analytical framework is essential to identify the current circumstance and potential trajectories to the future. Multi-level perspective (MLP) can be the theory and the tool to analyze the project, replacing the natural gas turbines to renewable energy, and its feasibility. Grin, Rotmans & Schot (2010) stated that many researchers have developed MLP to connect science, technology and economics. The interaction among culture, policy, science, technology, individuals, markets and many other factors enables transition to be occurred. Geels (2011) expressed that the process of transition is not a linier, but rather the interaction of three levels; niche, regime and landscape. Within niche level, evolutional innovation and development occurs while regime represents the established systems including socio-culture, policy, science, technology and economics. (Geels, The multi-level perspective on sustainability transitions: Responses to seven criticisms, 2011) Moreover, socio-technical landscape is the broader factors which influences niche and regime. (Geels, The multi-level perspective on sustainability transitions: Responses to seven criticisms, 2011)

8.1.1 Regime

Geels (2002) stated that "users, policy makers, societal groups, suppliers, scientists, capital banks etc" interact each other within the regime and influence the technological trajectories.

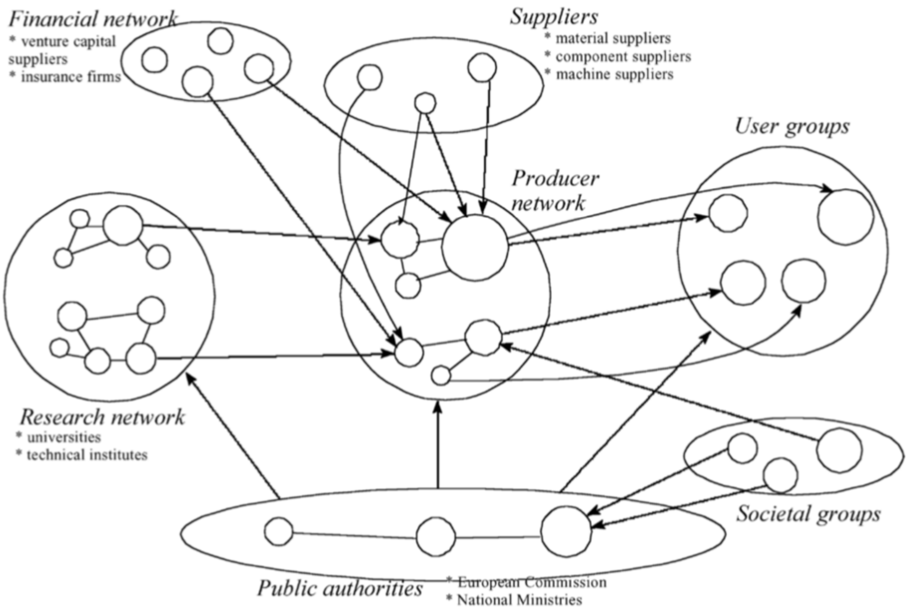


Figure 2: The multi-actor network involved in socio-technical regime (Geels, 2002)

Figure 2 shows how each actor group interact each other within socio-technical regime. Established regime tends to shut out outsiders. (Geels, 2011) The regime can be continuously challenged and pressed by landscape and niche. (Geels, 2011) However, the regime handles such pressure with technological development and innovation, which occurs within regime, and stabilize its system. (Geels, 2011) The stability can be one of the key characteristics of regime. The processes of self-adaption to the pressure can be illustrated as Figure 3.

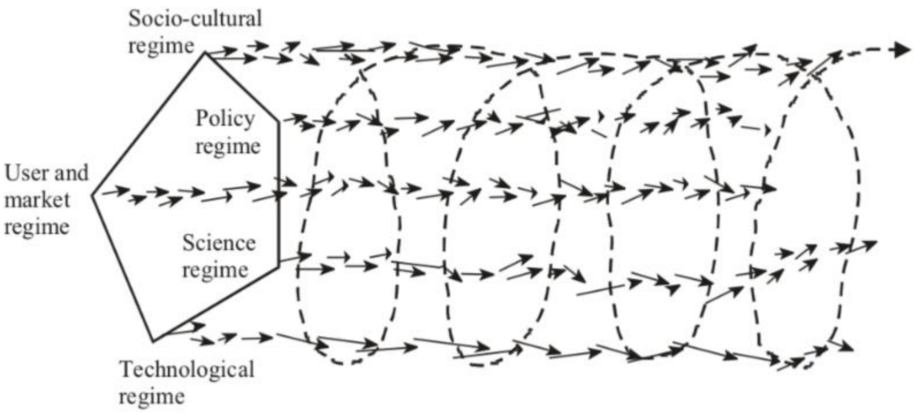


Figure 3: Alignment of ongoing processes in a socio-technical regime (Geels, 2004)

As it can be seen, socio-cultural regime, policy regime, science regime, technological regime and user and market regime shape pentagon. These regimes are continuously interacting and changing within its system. The regime itself may be stable; however, its stability is maintained by continuous developments rather than static circumstance. Grin, Rotmans & Schot (2010) pointed out that 'window of opportunity' can be opened by causing tensions within regimes and shaking its stability. Geels (2011) expressed that such challenge to regime's stability is called destabilization.

8.1.2 Niche

Niche is normally in the secured space and protected by firms and states. (Geels, 2011) The development of radical innovation can be seen with in niche. (Grin, Rotmans, & Schot, 2010) Niche is often needed to be protected since the regime presses niche. (Grin, Rotmans, & Schot, 2010) Geels (2011) expressed that actors in niche aim to enter the regime or take over the actors in regime. However, it is not an easy challenge for niche actors to tackle regime due to its stability. Geels (2011) stressed the significance of niche for transition since radical and disruptive innovation, which shakes the regime, can be developed within niche. According to Geels (2011), there are three core processes for the development of niche; expressing the vision to obtain social and economic attention, social networking to involve new actors and learning process on various aspects. Geels (2011) continued that the niche innovation, has proceeded these three procedures, can obtain the 'momentum'. If this 'momentum' managed to catch more attention of various actors, the 'window of opportunity' to enter the regime. (Geels, 2011)

8.1.3 Landscape

Geels (2011) stated that the socio-technical landscape is broad circumstance rather than specific factor. The regime and niche are often affected by the socio-technical landscape. (Geels, 2011) Landscape factors can be demographics, macro-economics, environment, ideologies and societal value, which shape the macro-system of human society. (Geels, 2011) The examples of landscape level can be birth rate, population growth, inflation, deflation, GDP, climate change, endangerment of species, capitalism, socialism, communism, human rights, freedom of speech and climate change. (Geels, 2011) According to Grind, Rotmans & Schot (2010), Driel and Schot (2005) distinguished among three types of landscape. First type of landscape is the factor which does not change or changes over tremendously long period of time; for example, climate and terrain. (Driel & Schot, 2005) Second type of landscape is the factor which changes over relatively long period of time; for example, the industrial revolution, which occurred between 18th and 19th centuries. (Driel & Schot, 2005) The last type of landscape is the factor which changes dramatically in short period of time or even over one night. (Driel & Schot, 2005) For example, oil shocks in 1973 and 1979, financial crisis in 2008 and Fukushima nuclear disaster in 2011. The one of the key characteristics of landscape can be that the landscape change may influence on regime and niche actors; however, regime and niche actors do not influence on landscape factors in short term. (Grin, Rotmans, & Schot, 2010)

8.1.4 Multi-level interaction

Grin et al (2010) compared niche innovation as the seeds of transition. Mokyr (1990) expressed that whether the seeds sprout or not depends on the environment where the seeds are sown. The environment can be the complex system and ongoing dynamics at regime and landscape. (Grin, Rotmans, & Schot, 2010) As it was mentioned, niche innovation often faces the barriers of regime, which is stable and established system. In order to breakthrough such barrier, the regime needs to be shaken by landscape change, which presses on existing regime. (Grin, Rotmans, & Schot, 2010) Grin, Rotmans & Schot (2010) pointed out that landscape itself does not influence regime directly; however, the perceptions and agenda of regime actors can be influenced by landscape change. (Grin, Rotmans, & Schot, 2010) The change of regime actors' perceptions can bring the tension in the regime, which creates the 'window of opportunity' for niche innovation. Figure 4 illustrates the relationship among socio-technical landscape, socio-technical regime and niche innovations.

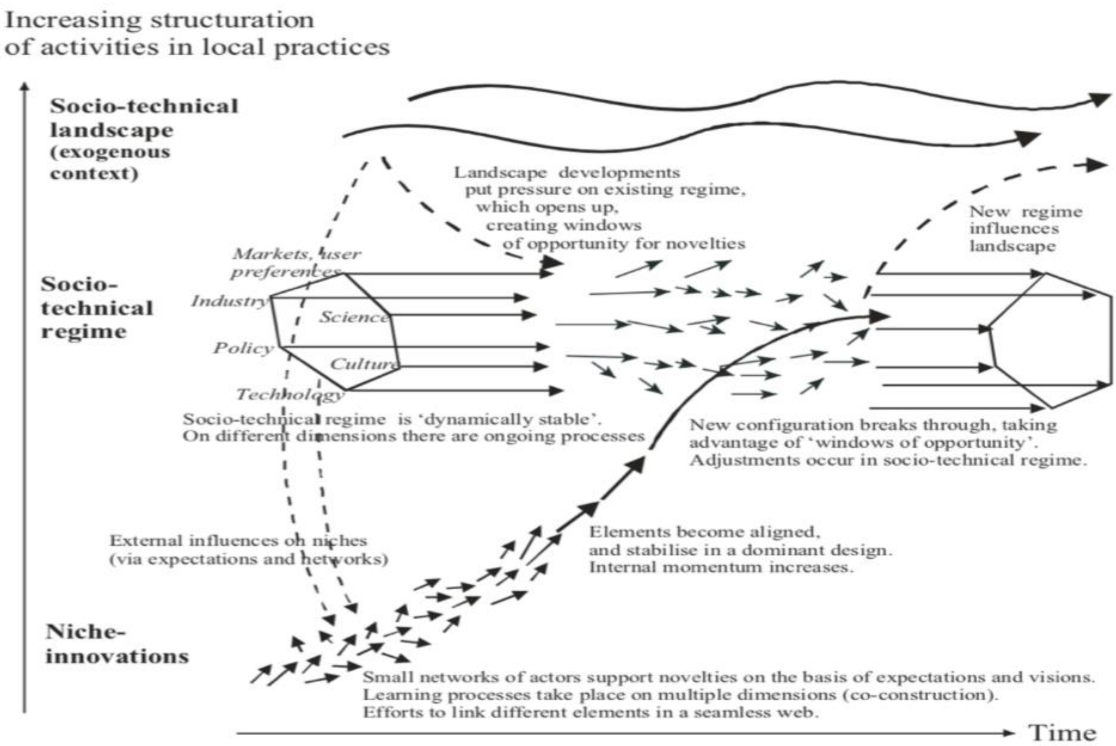


Figure 4: A dynamic multi-level perspective on system innovations (Geels, 2002)

In Figure 4, landscape change shook the regime and it became unstable. At the same time, the landscape influenced on niche innovation by expectations and networks. Mature niche innovation entered through the opened 'window (of opportunity)' into the regime. The niche innovation and regime actors formed the 'new regime' Transition from 'old regime' to 'new regime' was completed through such procedures. Although Geels' Multi-Level Perspective is widely used in academia, some issues of the theory were pointed out by other scholars. Geels (2011) responded to the criticisms such as "lack of agency, operationalization and specification of regimes, bias towards bottom-up change models, heuristics, epistemology and explanatory style, methodology, Socio-technical landscape as residual category, and flat ontologies versus hieratical levels". Langhelle, Kern & Meadowcroft (2017) developed Multi-Level Perspective by adding political landscape as Figure 5: The political landscape as a distinct and separate landscape illustrates.

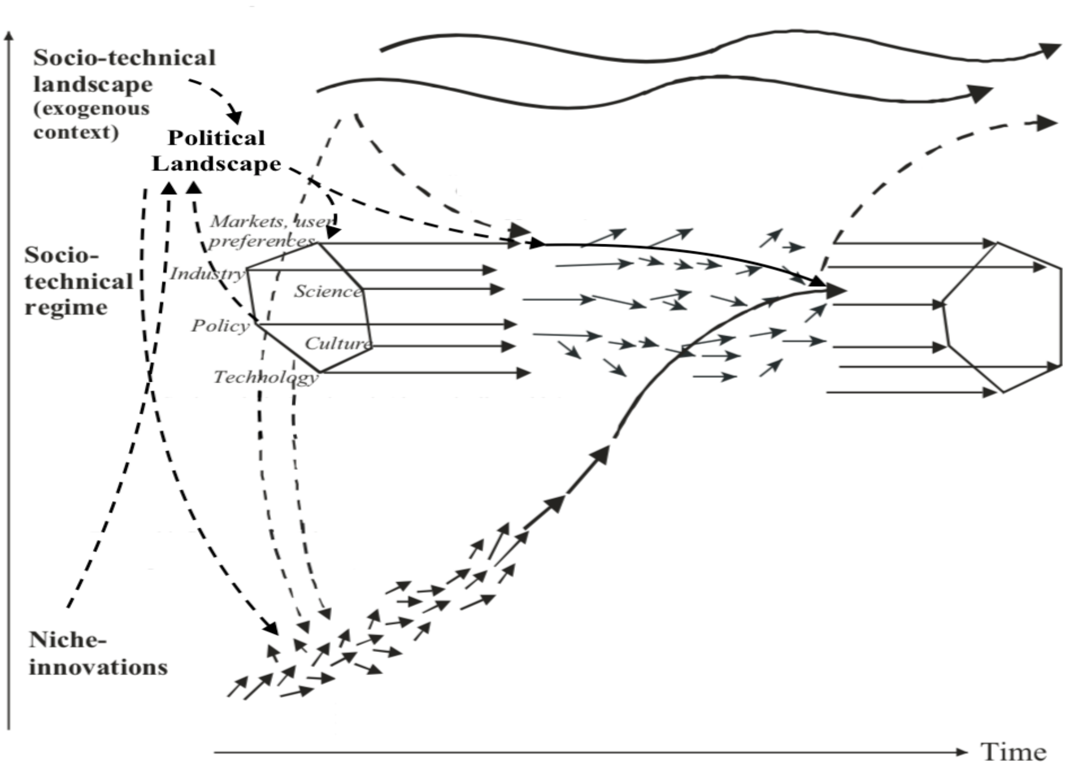


Figure 5: The political landscape as a distinct and separate landscape (Langhelle, Kern, & Meadowcroft, 2017)

Langhelle, Kern & Meadowcroft (2017) stated that niche and regime are influenced by political landscape as well as they influence the political landscape. Interaction among political landscape, niche and regime is significant for transition. They emphasized that political institutions may be key actors on all three levels. (Langhelle, Kern, & Meadowcroft, 2017) This can be one of solutions to the criticism of Multi-Level Perspective, lack of agency. (Langhelle, Kern, & Meadowcroft, 2017)

8.2 Transition pathways

Geels and Schot (2007) elaborated the MLP by adding 'timing' of the interaction and 'nature of interaction', the theory is called transition pathways. According to Geels and Schot (2007), 'timing' is one of the key factors since niche innovation needs to be developed to become a disruptive innovation when the 'window of opportunity'. If the niche innovation is not mature, it misses the momentum and loses the opportunity to enter. (Geels & Schot, 2007) Therefore, the timing 'when' the landscape change happens, or 'when' the regime becomes unstable, is an important factor. There are some factors to determine whether niche innovation is developed such as; stabilized learning processes in a dominant design, expansion of supportive network, involvement of key actors, high expectation for development, improvement of cost efficiency, improvement of performance and minimum 5% of market share. (Geels & Schot, 2007) According to Geels and Schot (2007), 'nature of interaction' is also a significant factor to develop the MLP. The interactions between landscape and regime can be reinforcing their relationship or disrupting their relationship. (Geels & Schot, 2007) In other words, former situation maintains the stable regime while latter situation creates tension within the regime and leads the 'window of opportunity' to be opened. (Geels & Schot, 2007) The theory, elaborated MLP with two new elements; 'timing' and 'nature of interaction', is called transition pathways. (Geels & Schot, 2007) Geels and Schot (2007) stated that there are four pathways; substitution pathway, transformation pathway, reconfiguration pathway and de-alignment and re-alignment pathway. Firstly, substitution pathway can be seen when "specific shock" occurs in landscape and affects regime. (Geels & Schot, 2007) Developed niche innovation enters into the existing regime through the 'window of opportunity' and form the new regime. (Geels & Schot, 2007) Second pathway is transformation pathway. In transformation pathway, the pressure from landscape is medium and "disruptive slow change" occurs. (Geels & Schot, 2007) Moreover, niche innovation is still immature; hence, it cannot breakthrough the barrier of regime. (Geels & Schot, 2007) As a result, the regime has time and room to adopt the pressure from landscape by acquiring the immature niche innovation and taking it into the regime. Third pathway is reconfiguration pathway. High pressure from landscape and developed niche innovations can be seen in this pathway. (Geels & Schot, 2007) The niche innovations, which support the regime, are employed in the regime and change the structure of existing regime. (Geels & Schot, 2007) When an issue is identified, the regime embraces the niche innovations to solve such issue. The interaction of multiple technologies is the key of this pathway. (Geels & Schot, 2007) The last pathway is de-alignment and re-alignment pathway. “divergent, large and sudden” change can be seen in this pathway. (Geels & Schot, 2007) Due to the continuous problems and landscape change, the regime becomes unstable. This process is called “de-alignment”. Niche innovation is still immature; however, several niche innovations merge in order to enter the regime. These merged innovations and regime actors form the new regime, and this process is called “re-alignment”.

9 *Research Strategy*

(Hofstrand & Mary, 2020) explained that the feasibility study is an analytical tool to assess a viability of an ‘idea’. This tool commonly used in business sector to assess whether the business idea or project will work or not. In addition, as Jebrin (2017) stated, the aim of the feasibility study is to assist decision makers to decide with the comprehensive information regarding to the specific project. He continued that the problems, successful result, costs, advantages and solutions will be identified throughout the process. Kenton (2020) explained that the relevant factors of the ‘idea’ such as technical, economic and legal factors, are accounted into analysis. As Claase (2012) stated comprehensive guidelines, requirements, or models on feasibility study design are lacking, there may not be standardized methods of feasibility study. In this thesis, the feasibility of the full electrification of offshore fields with shore power, offshore wind and hydrogen energy storage was analyzed with PEST analysis (Political, Economic, Social and Technical). In all of technological, economic, political and social analysis, the qualitative method was used with the data collected via various institutions’ publications, companies’ websites, scientific journals and academic thesis. In addition, quantitative method was also used including a number of calculations to estimate the cost and efficiency of technology and energy consumption. Furthermore, in political analysis, the survey regarding to oil and gas extraction, renewable energy and electrification of offshore fields, were sent out to Norwegian political parties, which currently hold more than a seat at parliament. Originally, interview was planned; however, due to COVID 19 crisis, the method was needed to be changed from interview to survey. Collected qualitative data was analyzed with qualitative data from the parties’ programs. Moreover, in social analysis, the online survey was created with the survey platform, called survey planet. Relatively short and simplified questions regarding oil and gas extraction in Norway, renewable energy and electrification were asked. The URL link of the survey was sent out via social media, family members, friends and colleagues. Originally, it was planned to be street interview; however, for the same reason above, the method was needed to be changed. Collected qualitative and quantitative data were analyzed. The Multi-Level Perspective theory, particularly transition pathways, was used for the comprehensive analysis of feasibility of electrification of offshore fields with renewable energy. Each method of electrification of offshore fields was discussed including advantages, disadvantages and limitations. Author's recommendation was stated in the end.

10 The methods to be used: PEST Analysis

In order to assess the feasibility of transforming offshore fields on Norwegian Continental Shelf into green offshore fields, comprehensive analysis regarding oil and gas extraction and renewable energy in Norway is needed. PEST analysis can be a useful tool for such analysis. Sammut-Bonnici & Galea (2015) stated that PEST analysis is an analytical tool to examine the environment, which is commonly used for business. PEST stands for Political, Economic, Social and Technological factors. (Sammut-Bonnici & Galea, 2015) Political factors include the government intervention such as trade law, labor law, tax policy, environment law, licensing and funding as well as political stability. (Sammut-Bonnici & Galea, 2015) Economic factors cover cooperate tax, carbon tax, product duties, GDP and economic trends. (Sammut-Bonnici & Galea, 2015) Social factors include consumer perception of products, consumer behavior and role models. (Sammut-Bonnici & Galea, 2015) Technological factors cover innovation in product design, innovation in system, new materials and their effect. (Sammut-Bonnici & Galea, 2015) Since PEST analysis was developed for business strategy, slight change within each factor is essential to examine the feasibility of green offshore fields. In this thesis, political factors will cover each Norwegian political party's current perspectives regarding oil and gas extraction and electrification of offshore fields, EU's political move for energy and environment, the relationship between Norway and EU. Economic factors will include the cost of electrification of offshore fields with power cables from shore, offshore wind power and offshore wind with hydrogen storage, funding to such technologies, taxation to greenhouse gas emission. Technological factors will include technologies of hydrogen, offshore wind power and submarine power cables. Social factors will include social reaction to climate change and social acceptance of oil and gas extraction, renewable energy and electrification of offshore fields.

Technological factors will be discussed first since each technology links to the discussion in economic, political and social factors. Hydrogen storage can be crucial to achieve full electrification of offshore fields with renewable energy; thus, hydrogen related technologies will be discussed in the beginning. The discussion of wind power and submarine power cables will be followed. Secondly, economic factors will be discussed since they are as significant as technological factors in order to achieve green offshore fields. Even if technologically feasible, if the cost of such technologies is astronomical figure, it cannot be said it is feasible. Therefore, the cost of each technology will be discussed before other two factors. Thirdly, political factors will be discussed. Norwegian politicians make domestic policies toward energy and environment and are part of international energy and environment rule making. Hence, by analyzing Norwegian political parties' perspectives regarding oil and gas extraction and electrification of offshore fields with renewable energy, the feasibility of green offshore fields can be examined. Social factors will be discussed in the end. These factors affect political factors through climate demonstration and election. However, their influence on national energy policy is currently relatively moderate in Norway; thus, the social acceptance of electrification of offshore fields with renewable energy will be examined in the end.

10.1 Technological Analysis

10.1.1 Hydrogen

Hydrogen was discovered by Henry Cavendish in 1766. (English, 2020) The characteristics of hydrogen and its potential were discussed in the book, "the mysterious island". (Dunn, 2002) It was published in 1874 and written by the father of science fiction, Jules Verne. (Hydrogen Europe, n.d.) Hydrogen Europe (n.d.) quoted a line from his book, "I believe that water will one day be employed as fuel, that hydrogen and oxygen which constitute it, used singly or together, will furnish an inexhaustible source of heat and light, of an intensity of which coal is not capable". A century later, hydrogen has been spotlighted and studied as the safe, clean and flexible energy source in the last few decades while climate change has been recognized as one of the major global concerns for the human and the earth. In this section, the characteristics of hydrogen, its production methods, and potential use will be discussed.

Furthermore, how the hydrogen can be a part of the stand-alone renewable energy system of the offshore oil and gas production will be studied.

10.1.1.1 What is hydrogen?

Hydrogen Europe (n.d.) statesd that hydrogen is referred as H_2 and generally in gaseous form. The atom of hydrogen (H) can be found in the periodic table as very first element. Hydrogen alone does not exist in nature (National Renewable Energy Laboratory (NREL), n.d.); thus, it can be found with other non-metallic elements. For example, hydrogen (H) combined with oxygen (O) is water (H_2O) and hydrogen (H) combined with carbon is methane (CH_4). (Hydrogen Europe, n.d.) Hydrogen Europe (n.d.) added that hydrogen has the lowest energy density by volume while it has the largest energy density by weight compare to other common energy sources. Figure 6 shows that the energy density of each common fuel by weight and volume.

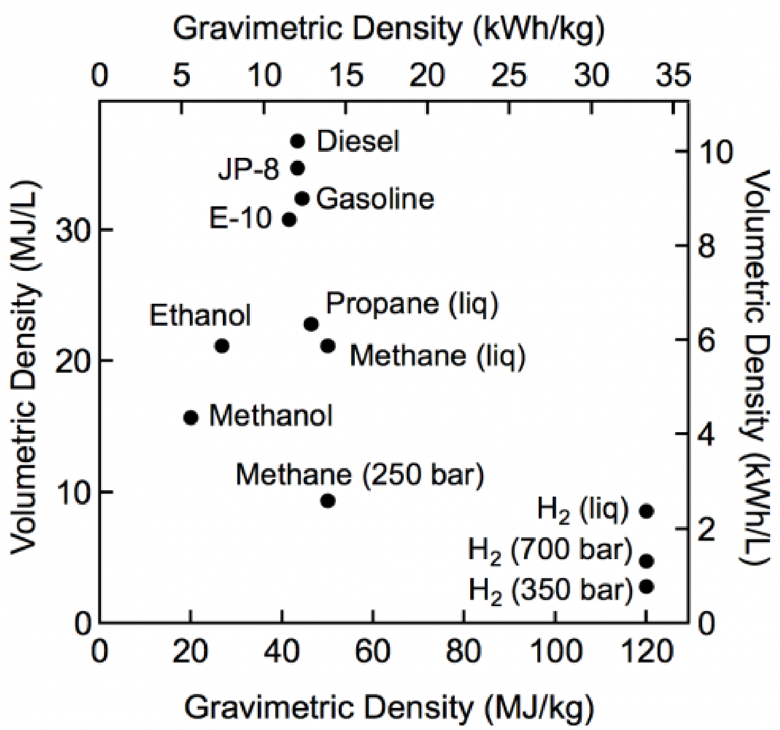


Figure 6: Comparison of specific energy and energy density (U.S. Department of Energy, n.d.)

According to Figure 6, for example, when liquid form of hydrogen H_2 (liq) and diesel fuel are compared, diesel is almost five times denser than H_2 (liq) by volume. That means H_2 (liq) requires 5 times larger space to be stored. On the other hand, H_2 (liq) is almost three times denser than diesel by weight, which means that H_2 (liq) has half weight comparing to diesel for the same amount of energy. In short, hydrogen is lighter weight and larger volume than other common fuels. Due to its rich energy efficiency, hydrogen can be used for many purposes such as transportation, electricity generation and heating with low pollution. (Hydrogen Europe, n.d.)

As it was discussed, hydrogen can be found in some organic matter, which exists significantly in the nature. It can be also used as energy source in several ways such as burning to create the heat or triggering electro chemical reaction to generate electricity. The most importantly, using hydrogen as energy source does not pollute the air since it emits water. It can be said that it is one of the most environmental storable energy sources for our society at this moment.

10.1.1.2 Hydrogen Production

“Electrolysis”, many students may have learned this well-known chemical reaction at schools. Electrolysis is the process of decomposition of water into hydrogen and oxygen by electrolyzing. This reaction may be the most known method to produce hydrogen. However, there are a number of methods are being tested and used to produce hydrogen in order to meet the increase in demand of hydrogen. IEA (2019) reported that hydrogen demand has increased three time since 1975 as the demand jumped up from 18.2 million tons in 1975 to 71.7 million tons in 2018. In the previous section, it was mentioned that hydrogen can be found in some other organic matter in the nature; thus, there are a number of different processes to extract hydrogen. Despite there are several methods to produce hydrogen from some energy source, almost only fossil fuel, especially natural gas, has been used for hydrogen production. (IEA, 2019) According to Hydrogen Europe, natural gas is the main primary energy source for hydrogen production as approximately 70% of hydrogen is currently produced by natural gas. In addition to natural gas, oil and coal are other main sources for hydrogen production. IEA (2019) added that 6% of total natural gas and 2% of total coal in the world were used to produce hydrogen. Through the hydrogen production with fossil fuel, approximately 830 million tons of CO_2 were emitted, which are 2.3% of global CO_2 emission in 2015. (IEA, 2019) (Ritchie & Roser, 2017) IEA (2019) stated that CO_2 emission is similar amount as the CO_2 emission of the United Kingdom and Indonesia together. Only 5% of hydrogen is produced from water, which is considered as truly renewable and green energy rather than hydrogen produced from fossil fuels. (Hydrogen Europe) Following methods of hydrogen production are currently being used or studied. Each method will be briefly explained to identify which process can be potentially used at offshore platform or offshore windmills.

10.1.1.2.1 Thermochemical process

Several thermal processes utilize the energy in fossil fuels or biomass in order to separate hydrogen from the structure of molecular. (U.S. Department fo Energy, n.d.) Additionally, heat with closed cycles is used to produce hydrogen from water and other sources. The major thermochemical processes are; natural has reforming, coal gasification, biomass gasification, biomass-derived liquid reforming, and solar thermochemical hydrogen (STCH).

10.1.1.2.1.1 Natural gas reforming

Natural gas reforming is one of the most mature methods compare to other hydrogen production. (U.S. Department fo Energy, n.d.) They continued that 95% of the hydrogen production in the United States as well as 70% of the hydrogen production in the world are made by this method. The fact that being able to utilize the existing gas pipelines for delivery is also the advantage of this method. There are two types of the thermal processes; steam-methane reformation (SMR) and partial oxidation. In SMR process, methane (CH_4) reacts with the 700 °C to 1000 °C temperature steam in the catalyst. (U.S. Department fo Energy, n.d.) Hydrogen, carbon monoxide and carbon dioxide will be produced. (U.S. Department fo Energy, n.d.) The heat must be continuously supplied in order to retain the high temperature. The chemical formula of this reaction can be described as below.

Steam-methane reforming (SMR) – Step 1

CH_4 + H_2O + (Heat: 700 °C - 1000°C)
=> CO (carbon monoxide) + $3H_2$ (Hydrogen) + * small amount of CO_2

The next step of SMR is using the reaction of carbon monoxide and steam in a catalyst to produce carbon dioxide and hydrogen, this reaction is called the water-gas shift reaction. (U.S. Department fo Energy, n.d.) The chemical formula of this reaction is:

Water-gas shift reaction – Step 2

$$CO + H_2O => CO_2 + H_2$$ *some heat will be released

Step 3: pressure-swing adsorption, is purifying the gas, which was produce in step 2, and removing CO_2 and other impurities from the gas in order to obtain the pure hydrogen. (U.S. Department fo Energy, n.d.) The significant advantage of this method is that hydrogen can be produced twice during both procedures: SMR and water-gas shift reaction. Ethanol, gasoline or propane can be used for this method. (U.S. Department fo Energy, n.d.)

Partial oxidation

In this method, the methane reacts with oxygen, which amount is often limited since it is from air, to produce hydrogen, carbon monoxide and a small amount of carbon dioxide. (U.S. Department fo Energy, n.d.) Due to its impureness of oxygen in the air, the amount of oxygen is often insufficient to extract hydrogen completely from methane. This chemical formula is described as below.

Partial oxidation of CH_4 (methane)

$$CH_4 + *½\ O_2 => CO + 2H_2 + Heat$$

* it is ½ dues to its impureness of oxygen in the air

The following step is same as the step 2 and 3 above. As it can be seen, it can produce $3H_2$ by steam-methane reforming while it can produce only $2H_2$ by partial oxidation. This means that for the same amount of input of methane, more hydrogen can be produced with steam-methane reforming comparing to partial oxidation. The process of partial oxidation is generally faster, and the equipment are more compact than SMR, however, its efficiency of hydrogen production is lower than SMR. (U.S. Department fo Energy, n.d.)

10.1.1.2.1.2 Coal gasification

According to U.S. Department of Energy (n.d.), various substance can be extracted from coal with the gasification such as chemicals, electricity, liquid fuel and hydrogen. Through the coal gasification process, hydrogen is extracted first due to the reaction of coal with oxygen. (U.S. Department of Energy, n.d.) The high temperatures and pressures in that processes are also essential to form the gas, which is the combination of carbon monoxide, hydrogen and other matters. (U.S. Department of Energy, n.d.) The chemical formula of this process can be described as:

Coal gasification process

$$CH_{0.8} \text{ (coal)} + O_2 \text{ (heating)} + H_2O \text{ (steam)} \Rightarrow CO + H_2 + \text{other substance}$$

After this process, water-gas shift reaction can also be used to separate carbon monoxide from the synthesis gas to extract hydrogen and extract more hydrogen by reacting carbon monoxide with steam (water). (U.S. Department of Energy, n.d.) The final step is pressure-swing adsorption to separate hydrogen from the synthesis gas (carbon dioxide and hydrogen) and adsorb it as other thermochemical methods. (U.S. Department of Energy, n.d.)

10.1.1.2.1.3 Biomass gasification

Although chemical formula of biomass can vary depending on what source the biomass is made from, the gasification process of each biomass is similar to coal gasification process as using heat and steam. (U.S. Department fo Energy, n.d.) The simplified chemical reaction can be described as:

$$C_6H_{12}O_6 \text{ (Simplified biomass chemical formula)} + O_2 \text{ (heating)} + H_2O \text{ (steam)}$$
$$\Rightarrow CO + CO_2 + H_2 + \text{other matters}$$

U.S. Department of Energy (n.d.) continued that between step 2: water-gas shift reaction and step 3: pressure-swing adsorption, additional procedures are often required in order to purify the syngas, which is the mix of hydrocarbon, carbon monoxide and carbon dioxide.

10.1.1.2.1.4 Thermochemical water splitting: Solar thermochemical hydrogen (STCH)

In this process, the high temperature heat, approx. 500 °C – 2000 °C, is used to trigger a number of chemical reactions which produces hydrogen. (U.S. Department fo Energy, n.d.) The system uses the closed cycle; thus, the chemicals can be reused, and only water is required to add within each process. U.S. Department of Energy (n.d.) emphasized that greenhouse gas emission via this method is relatively low or can be theoretically and potentially zero. In order to acquire high temperature (500 °C – 2000 °C) from the sun, concentrated solar power such as parabolic reflector with a receiver and solar tower with central receiver and heliostats. (U.S. Department fo Energy, n.d.) Solar thermochemical hydrogen reactor can be attached to the solar receivers. Each method can be illustrated as Figure 7.

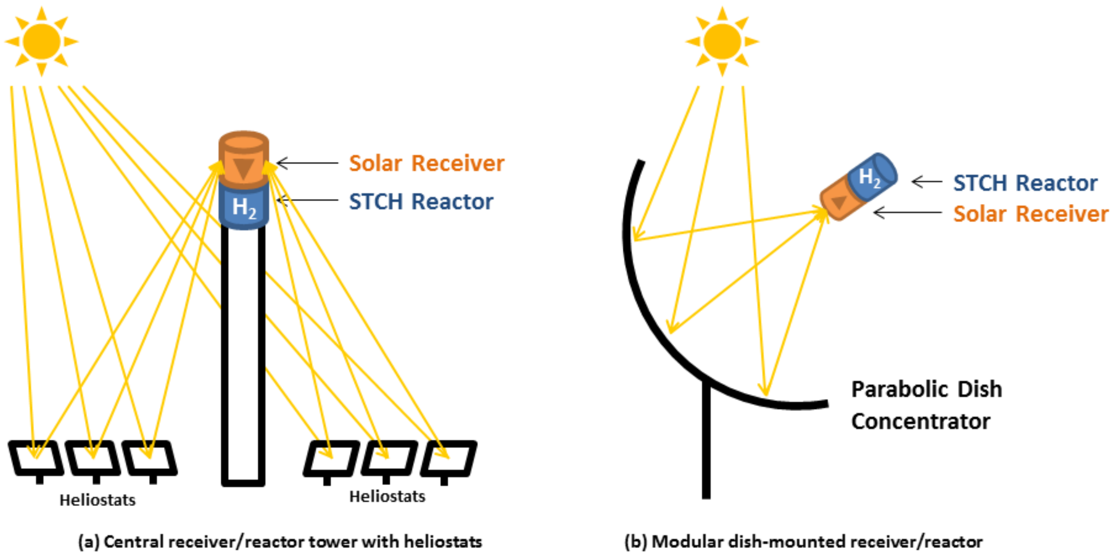


Figure 7: Central recceiver/reactor tower with heliostats (left) and modular dish-mounted receiver/reactor (right) (U.S. Department fo Energy, n.d.)

A great number of solar thermochemical water splitting for hydrogen production has been studied and researched. (U.S. Department fo Energy, n.d.) Two methods are introduced as examples: cerium oxide two step cycle and copper chloride hybrid cycle. Both cycles can be illustrated in Figure 8. As it can be seen, cerium oxide two step cycle requires only two chemical substances comparing to copper chloride hybrid cycle; however, the required heat temperature is significantly higher: 2000 °C for former and 500 °C for latter. (U.S. Department fo Energy, n.d.)

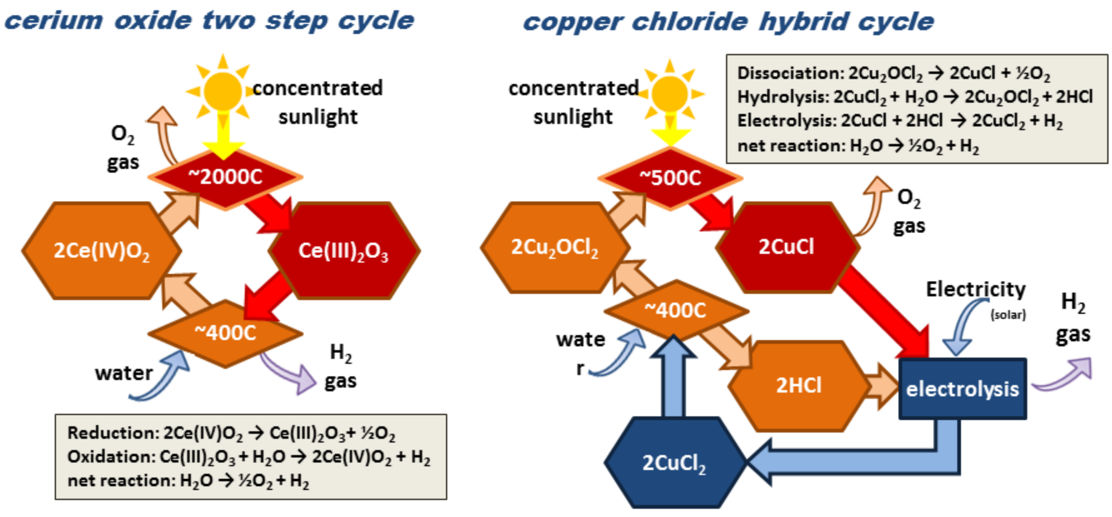


Figure 8:Cerium oxide two step cycle (left) and copper chloride hybrid cycle (right) (U.S. Department fo Energy, n.d.)

10.1.1.2.2 Electrolytic process

The water can be split into hydrogen and oxygen with an electric current. (The U.S. Department of Energy). This reaction can be seen within electrolyzers. Electrolyte membrane separates anode and cathode in the electrolyzer. Several electrolyte materials can be used such as solid polymer, solid oxide for PEM electrolyzer and liquid alkaline for ALK electrolyzer. (The U.S. Department of Energy) How each electrolyzer functions can be slightly different depending on electrolyte material.

10.1.1.2.2.1 PEM electrolysis

First potential material is polymer, which is a solid plastic material. (U.S. Department fo Energy, n.d.)

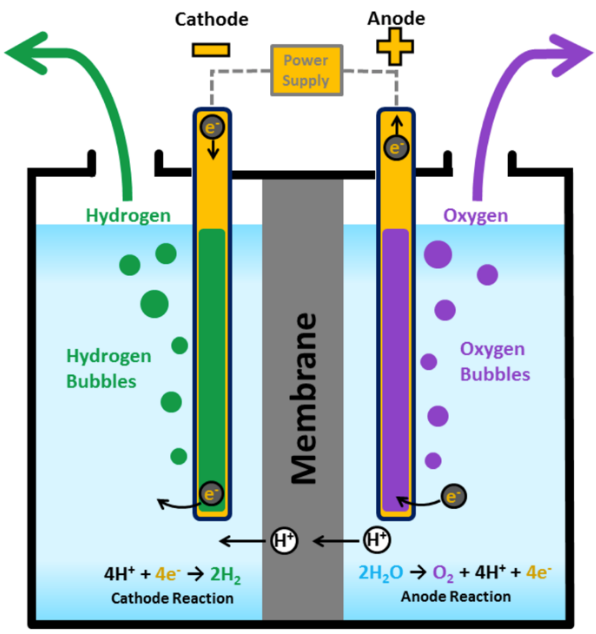


Figure 9: Electrilysis Process with electrolyzer (U.S. Department fo Energy, n.d.)

As Figure 9 illustrates, anode reaction occurs to water and produce oxygen and hydrogen ion, which is positively charged. (U.S. Department fo Energy, n.d.) This chemical reaction can be described as:

Anode: $2H_2O$ (Water)
=> O_2 (Oxygen) + $4H^+$ (Positively charged hydrogen ion) + $4e^-$ (Electron)

After anode reaction occurred, the electron moves from anode side to cathode side through power supply. In Figure 9, the movement of "e^- "(electron) is: purple side -> power supply -> green side. At the same time, polymer electrolyte membrane (PEM) works as a filter and only positively charged hydrogen ions can flow through to cathode side. The cathode reaction occurs in the left side of Figure 9. The chemical formula of such reaction is:

Cathode: $4H^+$ (Positively charged hydrogen ion) + $4e^-$ (Electron) => $2H_2$ (Hydrogen)

The required temperature for this method is approximately 70°C to 90 °C. (U.S. Department fo Energy, n.d.)

Kumar and Himabindu (2019) stated that PEM electrolysis has the 80 – 90% energy efficiency. In addition, the method has high current densities and its system can be designed compact and quick response. (Kumar & Himabindu, 2019) High purity of gases, 99.99% purity, is another significant advantage of this method. On the other hand, the method is relatively new and only partially established at the moment. Thus, the technology is yet facing challenges such as its high cost and low durability.

10.1.1.2.2.2 Alkaline water electrolysis

Another potential material is liquid alkaline of sodium hydroxide (NaOH) or potassium hydroxide (KOH).

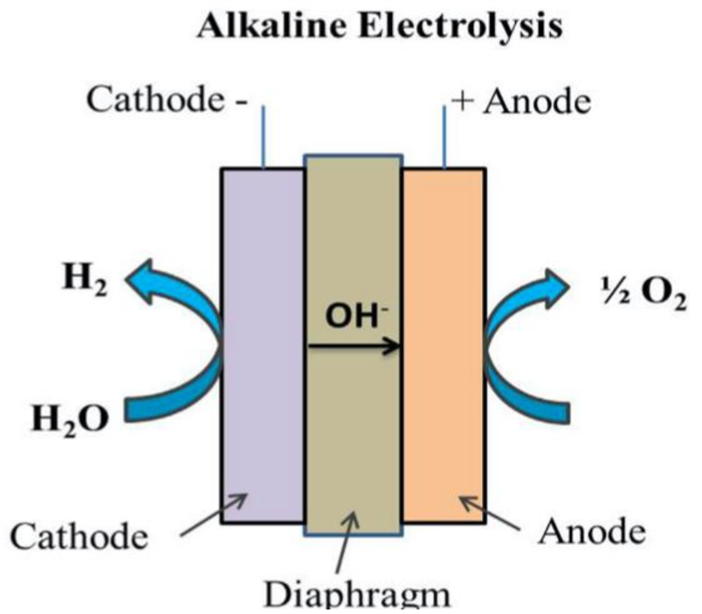


Figure 10: Alkaline Electrolysis Process (Kumar & Himabindu, 2019)

The reaction of alkaline electrolyzer starts from cathode side in Figure 10: Alkaline Electrolysis Process . The water reacts with electron from the direct current power supply and would be separated into hydrogen and hydroxide. Electrolyzing with liquid alkaline has been used in the industrial industry and commercialized for a century. (IRENA - International Renewable Energy Agency, 2018) This reaction can be described as (Kumar & Himabindu, 2019):

Cathode: $2H_2O$ (Water) + $2e^-$ (Electron) => H_2 (Hydrogen) + $2OH^-$ (Hydroxide)

Hydrogen can be collected after separation, and hydroxide flows through the alkaline electrolyzer to anode side. On the anode side, traveled hydroxide is separated into oxygen, water and electron. (Kumar & Himabindu, 2019) This chemical reaction is formulated as:

$$\text{Anode: } 2OH^{-} \text{ (Hydroxide)} \Rightarrow \frac{1}{2} O_2 \text{ (Oxygen)} + H_2O \text{ (Water)} + 2e^{-} \text{ (Electron)}$$

According to U.S. Department of Energy (n.d.), solid alkaline membranes have been tested in the laboratory, and the research shows the high potential for the use in the future.

Kumar and Himabindu (2019) stated that Alkaline electrolysis method has 70 – 80% energy efficiency and technology has been well established and commercialized at low cost. However, they pointed out that there are some disadvantages of this method such as low purity of gases, functional pressure, and current densities and decrease the capabilities of electrolyzer by carbonation on the electrode. (Kumar & Himabindu, 2019) The temperature requirement of commercialized alkaline electrolyzer is about 100°C to 150°C. (U.S. Department fo Energy, n.d.)

Solid ceramic can also be a potential material as the electrolyzer, and it is called solid oxide electrolyzer. (U.S. Department fo Energy, n.d.) The reaction of this method also starts from cathode side as the water reacts with electron and would be separated into hydrogen (H_2) and negatively charged oxygen ion (O^{2-}). (U.S. Department fo Energy, n.d.) This chemical reaction can be described as:

$$H_2O \text{ (Water)} + 2e^{-} \text{ (Electron)} \Rightarrow H_2 \text{ (Hydrogen)} + O^{2-} \text{ (Negatively charged oxygen ion)}$$

Hydrogen can be collected on cathode side after this reaction. Solid oxide electrolyzer works as a filter and only oxygen ion moves through the membrane to anode side.

On the anode side, negatively charged oxygen ion would be split into oxygen and electron. This reaction can be described as:

$$O^{2-} \text{ (Negatively charged oxygen ion)} \Rightarrow \frac{1}{2} O_2 \text{ (Oxygen)} + 2e^{-} \text{ (Electron)}$$

Compared to the first two methods, the solid oxide electrolyzer requires significantly higher temperature to function effectively as approximately 700°C to 800°C needed. (U.S. Department fo Energy, n.d.)

Overall, the significant advantage of electrolyzers can be that its size can vary from as small as home appliance to as large as hydrogen production facilities to distribute. (U.S. Department fo Energy, n.d.)Electrolytic process can help hydrogen production to eliminate greenhouse gases emission fully if the power supply is from renewable energy.

10.1.1.2.3 Direct solar water splitting process – Photoelectrochemical (PEC)

Photoelectrochemical materials (PEC) splits water to hydrogen and oxygen with solar energy. (U.S. Department fo Energy, n.d.) As Figure 11 illustrates, the shape of this semiconductor can be flat shape, which is similar to photovoltaic (PV) panels for solar power. This panel-based system is called electrode system. (U.S. Department fo Energy, n.d.)

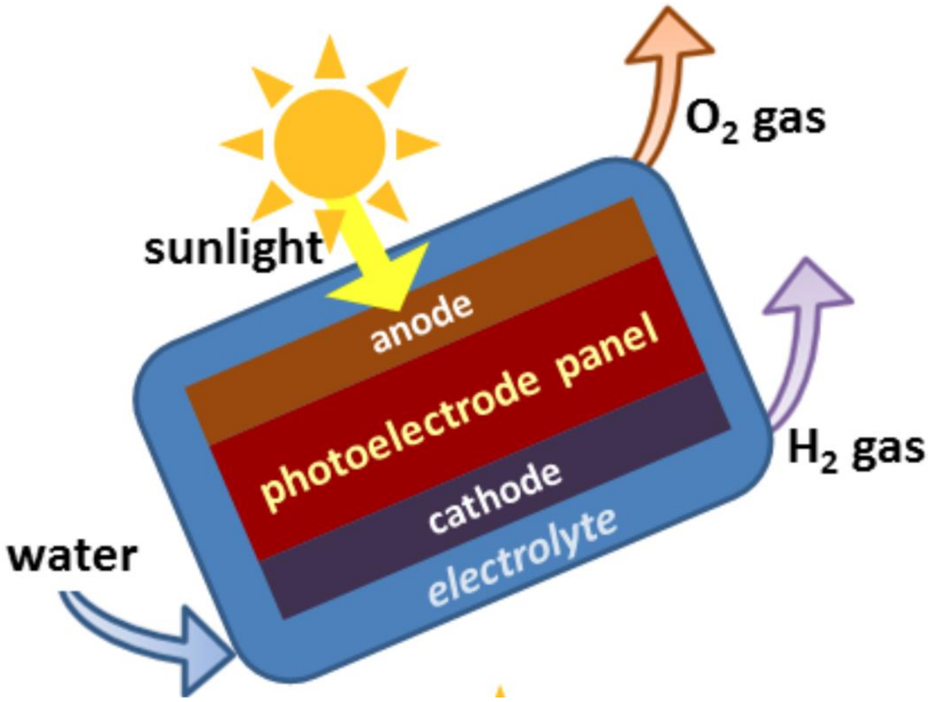


Figure 11: PEC reactor : electrode system (U.S. Department fo Energy, n.d.)

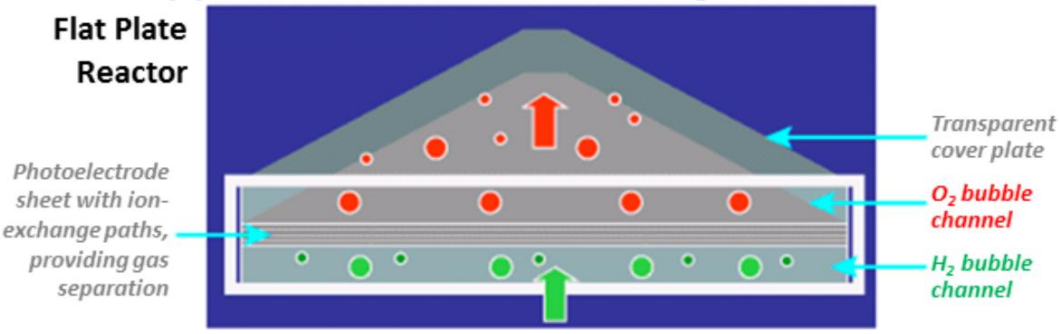


Figure 12: Electrode-based PEC reactordesign : Flat Plat Reactor (U.S. Department fo Energy, n.d.)

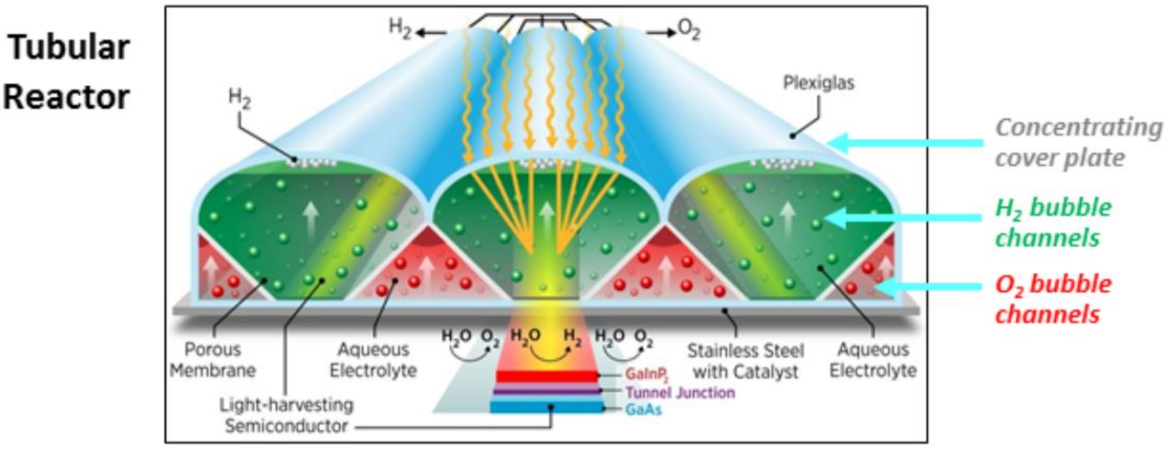


Figure 13: Electrode-based PEC reactordesign : Tubular Reactor (U.S. Department fo Energy, n.d.)

As this panel is similar to PV, a number of researches has been studied and technology is more mature than others. The various materials for photoelectrode semiconductors can be used such as indium gallium phosphide (InGaP), gallium arsenide (GaAs) and Nickel (Ni). These materials are used to trigger chemical reaction in order to split hydrogen and oxygen from water. As Figure 12 and Figure 13 show, the reaction of sunlight and semiconductors in the water creates bubbles of H_2 and O_2 in the water. Varadhan et al (2019) stated that the result of their research and improvement on III-V PEC semiconductors, which composed of InGaP and GaAs double junction photoelectrodes shows that STH (Solar to Hydrogen) of standalone III-V based PEC has up to 9% efficiency with high stability while wireless standalone III-V based PEC has up to 6% efficiency. (Varadhan, Fu, Kao, Horng, & He, 2019)

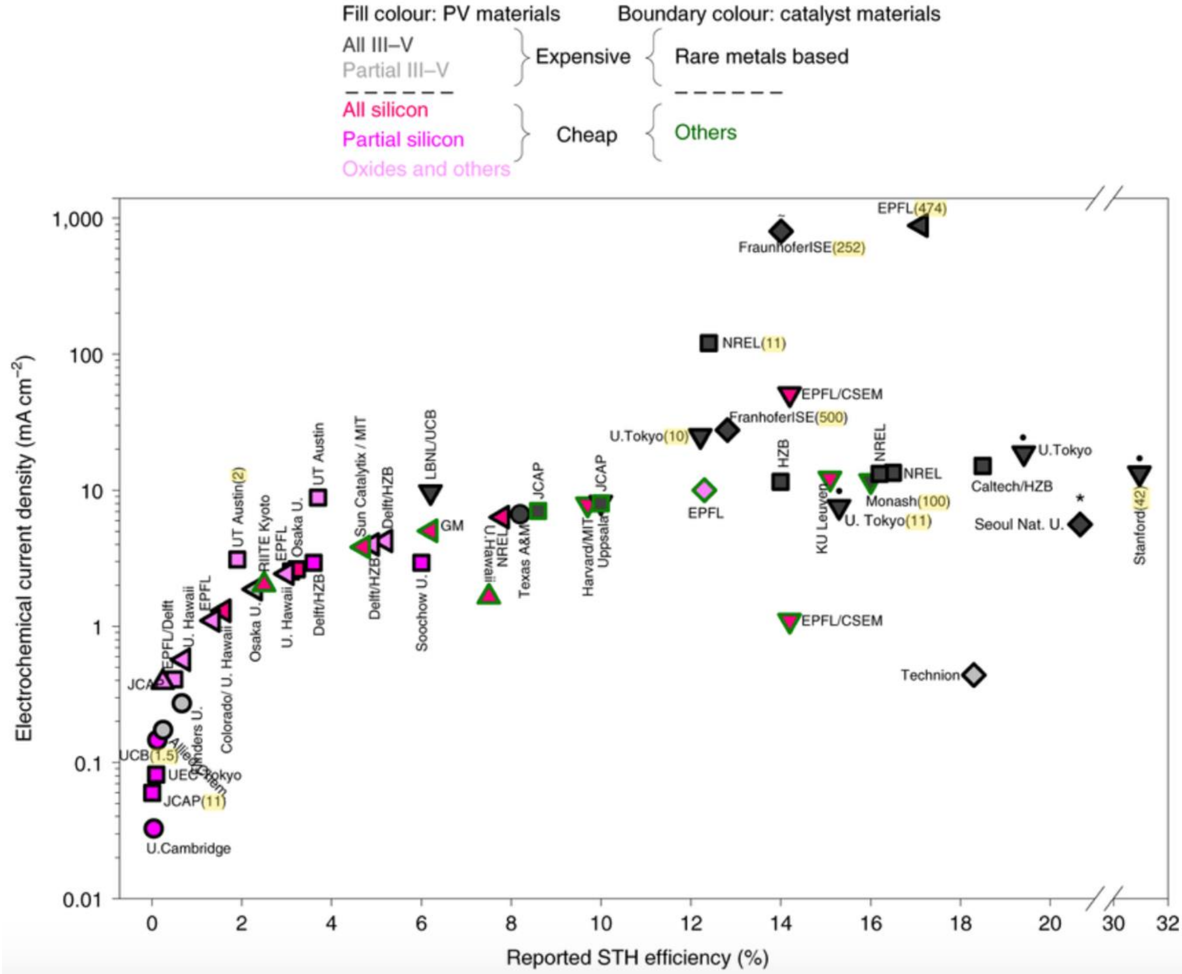


Figure 14: Reported STH efficiency (Tembhurne, Nandjou, & Haussener, 2019)

As Figure 14 shows, III-V based PEC has 6% - 30% of STH efficiency based on the researches of a number of institutions. The result of each institution shows significant difference in STH efficiency; however, the majority is within the range of 10% - 20%.

10.1.1.3 The use of hydrogen

10.1.1.3.1 Fuel cells

Fuel cells devices converts hydrogen to electrical energy. This system uses the reverse reaction of electrolysis. (Fuel Cell & Hydrogen Energy Association, n.d.) Figure 15 describes how the fuel cell works. U.S. Department of Energy (2015) explained that the common type of fuel cell for vehicle is polymer electrolyte membrane (PEM). The electrolyte membrane is located in between a cathode and an anode. As it can be seen in Figure 15, hydrogen is applied into anode while oxygen is applied into cathode. The hydrogen molecules separate into protons and electron by chemical reaction. (U.S. Department fo Energy, 2015) Its reaction can be shown as the equation below.

$$H_2 => 2H^+ + 2e^-$$

Separated electrons (-e) supply the power to motor of vehicle and travel back to cathode while separated protons ($2H^+$) directly travel to cathode through membrane. In cathode, traveled electrons, separated protons and oxygen are combined and form water and released. This reaction can be described as below. (U.S. Department fo Energy, 2015)

$$\frac{1}{2}O_2 + 2H^+ + 2e^- => H_2O$$

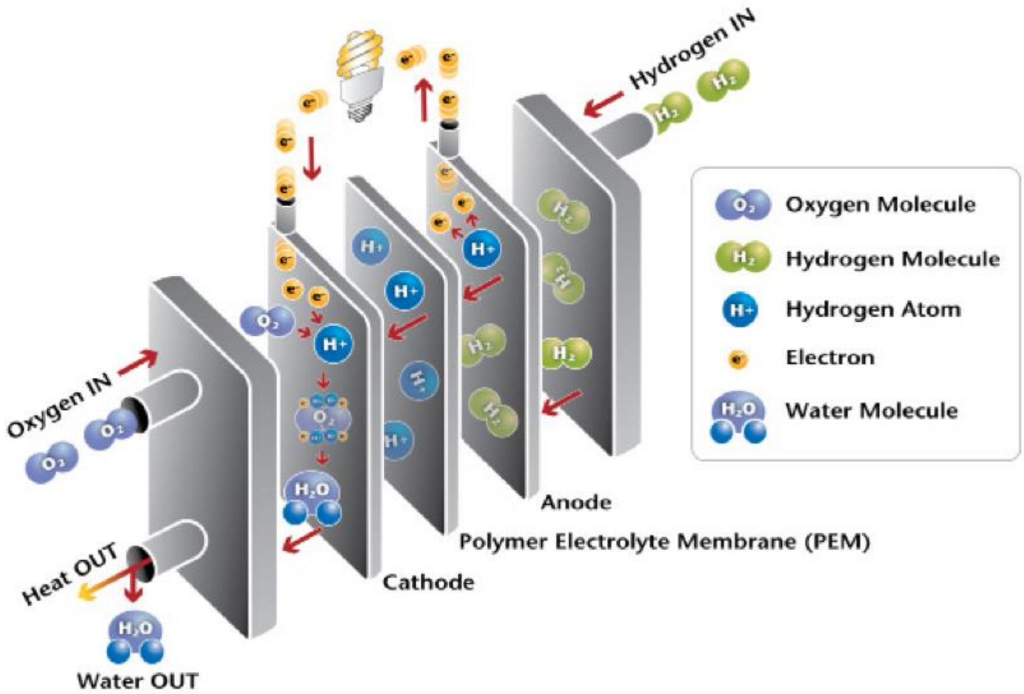


Figure 15: Mechanism of fuel cell (U.S. Department fo Energy, 2015)

U.S. Department of Energy (2015) reported that both PEM based and Alkaline based fuel cells have the efficiency of 60%.

10.1.1.3.2 Gas turbines

Most of offshore platform has gas turbines to generate electricity and it may be possible to utilize those turbines. ETN Global (2020) stated hydrogen can be used as fuel for gas turbines. They expressed that inputting low volume hydrogen, 0% – 10% volume of gas, does not require any modifications to the gas turbine system. (ETN Global, 2020) Additionally, inputting medium volume hydrogen, 10% - 30% volume of gas, may require some modifications; however, it will not be major changes. (ETN Global, 2020) On the other hand, inputting high volume hydrogen, 30% - 100% volume of gas, requires extensive changes to materials, designs and systems. (ETN Global, 2020) GE, Siemens, Mitsubishi Hitachi Power Systems and many other companies have been improving the compatibility of their gas turbines for hydrogen use. (ETN Global, 2020) Some already have the turbines can be operated by 100% hydrogen. Although it is technologically feasible to operate gas turbines with 100% hydrogen, major modification or replacement of turbines at offshore fields may be highly complicated since the turbines are built into the platforms.

10.1.2 Offshore Wind Power

IRENA (2016) explained that wind turbines captures wind and convert its kinetic energy to electrical energy. Larger rotors and longer blades have more swept area; hence, larger wind turbines can capture more wind and generate more electricity. Furthermore, wind speed also determines the electricity generation as when the wind speed increases to double, the potential electrical energy, can be harvested, increases eight times. (IRENA - International Renewable Energy Agency, 2016) GE launched the first 12 MW offshore wind turbine with rotor size of 220m, Haliade-X, which will be shipped in 2021. (GE, n.d.) Siemens Gamesa also launched 14 MW offshore wind turbine with rotor size of 220 m, SG 14-222 DD, which will be delivered by 2024. (Siemens Gamesa, n.d.) Figure 16 illustrates the comparison of the energy capacity of each wind turbine, which has different rotor dimension (RD).

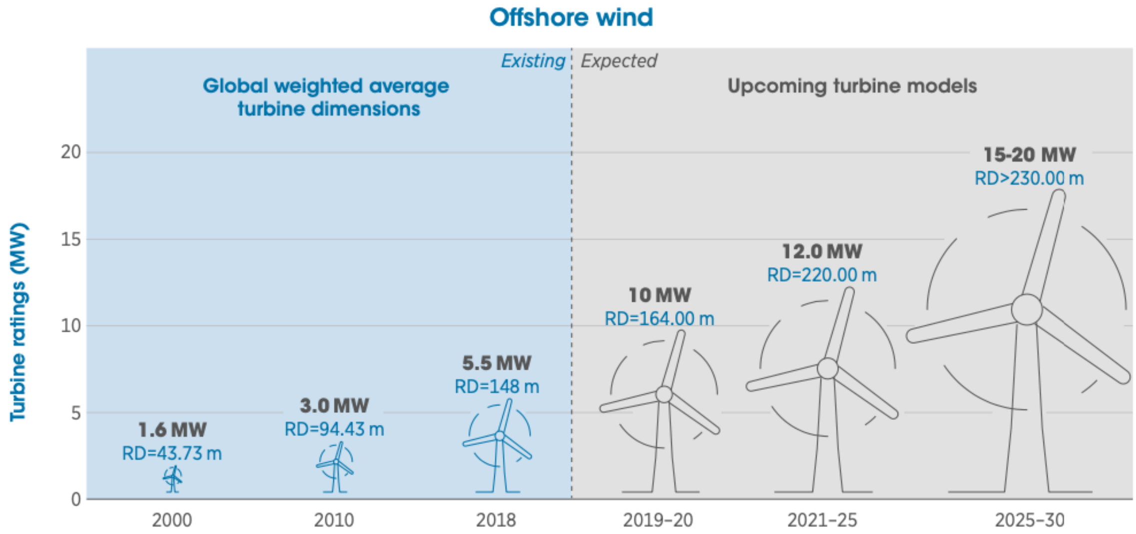
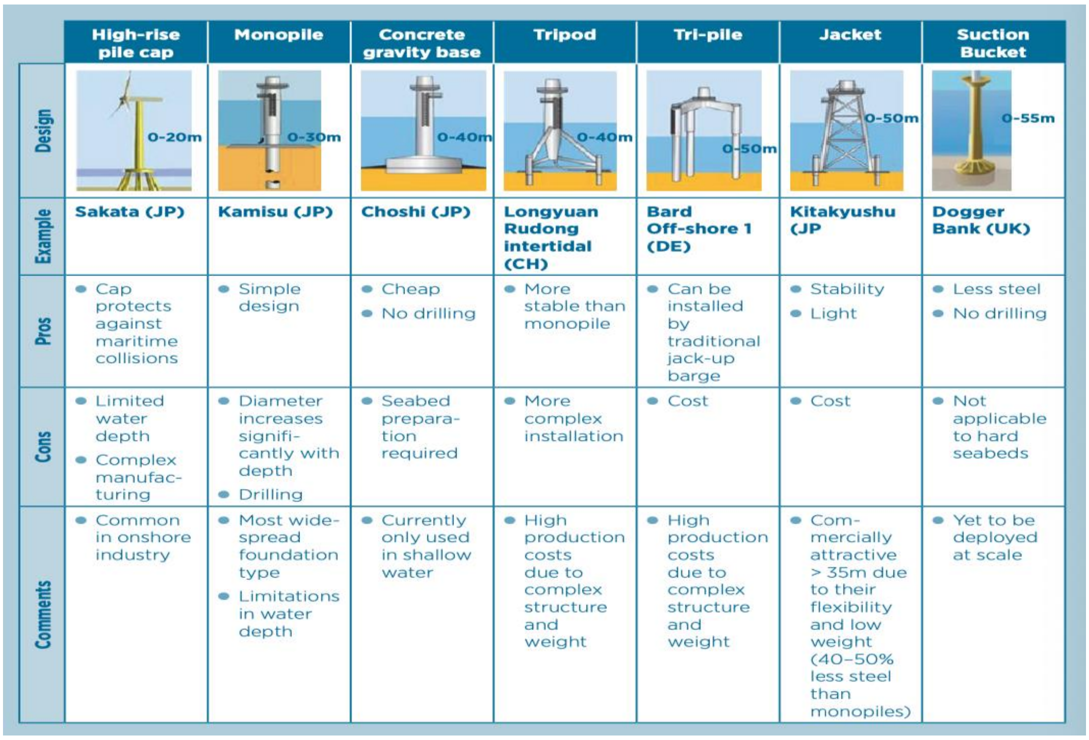


Figure 16: historical and ongoing development of large scale offshore turbines (IRENA - International Renewable Energy Agency, 2019)

IRENA (2016) continued that horizontal-axis turbines with three rotor blades, made from strengthened fiberglass, are used for the modern and typical large wind turbines due to its well-balanced gyroscopic forces. Fewer blades enables rotors to spin slower. The rotation speed needs to be controlled because excessive rotation speeds can cause the damage of the blades and other parts of wind turbines. (IRENA - International Renewable Energy Agency, 2016) There are two controlling the speed of blades systems; a pitch control system, which changes and adjusts the angle of the blades, and a stall system, which uses aerodynamic effects to decrease the speed of rotation. (IRENA - International Renewable Energy Agency, 2016) Both systems function to prevent the damage of blades caused by high rotation speed due to high wind. (IRENA - International Renewable Energy Agency, 2016) IRENA (2016) added rotating shaft is linked with gearbox, which makes the shaft of the generator of wind turbine to rotate. In addition, large wind turbines require high tower to hold the rotor and blades, transformer, electric cables, ladders, elevator and sensors to monitor and collect operational and meteorological data. (IRENA - International Renewable Energy Agency, 2016) Carbon Trust (2014) summarized and made the table of different types of the fixed-bottom foundations for offshore wind turbines in Figure 17. The condition of seabed, bottom of the sea, can be various as it can be sandy, rocky or muddy; hence, several option for each condition is needed.



	High-rise pile cap	Monopile	Concrete gravity base	Tripod	Tri-pile	Jacket	Suction Bucket
Design	0-20m	0-30m	0-40m	0-40m	0-50m	0-50m	0-55m
Example	Sakata (JP)	Kamisu (JP)	Choshi (JP)	Longyuan Rudong intertidal (CH)	Bard Off-shore 1 (DE)	Kitakyushu (JP	Dogger Bank (UK)
Pros	• Cap protects against maritime collisions	• Simple design	• Cheap • No drilling	• More stable than monopile	• Can be installed by traditional jack-up barge	• Stability • Light	• Less steel • No drilling
Cons	• Limited water depth • Complex manufac-turing	• Diameter increases signifi-cantly with depth • Drilling	• Seabed prepara-tion required	• More complex installation	• Cost	• Cost	• Not applicable to hard seabeds
Comments	• Common in onshore industry	• Most wide-spread foundation type • Limitations in water depth	• Currently only used in shallow water	• High production costs due to complex structure and weight	• High production costs due to complex structure and weight	• Com-mercially attractive > 35m due to their flexibility and low weight (40–50% less steel than monopiles)	• Yet to be deployed at scale

Figure 17: Summary of fixed-bottom foundation for offshore wind turbines (Carbon Trust, 2014)

Additionally, the depth of water exceeds 50 – 60m, floating foundation is considered as preferable due to its lower cost and less environmental damage for installation. (IRENA - International Renewable Energy Agency, 2016) There are currently three main types of floating foundations; tension leg platform, spar-submersible and spar-buoy. (IRENA - International Renewable Energy Agency, 2019) Each type is illustrated in Figure 18.

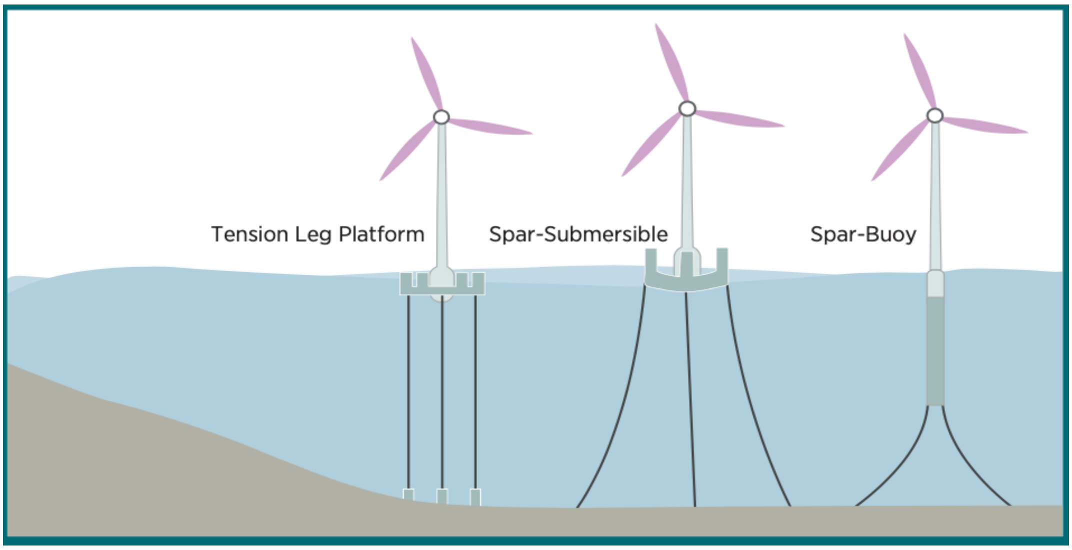


Figure 18: Different types of floating offshore wind (IRENA - International Renewable Energy Agency, 2019)

Some areas and regions such as Japan, the United States, South-East Asia, Oceania and Northern Europe, have deep water along the coastline or within Exclusive Economic Zone (EEZ). (IRENA - International Renewable Energy Agency, 2019) Floating foundation technologies expand the possibility of deployment of wind turbines in those countries and regions. (IRENA - International Renewable Energy Agency, 2019)

The height of the wind turbine tower can be different a site to a site as Simens Gamesa stated the hub height of many wind turbine models, SG 8.0-167 DD, SG 11.0-200 DD, and SG 14-222 DD, is “site specific”. (Siemens Gamesa, n.d.) (Siemens Gamesa, n.d.) (Siemens Gamesa, n.d.) The hub of wind turbine is located in the center of a rotor. In other words, it is at center of sweeping area. Hub height tells the distance between the hub and ground or the surface of sea. Therefore, the hub height is generally nearly equal to the tower height. SG 8.0-167 DD wind turbines were picked for Equinor’s Hywind Tampen project, and its hub height was set at 95m. (Quest Floating Wind Energy, 2018) Lantz et al (2019) studied whether difference of the hub height affects the capacity factor of wind turbines. Based on their estimate, the capacity factor increased 2% to 4% when the hub height increased from 80 m to 110 m. (Lantz, et al., 2019) In addition, another 2% to 4% increase in capacity factor by increasing the height from 110 m to 140 m could be seen in the result. (Lantz, et al., 2019) As a result, it can be said that the hub height determines the profitability of wind turbines as well as the size of rotor.

Inside the tower may be the most abundant space in the structure of wind turbines. Hitachi (n.d.), one of the wind turbine manufacturers, showed the layout of mechanical components in the tower in Figure 19: Equipment layout in the tower

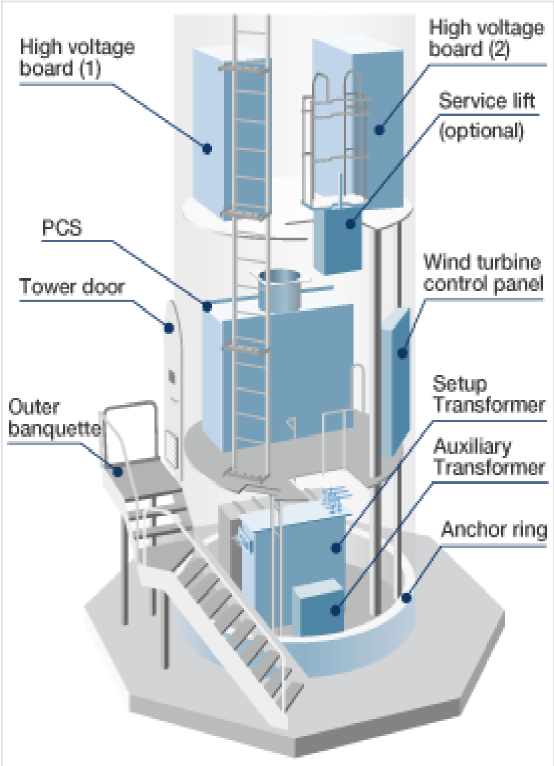


Figure 19: Equipment layout in the tower (Hitachi, n.d.)

As Figure 19: Equipment layout in the tower shows, several components to operate the wind turbines are located at the bottom of the tower. These devices are placed in the different floor in the tower. Each floor is connected by a ladder or an elevator, which continues to the top of the tower as Figure 20.

Figure 20: Elevator in the wind turbine (Zipp, 2012)

Above the top floor, which a component of wind turbine is located, it is open space and not utilized. The dimension of the tower can differ among the size of rotor. LaNier (2005) compared the dimension of 1.5 MW, 3.6 MW and 5.0 MW wind turbines with 100m hub height in his report. LaNier (2005) stated that the concrete and steel can be used as a material for the tower. Although all concrete tower, hybrid of concrete and steel tower and tubular steel tower were compared in LaNier's study, it will be focused on only tubular steel tower since 90% of wind turbine towers employ tubular steel towers. (World Steel Association, 2012) According to LaNier (2005), 1.5 MW wind turbine with 100 m hub height has 5.79 m diameter at base and 4.27m at mid height and 2.90 m at top. He added that 3.6 MW wind turbine with same hub height has diameter of 7.62 m at base it is 5.64 m at mid height and 3.96 m at top. (LaNier, 2005) Moreover, the tower of 5.0 MW wind turbine has a diameter of 8.84 m at base while it is 6.70 m at mid height and 4.57 m at top. (LaNier, 2005) As the comparison shows, when the rotor size increases, the diameter of the tower also increases accordingly if the hub height is same and same material is used for the tower. In reality, diameter of tower can vary because its material, hub height, and rotor size can be different a site to a site.

According to Quest Floating Wind Energy (2018), the tower of Siemens' 6.0 MW wind turbine for Hywind Scotland has a diameter of 7.5 m at the widest. The official data of the dimension of wind turbines of Hywind Tampen project has not been accessible; however, GCE NODE (2018) reported that the diameter of the tower at the sea line is approximately 9m to 10m. This indicates that even larger wind turbines such as Siemens' 11 MW and 14 MW requires wider tower, which can be possibly around 12 m to 15 m or even wider. Thus, larger wind turbine's tower may have extensive space to be utilized.

10.1.2.1 Offshore wind to hydrogen

Some companies and institutions have studied and proposed the idea to utilize the abundant space in the tower. British clean fuel company: ITM Power and Danish multinational power company: Østred proposed the concept of hydrogen wind turbine, which an electrolyzer is built into the tower of wind turbine. (ITM Power, 2020) Figure 21 illustrates their concept. The area circled in blue is within wind turbine tower and the area circled in yellow is the offshore substation, which would be located next to or center of wind turbine farms. There is a number of institutions, which have worked on the projects such as Wind2H2 - wind to hydrogen. (National Renewable Energy Laboratory - NREL) However, in the most of projects, electrolyzer is located onshore, circled in red in Figure 21, as well as a compressor for hydrogen storage. (National Renewable Energy Laboratory - NREL)

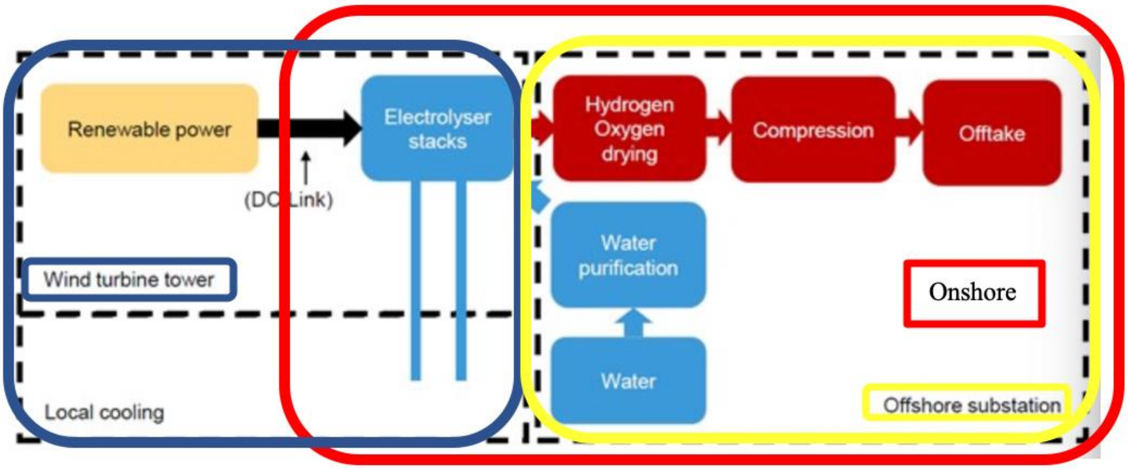


Figure 21: The concept of hydrogen wind turbine (ITM Power, 2020)

HYGRO also introduced the wind turbine with integrated electrolyzer, which is 4.8 MW wind turbine with 2 MW electrolysis system. (HYGRO, n.d.) The compressed hydrogen at 500 bar will be delivered to distribution system and storage. (HYGRO, n.d.) Figure 22 briefly explains how its system works.

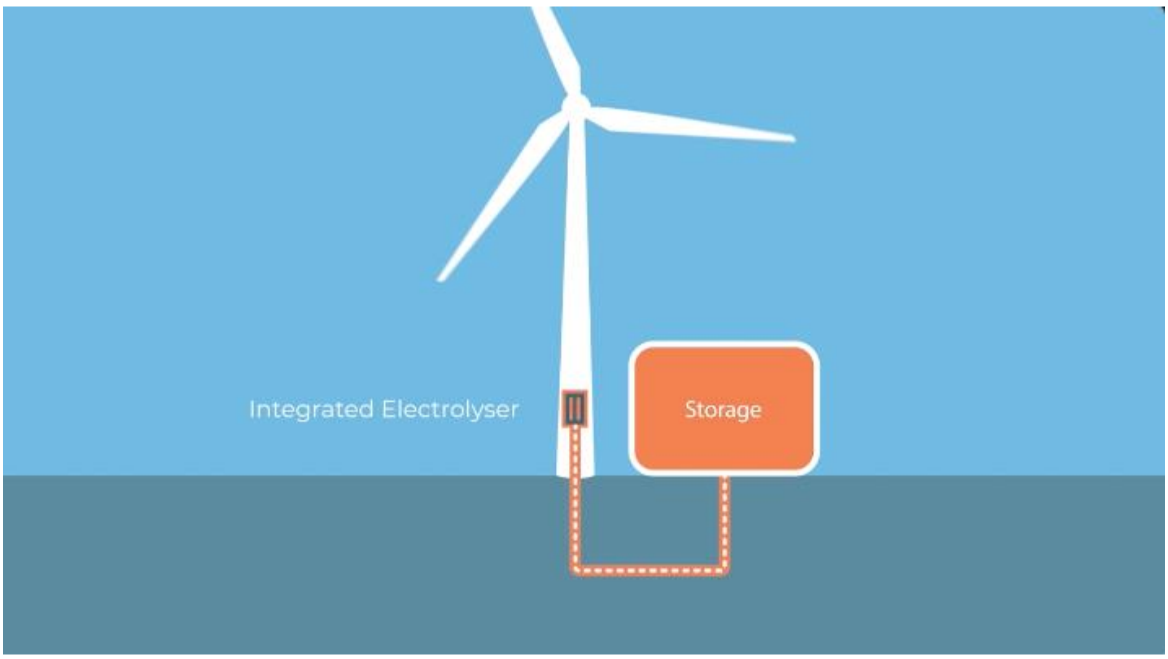


Figure 22: Hydrogen wind turbines (HYGRO, n.d.)

As few companies have the concepts of hydrogen wind turbines or even started to build them, it can be said that it is technologically mature enough to be used and more options for the offshore stand-alone renewable energy system are now available.

10.1.2.1.1 Reversible Fuel Cell

Previously, how electrolysis and fuel cell work was discussed. The electrolysis method is that electrolyzer separates hydrogen and oxygen from water by using electricity. Hence, input components of this method are electricity and water whereas output units are hydrogen and oxygen. On the other hands, fuel cell takes hydrogen and oxygen into the system and creates electrical energy and emit water through the process. Thus, input components are hydrogen and oxygen while output units are electricity and water. These two systems are almost reversed to each other; therefore, it is possible to be combined both electrolysis and fuel cell. This is called reversible fuel cell. (Blue Terra, n.d.) Figure 23 and Figure 24 illustrate how reversible fuel cell functions.

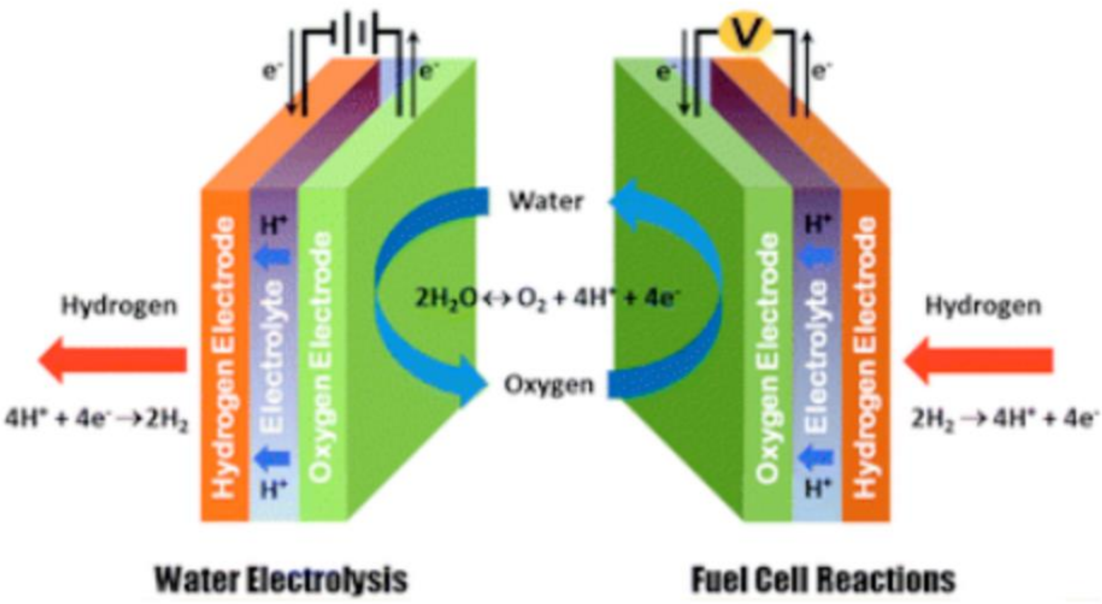


Figure 23: Reversible Fuel Cell (Center for Electrochemical Energy Storage, n.d.)

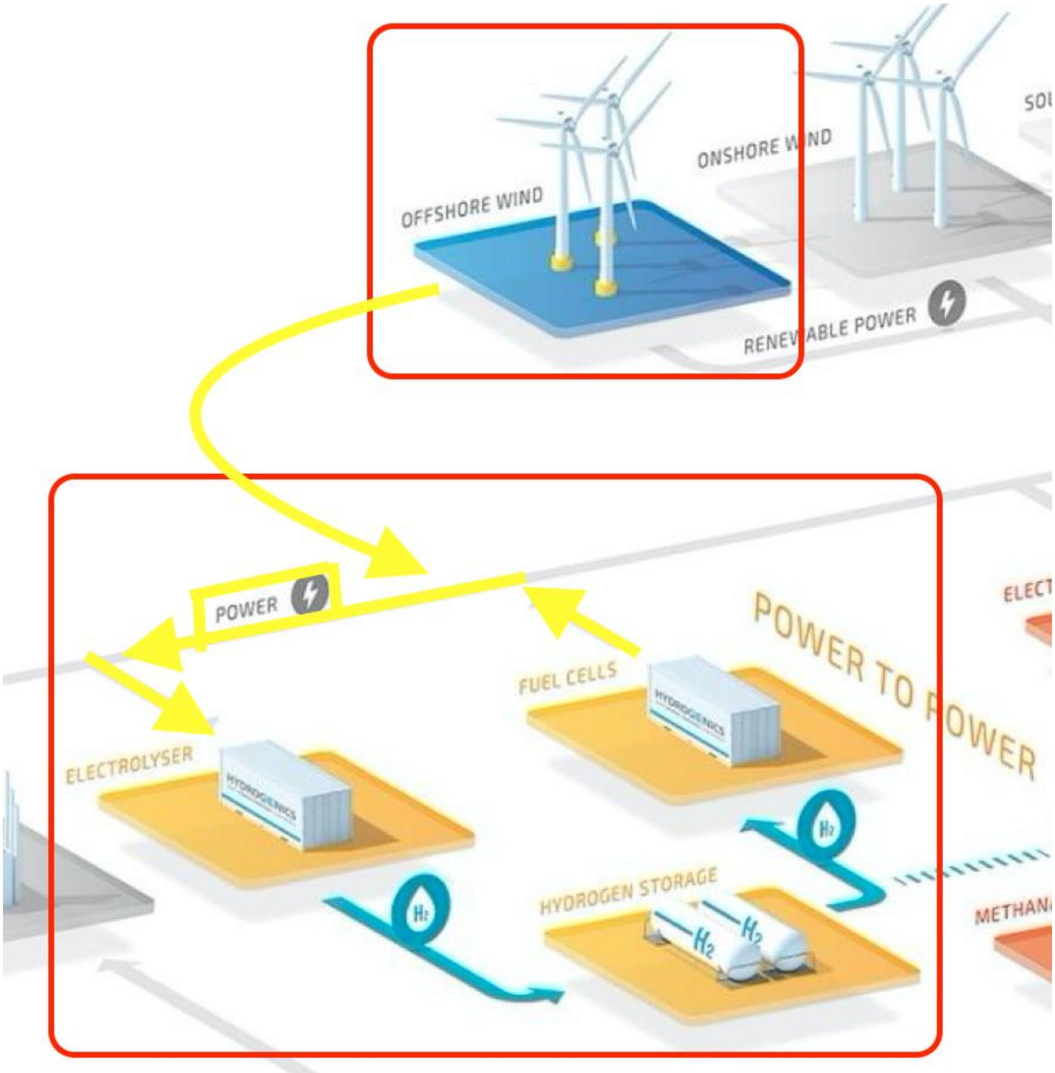


Figure 24: Reversible Fuel Cell with Offshore Wind Power System (Thomas, 2019)

Firstly, offshore wind power supplies electricity to electrolyser to generate hydrogen. Secondly, produced hydrogen is stored until it is needed. Finally, when electrical energy is demanded, supply hydrogen to fuel cells to generate electricity. This is the basic cycle of reversible fuel cell.

In offshore fields, electricity of offshore wind turbines can be supplied directly to each field. However, it may cause issues when electricity supply exceeds the demand since offshore wind power completely depends on wind. Therefore, this system can assist to convert such excessed electricity to storable energy, hydrogen. In this way, when demand of electricity exceeds the supply from wind power, lacking electricity can be supplemented by fuel cells.

There may be two options to install this system. First option is installing electrolyzer and fuel cells in the tower of offshore wind turbines. As it was mentioned previously, there are significantly large abundant space in the tower of wind turbines. Larger capacity of wind turbines also has larger space in the tower. Thus, utilizing such space can be an option. Since the maintenance and repairment may be required, it is more ideal that both units are located at the bottom of tower. Hydrogen gas tank can be placed upper side of tower.

Another option can be placing both electrolyzer and fuel cell on the floaters. On independent floater can be designated for the system. If the offshore wind uses multi-turbine platforms, the units can be placed in the middle of the platform. Multi-turbines platform is that several wind turbines are connected like mesh network. Figure 25 shows the example of multi-turbines platforms. (Froese, 2016)

Figure 25: The project of Atkins and Hexicon (Froese, 2016)

There are many ways to produce hydrogen as it was discussed in this study. Figure 26 shows the comparison of each hydrogen production method.

	Thermochemical: Natural gas reform	Thermochemical: Coal gasification	Thermochemical: Biomass gasification	Solar thermochemical hydrogen (STCH)	Electrolytic process	Photoelectrochemical (PEC)
Greenhouse Gas Emission from Production	YES	YES	YES	NO	NO	NO
Space needed	Large	Large	Large	Large	Small - Large	Large
Energy Source (Renewable or fossil)	Fossil	Fossil	Renewable	Renewable	Renewable / Fossil	Renewable

Figure 26: Comparison among different hydrogen production methods

Firstly, the coal gasification can be eliminated from the options since accessing and transporting coals to the offshore is difficult as well as the greenhouse gas would be emitted from the hydrogen production and the coal gasification unit is large. For the same reasons besides its renewability, it seems that biomass gasification does not suit to offshore environment. Solar thermochemical hydrogen (STCH) has the potential due to its 'greenness'. However, the system requires extensive temperature as 500 – 2000 °C. The central receiver is essential to concentrate the captured solar power. Adjusting the angle of solar panels for central receiver is technically difficult due to waves. Moreover, the technology of floating solar power is far from mature. Hence, deploying offshore solar power with central receiver is not technologically feasible option. On the other hand, photoelectrochemical (PEC) method of hydrogen production is one of the most compact and green options. As it was mentioned, the technology is similar to solar PV and mature. Although the unit size can be compact, its efficiency is relatively low as 10 – 20 %. Considering the fact that the climate and wave condition on the sea can be rough, floating PEC would not be as efficient as on the ground. It indicates that larger space on the sea needed. Therefore, offshore PEC may be technically possible; however, it is not the best option. Natural gas reform is another option. The main problems of this option are; greenhouse gas would be emitted during the gasification, energy source is fossil fuel, and the large natural gas reforming unit needs to be installed into the offshore platforms. The purpose of each offshore plant is to extract oil and gas, and the source of hydrogen, methane, is there; thus, it can be said that it is logical to utilize it and convert it to greener energy. However, in order to reduce greenhouse gas emission extensively, it would be ideal not to use fossil fuel; hence, it can be said that the technologically, natural gas reform for hydrogen is feasible, but not recommended environmentally. Lastly, electrolytic process has probably the best potential out of these options. As it was discussed before, electricity is used to separate hydrogen and oxygen from water. If this electricity comes from the gas turbines at offshore platforms, it will emit more greenhouse gases to produce hydrogen at each platform. However, if this electricity comes from the offshore wind turbines, this hydrogen can be called ‘green hydrogen’, which can be compressed and stored offshore. Technologically, the electrolyzer can be built into the tower of wind turbines; thus, each turbine acts as stand-alone hydrogen producing unit. In addition, the technology of wind turbines is mature and yet developing rapidly. For example, the technology of floating wind power enables more countries and regions to deploy the offshore wind turbines along the coast. The expansion of size of wind turbine can be another example of rapid growth of the technology as GE introduced its 12MW RD-220 m turbines in 2019, which was planned to be introduced 2021-2025. Larger wind turbine is not only more efficient to capture wind energy but also has more space in the tower; thus, there would not be a space issue to place the electrolyzer. Technologically speaking, it seems this method is one of the most feasible and realistic option.

10.1.3 Offshore hydrogen storage and distribution

In the previous section, the characteristics of hydrogen was discussed; high energy density and low volume density. Air Liquide (n.d.) also explains that 1 liter of gaseous form of hydrogen under normal pressure weighs 90 mg, and $11m^3$ is needed to store 1 kg of hydrogen which enables vehicle to run for 100 km. The required space to store standard hydrogen is extensive and it is essential to compress hydrogen. There are several ways to compress it; gaseous form hydrogen with high-pressure, liquid form hydrogen with low temperature and solid form hydrogen with other material or chemical. (Air Liquide, n.d.)

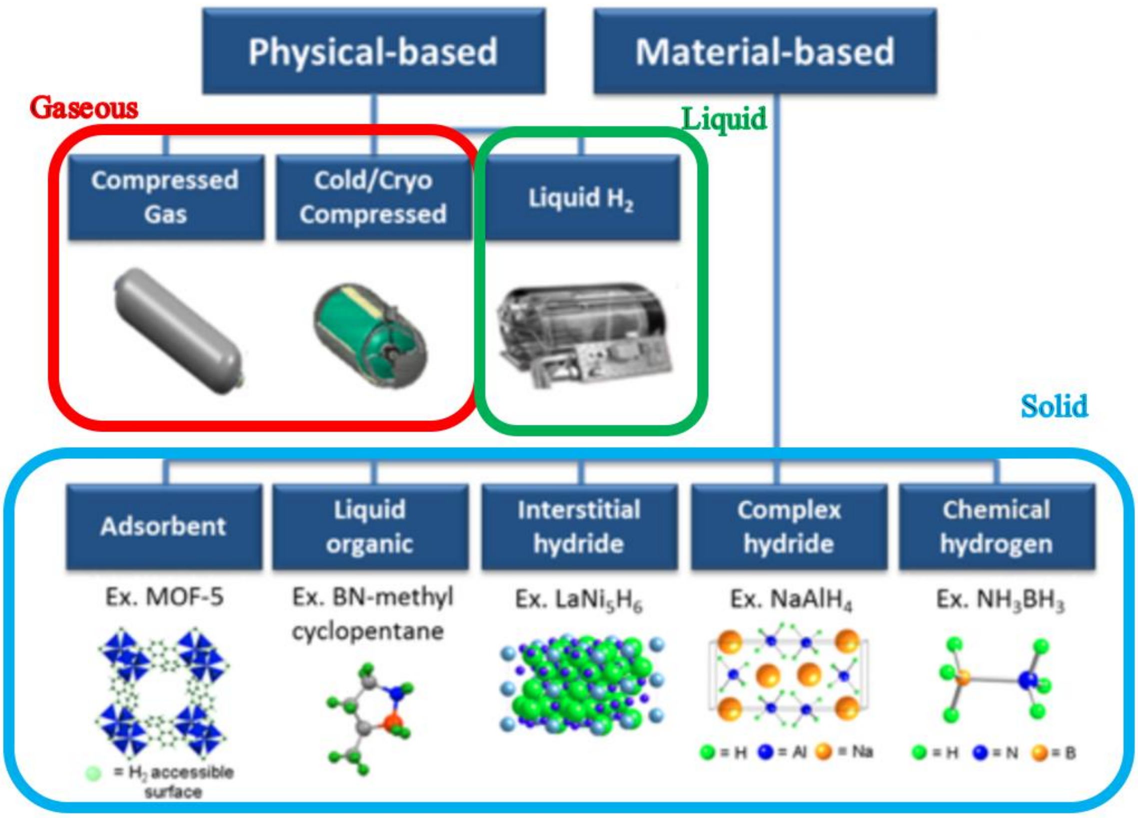


Figure 27: Different methods of hydrogen storage (U.S. Department fo Energy, n.d.)

Figure 27 shows the categorized hydrogen storage methods. Air Liquide (n.d.) explained that compressing gaseous form hydrogen is the easiest and the most mature technology. At 700 times pressed than normal atmosphere (700 bar), the density of hydrogen becomes 42 kg/m^3. (Air Liquide, n.d.) It is 466 times denser than 90 mg (0.09kg)/m^3 under normal pressure. In addition, Air Liquide (n.d.) continued that the most vehicle manufacturers have technology to implement hydrogen tanks which can keep high-pressure at 350 bar or 700 bar into each vehicle. Thus, it can be said that the technology of small-scale gaseous form hydrogen storage is mature. Hydrogen Europe (n.d.) reported that energy of 9% - 10% of hydrogen is needed to compress hydrogen to 350 bar level or 700 bar level.

Hydrogen can be liquefied as all types of gases on the planet can be theoretically liquefied. However, it requires extremely low temperature, - 252.87 °C, for liquefication of hydrogen. (Air Liquide, n.d.) The absolute lowest temperature, which is called ‘absolute zero degree’, is -273.15 °C. Thus, high-pressure at over 1000 bar is also required to reach such low temperature. Liquefied hydrogen (LH_2) has density of 71 kg/m^3 at -252.87 °C and 1013 bar and perfectly insulated tanks, which can keep this temperature, are essential. Hydrogen Europe (n.d.) added that this method of hydrogen storage is currently used for space travel. Highly developed insulated storage units and vessels is essential in order to maintain the liquid form of hydrogen. Its cost can be extensive. The required energy input for liquefication of hydrogen is roughly 30% of the hydrogen. (Hydrogen Europe, n.d.) This means that if '100kg' hydrogen needs to be liquefied, then '30 kg' hydrogen equivalent energy, which is approximately 100 kg gasoline, is required to put in. Additionally, maintaining this temperature demands continuous and significant energy input. Thus, this method is not realistic at least on the Earth but in space.

Solid form hydrogen can be produced by using the sorption process of hydrogen to other materials such as palladium, magnesium, lanthanum and aluminum. (Hydrogen Europe, n.d.) For example, theoretically, 1 m^3 palladium can absorb 900 m^3 hydrogen gas. (Hydrogen Europe, n.d.) Fruchart (2013) stated that Figure 28 shows the difference in volume and weight for each three main hydrogen storage methods. As it can be seen, $LaNi_5H_6$, which is complex hydride, is one of the most compact storage methods for 5 kg of H_2 and its volume is only 25% of gaseous form of hydrogen at 360 bar; however, total weight becomes 357 kg and it is 71 times heavier than gas form of hydrogen. MgH_2, which contains 5 kg of hydrogen, is also compact as its volume is only 30% of gaseous form of hydrogen at 360 bar while its weight is 66 kg and 13 times heavier than gaseous form of hydrogen.

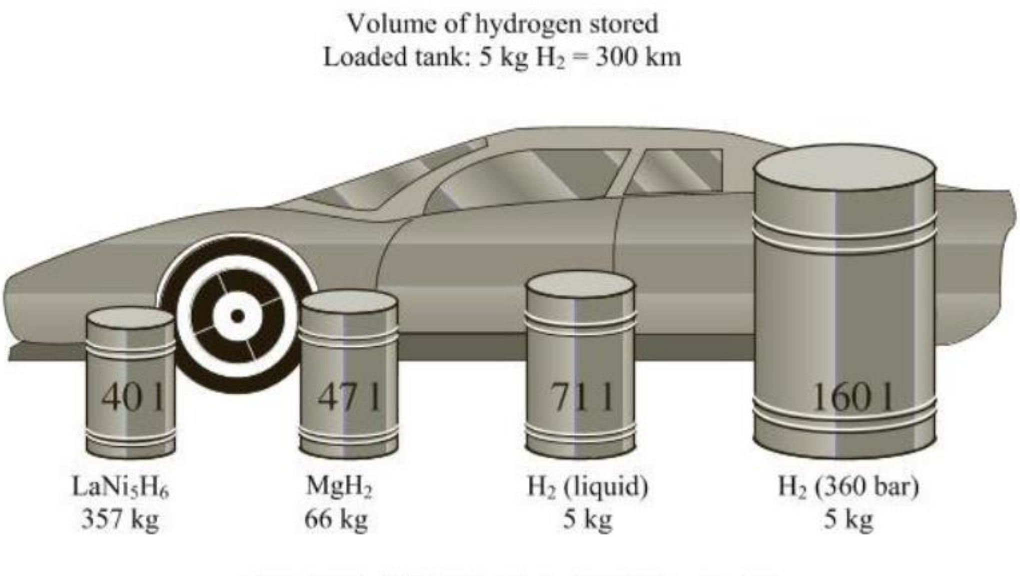


Figure 28: Volume of hydrogen stored im different methods (Fruchart, 2013)

Fruchart (2013) explained that the Figure 29 does not account for the mass of reservoir necessary to produce hydrogen and it shows only material capacity. He also pointed out that Figure 29 does not consider the physical and chemical risks nor the cost; thus, it can be used only to compare capacity of each hydride. (Fruchart, 2013) However, as it can be seen, a great number of materials for solid form hydrogen storage have been studied and tested.

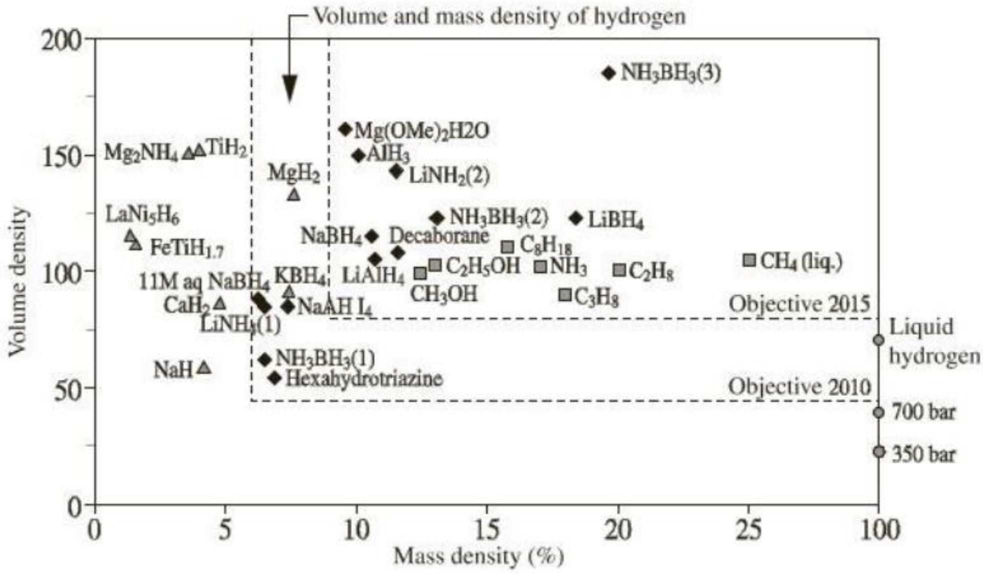


Figure 29: The volume density and mass density in percentage of different materials and methods (Fruchart, 2013)

Figure 30 shows the comparison of energy density among each energy storage method. (Fruchart, 2013) As it can be seen, all hydrogen storage methods; compressed gaseous, liquid and solid (hydrides), have significantly higher density of energy comparing to battery.

Storage mode	Wh/kg	Wh/l
Batteries		
Lead	30	70
NiMH	70	175
Li-metal-ion	100	200
Compressed H_2		
350 bar	2,000	700
700 bar	1,666	1,165
Liquid H_2	1,885	1,400
Hydrides		
Low temperature	535	2,000
High temperature	1,880	1,600
Activated charcoal	2,000	1,000
Hydrocarbon	11,660	8,750

Figure 30:Eenergy density of batteries, compressed hydrogen and hydrides (Fruchart, 2013)

Compressed hydrogen can be transported by trucks and boats. They are the simplest and easiest way to distribute from the hydrogen production or storage sites. However, as it was mentioned above, although hydrogen is compressed at 700 bar, the volume of hydrogen is yet large. Therefore, the hydrogen, which one truck or boat can transport, is quite limited. From technological point of view, it is possible to transport hydrogen with trucks and boats; however, there is another option to deliver hydrogen. It is utilizing existing natural gas pipelines or installing parallel pipelines of hydrogen along gas pipelines.

Melaina et al (2013) stated that hydrogen can be blended into existing natural gas pipeline with 5% to 15% by volume. Haeseldonckx and D'haeseleer (2006) also expressed that injecting up to 17% of hydrogen by volume into natural gas pipelines should not affect the pipelines. Moreover, Harrabin (2020) reported that up to 20 vol% of hydrogen can be added into natural gas pipelines without causing issues. These percentages may vary due to different locations, material used for pipelines, pressures of pipelines and domestic regulations. For example, 5% to 15% case is in the United States, 17% case is in Flanders area, and 20% in Keele, the United Kingdom. Melaina et al (2013) stated that injecting green hydrogen, produced from renewable energy, into natural gas pipeline network can reduce extensive amount of greenhouse gas emission. Murray (2020) added that blending 20 vol% of green hydrogen into natural gas can lead 6 million tons of CO_2 nationwide. The report from Department for Business, Energy & Industrial Strategy (2020) shows that estimated net CO_2 emission in the United Kingdom was 351.5 million tons; thus, 1.7% of CO_2 emission can be reduced by blending hydrogen into natural gas. Haeseldonckx and D'haeseleer (2006) pointed out that energy flow in the pipeline can be affected by ratio between natural gas and hydrogen. The graph below shows how the energy flow changes by increasing the amount of hydrogen in the pipeline.

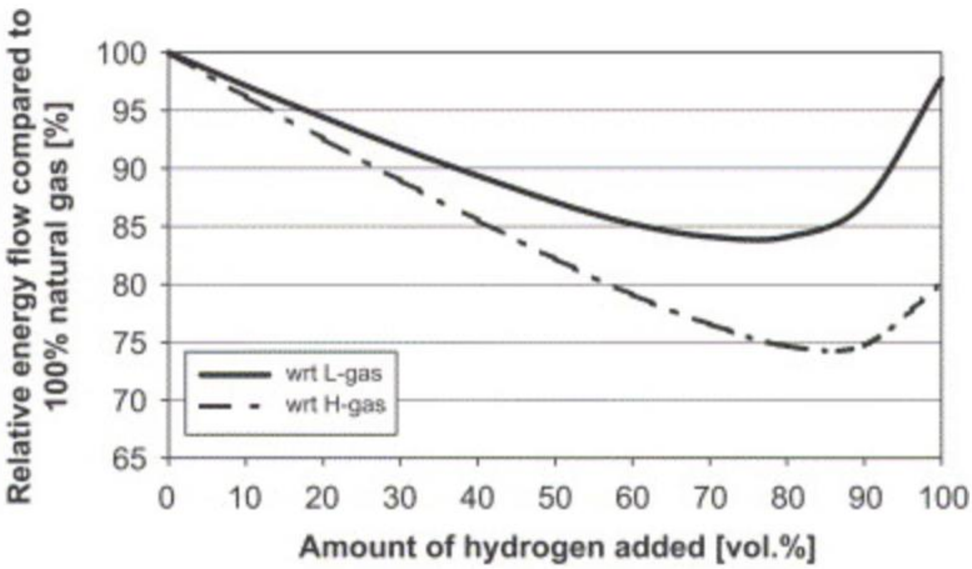


Figure 31: Energy flow of gas pipeline: hydrogen added into natural gas (Haeseldonckx & D'haeseleer , 2006)

According to Figure 31, high-pressure pipelines are affected its flow as it continuously reduces to 75% flow until 90 vol% of hydrogen is added. Although the flow increases again after more than 90 vol% of hydrogen added, the energy flow rate of pure hydrogen can reach only at 80% of pure natural gas energy flow. On the other hand, the decline of energy flow of the low-pressure pipelines by increasing the ratio of hydrogen is gentle and it hits bottom, 85% energy flow, when 80 vol% of hydrogen is blended in. Once the pipeline is filled with 100 vol% hydrogen, energy flow recovers nearly completely, 98% flow rate. This graph indicates that it would be more ideal to utilize existing low-pressure natural gas pipeline rather than high-pressure one. Additionally, in order to retain 95% energy flow, the ratio of the volume of hydrogen needs to be below 20% or above 95% for low-pressure pipelines. Otherwise, modification of pipelines is required. Figure 32 shows where high-pressure pipeline and low-pressure pipeline are used in the distribution system. As it can be seen, natural gas is compressed at the transmission lines or transport grid in order to store and transport more energy efficiently. On the other hand, when it reaches to distribution grid, pressure needs to be low for end-users' applications. (Haeseldonckx & D'haeseleer , 2006)

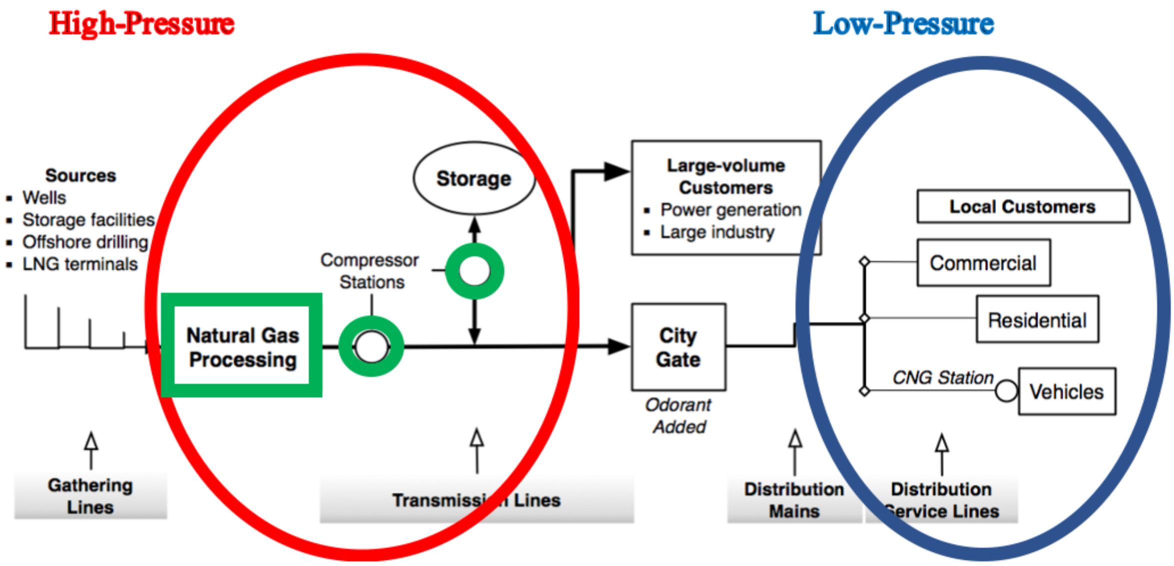


Figure 32: Distribution of gas through gas pipeline network (Haeseldonckx & D'haeseleer , 2006)

In the GRTgaz's report (2019), several technical challenges for hydrogen into natural gas network were pointed out such as tolerance of steel pipes, compressors, dehydration units, metering equipment and downstream equipment as well as economic challenges. Haeseldonckx and D'haeseleer (2006) expressed that drastic transition from natural gas to hydrogen is technically feasible. They provided a historic example in the Europe that city gas, which is a mixture of ½ CO and ½ H_2, was switched over to natural gas overnight. End-use applications were also modified or switched to natural gas compatible units. However, as Haeseldonckx and D'haeseleer (2006) mentioned, this drastic transition occurred in 1960s, and the distribution network was 1/3 of the size comparing to today. In addition, the facts that high-pressure transport grid did not exist back then and significantly a smaller number of end users comparing to today made this transition much simpler than it would be today. Another possibility, which Haeseldonckx and D'haeseleer (2006) suggested, was installing new parallel pipelines for hydrogen transport along the natural gas pipelines as illustrated in Figure 33.

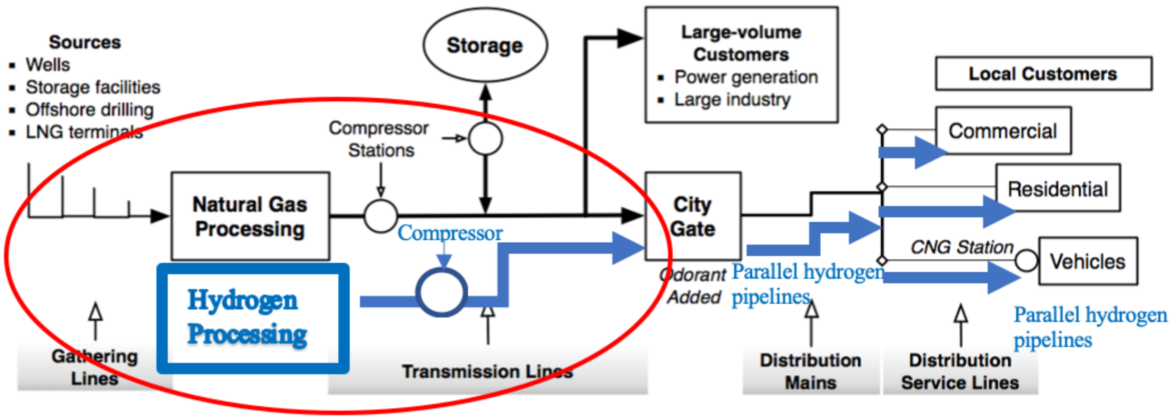


Figure 33: Parallel pipelines of natural gas and hydrogen (Haeseldonckx & D'haeseleer , 2006)

Although they expressed that this option is not realistic due to the lack of the space in the distribution network and extensive cost to build, it is possible to install parallel pipelines partially especially along the high-pressure natural gas pipelines like the red circle in Figure 33. It is because distribution grid is often used in dense area; thus, there can be some space issues for installation. However, transport grid tends to be used for long distance transport; therefore, it is more likely that high-pressure pipelines are deployed in rural area. In such case, a space would not be an issue. Though, the cost issue remains. Haeseldonckx and D'haeseleer (2006) strongly recommended to install piston compressor for hydrogen. It is because hydrogen requires higher pressure rate; thus, it can be problematic to inject hydrogen to high-pressure natural gas pipelines. Melaina et al (2013) stated that nearly all high-pressure pipeline in the United States are made of steel with 4-48 in diameters and operated at pressures of 42 – 84 bar generally and maximum 139 bar. Melaina et al (2013) added that the pressure higher than 139 bar can cause the cracking steel, which is hydrogen-induced. Therefore, modification of existing pipelines or new fully hydrogen compatible pipelines for transport grid is needed if injecting more than 20 vol% of hydrogen. Haeseldonckx and D'haeseleer (2006) emphasized that the most of European nations cannot switch to hydrogen overnight like in 1960s because the grids are connected to the neighbor countries; thus, such decision must be agreed by Europe not by a single country. A hydrogen injection trial in Keele, the United Kingdom, is the one of the unique cases because Keele University has own private gas network; thus, it could be isolated from main grid. (Murray, 2020) Harrabin (2020) reported that Worcester Bosch, a boiler manufacturer, produced the prototype of hydrogen ready boiler. He continued that an engineer can convert the boiler from natural gas boiler to hydrogen boiler within one hour. (Harrabin, 2020) If the government makes the regulations like all new natural gas applications needs to be hydrogen ready by certain year, end-users can be ready for ‘switching to hydrogen’ society.

Instead of blending hydrogen into existing gas pipeline, hydrogen can be stored in the floaters of wind turbines. Snieckus (2019) reported that hydrogen can be stored inside the floater, which is connected to offshore platform. Figure 34 shows the prototype of hydrogen storage within the wind turbine floaters.

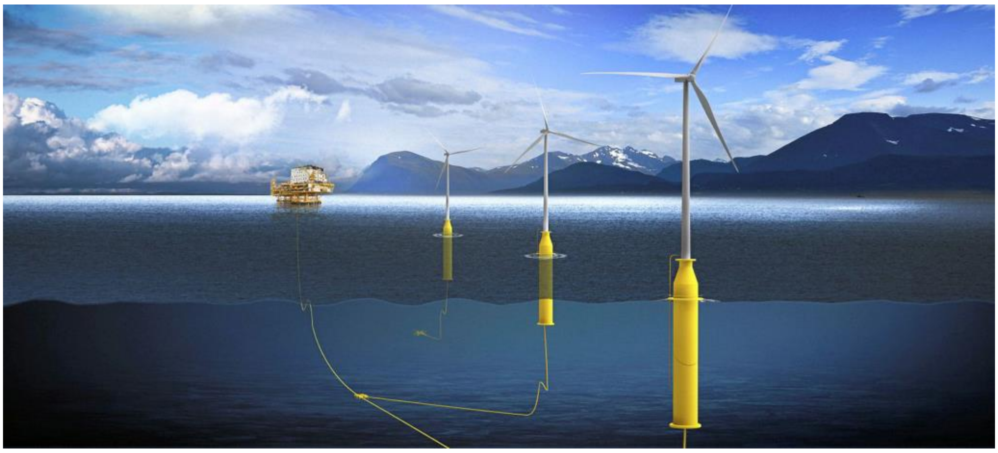


Figure 34: Hydrogen storage within floaters of offshore wind power (Snieckus, 2019)

Hydrogen can be also stored under the sea. Lee (2019) reported that ‘Deep Purple’ project, which places hydrogen tanks on the seabed. Figure 35 shows the project ‘Deep Purple’ and how the hydrogen tanks are laid.

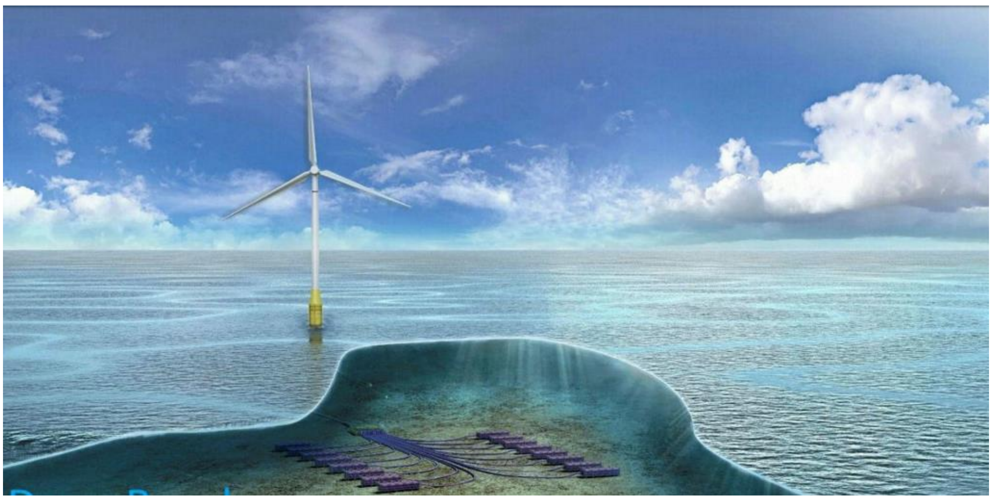


Figure 35: Deep Purple – Seabed Hydrogen Storage (Lee, 2019)

Another possibility is placing hydrogen tank on the floater of the multi-turbine platform, which is that each turbine is connected with beams. The hydrogen tank can be placed in the middle of the multi-turbine platforms.

As it could be seen, there are a number of hydrogen storage solution. Many solutions are still in development phase; however, some potential can be seen in all solutions.

10.1.4 Offshore Power Grid

North Sea Region (n.d.) reported that each offshore wind farms are connected to offshore AC substation with Alternating current (AC). The AC substation is also connected to offshore high voltage direct current (HVDC) converter station and DC cable connects between the DC offshore converter station to onshore converter station. (North Sea Region, n.d.) This is illustrated as Figure 36.

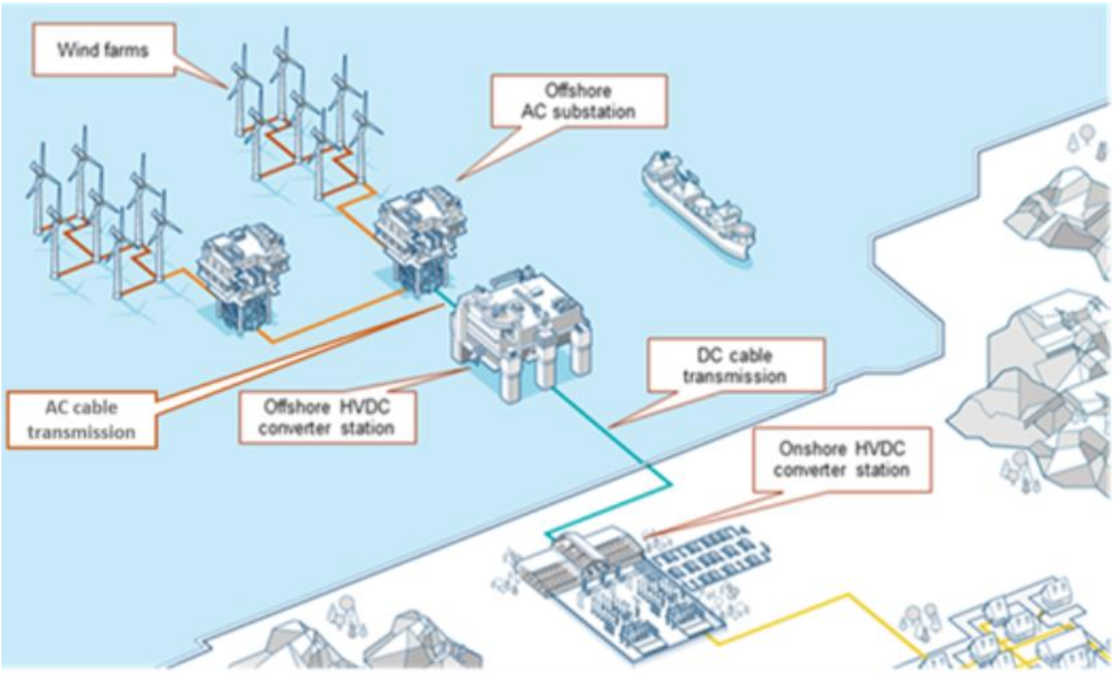


Figure 36: Transmission grid with offshore wind (ABB, 2016)

The location between offshore and onshore tends to be distant. Moreover, extensive electricity can be generated at offshore wind farm. Therefore, the cables connect each site need to be high voltage cables since more electricity can be transmitted with higher voltage cables. It is also significant to consider the energy loss by transmission. IEA (2014) stated that the loss of high voltage AC cable (HVAC) per 1000 km is about 7% while the energy loss of HVDC cable per 1000 km is about 3%. Hence, HVDC cable is suitable for high volume and long-distance transmission. (IEA, 2014) HVAC is more suitable to connect each wind turbines and AC substations due to its characteristics; the current can be shifted. Such flexibility helps to construct smart grid or mesh networks inter region. In addition to the energy loss in transmission line, further energy loss in electricity transmission occurs such as 1% - 2% by a transformer from generator to transmission line, 1% - 2% by transformer from transmission line to distribution networks and 4% - 6% by transformers and cables of distribution network. (EU, 2016) EU (2016) continued that energy loss in transmission is approximately 7% - 10% in developed countries.

Electrification of offshore fields with onshore power on Norwegian Continental Shelf is another option to achieve green offshore fields. Norway has rich reservoir storage for hydro power, and the hydro power can possible supply and meet the energy demand of offshore fields. According to Rystad Energy (2019), the electrification from onshore power has started in 1996.

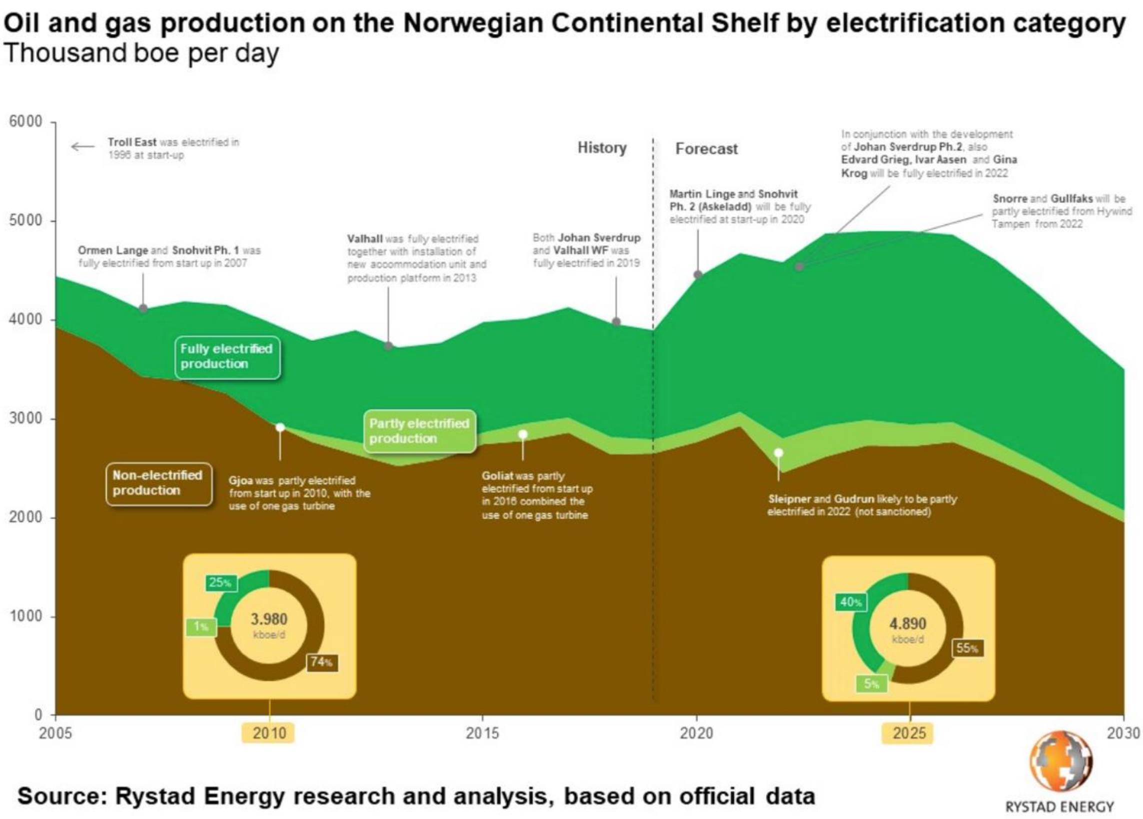


Figure 37: Oil and gas production on the Norwegian Continental Shelf by electrification category (Rystad Energy, 2019)

As Figure 37 shows, close to 50% of offshore fields may be electrified by both connecting to shore power and offshore wind farms by 2025. There are some ongoing projects, the electrification of offshore plants with onshore power on Norwegian Continental Shelf. Equinor (2018) reported that one of the largest Equinor's fields, Johan Sverdrup field, was electrified with power from the shore. The project has kept going, and the offshore power network has been expanding. One of the expansion projects was the electrification of Sleipner field. Equinor (2020) reported that the proposal of development plan, electrification of Sleipner field center, was submitted to the authorities. In this plan, Sleipner field center will be connected to Gina Krog field, which is already connected to Johan Sverdrup with power grid. The planned new offshore network is illustrated as Figure 38.

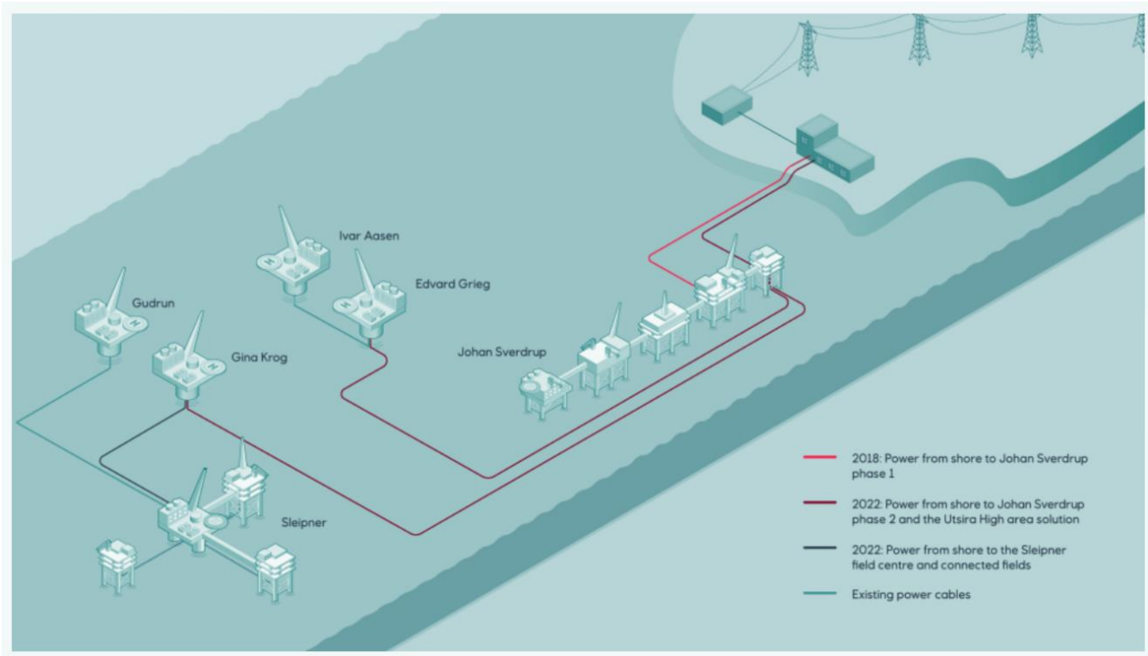


Figure 38: Power from shore to the Utsira High and Sleipner, Gina Krog and Gurden (Equinor, n.d.)

The expansion of the offshore grid network is currently favored technology despite of the transmission loss. This method may be one of the most mature and reliable way to achieve green offshore oil and gas plants. However, the combination of wind turbines and hydrogen has also advantage as it can utilize the existing natural gas pipelines. Technologically, it can be said that both methods are feasible.

10.1.5 Flaring

The World Bank explained that associated gas is produced during the oil extraction as a by-product. Previously, such gas was mostly ignited which is called a routine gas flaring. (The World Bank, n.d.) In the past few decades, some governments and oil companies have invested to develop technology to capture the associated gas. (The World Bank, n.d.) For example, according to CEO of Equinor, Sætre, Norway banned routine flaring in 1971. (Equinor, 2015) It has helped Norway not only to reduce the greenhouse gas emission but also to obtain more gas, which they can export. However, annually, 140 billion m^3 of associated gas is flared through oil extraction in the world. (Equinor, 2015) Hence, although Norway and some other oil producing nations have restricted the routine flaring, majority of countries still continue proceeding the routine flaring.

Flaring, however, has an important role in safety. Oil & Gas UK (2018) stated that flaring can be used to "burn gas that cannot be recovered; prevent over-pressuring; and to rapidly remove the gas inventory during an emergency." In addition, gas venting, which releases associated natural gas to the atmosphere directly, is widely used when the pressure of gas exceeded the safe level. (Oil & Gas UK, 2018) Thus, it can be said that routine flaring can be eliminated; however, flaring and gas venting are required to remain in the system due to the platform's safety mechanism.

10.1.6 Chapter discussion and analysis

In this chapter, the potential renewable energy technologies, which can substitute gas turbines at offshore platforms, were discussed. The key technologies are power grid, wind turbine and hydrogen. Firstly, Johan Sverdrup field, have been electrified and its power grids are planned to be extended to neighbor platforms like Gina Krog and Sleipner. In addition to Johan Sverdrup, Troll A, Gjøa, Vega, Ormen Lange, Valhall, Hod and Goilat have already completed its electrification during past few decades. (Norwegian Petroleum Directorate, 2020) Furthermore, Marting Linge is under development for electrification, and Troll B, Troll C, Oseberg Field Centre and Oseberg Sør are planned to be electrified. (Norwegian Petroleum Directorate, 2020) A number of fields have been connected to shore power with subsea power grid. Despite 6% to 10% energy loss in transmission, it can be said that the technologies of

High Voltage Direct Current (HVDC) and High Voltage Alternating Current (HVAC) are fully developed since its technology is already widely used both on land and under the sea. Hence, this technology may be one of the most reliable technology at this moment in order to replace gas turbines at offshore platforms.

Secondly, offshore wind power has significant potential to enable offshore fields to transform green offshore fields. Although wind power has long history of development, offshore wind turbines has been focused since last few decades. Figure 16 shows how offshore wind turbines have developed in size. The average size of wind turbines in 2000 was only 1.6 MW with rotor size of 43.73 m. The wind turbines, deployed for Hywind Tampen project, are 8 MW capacity with rotor size of 167 m. (Siemens Gamesa, n.d.) During last two decades, the size of rotor has increased almost 4 times. Siemens Gamesa also announced that they are planning to release 14 MW wind turbines with rotor size of 222 m by 2024, which is 5 times larger than 1.6 MW wind turbine and 33% larger than its 8 MW turbine. (Siemens Gamesa, n.d.) As it was mentioned previously, the rotor size is one of the important factors for wind turbine in terms of efficiency. Larger wind turbine has larger sweep area of blades; hence, more kinetic energy can be converted to electrical energy. In other words, ‘size matters’ when it comes to the efficiency of wind turbine. In addition, float technologies have also developed as well as wind turbine technologies. IRENA (2016) stated that if the depth of water exceeds 50 – 60 m, floating foundation has advantages over fixed bottom foundation. Since Norway has deep water along the coastline, development of floating technologies is also the key to deploy offshore wind turbines. Through Equinor’s Hywind projects; Hywind Demo, Hywind Scotland and Hywind Tampen, it seems that offshore wind technologies have developed and improved in terms of size and efficiency. Therefore, it can be said that offshore wind technology is also mature enough to replace the gas turbines at offshore plants.

The last and the most important technology is hydrogen related technologies such as production, fuel cell and storage. As it was discussed, there are some methods to produce hydrogen such as natural gas reform, coal gasification, thermochemical water splitting - solar thermochemical hydrogen (STCH), electrolysis and direct solar water splitting process - photoelectrochemical (PEC). In the previous discussion, it was identified that electrolysis seems the most feasible option for environmental offshore use. The efficiency of Polymer Electrolyte Membrane (PEM) electrolyzer is 80% - 90%, has potential to reach 99.99%, while alkaline electrolyzer has 70% - 80% efficiency. Though these efficiencies can be improved by further development of each technology, it can be said that the efficiency is high enough to be deployed. Fuel cell technology has been spotlighted in the vehicle industry and it has been developed by many companies and researchers. As some hydrogen vehicles have already launched, the maturity of fuel cell technology is at the level that fuel cell can replace the combustion engine in the vehicle. Although, the efficiency of fuel cell is yet about 60%, the technology is ready for manufacturing. The technology of hydrogen storage is also already available. As it was discussed, the characteristics of hydrogen are high energy density and low volume density. Hence, compressing is probably the key method for hydrogen storage. In the car industry, hydrogen is compressed at 350 bar and 700 bar. Liquified hydrogen is also technologically possible; however, it requires - 252.87 °C which is only 20.28 °C higher than absolute zero. As a result, liquid hydrogen is generally used in space such as space station and space shuttle. Technologically, it can be said that hydrogen can be compressed and stored in gas form and even in liquid form. In this thesis, it was suggested to implement reversible fuel cell into the tower of wind turbine, which has extensive empty and abundant space. Despite a number of researches on the reversible fuel cell, which is combined system of electrolyzer and fuel cell, the combined unit has not been fully developed. Therefore, as a combined unit, it can be said that it is not mature. However, even if combined single unit is not fully available, electrolyzer and fuel cell can be connected to work as reversible fuel cell. It may have lower efficiency than combined unit, but reversible fuel cell, which is operated by electrolyzer and fuel cell, can function technologically. Hydrogen tank can be placed within the tower, in the floater, on the floater or even on the seabed. Although these hydrogen related technologies are mature, merged and integrated system can be new; therefore, further study may require. Excessed hydrogen can be injected into existing gas pipeline. Up to 20 vol% of hydrogen can be blended into natural gas without modification of pipeline, and it can result in reduction of the CO^2 emission. Gas turbine may be utilized by using hydrogen as emergency power unit; however, in order to operate gas turbine with only hydrogen, major modification or swapping turbines are required. In addition, technology is not mature; hence, it can be said it is the least feasible technology out of the technologies above.

As a result, technologically, most of solutions such as connecting to shore with power grid, deploying wind turbines, implementing electrolyzer and fuel cell, storing hydrogen and injecting hydrogen into natural gas in the pipeline, are already available or soon to be available. Such technologies enable offshore field to transform to green offshore fields. In other words, it can be said that replacing gas turbine to renewable energy is feasible technologically.

10.2 Economic Analysis

Some data such as total energy consumption of offshore field is essential to estimate the cost of green offshore fields; however, the total energy consumption of all fields could not be found in research papers. Thus, the data, reported to Miljødirektoratet, has been used to find it out. Miljødirektoratet has the data of each offshore field in terms of energy consumption and CO_2 equivalent emission. The data of each field was collected and filled in the table. The data can be accessed by following steps.

Step 1: Access to the following link, the list of offshore fields (Norwegian Environment Agency, n.d.)
https://www.norskeutslipp.no/en/Lists/Overview-facility/?SectorID=700

Step 2: Select and click each field

Step 3: Select and click “Energy use”

Step 4: Select and click “Diesel” under “Energy use”

Step 5: Select and click “Natural gas” under “Energy use”

Step 6: Select and click “Carbon unites” – CO_2 equivalent emission is colored in red in the graph

Appendices 1 - 5 show how much each field emitted CO_2 equivalent greenhouse gases and consumed energy in 2018. The data has limitation due to the lack of such data of some fields on Miljødirektoratet’s database. However, the data of some small fields may be added to the connected or neighbored large fields’ data since they can be the satellite fields of large fields. For example, one of the small fields, Tamber, is connected to the large fields, Ula. Based on the Miljødirektoratet's data, 4,014,507,080 m^3 of natural gas and 240,470 tons of diesel were used for offshore oil and gas extraction while 11,117,190 tons of CO_2 equivalent greenhouse gases were emitted in Norway in 2018. Norwegian Petroleum Directorate (2019) reported the ratio of CO_2 emission among various sources on the platforms. (Figure 39)

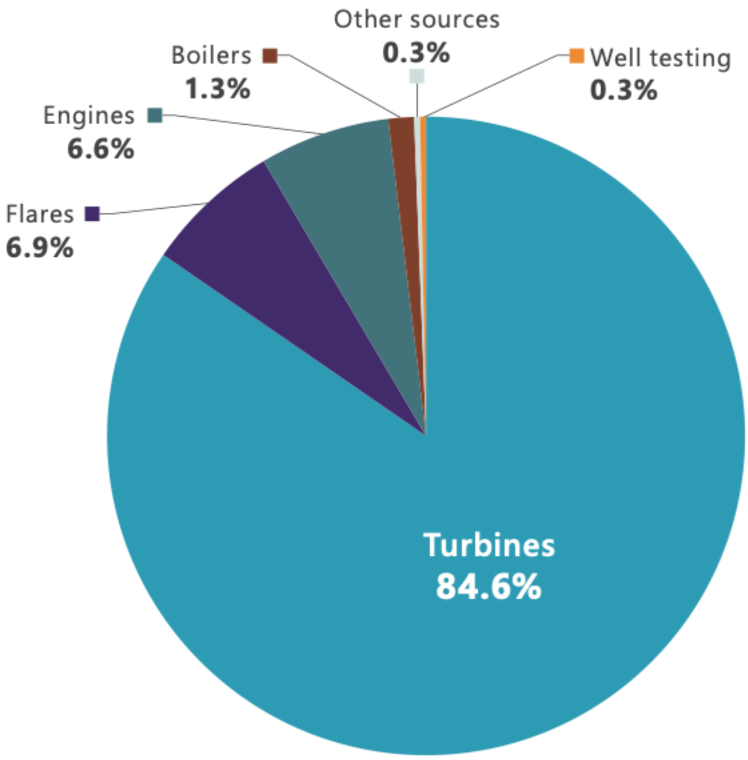


Figure 39: The ratio of CO2 emission among various sources on the platforms (Norwegian Petroleum Directorate, 2019)

As it can be seen, 86.4% of total greenhouse gas emission on the Norwegian Continental Shelf were from turbines while 6.9% from flaring, 6.6% from engines, 1.3% from boilers, 0.3% from well testing and 0.3% from other sources.

As it was mentioned in the beginning of this paper, Statistics Norway (2020) reported that 13.6 million tons CO_2 equivalent greenhouse gasses were emitted from stationary combustion of oil and gas extraction in 2018 whereas Norwegian Environment Agency (n.d.) stated that 11.1 million tons CO_2 equivalent were emitted in offshore petroleum industry. There are 2.5 million tons CO_2 equivalent gap between data from two governmental institutions. This difference can be caused due to two different methods to calculate the greenhouse gases emission, insufficient data available, inclusion of some of oil and gas activities, exclusion of some of oil and gas activities or other possible reasons. It can be said both data is from reliable source; however, the data from Norwegian Environment Agency seems more detailed and probably actual number since oil and gas companies are obliged to report their emission and energy consumption to Norwegian Environment Agency.

10.2.1 Energy consumption on Norwegian Continental Shelf

Statistics Norway (2020) reported that 304 million m^3 of natural gas was used for gas flaring and 6 million m^3 of natural gas was for venting at offshore platforms in 2018. The total of 310 million m^3 of natural gas was used for other purpose than turbines; thus, such amount needs to be subtracted from total consumption of natural gas.

$$4{,}014{,}507{,}080 \text{ m}^3 – 310{,}000{,}000 \text{ m}^3 = 3{,}704{,}507{,}080 \text{ m}^3$$

It can be estimated approximately 3.7 billion m^3 of natural gas was used to generate the electricity at offshore platforms. The energy of natural gas in m^3 can be converted into electricity in kWh as below.

1 Sm^3 = approx 40 MJ = 9.87 kWh (Norwegian Petroleum Directorate, 2019)

(1 Sm^3 = 1 Standard m^3 = 1m * 1m * 1m without pressure)

Although one source states that 1 m^3 of natural gas can be converted to 9.87 kWh, Energids.be stated that 1 m^3 of natural gas can be converted into 9.5278 kWh and 12.7931 kWh depending on the type of the gas. (Energids.be) It seems the conversion between natural gas and electricity varies composition to composition of gas. This limitation needs to be noted.

Natural gas : 3,704,507,080 m^3= 36,563,484,880 kWh

36,563,484,880 kWh of electricity can be generated from 3,704,507,080 m^3 of natural gas if the turbines can generate with 100% efficiency. In reality, it is nearly impossible that gas turbines achieve 100% efficiency especially at offshore platforms, which space is limited and costly. According to Tangerås and Tveiten (2018), the average efficiency of gas turbines at offshore platforms in Norway is about 32% while the highest efficiency of gas turbines is 45%. On the other hand, ABB's report (n.d.), gas-fired power plants at offshore platforms have average 38% energy efficiency at full load. (ABB, n.d.) However, ABB continued that offshore gas turbines rarely run at full load. (ABB, n.d.) Moreover, Mazzetti et al (2014) also stated that many gas turbines at offshore platforms operate at 60% to 70% load. Figure 40 shows the turbine's efficiency rate at different level of load of three types of gas turbines.

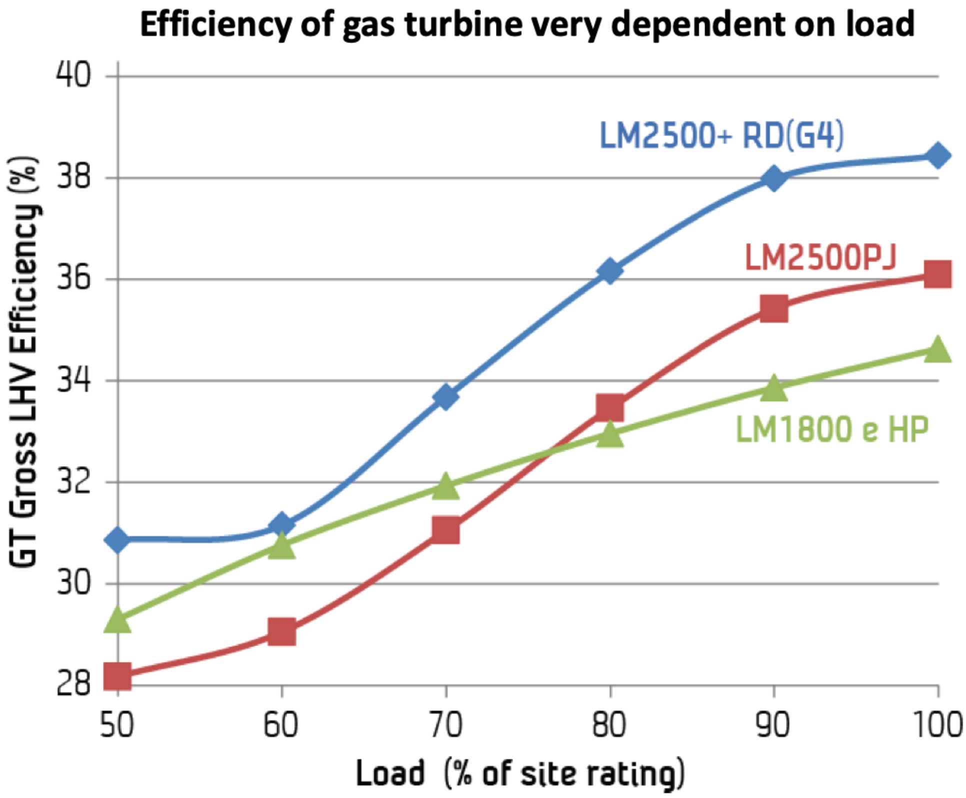


Figure 40: Efficiency of three types of gas turbine (Mazzetti M. J., 2013)

As it can be seen, efficiency of all turbines is around 29% to 31% at 60% of load and 31% to 34% at 70% load. Its average is 31.3%. Thus, gas turbines' average efficiency of 32% on Norwegian Continental Shelf may be verified.

36,563,484,880 kWh * 32% efficiency = 11,700,315,162 kWh = 11,700,315 MWh

As a result, it can be estimated that approximately 11.7 million MWh of electricity was generated and used at offshore platforms in 2018. Average 16,044 kWh of electricity was consumed per household in Norway in 2012. (Statistics Norway, 2014) It means that offshore plants consumed electricity, generated by natural gas, as much as 729,264 Norwegian homes.

11,700,315 MWh / 8760 hours (365 days * 24 hours) = 1,336 MW

As calculation above shows, in order to supply electricity demand at offshore fields through a year, turbines with 1,336 MW capacity and 100% efficiency are required. As it was mentioned earlier, fully efficient turbines are technologically not feasible.

10.2.2 Offshore wind power

10.2.2.1 Power production

According to Wind Europe (2018), the average offshore wind capacity factor is 37%, which includes many small wind turbines. However, if the condition, environment and location for wind turbines are more desirable, capacity factor can achieve 50%. For example, according to Enova, Equinor estimated 49.8% capacity factor in Hywind Tampen project. This capacity factor was found out by calculation below. (ENOVA, n.d.)

88 MW * 8760 hours * n = 384,000,000 kWh

(n is capacity factor)

770,880 MWh * n = 384,000 MWh

n = 384,000 MWh / 770,880 MWh

n = 0.49812 = 49.8%

Equinor’s another offshore wind project in North Sea, Hywind Scotland, has been operated for more than two years, and the company reported that the offshore wind farm has average capacity factor of 56%. (Equinor, 2019) These indicate that if desired location for wind turbines can be found around offshore fields, the capacity factor of wind turbines can be significantly higher that its average in Europe. Although the capacity factor of offshore wind turbines in Europe is 37%, average 50% capacity factor can be achievable with 8 MW or larger wind turbines on Norwegian Continental Shelf; hence, capacity factor will be set as 50% for the calculations.

50% capacity factor of wind turbines

1,336 MW / 37% = 3,611 MW

1,336 MW / 50% = 2,672 MW

If the wind turbines have 37% capacity factor, 3,611 MW capacity of wind turbines is required to substitute the gas turbines on the Norwegian Continental Shelf. On the other hand, if the wind turbines have 50% capacity factor, 2,672 MW capacity of wind turbines is needed. Siemens Gamesa has launched 11 MW and 14 MW wind turbines, which will be delivered by 2022 and 2024 respectively. However, only up to 8 MW offshore wind turbines are currently available from Siemens Gamesa.

Today: Siemens Gamesa 8 MW wind turbines

2,672 MW / 8 MW = 334 (avg 50% capacity factor)

2022 onward: Siemens Gamesa 11 MW wind turbines

2,672 MW / 11 MW = 243 (avg 50% capacity factor)

2024 onward: Siemens Gamesa 14 MW wind turbines

2,672 MW / 14 MW = 189 (avg 50% capacity factor)

334 of 8 MW wind turbines are required to replace natural gas turbine. In addition, the required number of wind turbines can be reduced to 243 of 11 MW wind turbines and about 189 of 14 MW wind turbines in the near future. This is the case that electricity to the existing

offshore fields is supplied by only offshore wind turbines. However, the fields, which are already electrified with shore power, will most likely continue being connected with onshore.

10.2.2.2 Initial installation cost

Capital expenditure of offshore wind turbine installation has been reduced dramatically over a decade. Equinor, is one of the front runners in offshore wind industry, has launched Hywind demo project in 2009 and Hywind Scotland project in 2017. Neville (POWER, 2009) reported that according to Equinor, the cost of 2.3 MW Hywind demo project was about 400 million NOK. It is roughly 174 million NOK per MW. In addition, Equinor announced that the cost of their 30 MW (6 MW x 5 turbines) Hywind Scotland project was around 2 billion NOK. It is approximately 67 million NOK per MW. (Equinor, n.d.) The cost reduction was about 62%. Holter (2019) reported that Equinor's next and ongoing 88 MW (8 MW x 11 turbines) offshore wind project, Hywind Tempen, will cost nearly 5 billion NOK. This is around 57 million NOK per MW and its reduction in cost from Hywind Scotland is about 15%. Hence, the cost reduction from Hywind demo to Hywind Tempen is approximately 68%.

Kikuchi and Ishihara (2019) compared the cost efficiency among three example projects of 100 MW floating offshore wind turbines; 2 MW x 50 wind turbines, 5 MW x 20 wind turbines and 10 MW x 10 wind turbines. Figure 41 shows the cost breakdown of each example.

	Unit	2 MW × 50	5 MW × 20	10 MW × 10
Design	[€k /kW]	0.1	0.1	0.1
Wind turbine	[€k /kW]	1.0	1.2	1.2
Floater	[€k /kW]	2.3	1.3	1.0
Mooring line	[€k /kW]	1.6	0.6	0.4
Installation cost	[€k /kW]	2.8	1.1	0.5
Cable	[€k /kW]	0.6	0.6	0.6
Initial Capital cost	[€k /kW]	8.4	4.9	3.8
Annual O & M cost	[€k /kW/year]	0.22	0.14	0.11

Figure 41: Estimated initial cost of offshore wind installation (Kikuchi & Ishihara, 2019)

As it can be seen, the initial cost of offshore floating wind turbines includes the cost of design, wind turbines, floater, mooring line, installation cost and cable. Based on this comparison, it seems that deploying larger wind turbines is more cost efficient due to less expenditure for floater, mooring line and installation cost. 1 EUR was about 10 NOK in January 2019 when their research was published. In addition, 1 MW is equal to 1000 kW. Thus, each Hywind projects can be converted to 17.4 €k per kW, Hywind Scotland for 6.7 €k per kW and Hywind Tampen for 5.7 €k per kW. Comparing between ten 10 MW turbines example and Hywind Tampen, the cost of Hywind Tampen is estimated rather higher. Tangerås and Tveiten (2018) also pointed out that Equinor's estimate was set higher than their calculation, which was 3.9 billion NOK. It is about 44 million NOK per MW, which is equal to 4.4 €k per kW. Hence, it can be said that Equinor may be expecting some complications during the development and set some buffer in their cost estimate. The calculations below are based on moderate and high capacity factor of Siemens Gamesa's 8 MW wind turbines and theoretical cost estimate and cost estimate with buffer.

Theoretical cost estimate (Tangerås and Tveiten model)

44 million NOK * 2,672 MW = 118 billion NOK (avg 50% capacity factor)

Cost estimate with buffer (Equinor's model)

57 million NOK * 2,672 MW = 152 billion NOK (avg 50% capacity factor)

As it can be seen, 118 billion NOK to 152 billion NOK may be needed to develop offshore wind farms to eliminate gas turbines from offshore platforms in Norway.

10.2.3 Gas turbines

GE have provided 'hydrogen calculator' which can estimate how much hydrogen is required to operate the specific model of their gas turbines. Moreover, they estimate percentage of hydrogen in the gas based on operational hours and CO_2 tax rate of the country. Tangerås and Tveiten (2018) stated that Gullfaks and Snorre use twelve GE's LM2500 turbines. The load is approximately 60% average (Tangerås & Tveiten, 2018) which is equivalent to 5,256 hours.

Percentage of hydrogen will be set as 100%. The CO_2 tax for natural gas combustion on Norwegian Continental Shelf is 730 NOK per ton (Brenna, 2020) which is equivalent to 74 USD (Currency rate of 1 USD = 9.8 NOK, 28th May 2020). The required hydrogen to operate a single GE's LM2500 was calculated with this tool. (Figure 42 and Figure 43)

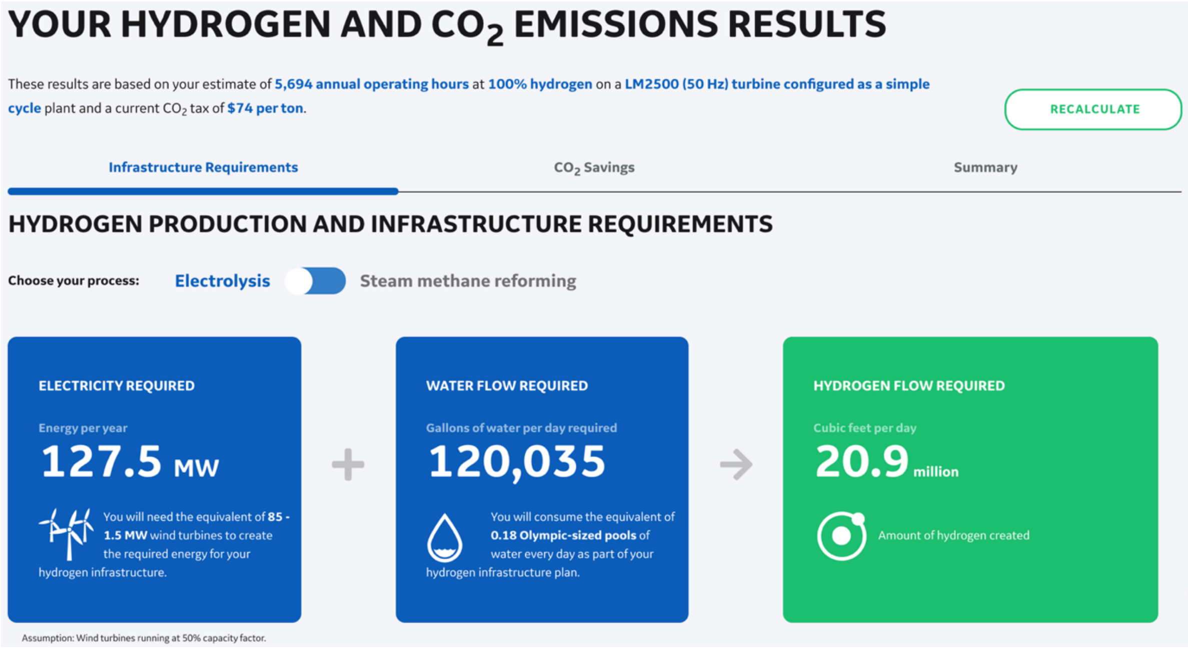


Figure 42: Estimated hydrogen and CO_2 emissions of GE's gas turbines (GE, n.d.)

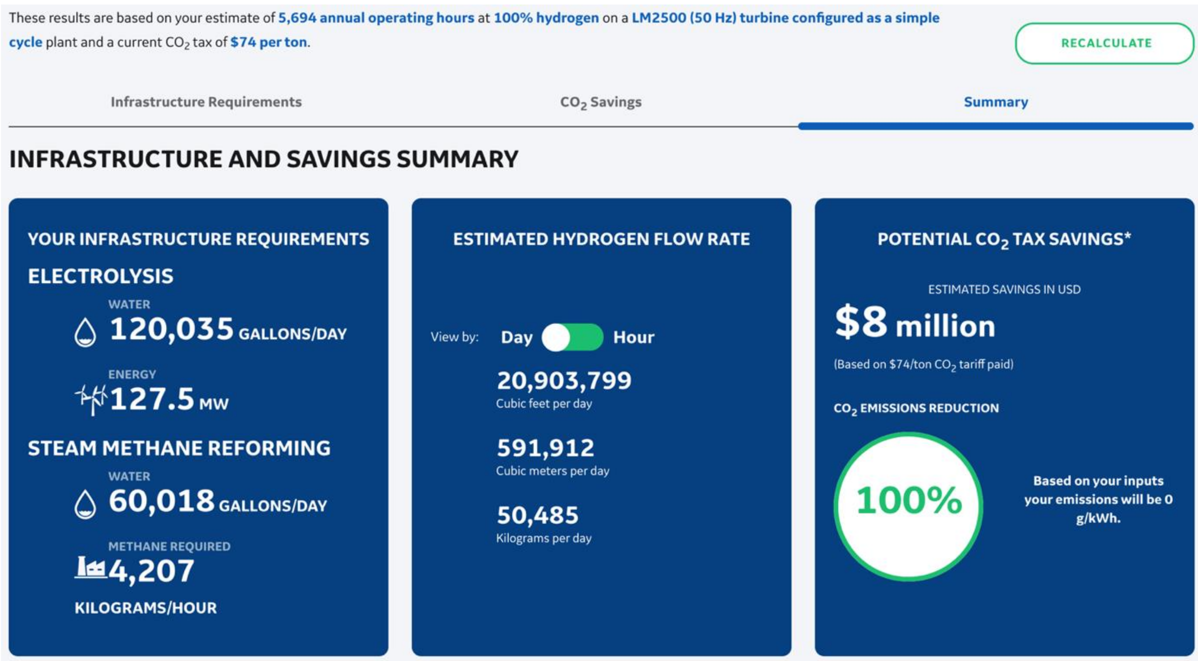


Figure 43: Estimated hydrogen and CO_2 emissions of GE's gas turbines (GE, n.d.)

As it can be seen, in order to run the LM2500 as it does with natural gas now, almost 21 million cubic feet of hydrogen is required. This can potentially reduce CO_2 tax extensively as nearly 8 million USD can be saved. However, a LM2500 turbine requires 127.5 MW electricity. Gullfaks and Snorre have twelve LM2500; hence, total of 1,530 MW capacity of electricity is required. It is 17 times larger capacity of Hywind Tempen, which can supply 30% of energy consumption to both Gullfaks and Snorre. Moreover, as ETN global (2020) stated, the cost of major modification can be extensive. As a result, it can be said that utilizing gas turbines is highly uneconomical.

10.2.4 Power cable from shore

10.2.4.1 Distance from shore

Equinor (2018) announced that one of their largest fields, Johan Sverdrup, was connected to the shore power in October 2018. The field became one of the electrified fields; Troll A, Gjøa, Ormen Lange, Valhall and Goilat. (Norwegian Petroleum Directorate, 2020) Norwegian Petroleum Directorate (2020) added that Vega is electrified via Gjøa, Hod via Valhall, and Marting Linge is under development. Furthermore, Troll B, Troll C, Oseberg Field Centre, Oseberg Sør, Sleipner and the Melkøya onshore facility are planned to be electrified. (Norwegian Petroleum Directorate, 2020) In addition to Johan Sverdrup, Gina Krogh, Ivar Aasen and Edvard Greig will also be connected to shore power via Johan Sverdrup. (Frøde, 2018)

Since the cost estimate is not the author's expertise, the cost of cable installation from shore will be calculated in simplified way. Therefore, there may be some difference between the estimated cost in this paper and actual cost.

Each field was categorized by geographical location as Figure 44: North Sea, Figure 45: Norwegian Sea and Figure 46: Barents Sea show. Major fields in each group, estimated used capacity of gas turbines in MW and the approximate distance from the shore are listed below. The electrified fields are in bold. The fields, planned to be electrified, are underlined.

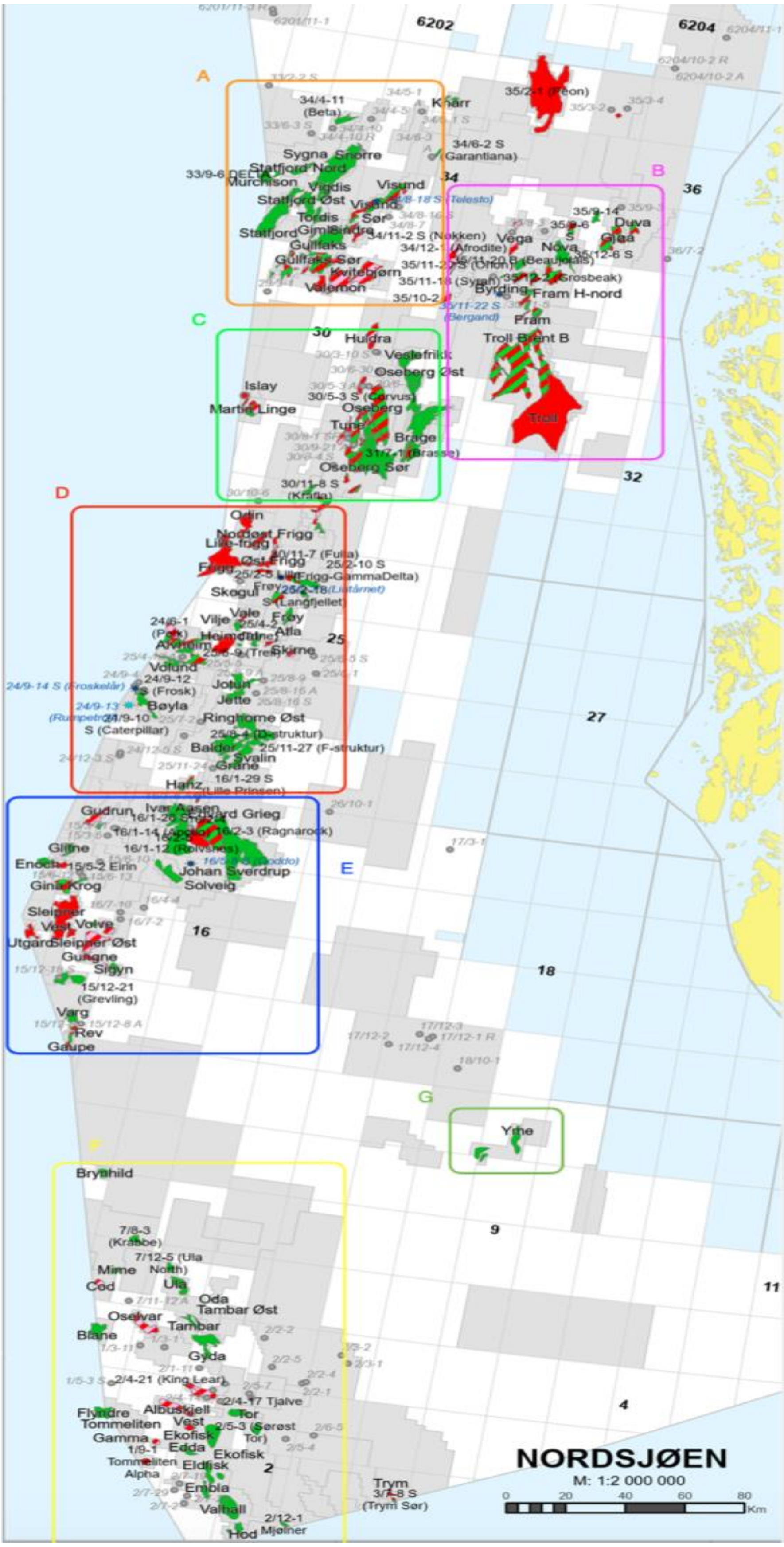


Figure 44: Oil and gas fields in North Sea (Norwegian Petroleum Directorate, 2019)

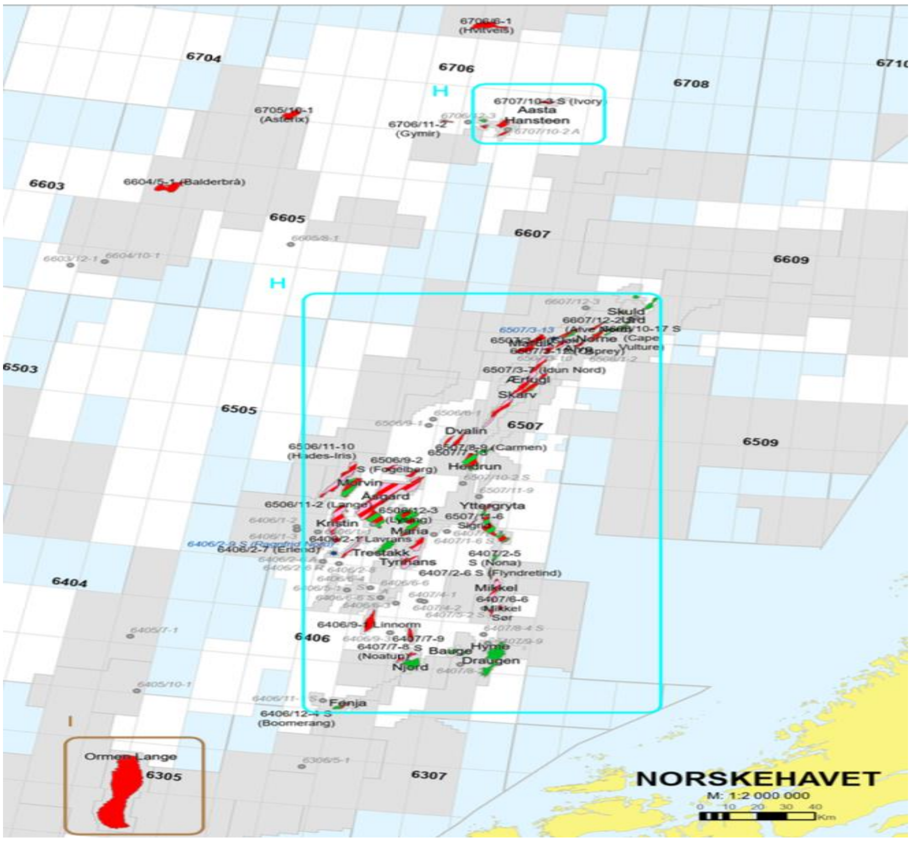


Figure 45: Oil and gas fields in Norwegian Sea (Norwegian Petroleum Directorate, 2019)

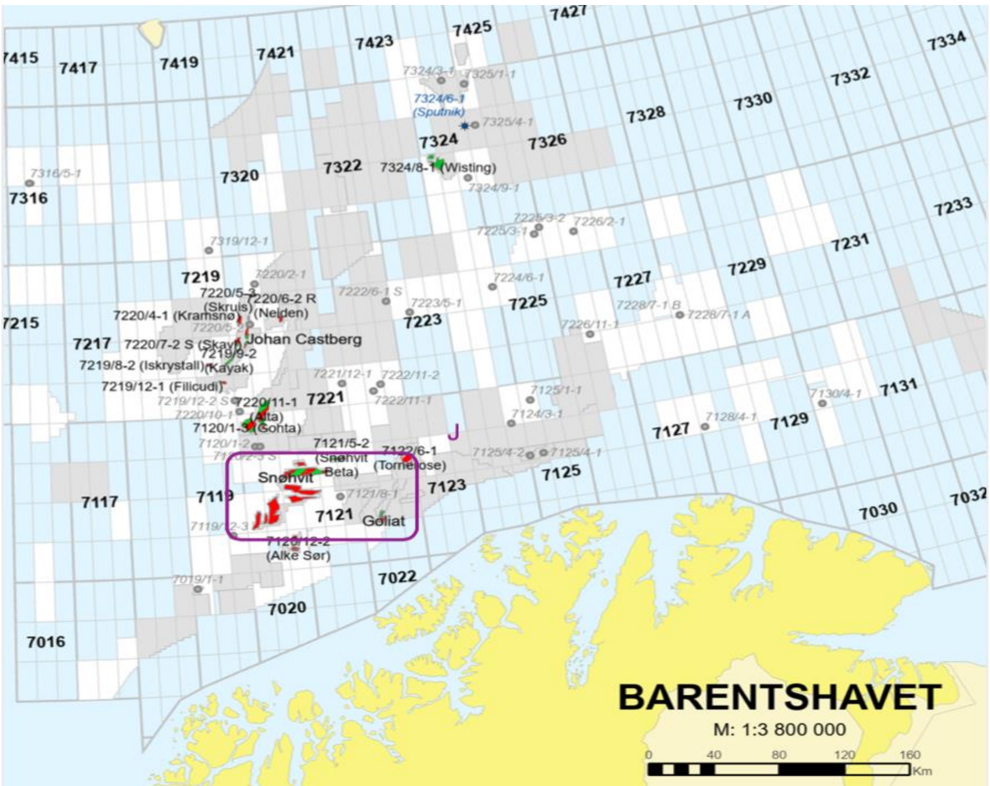


Figure 46: Oil and gas fields in Barents Sea (Norwegian Petroleum Directorate, 2019)

Group A: Gullfaks (Hub), Knarr, Kvitebjørn, Snorre, Statfjord & Visund – 694 MW : 160 km (Multiconsult, n.d.)

* Hywind Tampen 88 MW will be connected to Gullfaks and Snorre.

Group B 1: **Gjøa**, **Troll A** – 65 km (Equinor, n.d.)

Group B 2: <u>Troll B</u> (Hub) & <u>Troll C</u>– 116 MW : 80 km (Equinor, n.d.)

* Troll B - Kollsnes may be connected with 80 km cable and Troll B and C with 17 km cable.

Group C: Brage, **Martin Linge,** <u>Oseberg</u> (Hub), <u>Oseberg Sør</u>, Oseberg Øst & Veslefrikk – 362 MW : 130 km (Equinor, n.d.)

Group D: Alvheim, Balder, Grane (Hub), Heimdal & Jotun – 176 MW : 185 km (Equinor, n.d.)

Group E: <u>Edvard Greig</u>, <u>Gina Krog</u>, **Johan Sverdrup** (Hub), <u>Sleipner Vest</u> & <u>Sleipner Øst</u> – 302 MW : 140 km (Equinor, n.d.)

Group F: Ekofisk (Hub), Eldfisk, Gyda, Ula & **Valhall** – 287 MW : 290 km (Store Norske Leksikon, n.d.)

Group G: Yme (Hub) - - 110 km (Beerenberg, 2020)

Group H: Draugen (Hub), Heidrun, Kristin, Norne, Skarv & Åsgard – 629 MW :1500 km (Store Norske Leksikon, n.d.)

Group I: **Ormen Lange** (Hub)- - 120 km (Shell, n.d.)

Group J: **Goilat** (Hub) & Snøhvit – 6 MW : 85km (Equinor, n.d.)

Assumption 1: One of the fields of each group is connected to shore as a hub platform.
Assumption 2: The satellite fields, do not have the data of natural gas consumption, are already connected to main fields.

Assumption 3: The capacity of a hub field of Group A, B, C, D, F and H will be set as 650 MW. By doing so, some facilities will be capable of future expansion or development of new field nearby.

Note 1: Group B was divided to two since Gjøa and Troll A were already electrified, and Troll B and C may be directly connected to shore.

Note 2: The cost of electrification of Group E and G are already estimated; thus, each data will be added in the end.

Note 3: The electrification of Group B 1, Group I and a major part of Group J are already completed; thus, Group I and J will be excluded from this calculation.

The capacity of 100 MW cables Johan Sverdrup and Haugsneset, which is about 200 km apart. (Equinor, 2018) Equinor (2018) also announced that they plan to expand the capacity of power from to 300 MW in 2022. Førde (2018) reported that Equinor estimates 12 to 14 billion NOK to the electrification project of Utsira High. The cost includes 30 MW turbine in case the delay of electrification. (Equinor, 2015) NKT were chosen to supply and install 200 MW / 80 kV 200 km long cable for Johan Sverdrup field in the phase 2 of its electrification project. (Equinor, 2018) Just a little over 1 billion NOK was the budget in the contract. (Equinor, 2018) Equinor (2020) also announced that the estimated cost of electrification of Gina Krog is 640 million NOK for 62 km AC cable. Moreover, Equinor (2020) budgeted 850 million NOK for 28 km HVAC cable at Sleipner field. Taraldsen (2014) also reported that the electrification cost of following fields. The electrification of Gjøa costed 650 to 700 million NOK for 55 MW capacity and 105km of HVAC cable in 2007. (Taraldsen, 2014) At Valhall fields, electrification cost was 1.8 billion NOK for 78 MW capacity and 296 km of HVDC cable in 2011. (Taraldsen, 2014) The electrification of Troll A costed 240 million NOK for 30 MW capacity and 70 km of HVAC cable. (Taraldsen, 2014) At Goilat, the electrification cost was 1.3 billion NOK for 60 MW and 106 km of HVAC cable. (Taraldsen, 2014) Lie (2013) reported that Siemens signed the contract to install the 55 MW and 161 km HVAC cables to the Martin Linge field for 500 million NOK. The cost of Ormen Lange could not be found. Equinor (2020) announced that Aker Solutions was awarded for the Frond End Engineering Design of the electrification of Troll B and C. The study involves connecting Troll B and Kollsnes with 116 MW 80 km cable. In addition, the technical requirement and capital expenditure of connecting Troll B and C with 17 km cable will also be studied. (Equinor, 2020)

Yme field is currently closed; however, Aker Solutions estimated the cost of electrification of Yme field in 2017. (Aker Solutions, 2017) According to the report, the capital expenditure of the project was estimated at around 2.4 billion NOK. (Aker Solutions, 2017) The peak load of 54 MW, 114 km subsea cable and 12 km onshore power cable were accounted into this estimate. (Aker Solutions, 2017)

As Ulsund (2009) mentioned in his research, the selection of cables; HVAC vs HVDC, depends on the specific case. The distance, power and capacity need to be accounted into the selection. Johan Sverdrup phase 2, Goilat and Martin Linge electrification projects were added to the original figures of Ulsund's (2009) and Aker Kværner's (2008)(Figure 47)

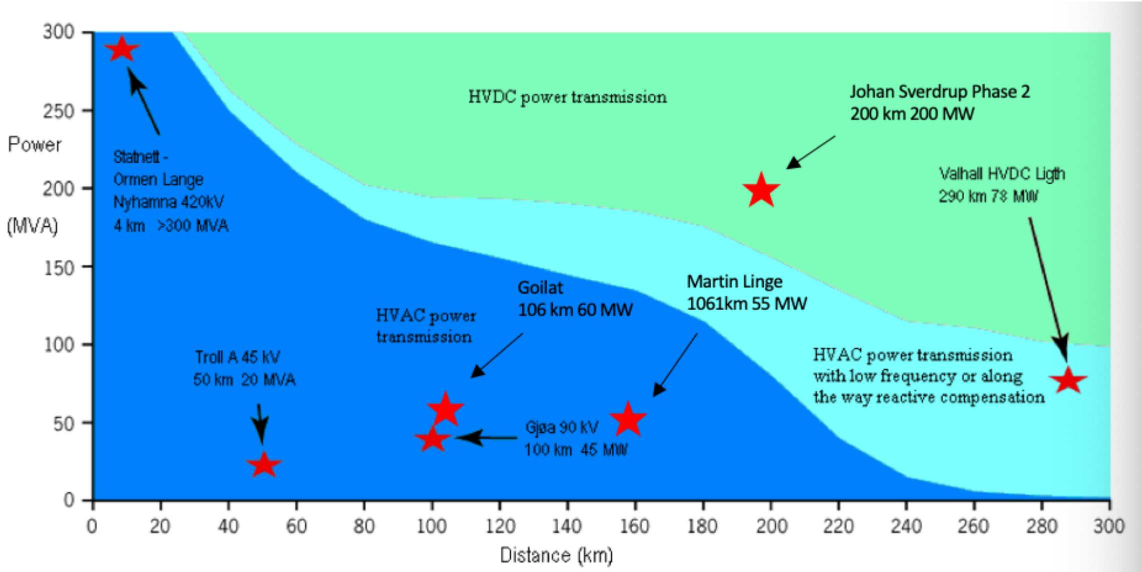


Figure 47: Indication of transmission capacity as a function of cable length (Aker Kværner Engineering and Technology, 2008)

Electrification projects above fitted precisely into this model. Based on this model, HVAC cable will be selected for Group B, and HVDC cable will be chosen for Group A, C, D, F and H. In addition, HVAC will be selected to connect all fields to a hub or a neighbor field except connection between Draugen field and Åsgard, which will be connected with HVDC. The distance between field and hub, shore or neighbor field was calculated and listed in Appendices 4 and 5.

The total distance of HVDC cable of each group is listed below.

Group A: 160 km

Group B: -

Group C: 130 km

Group D: 185 km

Group F: 290 km

Group H: 225 km

The total distance of HVAC cable of each group is listed below.

Group A: 105 km

Group B: 97 km

Group C: 78 km

Group D: 65 km

Group F: 87 km

Group H: 125 km

The references for distance to neighbor field are listed below.

Group A:

Knarr (Oil and Gas Journal, 2015), Kvitebjørn (Norwegian Petroleum, n.d.), Snorre (Tangerås & Tveiten, 2018), Statfjord (Equinor, n.d.) and Visund (Equinor, n.d.)

Group B:

Gjøa (Norwegian Petroleum, n.d.)

Group C:

Brage (Equinor, n.d.), Oseberg Sør, Oseberg Øst (Equinor, n.d.) and Veslefrikk (Norwegian Petroleum, n.d.)

Group D:

Alvheim (Norwegian Petroleum, n.d.) and Jotun (Norwegian Petroleum, n.d.)

Group F:

Eldfisk (Conoco Phillips, n.d.), (Harris & Stone, 1990) and Ula (Norsk Oljemuseum, 2016)

Group H:

Skrav (Equinor, n.d.), Skrav (PGNiG, n.d.), Heidrun (Norwegian Petroleum, n.d.), Kristin (Norwegian Petroleum, n.d.) and Åsgard-Draugen (Norwegian Petroleum Directorate, 2006)

10.2.4.2 Installation cost of power cable from shore

Hardy et al (2019) researched that the cost of High Voltage Direct Current (HVDC) cable and High Voltage Alternating Current (HVAC) cable. The graph below shows the cost of 650 MW capacity HVDC and HVAC cable for the specific distance. Based on this graph, the cost of electrification of each group was estimated in Figure 48.

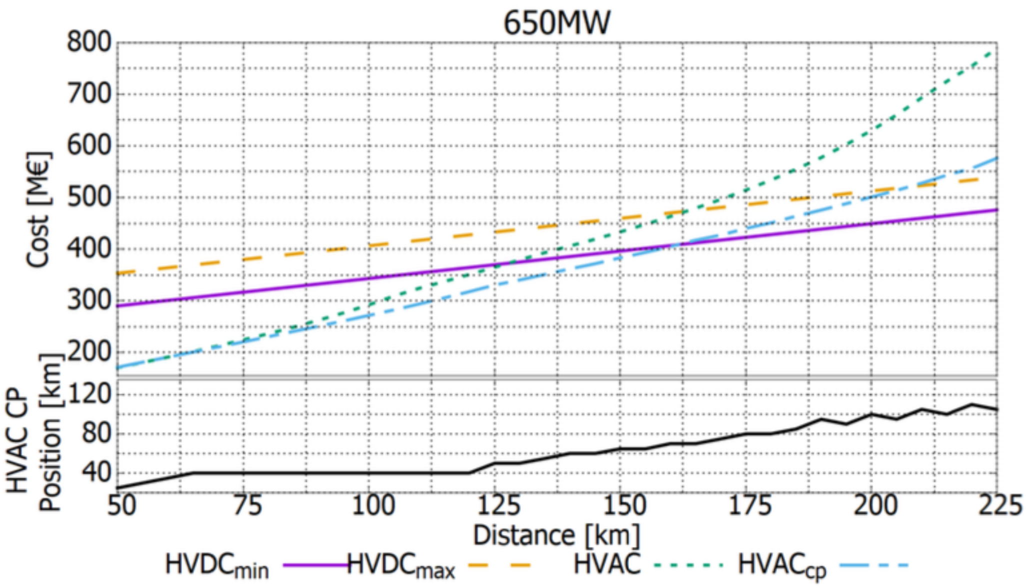


Figure 48: Initial Cost Comparison among HVDC and HVAC (Hardy, Van Brusselen, Hendrix, Van Hertem, & Ergun, 2019)

Currency rate of 1EUR = 11 NOK, 18th May 2020

Group A

Installing the cable to Group A (160 km to a hub) would cost approximately 4.5 billion NOK (410 million EUR) with HVDC cable and 3.1 billion NOK (280 million EUR) with HVAC cable. Total of 7.6 billion NOK.

Group B *

Installing the cable to Group B (80 km to a hub) would cost approximately 2.8 billion NOK (259 million EUR) with HVAC cable.

Group C

Installing the cable to Group D (130 km to a hub) would cost approximately 4.3 billion NOK (395 million EUR) with HVDC cable and 2.3 billion NOK (208 million EUR) with HVAC cable. Total of 6.6 billion NOK.

Group D

Installing the cable to Group D (185 km to a hub) would cost approximately 4.8 billion NOK (435 million EUR) with HVDC cable and 1.9billion NOK (174 million EUR) with HVAC cable. Total of 6.7 billion NOK.

Group F

Installing the cable to Group F (290 km to a hub) would cost approximately 5.9 billion NOK (540 million EUR) with HVDC cable and 2.6 billion NOK (232 million EUR) with HVAC cable. Total of 8.5 billion NOK.

Group H

The cable installation cost of Group H (225 km to a hub) would be around 5.2 billion NOK (475 million EUR) with HVDC cable and 3.7 billion NOK (334 million EUR) with HVAC cable. Total of 8.9 billion NOK.

The sum of estimated electrification cost of all fields is 54.1 billion NOK.

Group A: 7.6 billion NOK + Group B: 2.8 billion NOK + Group C: 6.6 billion NOK + Group D: 6.7 billion NOK + Group E: 12 billion NOK + Group F: 8.5 billion NOK + Group H: 8.9 billion NOK = 54.1 billion NOK

The estimated cost of Group E, Utsirahøyen - Johan Sverdrup, seems extensively higher comparing to other groups. However, Lie (2014) expressed that Add Energy estimated the cost of the project as 6.69 billion NOK. Lie (2014) added that Equinor rejected the Add Energy’s estimate but refused to show the detail of their cost estimation. Lie (2014) also pointed out that Equinor budgeted 9 billion NOK for the project although contracts with ABB and Aibel were total 6.5 billion NOK. Furthermore, Equinor added contingency budget of 3 billion NOK, approximately 25% of total budget. (Lie, 2014) Thus, it seems that 5.5 billion NOK out of 12 billion NOK budget was set as buffer by Equinor.

10.2.4.2.1 Limitation

- Limited available data of electrification of offshore fields since some data is classified.
- Hydro power on shore may be required expansion or modification to increase its capacity. The longer cable may be required to connect to suited location on shore. These potential extra costs are not considered in this cost estimate.
- Uncertain cost due to complication is not considered in this estimate.
- Estimated cost of Group C, D and F included large buffer of energy capacity; thus, if the cables were installed based om current demand of capacity, the cost could be lower than this estimate
- There are many methods and formula to estimate the cost of electrification; thus, the estimated cost may differ a method to a method.

Therefore, it can be said that estimating the cost of electrification of all fields is extremely difficult since the all required data cannot be obtained since some information may be confidential. However, based on available data, it may be able to say that total cost of electrification of offshore fields on Norwegian Continental Shelf is about 50 billion NOK.

10.2.5 Energy storage

10.2.5.1 Required extra electricity from wind power

Neill & Hashemi (2018) stated that the wind turbine requires minimum and maximum wind speed to generate electricity, which is 3.5 m/s and 25 m/s respectively. Blade does not rotate with any wind below 3.5 m/s. (Neill & Hashemi, 2018) In addition, wind turbine stops to rotate for safety reason when the wind exceeds 25 m/s. (Neill & Hashemi, 2018) Figure 49 shows the relationship between wind speed and electricity generation of wind turbines. As it can be seen, when wind speed exceeds 3.5 m/s, wind turbine starts generating electricity. When wind speed hits 12 m/s to 14 m/s, wind turbine generates maximum capacity of electricity. However, when wind blows 25 m/s or higher, then wind turbine stops due to technical and safety reasons.

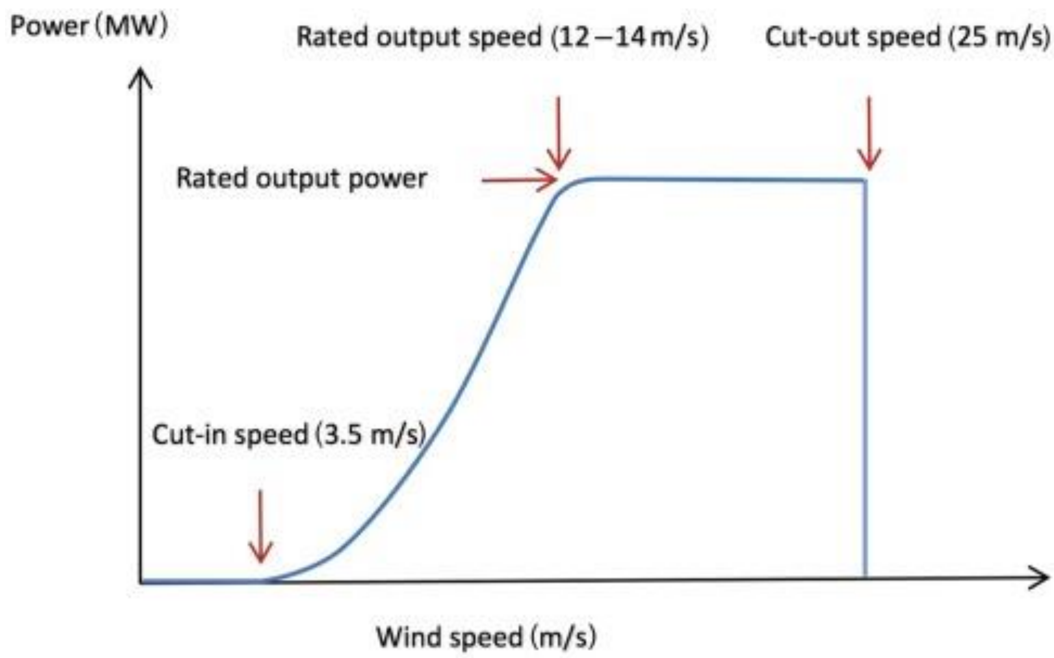


Figure 49: Productivity of Wind Turbines based on wind speed (Neill & Hashemi, 2018)

The wind data of Ekofisk, Gullfaks C, Heimdal, Sleipner A, Troll A, Heidrun, Aasta Hansteen and Draugen was obtained on Seklima.met.no. (Norsk Klima Service Senter, n.d.) Detailed data can be seen in Appendies 6 - 52. The number of days that maximum wind speed did not exceed 3.5 m/s and the number of days that average wind speed did not exceed 3.5 m/s in the past 12 months are listed in Figure 50.

Fields	# of days maximum wind speed below 3.5 m/s	# of days average wind speed below 3.5 m/s	# of consecutive days average wind speed below 3.5 m/s
Ekofisk	1 day	23 days	3 days
Gullfaks C	5 days	30 days	4 days
Heimdal	3 days	35 days	4 days
Sleipner A	3 days	19 days	2 days
Troll A	1 day	39 days	3 days
Heidrun	6 days	27 days	3 days
Aasta Hansteen	3 days	18 days	3 days
Draugen	4 days	26 days	3 days

Figure 50: Number of days of zero or low possibility to generate electricity by wind turbines at several offshore fields on Norwegian Continental Shewlf in 2019-2020

Considering the data above, the energy for 4 to 5 days needs to be stored for the case wind dies out. 52% of energy would be lost during the cycle of reversible fuel cell, and this will be explained in the efficiency of reversible fuel cell. 52% of energy loss through a reversible fuel cell cycle means that electricity for 8 to 10 days needs to be input, which is equivalent to around 3% of annual energy consumption. Thus, 3% of the electricity consumption on Norwegian Continental Shelf in 2018, 11,700,315 MWh, is 351,009 MWh.

10.2.5.1.1 Limitation

Wind data of only 8 offshore fields was available; hence, estimated power to be stored can be changed if the wind data of all offshore fields are available. There may be significant difference of wind speed and consistency a field to a field.

10.2.5.2 Reversible fuel cell

10.2.5.2.1 Efficiency

As Kumar and Himabindu (2019) expressed, PEM electrolysis has 80 to 90% energy efficiency while Alkaline electrolysis has 70 to 80 % efficiency. Thus, it can be said that both types of electrolyzer have around 80% efficiency in electrolysis process. Fuel cell, on the other hands, have slightly lower energy efficiency as it is up to 60%. (U.S. Department fo Energy, 2015) As a result, one cycle of energy efficiency is 48%. These efficiency rates are illustrated as Figure 51.

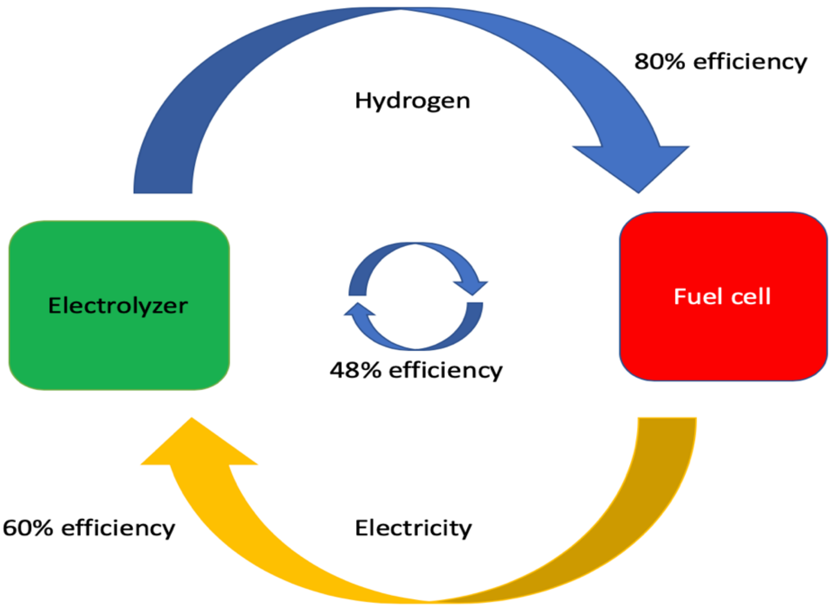


Figure 51: Efficiency of one cycle of reversible fuel cell

This means that output will be nearly half of input after one cycle. For example, if 100 MWh of electricity, which is generated by offshore wind turbines, supplied into electrolyzer, 80 MWh equivalent hydrogen can be produced. If 80 MWh equivalent hydrogen were put into fuel cell, 48 MWh electricity can be generated. As a result, nearly half of energy will be lost during a cycle.

10.2.5.2.2 Installation cost of electrolyzer

10.2.5.2.2.1 Capacity base cost estimate

Berger (2017) reported that the capital expenditure of 1 MW capacity of PEM electrolyzer costs 525 EUR (5,775 NOK) per kW. He added that 455 EUR (5,005 NOK) per kW for 5 MW PEM electrolyzer and 420 EUR (4,620 NOK) per kW for 10 MW. (Berger, 2017) Nel, Norwegian renewable energy company, announced that the estimated cost of their 400 MW giga factory of electrolyzer is up to 175 million USD and 0.45 million USD per MW, which is equivalent to 450 USD (4,410 NOK) per kW. (Nel, 2020) (Nel, 2017) Thus, the cost range of 1 MW to some hundreds MW capacity of electrolyzer is around 4.5 million NOK to 6 million NOK per MW today. The size of Siemens's 1.25 MW capacity of electrolyzer, Silyzer 200, is 6.3 m x 3.1 m x 3.0 m. (Siemens, 2016) (Figure 52) This can be fitted into the tower of 8 MW – 14 MW Siemens's wind turbines.

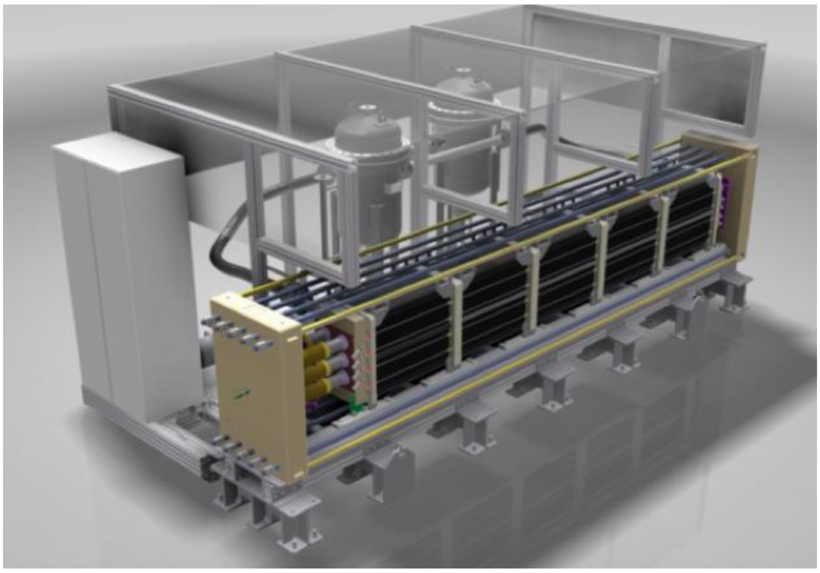


Figure 52: SILYZER 200 / Electrolyser basic system (Siemens, 2016)

80 MW * 4.5 million NOK to 6 million NOK = 360 million NOK to 480 million NOK

10.2.5.2.2.2 Quantity base cost estimate

The required number of wind turbines to replace gas turbines at each field was estimated previously. Based on the estimate, 334 of 8 MW wind turbines, 243 of 11 MW wind turbines or 189 of 14 MW wind turbines would be needed. If reversible fuel cell system is integrated into each wind turbine, its cost would be the amount below.

334 wind turbines* 4.5 million NOK to 6.0 million NOK
= 1.5 billion NOK to 2 billion NOK

243 wind turbines * 4.5 million NOK to 6.0 million NOK
= 1.1 billion NOK to 1.4 billion NOK

189 wind turbines * 4.5 million NOK to 6.0 million NOK
= 850 million NOK to 1.1 billion NOK

10.2.5.2.3 Installation cost of fuel cell

10.2.5.2.3.1 Capacity base cost estimate

On the other hands, Alshehri et al (2019) stated that the capital cost of PEM fuel cells is between 1.5 million EUR (16.5 million NOK) and 3 million EUR (33 million NOK) per MW. In addition, Nikkei BP reported that Toshiba's 1 MW fuel cells, H_2One^{TM} cost approximately 100 million JPY, which is equivalent to 9 million NOK. (Currency rate of 1 NOK = 11 JPY, 28th May 2020) (Nikkei BP, n.d.) Momota (2015) also reported that Toshiba is aiming to set the price for 1 MW H_2One^{TM} around 100 million JPY (9 million NOK) after increasing its production to 50 units per year. Hence, it can be said the cost range can be between around 10 million NOK and 30 million NOK per MW. The size of fuel cell is about same as 20 feet container. (Toshiba, 2019) The dimension of 20 feet standard container is 6.1 m x 2.4 m x 2.6 m. (Container Container, n.d.) 1 MW fuel cell can also be fitted into the tower of 8 MW or larger wind turbines. Figure 53 is Toshiba's H_2One^{TM}.

Figure 53: Toshiba’s H2OneTM (Yao, 2020)

Source: Yao, 2020

80 MW * 10 million NOK to 30 million NOK = 800 million NOK to 2.4 billion NOK

10.2.5.2.3.2 Quantity base cost estimate

334 wind turbines* 10 million NOK to 30 million NOK
= 3.3 billion NOK to 10 billion NOK

243 wind turbines * 10 million NOK to 30 million NOK
= 2.4 billion NOK to 7.3 billion NOK

189 wind turbines * 10 million NOK to 30 million NOK
= 1.9 billion NOK to 5.7 billion NOK

10.2.5.3 Hydrogen Tank

10.2.5.3.1 Space

Produced hydrogen can be stored in the tower of wind turbines. The height of tower was generally around 100 m as it was mentioned in previous chapter. Although reversible fuel cell, electrolyzer and fuel cell, is placed lower level of tower as well as control panel of wind turbines and transformers, the majority of space in the tower is probably still available. If higher level of tower, total of 80m, is available, the available volume can be calculated as below.

Assumption 1: Width of tower of Siemens' 8 MW wind turbines is 10 m at widest
Assumption 2: Mid height width is 75% of widest and top height width is 50% of widest based on LaNier's data (2005)
Assumption 3: A quarter of tower is used for fuel cell unit, transformer and control pane

$$(10 \text{ m} * 87.5\% - 10 \text{ m} * 50\%) / 2 * 3.14 * 75 \text{ m} = 6.875 * 3.14 * 75 \text{ m}$$
$$= 1619 \text{ m}^3$$

Thus, 1619 m^3 of space is probably available in the upper level of tower. At least a quarter of circle of the tower needs to be utilized for ladders and elevator; however, the three quarters can be used for hydrogen tank. It means that hydrogen can be stored in approximately 1214 m^3 of space. In the previous chapter, it was found out that 351,009 MWh of energy needs to be stored in order to supply enough power to platforms due to the change of weather condition. It can be converted to 351,009,450 kWh.

In the previous calculation, it was found out that 334 of 8 MW wind turbines are needed; hence, the required energy storage of each wind turbine can be calculated as below.

$$700{,}800{,}000 \text{ kWh} / 334 \text{ wind turbines} = 1{,}050{,}926 \text{ kWh}$$

According to Hydrogen Europe, density of hydrogen in atmosphere is 0.0899 kg/m^3. Furthermore, its density is 15.6 kg/m^3 at 200 bar and 33 kg/m^3 at 500 bar. (Hydrogen Europe, n.d.) 1kg of hydrogen is equivalent to 33.3 kWh. (Hydrogenics, 2018)

Hydrogen storage at atmosphere pressure

$$1214\ m^3 * 0.0899\ kg/m^3 * 33.3\ kWh/kg = 3{,}634\ kWh$$

Hydrogen storage at 200 bar

$$1214\ m^3\ 15.6\ kg/m^3 * 33.3\ kWh/kg = 630{,}649\ kWh$$

Hydrogen storage at 500 bar

$$1214\ m^3 * 33\ kg/m^3 * 33.3\ kWh/kg = 1{,}334{,}065\ kWh$$

As it can be seen, if the hydrogen is stored within the tower, it requires to be compressed at 500 bar in order to store enough to supply the electricity to the offshore plants. As a result, the cost of compressor need to be added.

10.2.5.3.2 Cost of compressor

National Renewable Energy Laboratory (2014) stated that the cost of hydrogen compressor is between 695,000 USD and 1,409, 000 USD, which are equivalent to 6.8 million NOK and 13.8 million NOK based on currency rate of 1 USD = 9.8 NOK, 28th May 2020. Thus, the total cost of compressor for 334 of 8 MW wind turbines would be calculated below.

6.8 million NOK * 334 wind turbines = 2.28 billion NOK

13.8 million NOK * 334 wind turbines = 4.6 billion NOK

Furthermore, the hydrogen tank needs to be well insulated; hence, the material can be also costly. However, as it was discussed in the technological chapter, there can be more options to store the hydrogen in the offshore such as utilizing the floater and seabed hydrogen storage. There is not sufficient financial data for such technologies; hence it is unable to estimate the cost.

10.2.5.3.2.1 Limitation

The cost of both electrolyzer and fuel cells may have been estimated high, especially in quantity base cost estimate. It is because the required capacity of energy storage for 8 MW, 11 MW and 14 MW is 240 kW, 330 kW and 420 kW respectively based on that 3% of energy storage required. Therefore, the units with smaller capacity can be used instead of 1 MW system. It enables to reduce the cost. In addition, as Toshiba mentioned, cost of manufacturing can be reduced if the units can be mass-produced.

10.2.6 Hydro power in Norway

According to international hydropower association (iha - international hydropower association, 2017), the installed hydropower capacity is 31,626 MW including 1,392 MW with pumped storage and 144 TWh of electricity was generated by hydropower in 2016. (iha - international hydropower association, 2017) Approximately 10% of electricity, 16.5 TWh, was exported to neighbor countries. (iha - international hydropower association, 2017) This indicates that 16.5 TWh can be consumed domestically if it is needed. As it was estimated previously, 11,700,315 MWh, which is equivalent to 11.7 TWh, was generated by gas turbines on Norwegian Continental Shelf. EU (2016) pointed out that roughly 10% of energy can be lost in transmission.

$$11.7 \text{ TWh} / 0.9 \text{ (10\% loss)} = 13 \text{ TWh}$$

If 13 TWh can be supplied, it would be sufficient to operate offshore plants in Norway. Thus, it can be said that Norway already has enough onshore energy capacity to meet the energy demand on NCS. The capacity of hydro power plant may continue increasing since Statkraft has invested 1.95 billion USD, which is equivalent to 19.1 billion NOK (Currency rate of 1 USD = 9.8 NOK, 28th May 2020), to their power stations. (iha - international hydropower association, 2017) Moreover, iha (2017) reported that in 2016, Norway approved 35 new hydropower plants with the capacity of 154 MW.

10.2.7 Investment

Governmental investment organization, Enova, published their annual report of 2019. (ENOVA, 2019) Their overall investments to environmental projects of past three years are listed in Figure 54.

Sector/activity	2017	2018	2019	Total
	NOK million	NOK million	NOK million	NOK million
Industry	423	397	1 054	1 873
Transport	927	780	998	2 706
Energy system	190	158	2 869	3 217
Non-residential buildings and property	416	407	323	1 146
Households and consumers	165	275	334	773
International	2	4	1	8
Consultation and communication	53	44	48	145
External analyses and development measures	38	20	29	87
Administration contribution	157	155	159	470
Total	**2 371**	**2 239**	**5 815**	**10 426**

Figure 54: Climate and Energy Fund's allocations (ENOVA, 2019)

According to Enova's report (2019), 2 to 5 billion NOK has been spent by Enova through the Climate and Energy Fund. Between 2018 and 2019, Enova's investment to Energy system has increased rapidly from 158 million NOK to 2.9 billion NOK. It is because Enova invested 2.3 billion NOK to Equinor's Hywind Tampen project. (ENOVA, 2019) Norwegian government stated that the purpose of Enova is to assist companies and organizations to tackle the barriers to entry to the energy and environment market. (Government Norway, n.d.) Thus, it may be doubtful that Enova continue investing the vast amount to offshore wind when the companies obtain competitiveness in the market. However, public and private investment banks started showing their interests in green economy. Government Norway (n.d.) stated that the energy and environment sectors have received over 700 million EUR, which is more than 40% of the funding for sustainable growth in Europe. European Investment Bank (n.d.) also announced that the EIB group aims to invest 1 trillion EUR to environmental and climate action projects next a decade. European Commission (n.d.) also announced that EU will invest over 10 billion EUR to support innovative low carbon technologies via Innovation Fund by 2030. Norton (2020) reported climate change was one of the key topics in World Economic Forum in Davos. She added that Bank of America Israel estimated the climate solutions market may increase from 1 trillion USD to 2 trillion USD by next 5 years. (Norton, 2020) In addition, divestment from fossil fuels has also been discussed. (Norton, 2020) Hence, they may consider investing to green offshore oil and gas platforms as contradicted, so some investment banks may step back from the projects. Although some investors may stay away from green offshore projects, it is likely that oil and gas still remain as key energy sources next some decades. Therefore, some investors may be interested in this project, which is transitional project from fossil society to green society.

10.2.8 Tax saving

10.2.8.1 CO_2 tax on Norwegian Continental Shelf

Brenna (2020) reported that Ann-Cathrin Vaage from Equinor stated that the company pays 730 NOK per ton of CO_2 as CO_2 emission tax. According to Miljødirektoratet, 11,117,190 ton CO_2 equivalent was emitted on Norwegian Continental Shelf. Approximately 85% of emission came from turbines.

$$11{,}117{,}190 \text{ ton} * 85\% = 9{,}449{,}611 \text{ ton}$$

Approximately 9.5 million tons of CO_2 was emitted from turbines in NCS.

$$9{,}449{,}611 \text{ ton} * 730 \text{ NOK} = 6{,}898{,}216{,}030 \text{ NOK}$$

Annually, the oil and gas companies pay around 7 billion NOK due to a CO_2 emission tax. It seems that the vast amounts of 7 billion NOK can be eliminated by replacing gas turbines to renewable energy. As many political parties consider increasing greenhouse gas emission tax, it will be more than 7 billion NOK if the gas turbines are replaced to renewable energy over next some years.

10.2.9 Chapter discussion and analysis

The electricity consumption on Norwegian Continental Shelf in 2018 was estimated as 11,700,315 MWh (11.7 TWh) based on the natural gas consumption. In order to supply such demand, extensive investment is needed; thus, the initial cost of installment of each technology; subsea power grid, offshore wind turbines and reversible fuel cell, was estimated.

Firstly, the installation cost of electrification with onshore power was estimated as 54.1 billion NOK. This estimate was based on many assumptions above and had a number of limitations as listed previously; thus, there might be quite a gap between this estimated cost and the actual installation cost. The question here is that whether 54.1 billion NOK for electrification is doable or not. As it was discussed, if the electrification is completed, almost 7 billion NOK of tax can be reduced every year. It means that the cost can be paid back within 8 years if the operation cost is not considered. As a result, if it is expected to recover oil and gas in the field for more than 10 years, it can be beneficial for oil and gas companies to invest in electrification with shore power. However, this cost estimate does not include the cost of electricity consumption. Hence, the cost of cable installation may look reasonable, but return of investment may take longer than 10 years due to additional electricity bill. Since 95% of electricity is generated by renewable energy, hydro power, in Norway, connecting to shore power can mean the electricity used at offshore field came from renewable energy source. In addition, as it was mentioned, iha (2017) stated that approximately 16.5 TWh, was exported to neighbor countries. Even if 10% of electricity is lost in transmission, 14.85 TWh can be consumed domestically if Norway does not export electricity. It is more than electricity consumption on Norwegian Continental Shelf in 2018, 11.7 TWh. As a result, offshore platforms, connected to shore power, can be considered as green offshore platforms. It seems electrification with shore power is the most popular method to reduce greenhouse gas emission for oil and gas companies in Norway since as it was mentioned, more than 10 fields are already electrified or planned to be electrified. However, if electricity demand increases onshore in Norway or neighbor countries press Norway to export electricity, it may exceed the capacity of hydro power plants. In fact, Figure 55 shows, the electricity consumption has been increasing over some decades. (NVE - Norges vassdrags- og energidirektorat, 2018) Although energy efficiency of new technologies such as home appliances have improved dramatically since 1976, popularity of electric vehicle (EV) in Norway may push the curve of electricity consumption upwards.

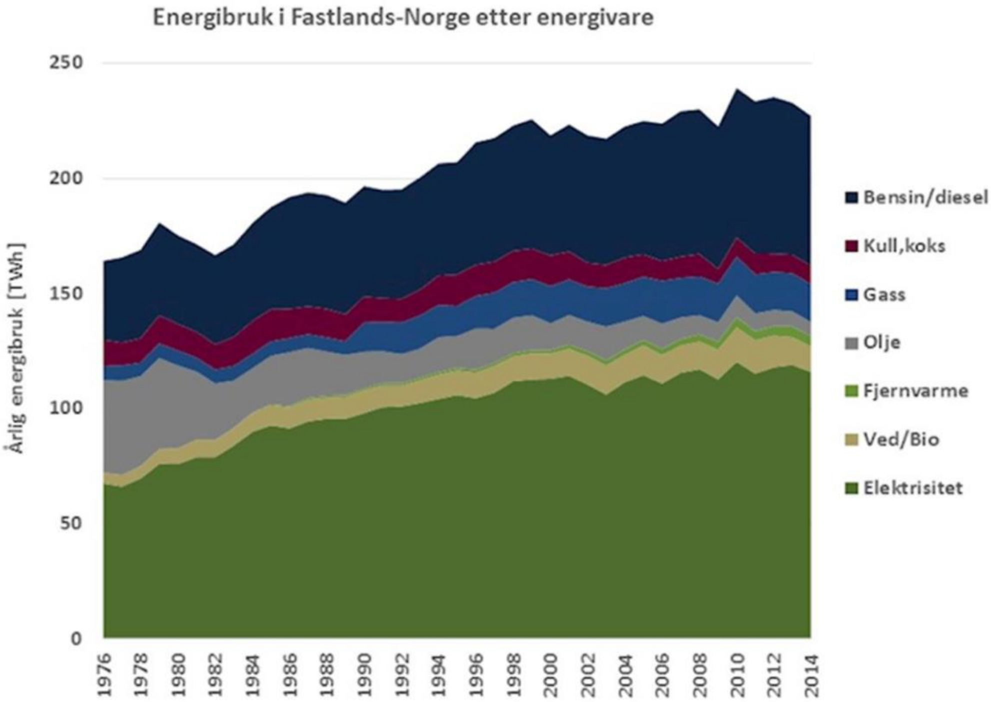


Figure 55: Energy consumption in mainland Norway by energy product (NVE - Norges vassdrags- og energidirektorat, 2018)

Therefore, further development of hydro power plant or other renewable may be required to meet the electricity demand in Norway. Such cost is not included in this cost estimate; however, it is important to be noted since the extra cost can be extensive.

Secondly, the cost of installation of offshore wind turbines, which can generate sufficient electricity to supply offshore plants, was estimated in this chapter. The estimated cost of 334 wind turbines, capacity of 8 MW each, was somewhere between 118 and 152 billion NOK. Comparing to connecting to shore power with power cables, the estimated cost is twice to three times higher. In order to pay back the cost, it may take 16 years to 22 years by saving CO^2 tax. However, the differences between electrification with onshore power and offshore wind turbines is its versatility and reusability. For example, when oil and gas run out in the field, the platforms would be demolished, and the subsea cables would be collected. The money invested for the subsea cable can no longer be paid back. However, wind farms can remain where they are located after demolition of plants and continue generating electricity. Since offshore wind turbines have been spotlighted for the high potential renewable energy for Europe, the possibility of that the offshore wind turbines can be reused to supply electricity for other users in the future may attract public and private investors. The potential investors can be Enova, European Investment Bank, A Just Transition Fund, private investment banks, oil and gas companies, power companies and other companies, which are seeking to enter energy industry. EU estimated a total of 1 trillion EUR, which is equivalent to 11 trillion NOK (currency rate of 1EUR = 11 NOK, 18th May 2020), will be invested over next 10 years for their project, the European Green Deal. (European Comission, 2019) Oil and gas company, Equinor, seeks to lead the offshore wind industry through Hywind projects. Investing and developing offshore wind technologies are probably part of the company's R&D of renewable energy. The developed offshore wind technologies and systems can be exported to the countries and regions, where have gales and deep water along the coastline, such as Japan, the United States, the United Kingdom, Australia, South-East Asia, and Northern Europe. Although the estimated initial expenditure is higher than electrification with shore power, financial potential regarding profitability in long run is worthy of note.

Thirdly, and the most importantly, the key of success to deploy the offshore wind turbines, which substitute gas turbines at offshore fields, can be the energy storage. Wind power fully relies on weather condition. As a result, when the wind dies out or too strong wind blows, wind turbines stop to rotate. However, at offshore platforms, the electricity is continuously demanded for its oil and gas extraction activities, living space, air conditioning and so on. It is crucial that electricity is continuously supplied to the field; hence, the energy needs to be stored for when wind turbines stopped to generate electricity or generated insufficient electricity for the platforms. Hydrogen was focused in this thesis due to high affinity with existing gas pipeline and wind turbines in offshore setting. Electrical energy can be converted to hydrogen with an electrolyzer, and the cost of 1 MW capacity of PEM electrolyzer was estimated around 4.5 million NOK to 6 million NOK. Fuel cell generates electricity with hydrogen, and the cost of 1 MW capacity of fuel cell unit was estimated around 10 million NOK to 30 million NOK. Since the electrolyzer functions almost reversed fuel cell, these two systems can be combined. The combined system of electrolyzer and fuel cell is called reversible fuel cell. The cost information of reversible fuel was limited; thus, the cost of each unit of electrolyzer and fuel cell, which have 1 MW capacity, will be used for analysis. The estimated cost of 1 MW capacity of reversible fuel cell was 14.5 million NOK to 36 million NOK. This system is compact enough to be implemented within the tower of 8 MW wind turbines; hence, the estimated total cost to install the reversible fuel cell in the 334 wind turbines was 4.8 billion NOK to 12 billion NOK. As it was discovered previously, the capacity of 3% of energy consumption needs to be stored. The estimate was based on the wind data at eight offshore fields and the efficiency of one cycle of reversible fuel cell, which is approximately 48%. In order to store such amount of hydrogen within the tower of wind turbine, hydrogen needs to be compressed at 500 bar. Although the space in the floater can also be utilized for hydrogen storage, it requires additional cost of compressor, which was estimated around 2.28 billion NOK and 4.6 billion NOK. These costs would be an additional cost to the wind turbines; however, the costs can be dropped when technologies develop further, and units are mass produced. Since the wind turbines with hydrogen storage can be innovative technology, EU's innovation fund may be able to support financially as well as more private investors, interested in renewable energy industry, may be willing to participate with the project due to its high potential. In addition, excessed hydrogen can be injected into existing natural gas pipelines. Up to 20 vol% of hydrogen can be blended into the pipeline without modifications. It means that oil and gas companies not only supply more environmental natural gas, but also can make additional profit due to increase in volume of gas. Considering economic incentive of hydrogen production as well as CO^2 tax reduction, possibility to create a new market and potential financial support from public and private funds, it can be said that the cost of deploying wind turbine with reversible fuel cell and hydrogen storage to replace gas turbine on Norwegian Continental Shelf is economically feasible.

10.3 Political Analysis

According to the country report by Bureau of Democracy, Human Rights and Labor of United States (2017), Norway adopts a system of constitutional monarchy and parliamentary democracy. Its constitution was adopted in 1814, and the power of monarchy was divided into the legislature (Storting), the government (regjering) and the court (domstol). (Stortinget, 2015) In 1884, parliamentarianism was introduced to Norway, and "the governments have been dependent on having the confidence of the Storting". (Stortinget, 2015) Such separation of power is the principal of modern democratic countries in order to check each other and avoid the extreme power. (Stortinget, 2015) The balanced triangle of these three branches is the key of democracy. (Government Norway, 2017) The party, has majority of the seats in the parliament, can form the government. (Government Norway, 2017) 169 members of parliament are elected by general election, which is conducted every four year, and this parliament cannot be dissolved for four year. (Stortinget, 2015) The leader of the majority party or coalition of parties becomes the prime minister, who can appoint ministers and other cabinet members. (Government Norway, 2017) Last time, a single party achieved a majority (more than 50%) of the seats was in 1957, Labor Party (Arbeiderpartiet: AP) obtained 78 seats out of 150, which is 52%. (Nohlen & Stöver, 2010) Since then, there was no single party has achieved a majority for more than a half century. (Nohlen & Stöver, 2010) Therefore, the parties have needed to find partners for coalition to form the government. The result of the recent election, general election of Norway in 2013, can be a good example to understand its system. The labor party (AP) obtained 55 seats out of 169 seats, which is the most seat comparing to other parties. (Valg, 2013) Conservative Party (Høyre: H) obtained 48 seats, which was second place. (Valg, 2013) At that time, AP formed the government with Centrel Party (Senterpartiet: SP) and Socialist Left Party (Sosialistisk Venstreparti: SV). Each party obtained 10 seats and 7 seats respectively. (Valg, 2013) Thus, the government obtained 72 seats (55+10+7). On the other hand, prior to the 2013 general election, the Conservative party discussed the possibility of coalition with other opposition parties such as Progress Party (Fremskrittspartiet), Christian Democratic Party (Kristelig Folkeparti) and Liberal Party (Venstre). (Government Norway, 2013) Each party obtained 29 seats, 10 seats and 9 seats respectively. (Valg, 2013) Opposition parties obtained majority seats, 96 seats (48+29+10+9). Thus, the government was handed over from red-green coalition to opposition parties. The leader of Conservative party, Erna Solberg, announced that the new government would be formed with Progressive Party. (Government Norway, 2013) The total obtained seats are 77; thus, it was minority government. Bjerkem (2016) reported that Christian Democratic Party and Liberal Party declined to join the formation of government due to Progress Party: however, they agreed to form minority coalition with confidence and supply from both parties. It means that both parties are not the part of the government but support the government from outside. It may be difficult to see the agenda of multi-party government; however, who is appointed to the minister of particular ministry may help to see it. Therefore, it is important to understand the Norwegian political system and each party’s standpoint towards renewable energy, oil and gas in order to assess the feasibility of green offshore plants with hydrogen wind turbines. In addition, although Norway is not a member of EU, there is tight-knit relationship via European Economic Area (EEA) and many other European agreements, organizations and partnerships. As a result, the influence by EU may affect Norway’s political discussion and decision. This geopolitical factor will also be considered in this chapter.

Each political party has own targets and goals. Some may have same or similar perspective to the particular issues. Although each politician or a member of parliament may have different opinion on the issues or agenda, it will be focused on the opinions as the party in this essay. The parties are selected based on whether the party currently holds the seat at Storting.

10.3.1 Survey

The survey was sent out to each party to identify the current position of each party in terms of oil and gas, renewable energy, green offshore field and finance. In order to improve the response rate, multiple-choice question format was selected. Since expected respondents are Norwegian political parties, each question is in Norwegian language. Each question, choice of answers and answers from the party will be translated by the author. Each question and choices of answers are listed below. Original questions and choices in Norwegian are in Appendices 53 - 56. Original answers from each party can be found in appendices 65 - 84. The collected answers will be also compared to their statements, posted on the parties' websites or programs. The primary and secondary qualitative data would be collected through parties' programs and survey, and they will be analyzed in the end.

1. Oil and gas extraction
   a) Is the party for or against to existing oil and gas extraction in Norway?
      1) Very supportive
      2) Supportive
      3) Neutral
      4) Against
      5) Very against

   b) Is the party for or against to explore and develop new oil and gas fields in Norway?
      1) Very supportive
      2) Supportive
      3) Neutral
      4) Against
      5) Very against

c) How soon should Norway leave the oil and gas extraction fully?
   1) Immediately
   2) by 2030
   3) by 2040
   4) by 2050
   5) Never

Explanation and motive:
These questions were asked to identify their position in terms of oil and gas extraction in Norway.

2. Renewable energy
   a) Is the party for or against to expand renewable energy in Norway besides existing hydro power?
      1) Very supportive
      2) Supportive
      3) Neutral
      4) Against
      5) Very against

   b) Is the party for or against to offshore wind power or wind farm on Norwegian Continental Shelf?
      1) Very supportive
      2) Supportive
      3) Neutral
      4) Against
      5) Very against

   c) It the party for or against to invest in hydrogen in Norway?
      1) Very supportive
      2) Supportive
      3) Neutral
      4) Against
      5) Very against

Explanation and motive:

These questions were asked to identify their position in terms of renewable energy in Norway particularly offshore wind and hydrogen.

3. Green offshore fields
   a) Is the party for or against to the electrification of offshore fields by connecting to shore power (renewable sources)?
      1) Very supportive
      2) Supportive
      3) Neutral
      4) Against
      5) Very against

   b) Is the party for or against to the electrification of offshore fields by offshore wind power?
      1) Very supportive
      2) Supportive
      3) Neutral
      4) Against
      5) Very against

   c) Does party believe that energy storage solution is essential to achieve green offshore fields?
      1) Yes, with battery
      2) Yes, with hydrogen
      3) No, natural gas is fine
      4) No, onshore power is flexible enough

   d) Technologically, it is possible that *electrolyzer can be built in the windmills. Any excessed hydrogen can be blended into natural gas which makes natural gas greener.
      * Electrolyzer splits water into hydrogen and oxygen with electricity.
      Does party support to convert offshore windmills to hydrogen wind turbines?

1) No, just power (from the shore) is good
2) Yes, some windmills can generate hydrogen as energy storage
3) Yes, all windmills can be switched to hydrogen wind power

e) How soon should all offshore fields be electrified with renewable energy?
1) As soon as it can
2) by 2030
3) by 2040
4) by 2050
5) Not needed

Explanation and motive:
These questions were asked to identify their position in terms of more environmental offshore oil and gas activities in Norway by electrification. It aimed to discover which energy sources of shore power, offshore wind and energy storage, they are focusing on and in what timeline.

4. Finance
a) Does the party consider the offshore wind power as Norway's future export item?
1) Yes
2) No

b) Is the party willing to support financially (including tax incentives) to the expansion of renewable energy in Norway? If yes, in what extent?
1) Yes – Extensively or more than now
2) Yes – Similar to now
3) Yes – Less than now
4) Yes – Not sure
5) No

c) Is the party willing to support financially (Including tax incentives) to the full electrification of offshore field? If yes, in what extent?
1) Yes – Extensively or more than now
2) Yes – Similar to now
3) Yes – Less than now

4) Yes – Not sure
5) No

d) Is the party willing to support financially (Including tax incentives) to the offshore wind? If yes, in what extent?
   1) Yes – Extensively or more than now
   2) Yes – Similar to now
   3) Yes – Less than now
   4) Yes – Not sure
   5) No

e) Is the party willing to support financially (Including tax incentives) to the hydrogen as energy storage solution to achieve green offshore fields? If yes, in what extent?
   1) Yes – Extensively or more than now
   2) Yes – Similar to now
   3) Yes – Less than now
   4) Yes – Not sure
   5) No

Explanation and motive:
These questions were asked to identify their position in terms of financial support to offshore green projects. Whether they are willing to support financially, or they expect oil and gas companies' self-help effort could be discovered.

10.3.2 Political parties in Norway

10.3.2.1 Labor Party (AP)

49 seats (Valg, 2018) - Social Democrat (Overland, 2019)

According to the Labor Party's program (2017), oil and gas are valuable resources, which belongs to the community, and they are of strategic importance to achieve the world leading business development in the sea for Norway. The Labor Party will commit to balance the interests of oil industry against other considerations through comprehensive plans.

(Arbeiderpartiet, 2017) Labor Party emphasized that the party wants a vast investment in offshore wind; thus, the offshore wind on Norwegian Continental Shelf can contribute to the energy transition in Europe. (Arbeiderpartiet, 2017) In addition, for oil and gas industry, investing to electrification and offshore wind assist Norway to be a front runner of reducing the greenhouse gas emission in the world. (Arbeiderpartiet, 2017) In terms of economic point of view, Norway has extensive potential and reserved renewable energy sources both on land and at sea. (Arbeiderpartiet, 2017) Therefore, exporting excessed power from renewable energy can be not only assisting environmentally but also a valuable item economically. (Arbeiderpartiet, 2017) Haugan (2019) reported that the Labor Party is willing to spend several billions of NOK for the climate proposes to make a North Sea Plan. In the Labor Party's own North Sea plan, it is suggested to continue investing electrification, offshore wind and CO_2 capture storage (CCS). The leader of the Labor Party wants to allocate 10 million NOK to prepare its North Sea plan. (Haugan, 2019) These statements and plans indicate that the Labor Party is willing to push Norway's climate action forward while maintaining the revenue from oil industry. Therefore, it is likely that the Labor Party supports the green offshore field with hydrogen if there is cost merit.

Respondent: Maria Varteressian – Political advisor (Energy and Environment) of Labor Party's Parliament team

1. Oil and gas extraction
   a) Is the party for or against to existing oil and gas extraction in Norway?
      Answer: 2) Supportive

   b) Is the party for or against to explore and develop new oil and gas fields in Norway?
      Answer: 2) Supportive

   c) How soon should Norway leave the oil and gas extraction fully?
      Answer:
      None of the above options. End date for the oil and gas industry is not relevant, we must rather set a start date for new industries that will spring from the oil and gas industry's expertise.

2. Renewable energy
    a) Is the party for or against to expand renewable energy in Norway besides existing hydro power?
    Answer: 2) Supportive

    b) Is the party for or against to offshore wind power or wind farm on Norwegian Continental Shelf?
    Answer: 1) Very supportive

    c) It the party for or against to invest in hydrogen in Norway?
    Answer: 1) Very supportive

3. Green offshore fields
    a) Is the party for or against to the electrification of offshore fields by connecting to shore power (renewable sources)?
    Answer: 1) Very supportive

    b) Is the party for or against to the electrification of offshore fields by offshore wind power?
    Answer: 1) Very supportive

    c) Does party believe that energy storage solution is essential to achieve green offshore fields?
    Answer: I am not sure what you ask in this question.

    d) Technologically, it is possible that *electrolyzer can be built in the windmills. Any excessed hydrogen can be blended into natural gas which makes natural gas greener.
    *Electrolyzer splits water into hydrogen and oxygen with electricity.
    Does party support to convert offshore windmills to hydrogen wind turbines?

    Answer:
    There is a difference between green hydrogen (from electrolysis) and blue hydrogen (from natural gas) The latter is made using CCS. I have never heard of mixing

electrolysis-based hydrogen in natural gas. The product you will then be left with is neither hydrogen nor gas. But maybe I misunderstand the question?

e) How soon should all offshore fields be electrified with renewable energy?

   Answer:
   Do you mean absolutely all petroleum installations that exist, or only those that can be electrified? In the case of the latter, it is "as soon as possible" the right alternative, but there are many prerequisites for what will be "possible and soon"

4. Finance

a) Does the party consider the offshore wind power as Norway’s future export item?
   Answer: 1) Yes
   It is probably not the wind power itself that becomes an export item, but the technology and expertise. But in the long term, it will be possible to sell wind power produced on the Norwegian shelf to the European market.

b) Is the party willing to support financially (including tax incentives) to the expansion of renewable energy in Norway? If yes, in what extent?
   Answer: 1) Yes – more than now

c) Is the party willing to support financially (Including tax incentives) to the full electrification of offshore field? If yes, in what extent?
   Answer: None of alternatives, I am not sure what you mean by full electrification

d) Is the party willing to support financially (Including tax incentives) to the offshore wind? If yes, in what extent?
   Answer: 1) Yes – more than now

e) Is the party willing to support financially (Including tax incentives) to the hydrogen as energy storage solution to achieve green offshore fields? If yes, in what extent?
   Answer:

Hydrogen production will / should be used for, for example, green shipping, the process industry or sales to the European power market. Not to make offshore fields green.

Comment from the respondent:
"As an industrial party, the Labor Party works to facilitate the development of existing and the creation of new industry. The expertise from the oil and gas industry is central to the development of adjacent industries such as hydrogen, ccs and offshore wind."

Analysis:
It seems that the respondent's answers are corresponded to party's program. For example, both party's program and the respondent stated that the Labor party is interested in continuing oil and gas extraction including discovering new oil and gas fields on Norwegian Continental Shelf while reducing CO^2 emission from the extraction activities. In addition, it seems that the Labor party is also interested in renewable energy especially onshore and offshore wind, and they are willing to support politically and financially. The party showed the strong interest in CCS. Currently, it seems the method of electrification of offshore fields, they are considering, is mainly connecting to shore power. Although the party is interested in expansion of offshore wind, it seems that connecting the offshore wind turbines and offshore platforms is not their primary method to electrify offshore fields on Norwegian Continental Shelf. In terms of hydrogen, the respondent stated that hydrogen will and should be used for shipping industry, process industry and European power market as commodity. The respondent also stated that the party does not intend to use hydrogen to make offshore fields green. These statements indicate that Labor party's focus is maintaining the balance between oil and gas extraction and expansion of renewable energy production. It also can be indicated that the party's primary option for electrification of offshore fields is shore power, and offshore wind may be used as secondary option. Today, based on the statements, it can be said that the party supports electrification of offshore fields with connecting to shore power and possibly offshore wind but not hydrogen. It may be that hydrogen was excluded from the options for electrification of offshore field due to the lack of awareness of technological potential of hydrogen. For example, the respondent was not aware of that hydrogen can be blended into natural gas since she pointed out hydrogen and natural gas are two separate things. Thus, increasing awareness of technological potential of hydrogen may lead to include hydrogen for electrification of offshore fields in the future.

10.3.2.2 Conservative Party (H)

45 seats (Valg, 2018) – Conservative - Current ruling party

According to the Conservative Party (2017), in their Høyre Program 2017-2021 (2017), the oil and gas resources have played significant role to develop Norway, and such role will continue for many years to come. Intensive research, competence and technological development of the oil and gas industry need to be continued to retain competitiveness in the future. The Conservative Party (2017) continued that they want to provide a balanced and stable framework for development petroleum activities in the North Sea and Barents Sea. In addition, the Conservative Party (2017) stated that the party wants oil and gas industry to increase the extraction rate on the Norwegian Continental Shelf under the Norway's strict climate policy framework circumstance. To support to increase oil and gas industry's competitiveness, they would consider tax-related support or legal support. (Høyre, 2017) The party believes that the oil and gas will still be needed in a low-carbon society; thus, production of 'greener oil and gas' by electrification of both new and existing fields is important. (Høyre, 2017) Moreover, the electrification needs to be reasonable economically and environmentally. The Conservative Party (2017) added that Norway has high potential to generate extensive amount of green energy with hydropower, wind power, bioenergy and other renewable energy sources; thus, they would support the companies to develop environmental technology.

As the leading party of current government, the Conservative Party uses political tools to support offshore wind. For example, as the Minister of Petroleum and Energy, Tina Bru (Conservative Party Rogaland), accounted that the government has approved the offshore wind development in both Utsira North and Southern North Sea II areas. (Bru, 2020) She continued that the companies and organizations can apply for a license to develop offshore wind projects on the Norwegian Continental Shelf from 2021. (Bru, 2020) Prior to this news, Bru (2020) also announced that the government approved the project of Hywind Tampen, world's largest floating wind farms and Norway's first large-scale offshore wind farms. Licensing and approve the projects are the political tools of authorities and they support the development of wind power projects. However, Bru (2020) emphasized that fishing is also Norway's one of the most important industries; thus, it is crucial to have constructive dialog with fisheries organizations. Another political tool, the government uses, is funding via Enova, governmental organization. Enova was founded in 2002 as subsidiary of the Ministry of Petroleum and Energy. (Gheorghe & Muresan , 2011) Enova invests to individual businesses to develop renewable or environmentally friendly technologies. (ENOVA, 2018) Enova invests more than 2 billion NOK to green technologies every year. (ENOVA, 2018) Enova is currently governed under Ministry of Climate and Environment, which transfer was completed in 2018. (Government Norway, 2018) Enova is funded by the tax, called Enova tax, which the grid companies are required to collect 1øre per kWh from the customers. (Statistics Norway, n.d.) For the Hywind Tampen project, Enova will invest up to 2.3 billion NOK while Equinor signed the contract of the investment of 3.3 billion NOK. (Equinor, 2019) Approximately 40% of the investment is from the government owned organization. Nossen (Nossen, 2020) reported that Stefan Heggelund, the member of energy and environment committee and Conservative Party, emphasized the Conservative Party has significant role to take initiatives to the climate action of Norway, and the Conservative Party will support the green projects throughout Norway with the government and Enova. Although, at local level, the Conservative Party of some municipalities may be against to create wind power. For example, the Conservative Party in Porsanger municipality concluded to be against wind power in its municipality. Thus, there can be different perspective in terms of wind power between local and national level within the party.

Respondent: Liv Kari Eskeland – Member of parliament for Conservative Party and Member of The Standing Committee on Energy and the Environment

1. Oil and gas extraction
   a) Is the party for or against to existing oil and gas extraction in Norway?
      Answer: 1) Very supportive

   b) Is the party for or against to explore and develop new oil and gas fields in Norway?
      Answer: 1) Very supportive
      Comment: "Equally important thing is to utilize the infrastructure that has been established to extract maximum (oil and gas) from the fields that have been developed."

   c) How soon should Norway leave the oil and gas extraction fully?
      Answer: "We do not set end date."

2. Renewable energy
   a) Is the party for or against to expand renewable energy in Norway besides existing hydro power?
   Answer: 1) Very supportive

   b) Is the party for or against to offshore wind power or wind farm on Norwegian Continental Shelf?
   Answer: 1) Very supportive
   Comment:
   "We see this mainly as an industrial development and technology development where we can bring our expertise and technology to other parts of the world"

   c) Is the party for or against to invest in hydrogen in Norway?
   Answer: 1) Very supportive

3. Green offshore fields
   a) Is the party for or against to the electrification of offshore fields by connecting to shore power (renewable sources)?
   Answer: 2) Supportive

   b) Is the party for or against to the electrification of offshore fields by offshore wind power?
   Answer: 1) Very supportive

   c) Does party believe that energy storage solution is essential to achieve green offshore f ields?
   Answer: 2) Yes, with hydrogen
   Comment:
   "Hydrogen or ammonia. Where (hydrogen or ammonia) is convenient to be used rather than electricity from land is good. This is not an 'either / or' question but 'both / and'. Where hydrogen or ammonia is not possible, gas turbines can also be an alternative."

d) Technologically, it is possible that *electrolyzer can be built in the windmills. Any excessed hydrogen can be blended into natural gas which makes natural gas greener.
*Electrolyzer splits water into hydrogen and oxygen with electricity.
Does party support to convert offshore windmills to hydrogen wind turbines?

Answer: 2) Yes, some windmills can generate hydrogen as energy storage
"The most optimal method is of course to use the power directly. Secondary option is to store (energy) in hydrogen / ammonia bonds."

e) How soon should all offshore fields be electrified with renewable energy?

Answer: 1) As soon as it can
"As soon as it is socio-economically profitable. This will eventually be part of an offshore power grid that can be used after some of the oil and gas installations are outdated."

4. Finance

a) Does the party consider the offshore wind power as Norway's future export item?
Answer: 1) Yes

b) Is the party willing to support financially (including tax incentives) to the expansion of renewable energy in Norway? If yes, in what extent?
Answer: 2) Yes – similar to now

c) Is the party willing to support financially (Including tax incentives) to the full electrification of offshore field? If yes, in what extent?
Answer: 2) Yes – similar to now

d) Is the party willing to support financially (Including tax incentives) to the offshore wind? If yes, in what extent?
Answer: 2) Yes – similar to now

e) Is the party willing to support financially (Including tax incentives) to the hydrogen as energy storage solution to achieve green offshore fields? If yes, in what extent?

Answer: 1) Yes - Extensively or more than now

Comment:

"As there is no energy storage in hydrogen offshore now, it must necessarily be 1) if we support this"

Analysis:

Based on the answers and statements from Eskeland, a member of parliament of Conservative Party, it seems that the party is very supportive of oil and gas extraction both now and future, which corresponds the Conservative Party's Program 2017-2021. In the program, the party stated that the party supports renewable energy including offshore wind; however, how much the party supports hydrogen could not be identified since hydrogen was mentioned in only two sentences. According to Eskeland, the party believes hydrogen or ammonia can be useful in offshore fields where electrification is difficult or costly. Both party's program and Eskeland's statements showed that Conservative Party is supportive of electrification of offshore fields. Eskeland emphasized that when how to achieve electrification of offshore fields are discussed, it is important to think "both / and" instead of "either / or". This statement indicates that the party believes that full electrification of offshore fields can be achieved with the power from shore, offshore wind and among other options rather than just the power from shore. This could be one of the reasons why Eskeland chose 2) supportive for question 2.a while she chose 1) very supportive for question 2.b and 2.c since currently connecting to shore power is weighed and focused mainly in the discussion. Eskeland also commented that it is ideal that all offshore fields are fully electrified by renewable energy as soon as it can; however, it needs to be socio-economically profitable. She also pointed out that the offshore wind power with hydrogen storage, can be connected to offshore grid in the future when the oil and gas extraction is outdated. In terms of financial or legal support to electrification, Eskeland stated that the party maintains the same level of support for renewable energy, electrification of offshore fields and offshore wind, while she believes that the party should support and invest more to offshore hydrogen storage since there is none at the moment. This statement indicates that the party thinks that offshore hydrogen storage is yet niche technology and requires support, which they are willing to provide, while offshore wind and other renewable technologies have been developed enough. These perspectives in terms of electrification of offshore fields with wind power and hydrogen storage were lacking in the party's program; however, based on what a current member of parliament for Conservative Party stated, it can be said that Conservative Party would assist oil and gas industry to transform its offshore fields to green offshore fields politically and financially at national level. However, disagreement with local Conservative Party in some municipalities may be remained as an issue during selecting location of wind farms and hydrogen storage.

10.3.2.3 Progress party (FrP)

27 seats (Valg, 2018) – Liberalism (Fremskrittspartiet, 2017)

According to the Progress Party's program (2017), Prinsipp- og handlingsprogram 2017-2021, stated that they want to promote and increase the use of natural gas domestically for both value creation, household and transportation. They believe that the natural gas such as LNG and LPG, liquid natural gas and liquified petroleum gas, should not be included to the Norway's special requirements for CO_2 cleansing. (Fremskrittspartiet, 2017) The Progress Party (2017) continued that petroleum business in Norway is the largest and the most important industry for Norway, which creates many employments and well-paid jobs; thus, retaining their competitiveness is crucial for the country. They pointed out that exploring and developing the oil and gas field on the Norwegian Continental Shelf can be costly and complex; therefore, the stable and predictable framework is the key for petroleum industry. (Fremskrittspartiet, 2017) The Progress Party (2017) emphasized that they will support petroleum industry to maintain its competitiveness technologically and economically. The party also supports to assess the oil and gas developments in Northern Norway such as Nordland VI, VII, Troms II and the Barents Sea North as soon as they can. (Fremskrittspartiet, 2017)The Progress Party (2017) stated that they want to facilitate small scale wind power while deployment mini or micro wind power should be determined by local municipalities. In the party's program (2017), they highlighted that alternative energy needs to distribute the power at low price and the state or local authority should not be able to force the established building to connect the alternative energy if the cost of it is more than normal cost. Progress Party held the national meeting in May 2019 and made the statement that they want to stop further development of wind power onshore in the party's resolution due to its environmental impact on nature. (Fremskrittspartiet, 2019) Although the party does not support further development of onshore wind power, they continue supporting offshore wind power. (Hovland, Forslag til helgens landsmøte i Frp: Vil stanse vindkraft på land, 2019) The Progress Party stated that the party wants to have comprehensive strategy for the research, the development of technology and use of hydrogen as an energy carrier. (Fremskrittspartiet, n.d.)

According to party's program, the party's primary focus seems oil and gas since the importance of oil and gas for the country was discussed over 9 pages in 120-page program while wind power was discussed in 2 sentences, and hydrogen was not even mentioned in the program. (Fremskrittspartiet, 2017) As the party stated that they are against further onshore wind power but supportive of offshore wind power in their national meeting in 2019, it indicates that the importance of offshore wind may have increased within the party after 2017, when the program was published. Hydrogen, on the other hand, was barely mentioned in the party's website under climate and environment section, and such fact indicates that the party may believe that the hydrogen is relatively less important. The party clearly stated that they support the increase of the use of natural gas domestically and for household.

Respondent: Liv Lønnum – Political advisor (Energy and Environment) of Progress Party's Parliament team

1. Oil and gas extraction
   a) Is the party for or against to existing oil and gas extraction in Norway?
      Answer: 1) Very supportive

   b) Is the party for or against to explore and develop new oil and gas fields in Norway?
      Answer: 1) Very supportive

   c) How soon should Norway leave the oil and gas extraction fully?
      Answer: 5) Never

2. Renewable energy
   a) Is the party for or against to expand renewable energy in Norway besides existing hydro power?
      Answer: 2) Supportive

   b) Is the party for or against to offshore wind power or wind farm on Norwegian Continental Shelf?
      Answer: 2) Supportive

   c) It the party for or against to invest in hydrogen in Norway?

Answer: 2) Supportive

3. Green offshore fields
   a) Is the party for or against to the electrification of offshore fields by connecting to shore power (renewable sources)?
   Answer: 2) Supportive

   b) Is the party for or against to the electrification of offshore fields by offshore wind power?
   Answer: 2) Supportive

   c) Does party believe that energy storage solution is essential to achieve green offshore fields?
   Answer: No answers

   d) Technologically, it is possible that *electrolyzer can be built in the windmills. Any excessed hydrogen can be blended into natural gas which makes natural gas greener.
   *Electrolyzer splits water into hydrogen and oxygen with electricity.
   Does party support to convert offshore windmills to hydrogen wind turbines?

   Answer: 2) Yes, some windmills can generate hydrogen as energy storage

   e) How soon should all offshore fields be electrified with renewable energy?
   Answer: 5) Not needed

4. Finance
   a) Does the party consider the offshore wind power as Norway's future export item?
   Answer: 1) Yes

   b) Is the party willing to support financially (including tax incentives) to the expansion of renewable energy in Norway? If yes, in what extent?
   Answer: 4) Yes – Not sure
   c) Is the party willing to support financially (Including tax incentives) to the full electrification of offshore field? If yes, in what extent?

Answer: 5) No

d) Is the party willing to support financially (Including tax incentives) to the offshore wind? If yes, in what extent?
Answer: 4) Yes – Not sure

e) Is the party willing to support financially (Including tax incentives) to the hydrogen as energy storage solution to achieve green offshore fields? If yes, in what extent?
Answer: 4) Yes – Not sure

Comment from the respondent:
"FrP is positive about working for changes to the renewable society. It requires some technological development that your questions reflect. We want as much as possible that it should be developed on market terms and with the policy instruments we have in Norway. There are several of your questions that have not been fully discussed in the party (eg financial / tax schemes for offshore wind, CCS, hydrogen, etc.) and which will be part of the program work that is currently underway. Our suggestions for solutions and a position on several of your questions, I therefore expect to come eventually."

Analysis:
As both Progress Party's program and political advisor (energy and environment) of Progress Party, Lønnum, stated clearly that oil and gas are significant resources for Norway and the party continues supporting the development of oil and gas extraction on Norwegian Continental Shelf. Lønnum added that the party does not consider phasing out oil and gas extraction. Based on the response from Lønnum, while the party is 1) very supportive of oil and gas extraction, they are 2) supportive of renewable energy including offshore wind power. This indicates that the party's primary focus is oil and gas rather than renewable energy, which corresponds with the party's program. Hydrogen was lacking in the party's program; however, Lønnum stated that they are 2) supportive of hydrogen storage, and she stated that offshore wind power with hydrogen storage can take part of electrification of offshore fields. Although the party may support both politically and financially for electrification of offshore fields with connecting to shore power, offshore wind power and offshore wind power with hydrogen storage, Lønnum answered that the party believes that not all offshore fields needs to be electrified and financial support therefore is not necessary.

Hence, even if the party supports electrification of offshore fields, the degree of the support remained as unclear.

10.3.2.4 Centre Party (Sp)

19 seats (Valg, 2018) – Agrarian centrist (Overland, 2019)

Centre Party is the agrarian party, which main focus is to protect and develop agriculture in Norway. (Senterpartiet, 2017) In the party's program, Central Party (2017) endorses the main steam of petroleum policy in Norway since the revenue from oil and gas can provide the nation more freedom in action. However, the environmental impact from oil and gas production needs to be strictly assessed and CO_2 tax needs to be set high to commit the Paris Agreement. (Senterpartiet, 2017) The party does not support the oil and gas extraction in Lofoten, Vesterålen or outside Senja due to the risk of serious environmental impact to the nature and agri- and aquaculture in the area. (Senterpartiet, 2017) The Centre Party (2017) supports the electrification of the field on Norwegian Continental Shelf. The party also stated to support offshore floating wind power production. (Senterpartiet, 2017) Since the offshore wind will be far from the shore, seabird stocks, the hearing of reindeer and damage to the nature on the coastline is limited. (Senterpartiet, 2019) The party emphasized that the government should ensure to utilize the wind power as much as petroleum and hydropower, and the wind, natural resource of Norway, should be protected from foreign capital. (Senterpartiet, 2019) In the party's resolutions (2019) the party stated that they want to improve the competitiveness of Norwegian hydrogen. The Centre Party (2017) highlighted that they want to ensure that Enova to contribute to the development of hydrogen as a transition from fossil fuel society to green society.

Based on the statements above, it indicates that the Centre Party supports oil and gas production as long as its damage to environment is heavily controlled and assessed. At the same time, they are supportive of the most options of renewable energy especially offshore wind, which environmental impact on the nature on Norwegian coast area is limited. It seems that they consider wind power is as important as hydro power and petroleum for Norway. It also appears to be that the party wants the hydrogen technology to be development. Such supports seem both political and financial.

10.3.2.5 Socialist Left Party (SV)

11 seats – Socialist (ndla, 2019)

The position of Socialist Left Party in terms of oil is different from the parties above. Regardless of financial benefit from oil and gas production, the party stated that they are willing to leave oil and gas and shift to zero-carbon society with renewable energy. (Sosialistisk Venstreparti, 2017) They continued that the fossil fuel causes the climate change, which affect people in poor countries. (Sosialistisk Venstreparti, 2017) The party does not accept any new oil and gas development and encourage the existing fields to be electrified with renewable energy. (Sosialistisk Venstreparti, 2017) SV emphasized the importance of phase out fossil fuels by 2040 and claimed that Norwegian Pension Fund should pull out of investment in all fossil fuel related sectors. The Socialist Left Party (2017) announced that they would focus on and support new forms of renewable energy including biofuels, biogas, solar energy wave power, offshore wind and any other energy production and storage.

Based on these statements above, it can be said that the environmental goal of Socialist Left party is one of the most ambitious ones comparing to other parties' targets. It can be clearly seen that they are against the oil and gas extraction. As Hovland (2020) reported, it is rare that SV wants to invest in oil industry, but to accelerate the green shift in oil industry by electrification of the shelf. In his article, it said that SV suggested to establish infrastructure for hydrogen distribution along the coast and develop zero emission fast boats. (Hovland, 2020) Considering their enthusiastic ambition towards zero carbon society, it can be said that receiving political and financial support for offshore wind and hydrogen is possible.

Respondent: Ingrid Tungen– Political advisor (Climate and Environment) of Socialist Left Party's Parliament team

1. Oil and gas extraction
   a) Is the party for or against to existing oil and gas extraction in Norway?
      Answer: 4) Against
      Comment:
      "SV is initially to replace fossil energy production with renewable; thus, eventually discontinue oil and gas extraction in Norway, also existing (oil and gas)."

b) Is the party for or against to explore and develop new oil and gas fields in Norway?

Answer: 5) Very against

Comment:

“SV will not support more licensing rounds on the Norwegian Continental Shelf and will phase out the exploration refund scheme, and if that is what is in the "new" oil and gas fields, then alternative 5) will be suitable. However, this does not mean that SV will be against all changes and new drilling on adjacent fields in open areas.”

c) How soon should Norway leave the oil and gas extraction fully?

Answer: No answers

Comment:

“SV has not decided on a date for discontinuation of production on the Norwegian Continental Shelf, or whether it is necessary with an absolutely full discontinuation and no production. The most important thing for SV is that any production is in accordance with the goal of a zero-emission society by 2040. There may also be solutions with carbon capture and storage to make it so that it is not possible to decide whether it means that absolutely all production on the Norwegian shelf will be phased out.”

2. Renewable energy

a) Is the party for or against to expand renewable energy in Norway besides existing hydro power?

Answer: No answers

Comment:

“SV is to develop renewable energy in Norway where it can be done without major losses of nature and biological diversity. It will also mean that expansions and upgrades of «existing hydropower» can also be problematic and it may be desirable to, for example, increase the amount of water in connection with revisions of the hydropower licenses.”

b) Is the party for or against to offshore wind power or wind farm on Norwegian Continental Shelf?

Answer: No answers

Comment:

“SV is for developing offshore wind power on the Norwegian Continental Shelf, but it must be done on the premises of the fisheries, biodiversity and any consequences. It is therefore difficult to say that the party will be supportive of all projects.”

c) It the party for or against to invest in hydrogen in Norway?
   Answer: 1) Very supportive
   Comment:
   “SV has proposed a fund of 1 billion (NOK) to invest in green hydrogen in Norway.”

3. Green offshore fields
   a) Is the party for or against to the electrification of offshore fields by connecting to shore power (renewable sources)?
      Answer: 1) Very supportive
      Comment:
      “SV has proposed electrifying offshore fields where possible and including it as a condition in the licensing process for long time.”

   b) Is the party for or against to the electrification of offshore fields by offshore wind power?
      Answer: No answers

   c) Does party believe that energy storage solution is essential to achieve green offshore fields?
      Answer: No answers
      Comment:
      “SV does not have a policy on this point and is a purely technical issue. Our goal is that production of oil and gas must also take place without greenhouse gas emissions. Therefore, clean gas turbines as they work today will not be good enough, but whether the battery or shore power is flexible enough will depend on the different fields.”

   d) Technologically, it is possible that *electrolyzer can be built in the windmills. Any excessed hydrogen can be blended into natural gas which makes natural gas greener.
      *Electrolyzer splits water into hydrogen and oxygen with electricity.
      Does party support to convert offshore windmills to hydrogen wind turbines?

Answer: No answers

Comment:

“This is not something SV has a policy on. If it is possible to make hydrogen using wind power which can then be used for a purpose or as a surplus for the operation of boats and so on, then it can be good. We see that there are various projects on this, and among other things, projects related to the production of hydrogen which are then stored or exported through the natural gas network. This is something we support, but our purpose is that in the long run we replace fossil production with renewable. Offshore wind turbines that both produce clean electricity and supply to land where the energy can be used for other things such as offshore hydrogen production or ammonia production can be good solutions.”

e) How soon should all offshore fields be electrified with renewable energy?

Answer: 1) As soon as it can

Comment:

“SV is for that the emission from the Norwegian Continental Shelf must go down as soon as possible as on land. It includes electrification of the shelf.”

4. Finance

a) Does the party consider the offshore wind power as Norway’s future export item?

Answer: 1) Yes

Comment:

“This may be the case if we start stimulating technology development quickly enough, but it is not the case today.”

b) Is the party willing to support financially (including tax incentives) to the expansion of renewable energy in Norway? If yes, in what extent?

Answer: 1) Yes – Extensively or more than now

Comment:

“Yes, but it depends on which renewable energy it is talking about.”

c) Is the party willing to support financially (Including tax incentives) to the full electrification of offshore field? If yes, in what extent?

   Answer:

   Comment:

   "SV wants to support electrification, but it may be through changing tax incentives that exist today so that it will not be a financial support as such, but a revenue-neutral restructuring. SV will first and foremost set requirements in licenses, and open up the possibility of changing older licenses"

d) Is the party willing to support financially (Including tax incentives) to the offshore wind? If yes, in what extent?

   Answer: 1) Yes – Extensively or more than now

   Comment:

   "Today, there is no support system for new renewable energy beyond green certificates and support from Enova for solar installations among other things. Therefore, SV believes that a support system must be put in place to speed up the development of offshore wind without clarifying how."

e) Is the party willing to support financially (Including tax incentives) to the hydrogen as energy storage solution to achieve green offshore fields? If yes, in what extent?

   Answer:

   Comment:

   "SV is to support the development of hydrogen as an energy storage and energy carrier, and we believe that we should invest in this with a hydrogen fund. This will be to develop hydrogen solutions in all industries. But as mentioned under the question of tax incentives, we believe that it is the oil and gas industry itself that must be responsible for the actual investments in order to reduce greenhouse gas emissions on the shelf and that stricter regulatory requirements should be set for the industry. This does not mean that Enova or the equivalent will not come in with support to get innovation in concrete solutions such as Hywind Tampen, but in principle, the party is not for an independent support scheme for the oil and gas sector."

Comment from the respondent:

"Here are our answers to the questions you have asked. As you will see, there are many questions we cannot answer one of the options you set up because it either does not fit, or the premise of the question does not allow us to answer yes or no. This includes answering purely technical choices and when the questions are too general. I have tried to explain where this is, so you can possibly ask more questions if necessary."

Analysis:

Both Socialist Left Party's program and Tungen, political advisor (Climate and Environment) of Socialist Left Party, stated that they are against oil and gas production. It seems that they believe that current extraction should be phased out eventually, and new licenses of oil and gas fields should not be approved. According to Tungen, although the party wants to discontinue the oil and gas production, when to phase out has not been determined yet. The party's program and Tungen added that the party aims to achieve zero-emission of greenhouse gas by 2040. If the carbon capture technology is developed by then, the party may allow oil and gas production. Thus, end date of oil and gas extraction is still under discussion. In the party's program, it seemed that Socialist Left Party supports various types of renewable energy. However, Tungen emphasized that development of renewable energy cannot damage the nature and biodiversity. For example, the risk of damage on fisheries and marine biodiversity needs to be concerned when developing and deploying offshore wind power. Hydrogen, on the other hands, was one of the few renewable energies that Tungen stated clearly that the party supports. She pointed out that the party submitted a proposal of a fund of 1 billion NOK to invest green hydrogen, which is generated by renewable energy. Tungen stated that the party has long history of supporting electrification of offshore fields by connecting to shore power since they have proposed to add into the requirements for new licenses of extraction. Tungen stated that if offshore wind power with hydrogen storage is used to supply power to land or hydrogen to boats, then the party can support. However, if it is to supply power to the offshore fields, then the party is against since they are aiming to replace oil and gas to renewable energy in near future. In terms of financial support, Tungen stated that the party is willing to support electrification of offshore fields by changing tax incentives. In addition, she emphasized that there is no support system for renewable energy besides green certificate and ENOVA; hence, it is important to place a support system in order to speed up the development of renewable energy. This indicates that the party is weighing with renewable energy and the financial support may become larger than now.

Tungen stressed that in principal, oil and gas industry should invest and reduce greenhouse gas emission by themselves. She also said that it does not mean that they do not receive any financial support from ENOVA as Equinor has received extensive financial support for its Hywind Tampen. Based on the party's program and comments from Tungen, it can be indicated that Socialist Left Party may not support electrification with offshore wind and hydrogen storage but electrification of offshore fields with connecting shore power due to their ambition to phase out oil and gas on Norwegian Continental Shelf.

10.3.2.6 Liberal Party (V)

8 seats (Valg, 2018) – Social Liberal (Overland, 2019)

A member of the coalition government

Liberal Party (2017) stated that shifting to renewable energy from fossil fuel needs to be accelerated. For that reason, the Liberal Party (2017) announced that they will not support the 24th licensing round of Norwegian Continental Shelf. The party emphasized that the remaining oil and gas production on the Norwegian Continental Shelf has to be extracted as low greenhouse gas emission as possible. (Venstre, 2017) The party stated that the vulnerable area such as Lofoten, Senja, Vesterålen and some area in North needs to be permanently protected. (Venstre, 2017) Another statement from Liberal Party (2017) was that the higher CO_2 tax or greenhouse gas emission related tax needs to be applied into new tax scheme in Norway. Bruseth (2019) reported that the extensive amount has been and will be invested into the offshore renewable globally. He continued that Norway is an offshore technology leader and its technological advantage can create opportunities for Norway to become a world leader of offshore renewable power. (Bruseth, 2019) The Liberal Party believes that leading such growing market is the key for 'after oil' for Norway. (Bruseth, 2019) In addition, hydrogen can play an important role in transport sector. (Venstre, 2017) Through state-owned investment company, Norsk Fornybar AS and Enova, they can contribute financial support to the research and development of renewable energy technology. (Venstre, 2017)
Although Liberal Party is currently a part of a coalition government, it seems that its position towards oil and gas seems more against rather than for. They believe that Norway's offshore field should be the world most green field by electrification of existing offshore fields. It seems that they are not fully against the exploration of new oil and gas field; however, they would rather use such investment to renewable energy such as offshore wind. Unlike Centre

Party, they support onshore wind power as well, which can be contradicted to their statement of protecting nature. It is likely that Liberal Party would support renewable energy projects politically and financially via state-owned investment companies. According to their program 2017-2021, the use of hydrogen is limited within transport sector; however, considering their motivation for greener offshore plants, it is possible that they will consider hydrogen as an additional tool for green offshore fields.

10.3.2.7 Christian Democratic Party (KrF)

8 seats (Valg, 2018)
Christian Democracy : Social Conservative (Kristelig Folkeparti, n.d.)
A member of coalition government

Christian Democratic Party stated that the oil and gas business on the Norwegian continental shelf is supporting the Norwegian economy significantly, and the business has created many jobs including both direct and indirect to oil and gas industry. (Kristelig Folkeparti, 2017) They emphasize that revenue from oil and gas business is important for the country; hence, the party supports to ensure predictable framework for oil and gas exploration and extraction. According to KrF (2017), it is important to increase the recovery rate of developed fields, electrify offshore installations with clean energy. The development of new oil and gas fields should be targeted area, which is profitable and is not environmentally vulnerable. (Kristelig Folkeparti, 2017) At the same time, the party is against new oil and gas projects in Lofoten, Vesterålen, Senja and Barents Sea. (Kristelig Folkeparti, 2017) In addition, KrF (2017) wants to achieve zero-emission society by phasing out fossil fuels and shifting to green energy. KrF supports the development of various renewable energy such as hydropower, onshore and offshore wind power, wave power, tide power, solar power and bio energy with the state-owned organizations and companies; Research Council of Norway, Innovation Norway and Enova. The party expressed that they want to increase CO_2 tax and apply new green taxes in various sectors. (Kristelig Folkeparti, 2017)

KrF is also currently a part of a coalition government. Although, KrF wants to keep certain areas, which are environmentally vulnerable, as oil and gas extraction free zones, it seems that the party is not against development of new oil and gas fields as long as it is outside of such areas. The electrification of offshore fields was mentioned just once in the party's program. This indicates that the party is not as enthusiastic as other parties in terms of electrification of offshore installations. Similar to Liberal Party's program, KrF mentioned about hydrogen in only transport section, vehicle and ships. Based on their statements in the party's 2017-2021 program, even if the party may consider any renewable sources as 'solutions', it remained as unclear that they would support green offshore plants with hydrogen.

The last two parties have only 1 seat each at the parliament; however, when the votes are tied, one vote becomes a casting vote. For example, Labor Party submitted the proposal, and Centre Party, Liberal Party and Christian Democratic Party supported the proposal while other parties besides Green Party are against. In such case, votes would be equal as support : AP - 49 + Sp - 19 + V - 8 + KrF - 8 = 84, against : H - 45 + FrP - 27 + SV - 11 + R - 1 = 84. Then, the Green Party's vote decides whether the proposal would be passed or declined. In the democratic parliament, small party can have significant influence under majority rule. Therefore, the party's perspectives in terms of oil and gas, and renewable energy will also be studied.

10.3.2.8 Green Party (MDG)

1 seat (Valg, 2018) – Green ideology (Overland, 2019)

As the name of party describes, Green Party focuses environment among other sectors in their politics. MDG stated that they do not support opening new oil and gas fields on the Norwegian Continental Shelf. Moreover, existing fields should be phased out over a 15-year period. (Miljøpartiet De Grønne, 2017) According to the party's program 2017-2021, the party demands all new approved oil and gas fields to be electrified with renewable power. (Miljøpartiet De Grønne, 2017) MDG stated that the party wants to eliminate all incentives and benefits to oil and gas companies and provide such benefits to green industries instead. (Miljøpartiet De Grønne, 2017) Large-scale investment in offshore wind is one of the Green Party's vision, and the party hopes that over 100 TWh would be generated by offshore wind power by 2030. (Miljøpartiet De Grønne, 2017) The party added that marine wildlife and nature need to be protected at the same time. (Miljøpartiet De Grønne, 2017) The Green Party stated that they want to develop the national strategy of green shift. (Miljøpartiet De Grønne, n.d.) MDG (2017) proposed that one of the largest pension funds in the world, Government Pension Fund Global (GPFG) should extract all investment in fossil energy and invest minimum 5% in renewable energy industry. (Miljøpartiet De Grønne, 2017)

Green Party may be the most enthusiastic and aggressive party when it comes to environment. Some of their proposals and statements in terms of energy are more drastic comparing to other parties. As the party stated, no new licenses for exploration and extraction of oil and gas is the absolute demand to be a part of coalition government or sign the declaration of cooperation. (Miljøpartiet De Grønne, n.d.) It indicates that it would be less likely that Green Party will become a part of coalition government since all three largest parties: Labor Party, Conservative Party and Progress Party, are supportive of awarding licenses for oil and gas extraction at the moment. However, as the party demands electrification of existing offshore installations with renewable energy, they probably press the government and oil companies to electrify new offshore plants with renewable energy when it's built. Hydrogen was not mentioned in their program 2017-2021. However, based on their statements, it is doubtful that they would be supportive to operate the offshore installations with green hydrogen since it means oil and gas extraction may continue.

10.3.2.9 Red Party (R)

1 seat (Valg, 2018) – Socialist (Overland, 2019)

Red Party (2017) claimed that Norway should phase out fossil fuels, and new oil and gas exploration and extraction will not be permitted on the Norwegian Continental Shelf. Moreover, all benefits and subsidies for oil and gas industry need to be phased out. (Rødt, 2017) The party's target is stopping 90% of oil and gas extraction in Norway by 2030. (Rødt, 2017) The Red Party stated that Equinor needs to be renationalized and leaves from oil and gas operations. They party demands and estimates if the Government Pension Fund Global invests green industries, 100,000 jobs can be created. Red Party (2017) emphasized that Norway should focus on tidal power, geothermal power and offshore wind power.

It seems that the Red Party's statements and standing position towards oil & gas and renewable energy are similar to what Green Party claims. The Red Party also highlighted that the party commits offensively to replace fossil fuels to renewable energy. The party did not mention electrification of offshore plants nor hydrogen in the party's program 2017 – 2021. Red Party's youth organization, Red Yough (Rød UNGDOM) stated that electrification of shelf can be important; however, each project must be assessed and evaluated separately and if the electrification on particular offshore installations does not create great outcome and efficiency, the projects should not be proceeded. Although the statement is from youth party, this indicates that Red Party may support the electrification of offshore plants case by case. Thus, it can be said that the Red Party may be supportive of green offshore plants with hydrogen, but it seems that their approval would be based on efficiency and outcome.

Respondent: Mailiss Solheim-Åkerblom – Regional secretary for Red Party (West Norway)

1. Oil and gas extraction
   a) Is the party for or against to existing oil and gas extraction in Norway?
      Answer: 2) Supportive
      Comment:
      "It is important for Rødt that the green transition does not take place at the expense of jobs and is therefore positive to the employment the industry contributes to today - but within a short period of time, skills and jobs must go from fossil to renewable sector."

   b) Is the party for or against to explore and develop new oil and gas fields in Norway?
      Answer: 5) Very against

   c) How soon should Norway leave the oil and gas extraction fully?
      Answer: 2) by 2030
      Comment: "90% of the extraction will be stopped by 2030."

2. Renewable energy
   a) Is the party for or against to expand renewable energy in Norway besides existing hydro power?
      Answer: 1) Very supportive

b) Is the party for or against to offshore wind power or wind farm on Norwegian Continental Shelf?
Answer: 2) Supportive

c) It the party for or against to invest in hydrogen in Norway?
Answer: 2) Supportive

3. Green offshore fields
   a) Is the party for or against to the electrification of offshore fields by connecting to shore power (renewable sources)?
   Answer: 4) Against
   Comment: "Hydropower should not be used to electrify the shelf"

   b) Is the party for or against to the electrification of offshore fields by offshore wind power?
   Answer: 3) Neutral
   Comment:
   "Today's program says nothing about electrification using offshore wind power."

   c) Does party believe that energy storage solution is essential to achieve green offshore fields?
   Answer: No answers
   Comment: "(The party) has not programmed anything at this point."

   d) Technologically, it is possible that *electrolyzer can be built in the windmills. Any excessed hydrogen can be blended into natural gas which makes natural gas greener.
   *Electrolyzer splits water into hydrogen and oxygen with electricity.
   Does party support to convert offshore windmills to hydrogen wind turbines?

   Answer: No answers
   Comment: "(The party) has not programmed anything at this point."

   e) How soon should all offshore fields be electrified with renewable energy?
   Answer: No answers

Comment: "(The party) has not programmed anything at this point."

4. Finance
   a) Does the party consider the offshore wind power as Norway's future export item?
      Answer: 1) Yes
      Comment: "Especially the technology, not the power"

   b) Is the party willing to support financially (including tax incentives) to the expansion of renewable energy in Norway? If yes, in what extent?
      Answer: 1) Yes – Extensively or more than now

   c) Is the party willing to support financially (Including tax incentives) to the full electrification of offshore field? If yes, in what extent?
      Answer: No answers
      Comment: "(The party) has not programmed anything at this point."

   d) Is the party willing to support financially (Including tax incentives) to the offshore wind? If yes, in what extent?
      Answer: 1) Yes – Extensively or more than now

   e) Is the party willing to support financially (Including tax incentives) to the hydrogen as energy storage solution to achieve green offshore fields? If yes, in what extent?
      Answer: No answers
      Comment: "(The party) has not programmed anything at this point."

   Comment from the respondent:
   "As an industrial party, the Labor Party works to facilitate the development of existing and the creation of new industry. The expertise from the oil and gas industry is central to the development of adjacent industries such as hydrogen, ccs and offshore wind."

Analysis

Both Red Party's program and respondent, Solheim-Åkerblom, stated that the party is against further development of offshore fields in Norwegian Shelf Continent. They added that 90% of offshore fields should be stopped by 2030. It can be seen that the party is one of the most ambitious parties in terms of phasing out oil and gas extraction. Solheim-Åkerblom stated that they are politically and financially supportive of develop renewable energy; however, they emphasized that such technologies should not be developed for the electrification of offshore fields. It may be able to be said that if the offshore wind and hydrogen storage are deployed to electrify offshore fields, they are most likely against to the electrification of offshore fields. It seems answers from Red Party is based on what is written in the party's 2017-2021 program. It can be indicated that it is probably that updated discussion within the party is not reflected to the answers from Red Party.

10.3.3 Geopolitical perspective: Norway and EU

Norway is located in European region; however, the country is not a member of EU. (Government Norway, 2015) Norway and EU have a strong relationship through the Agreement on the European Economic Area (EEA). (Government Norway, 2015) Those agreements enable Norway to access the EU's internal market and obtain "free movement of goods, persons, services and capital". (Government Norway, 2015) Government Norway added that EEA is not only economic agreement, but also covers a number of sectors such as education, research, environment, social policy, culture and so on. Although Norway is not a member state of EU, roughly three-quarter of EU legislation are adopted in Norway. (Government Norway, 2012) Borchardt (2010) stated that EU member nations can select the methods how they achieve the target and directives which are decided by EU administration. Norwegian administration may proceed similarly due to EEA. Gänzle and Henökl (2018) added that it is difficult for Norway to use a veto against new EU legislations which coordinate with EEA laws. In addition, Gänzle and Henökl (2018) pointed out Norwegian bureaucracies sometimes directly link and interact with EU administrative bodies. European Commission (2019) reported that Norway and Iceland agreed to apply some EU climate laws such as effort sharing regulation and regulation on land, land-use change. Based on these deep cooperation and interaction at many levels between Norway and EU, where EU heads to in terms of climate policies and how EU tries to achieve its ambitious target to tackle climate change may influence Norwegian administration.

EU is aiming to be carbon neutral by 2050, and its political approach is named ‘European Green Deal’. (European Comission, 2020) European Commission (2019) stated that the ambition, zero net emission of greenhouse gases by 2050, can be achieved by various climate policies and involvement of every sector. According to European Commission (2019), more than 75% of greenhouse gas are emitted by energy sector in EU. Thus, energy sector may be one of the most important sectors to achieve their ambition. European Commission (2019) explained that zero net greenhouse gas emission can be achieved via natural carbon sinks and carbon capture storage (CCS). It indicates that EU expects that some greenhouse gas will still be emitted in 2050; however, the volume will be lower so that emitted pollution can be absorbed by nature or CCS. Although the demand of fossil fuel may remain within EU in 2050, it is likely that stricter climate policies will hinder oil and gas extraction activities towards 2050. The pressure from EU on Norwegian administration in terms of oil and gas extraction may appear eventually. The strong interest in CCS by Norwegian administration and oil and gas industry may be because they are already facing such pressure or expecting it in near future. (Norwegian Petroleum, n.d.) In that perspective, Norwegian administration may support replacing gas turbines to renewable energy at offshore platforms.

10.3.4 Chapter discussion and analysis

In order to achieve offshore fields to transform to green offshore fields, whether the party supports to oil and gas extraction now and in the future, and whether the party supports electrification of offshore fields with offshore wind and / or hydrogen storage need to be examined. Though analyzing each party’s program and answers for the survey from some parties, it can be identified how supportive each party is in terms of continuing oil and gas production and electrification of offshore fields with renewable energy. Based on the previous analysis, which position each party currently stands regarding both oil and gas extraction and electrification of offshore fields is illustrated in Figure 56.

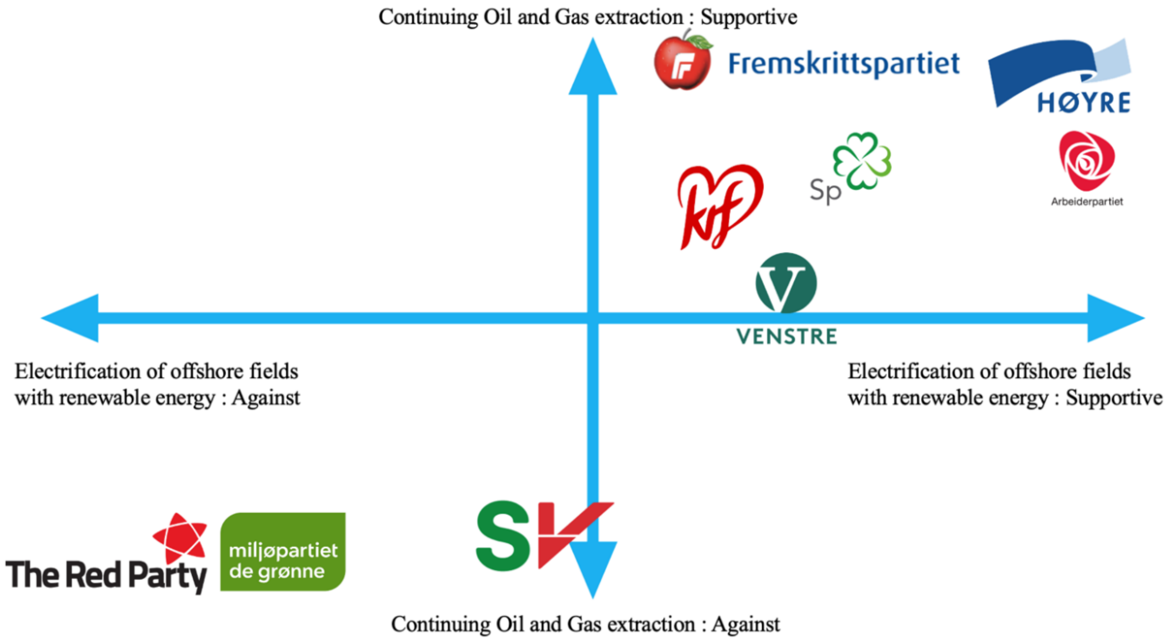


Figure 56: Norwegian parties' political standing regarding continuing oil and gas extraction of electrification of offshore fields with renewable energy

As it can be seen, Conservative Party (Høyre) is the most supportive of both continuing oil and gas extraction and electrification of offshore fields with renewable energy. Progress Party (Fremskrittspartiet) is very supportive of oil and gas and moderately supportive of electrification of offshore fields with renewable energy. Labor Party (Arbeiderspartiet), on the other hand, is moderately supportive of oil and gas and very supportive of electrification of offshore fields with renewable energy. It can be said that these three parties may support green offshore fields in order to continue oil and gas extraction for long time. This can be indicated from their statements that they do not set the end date of oil and gas extraction or do not consider phasing out oil and gas. As it was mentioned previously, Conservative Party holds 45 seats, 26 seats for Progress Party and 49 seats for Labor Party at parliament; thus, the total of 120 representatives of each party out of 169 seats can be supportive to green offshore fields. In addition, it seems that Centre Party (Sp), Liberal Party (Venstre) and Christian Democratic Party (krf) are relatively supportive of continuing oil and gas extraction at the moment; however, they stated that they demand stricter requirements for licensing round. In other words, it can possibly be said that if oil and gas extraction in the shelf can be fully operated with renewable energy, it may meet their demand. Thus, they can be counted as supportive parties of green offshore fields. The number of seats of Centre Party, Liberal Party and Christian Democratic Party are 19, 8 and 8 respectively. Thus, if 35 representatives of these parties were added to 120 representatives, the total of 155 representatives can be supportive, which is more than 91% of total seats at parliament. On the other hands, Socialist Left Party stated that they are against continuing oil and gas extraction on Norwegian Continental Shelf. They also stated that they are supportive of expansion of renewable energy including offshore wind and hydrogen storage; however, they stated that those renewable energy should not be used to supply power to offshore fields. It seems that Red Party is even more clearly stated that they are against continuing oil and gas extraction since they proposed to phase out 90% of extraction by 2030. Red Party is one of few parties setting end date of oil and gas, and it seems they demand drastic change within energy industry. They are against electrification of offshore fields as well since they believe that oil and gas extraction should be phased out sooner than later. According to the Party's program (2017), Green Party also demands Norway to phase out oil and gas over a 15 years period, which indicates that they aim phasing out oil and gas 'over a 12 years period' as of now. It seems that these parties are strongly against continuing oil and gas extraction; thus, it is likely that they would not support green offshore fields since transforming offshore fields to green offshore fields can mean that oil and gas extraction may continue for long time. The current number of seats of Socialist Left Party, Red Party and Green Party is 11, 1 and 1 respectively. Thus, 13 representatives at parliament may be against green offshore fields. Considering EU's move towards environment including European Green Deal and close relationship between Norway and EU in terms of energy and environment, if more than 90% of representative at parliament is supportive of electrification of offshore fields with renewable energy, it can be said that green offshore field is politically supported. Hence, it may be able to say that it is feasible politically.

10.3.5 Limitation

Some parties, Centre Party, Liberal Party, Christian Democratic and Green Party did not answer the survey; thus, this analysis is based on only their 2017-2021 programs, which were published in 2016/2017. As a result, the party's target and standing in terms of oil and gas and electrification of offshore fields may be different from current parties' perspectives. Some respondents provided updated discussion within the party through the survey. For example, the respondents of Conservative Party, Progress Party, Labor Party and Socialist Left Party showed parties' perspectives of utilizing hydrogen and electrification of offshore fields with renewable energy, which are not mentioned with detail in the parties' programs. On the other hands, answers from Red Party seem based on current party's program, and it seems that updated discussion within the party was not reflected. Therefore, analysis of Red Party may be limited as Centre Party, Liberal Party, Christian Democratic and Green Party. Politics can sometimes be complicated, and each party seeks political initiative; therefore, although vast majority of members of parliament may be supportive of green offshore fields, it is possible that those supporters may vote 'against' for their own political gain in political power game. Such complexity was not reflected in this analysis.

10.4 Social Analysis

The polls and surveys for specific issue or project are often conducted to see the reaction of society. The results can influence decision making in politics. It is a passive way to express opinions of society since if the polls and surveys are not conducted, politicians do not know how society thinks in terms of specific matters. Thus, in democratic countries, it can be said that one of the most effective and active ways to express the opinions of society is voting in the elections. Elected politicians represent the supporters. If the supporters are not satisfied with their performance, they can vote for other politicians or parties in the next election. Therefore, analyzing voting behavior can be as important as the results of polls and surveys in order to understand the position of society in terms of a specific issue or project.

Another possible way to express society's opinions is the demonstration. Laville and Watts (2019) reported that millions of people joined the demonstration to demand immediate climate actions to companies, governments and societies in 185 countries in 2019. In Norway, Naturvernforbundet (2019) reported that more than 40,000 youths joined to climate demonstrations on the Friday of 22nd March 2019. This school strike was widely supported; at the same time, some politicians questioned and criticized school strike. For example, the spokesperson of former prime minister of the United Kingdom, Therese May, commented that "that time is crucial for young people precisely so that they can develop into the top scientists, engineers and advocates that we need to help tackle this problem". (BBC, 2019) Although, these demos were controversial method for some people, raising voice by joining demo was one of few ways to deliver the voice of youths, who do not have a vote for general election yet, to the politicians and corporations in the world.

Analyzing consumer buying behavior can also be a tool to see the social reaction to the issue. Choosing more environmentally friendly products over others, or boycotting the non-green items shows how important to solve the climate change for consumers. For example, BBC (2019) reported that 'flight shame' seems spreading within Europe. According to the result of survey by Swiss bank UBS, 20% of people had reduced the number of flights as their climate action. (BBC, 2019) Some of them switched from taking flights to trains even though the journey takes extensively longer time. (BBC, 2019)

10.4.1 Survey

In order to discover the social acceptance of the projects, replacement of gas turbines on the offshore platforms to renewable energy, online survey was conducted. The targets of the survey are Norwegian citizen and expatriates with permanent residency of Norway because these targeted groups have votes in general and/or municipality election in Norway. In addition, residents of Norway may concern and be more serious about what happens in domestically rather than residents of other nations concern about what happens in Norway. Norwegian government and companies may concern the climate demonstrations within the country rather than in other countries; thus, Norwegian and foreign citizens, residing in Norway, are targeted for this survey.

10.4.1.1 Sample size

According to statistics Norway (2020), Norway has population of 5,367,580 as of 1st January 2020. Moreover, 790, 497 foreign citizens reside in Norway on 1st January 2020. (Statistics Norway, 2020) The total of 6,158,077 people would be the targeted for this survey. The total of 104 people responded to the survey. The validity of the sample size can be examined by finding out the margin of error at 95% confidence level. 95% confidence level means that the results will be same 95% of the time if the same survey is conducted. (Survey Monkey, n.d.) Survey Monkey (n.d.) also stated that confidence level 95% is the most commonly used. In addition, it is recommended that the margin of error is in the range of 1% to 10%. (Survey Monkey, n.d.) The margin of error represents accuracy of the result within certain percentage. (Australian Bureau of Statistics, 2018) The margin of error was calculated by sample size calculator of Australian Bureau of Statistics. (Figure 57)

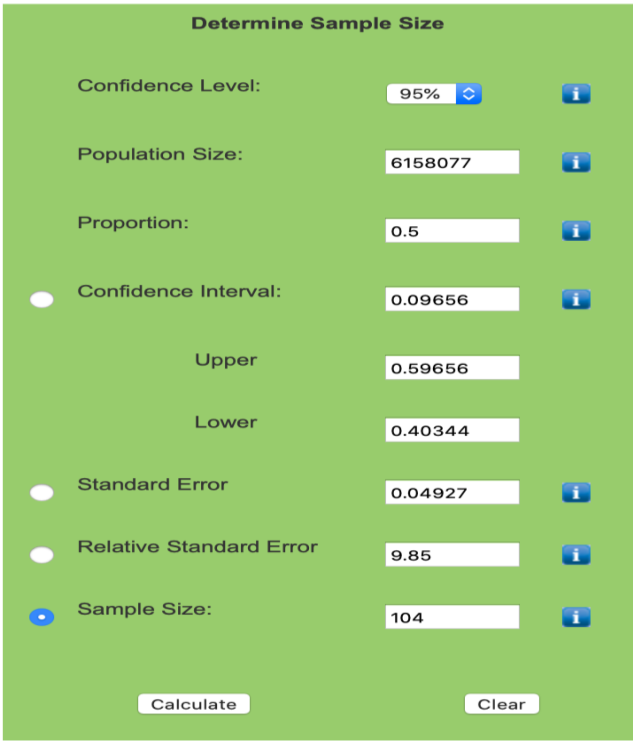


Figure 57: The margin of error (Australian Bureau of Statistics, 2018)

According to this calculation (Figure 57), the margin of error (confidence interval) was calculated as 9.66% at confidence level 95%, which is in the range of 1% to 10%. Although, 5% of the margin of error is the most commonly used, 9.66% is still in recommended range. (Survey Monkey, n.d.) Thus, it can be said that the sample size of 104 is valid.

10.4.1.2 Survey format

Originally, it was planned to conduct street survey as a random survey, However, due to COVID-19 crisis, the method needed to be changed to online survey. Online survey was created with a survey tool, called 'survey planet'. It was chosen since the tool could provide Norwegian language option. The online survey was shared and answered through social media such as Facebook and LinkedIn. In addition, the author's colleagues at supermarket, the colleagues of author's spouse at an oil company, family members and their friends participated the survey in June 2020. The survey was conducted anonymously; therefore, the answers from respondents may be more honest than street survey. Multiple submission from same device is restricted.

One of the most ideal methods to assess the social acceptance of this project can be that participants are provided detailed information of the project before they are asked the question, ‘do you support it or not?’. However, it requires participants to spend some time to understand the project. As it was calculated above, required sample size is around 100; thus, it seems that it is not the most efficient and effective method. For this research, probable social acceptance to the project will be identified by analyzing participants’ answers for survey questions. 20 survey questions were created based on factors; voting behavior, demonstration and consumer buying behavior. All questions are in multiple choice question format in order to reduce the duration for respondents. Expected duration of the survey was 3 minutes. All questions, choices and instruction of the survey were in Norwegian since most people in the target groups speak Norwegian language as their mother tongue or second language. Original questions and choices of answer are in Appendices 57 – 60. The detailed answers from participants are in Appendices 61 – 64. Following questions and choices of answer were translated in English by the author. The explanation and motive for the question were added after the choices of answers. Those were not written in survey. Moreover, the pie chart, created based on the result, was added in the end of each question. Choice of answers were written in Norwegian, which are on the right side of pie chart. They are in same order as choices of answers in English listed above each pie chart.

10.4.1.3 Survey questions, choices of answers and results

Q1. Are you for or against oil and gas extraction in Norway? (Figure 58)

Very supportive

Supportive

Neutral

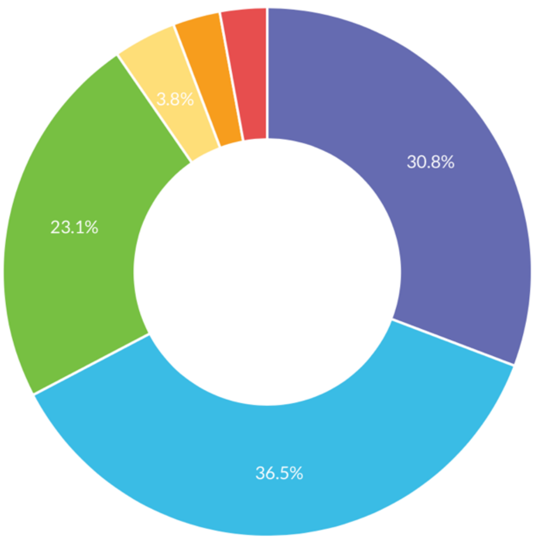
Against

Very against

Do not know

Explanation and motive: Replacing gas turbines on Norwegian Continental Shelf to renewable energy means that oil and gas extraction will be continued. Thus, it can be expected that participants answered ‘Against’ and ‘Very against’ are likely to say ‘No’ to this project. On the other hands, participants chose ‘Very supportive’ and ‘Supportive’ in Q1, they may support continuing oil and gas extraction in Norway. Thus, if green offshore assists the oil and gas industry’s sustainability, they may support the project.

Result:



Choice	Total
Veldig støttende	32
Støttende	38
Nøytral	24
Mot	4
Veldig imot	3
Vet ikke	3

Figure 58: Q1. Are you for or against oil and gas extraction in Norway?

Q2. Are you for or against more exploration and development of oil and gas extraction in Norway? (Figure 59)

Very supportive
Supportive
Neutral
Against
Very against
Do not know

Explanation and motive: Participants showed less supportiveness comparing to Q.1 may concern about future environment and climate change.
35 same, 22 decrease

Result:

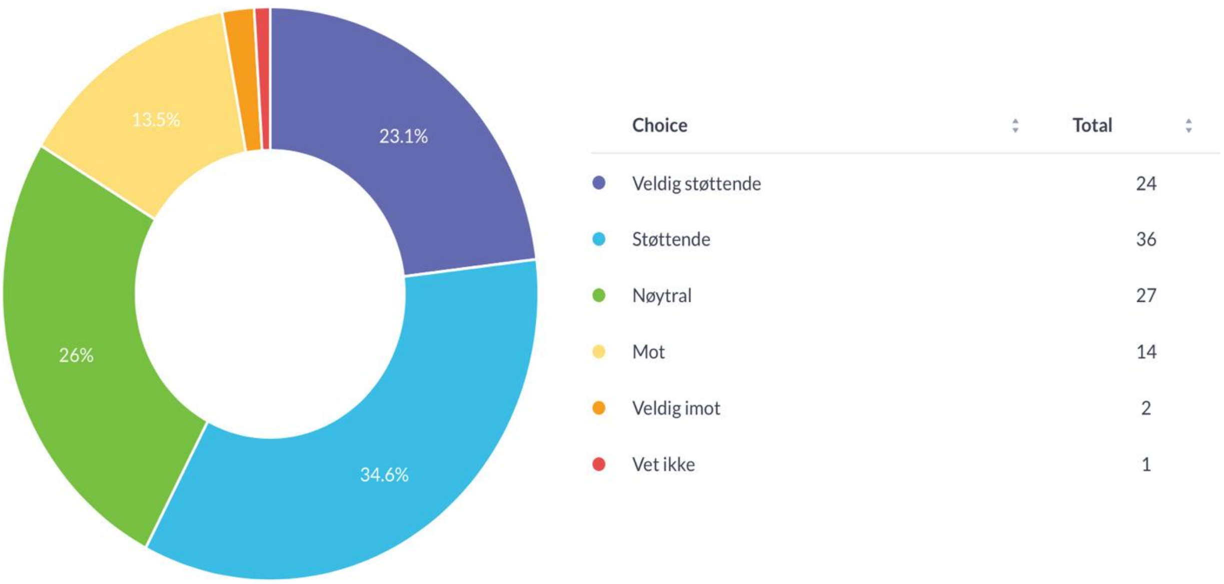


Figure 59: Q2. Are you for or against more exploration and development of oil and gas extraction in Norway?

Q3. Are you for or against the development of oil and gas field in areas like Lofoten? (Figure 60)

Very supportive

Supportive

Neutral

Against

Very against

Do not know

Explanation and motive: It can be indicated that participants answered, 'Very supportive' and 'Supportive' to this question may think economy comes first over environment.

Result:

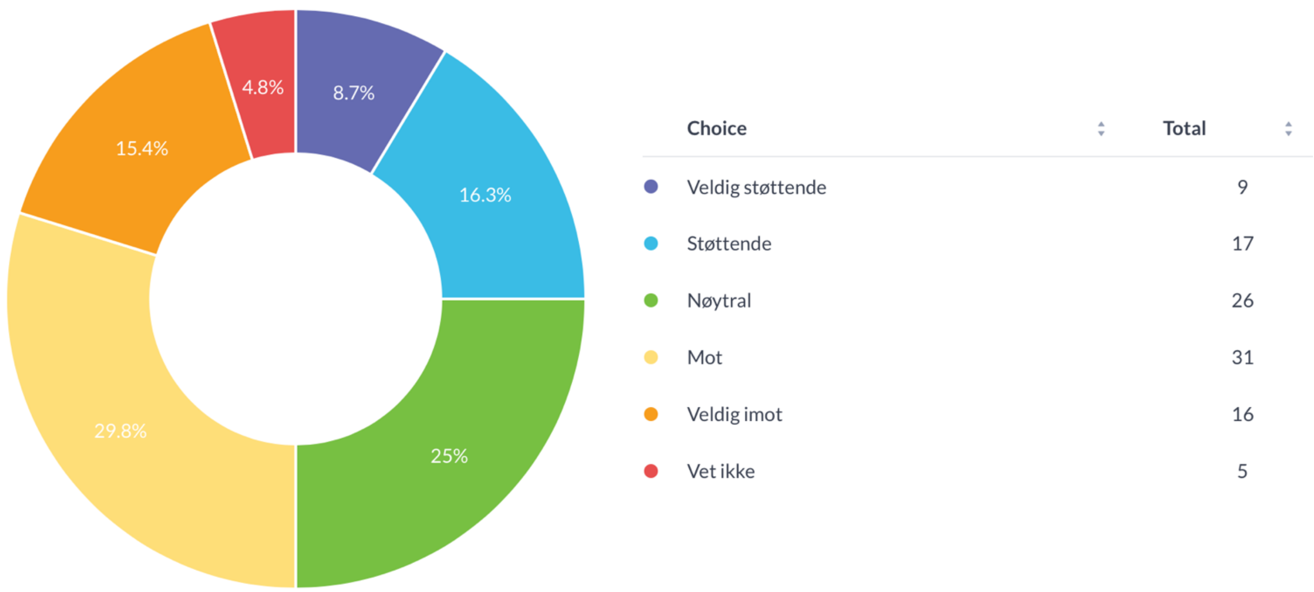


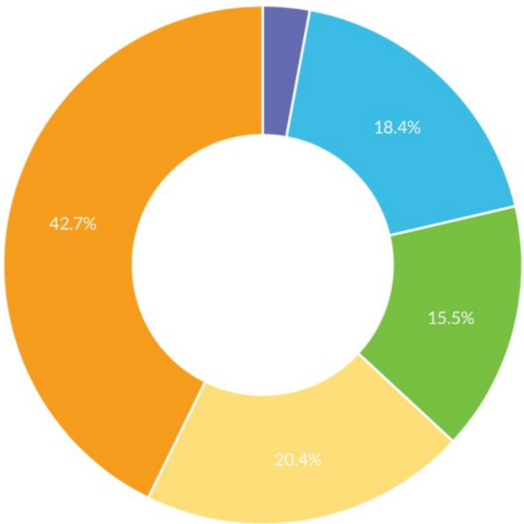
Figure 60: Q3. Are you for or against the development of oil and gas field in areas like Lofoten?

Q4. Do you think Norway should leave oil and gas? If yes, in what timeline? (Figure 61)

Yes: immediately
Yes: by 2030
Yes: by 2040
Yes: by 2050
No

Explanation and motive: It can be expected that participants answered ‘immediately’ to this question are against the gas turbine replacing project.

Result:



Choice	Total
Ja - umiddelbart	3
Ja - innen 2030	19
Ja - innen 2040	16
Ja - innen 2050	21
Nei	44

Figure 61: Q4. Do you think Norway should leave oil and gas? If yes, in what timeline?

Q5. Do you think Norway should shift from oil and gas to renewable energy? (Figure 62)

Yes: but gradually and slowly

Yes: gradually but with speed

Yes: ASAP

No

Explanation and motive: It can be indicated that participants answered ‘Yes: but gradually and slowly’ and ‘Yes: gradually but with speed’ may support the green offshore project since they expect the energy transition from oil to renewable. On the other hands, participants said ‘Yes: ASAP’ may not support the project since they do not want oil and gas extraction to be continued. In addition, participants answered ‘No’ are also likely to say ‘No’ to the green offshore projects since they may think oil and gas industry can be as it is.

Result:

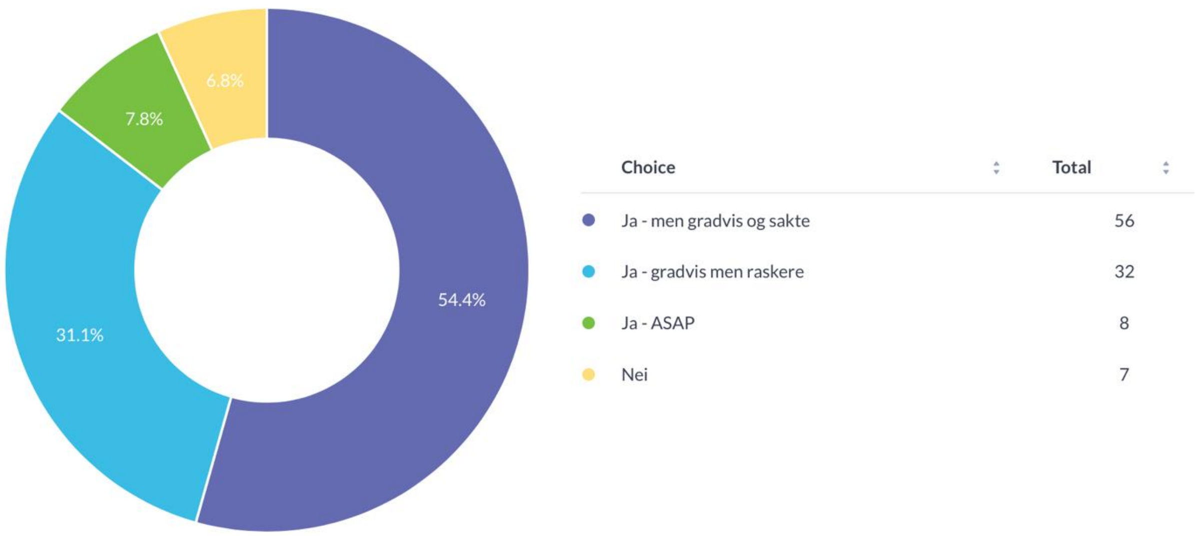


Figure 62: Q5. Do you think Norway should shift from oil and gas to renewable energy?

Q6. There were climate protests all around the world in October 2019.
Have you participated or are you thinking to participate next time? (Figure 63)

Yes: I have, and I will next time

Yes: I have, but not sure for next time

Yes: I have, but not next time

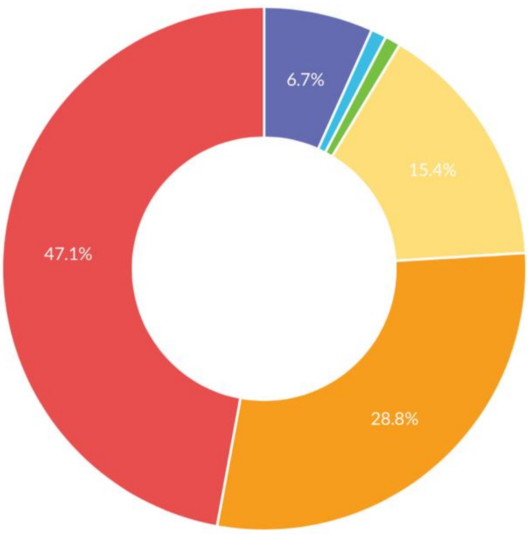
No: I have not, but I will next time

No: I have not, and not sure for next time

No: I have not, and I will not

Explanation and motive: It can be indicated that participants chose ‘Yes: I have, and I will next time’ have very strong interests in climate change, and participants answered ‘No: I have not, but I will next time’ have strong interest in environment issues.

Result:



Choice	Total
Ja, det har jeg og det vil jeg neste gang	7
Ja, det har jeg, men er ikke sikker på for neste gang	1
Ja, det har jeg, men ikke neste gang	1
Nei, det har jeg ikke, men det vil jeg neste gang	16
Nei, det har jeg ikke og er ikke sikkert for neste gang	30
Nei, det har jeg ikke, og jeg vil ikke	49

Figure 63:Q6. There were climate protests all around the world in October 2019. Have you participated or are you thinking to participate next time?

Q7. Do you have a car? (Figure 64)

Gasoline car

Diesel car

Hybrid car

Electric car

Hydrogen car

No, I do not have one

Explanation and motive: The ratio of eco car; hybrid, EV and Hydrogen car, against combustion vehicles; gasoline and diesel cars will be compared.

Result:

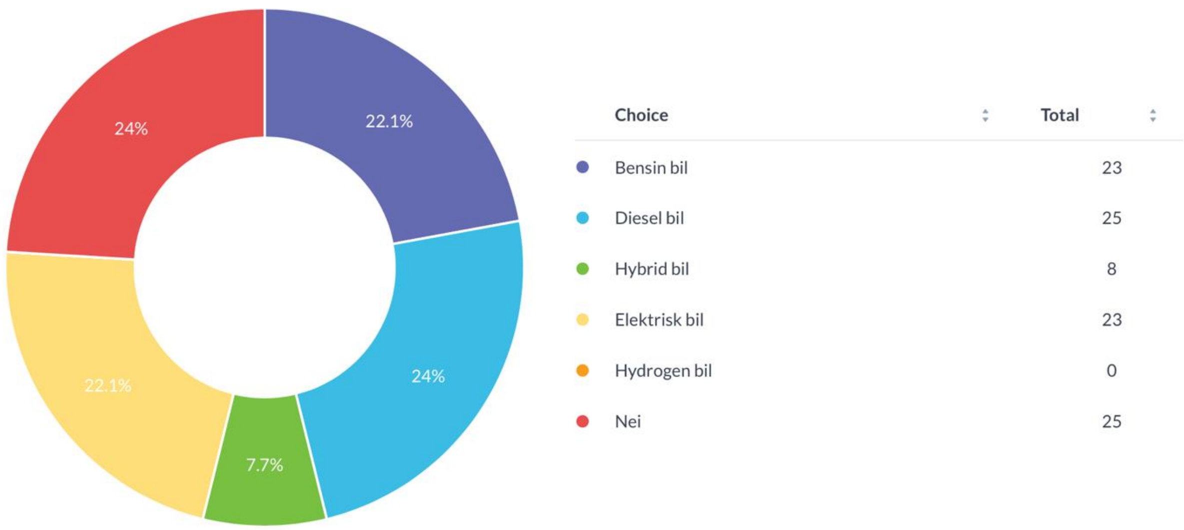


Figure 64: Q7. Do you have a car?

Q8. Will you consider buying electric vehicles even though all tax incentives and benefits are removed? (Figure 65)

Yes

No

Explanation and motive: It can be said that participants who currently have eco cars but chose ‘no’ to this question means that they choose eco cars over combustions due to the tax and other benefits on the road.

Result:

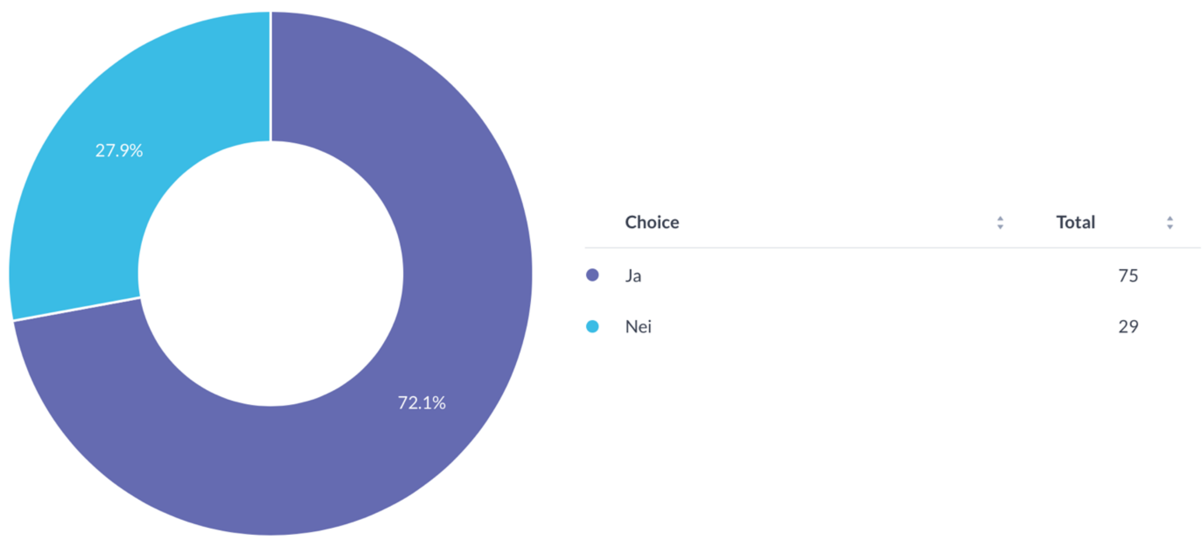


Figure 65:Q8. Will you consider buying electric vehicles even though all tax incentives and benefits are removed?

Q9. Would you give up car and use public transportation for your climate action? (Figure 66)

Yes

No

Explanation and motive: It can be indicated that participants chose ‘Yes’ to this question concerns the climate change and are willing to take actions.

Result:

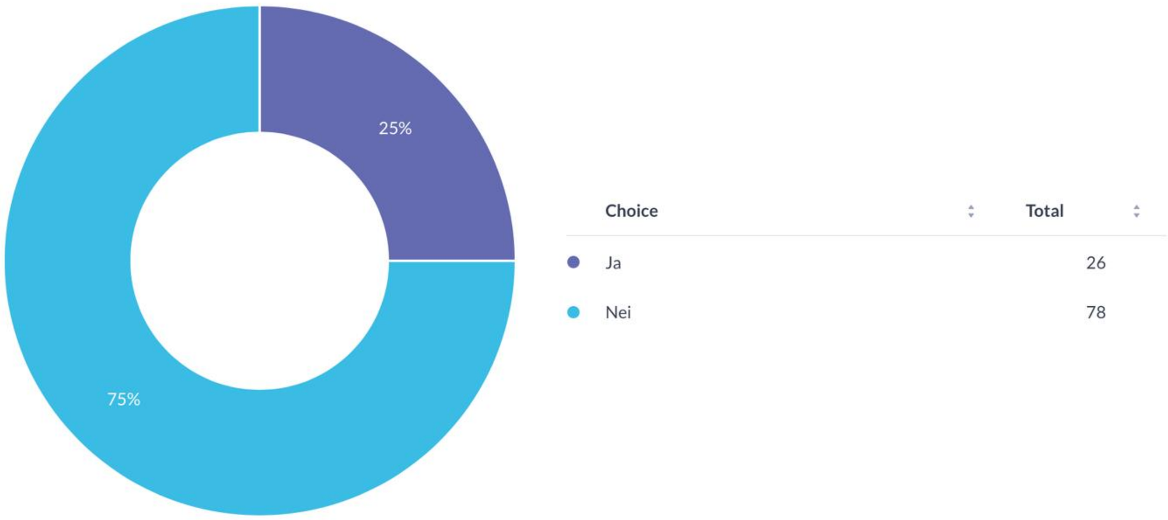


Figure 66: Q9. Would you give up car and use public transportation for your climate action?

Q10. Would you avoid using flight for your climate action? (Figure 67)

Yes

No

Explanation and motive: Explanation and motive: It can be indicated that participants chose ‘Yes’ to this question concerns the climate change and are willing to take actions. It can be said that those who answered ‘No’ to both Q.9 and Q.10 take climate actions seriously; thus, it is likely that they will be against to offshore green projects since the project may be controversial for them.

Result:

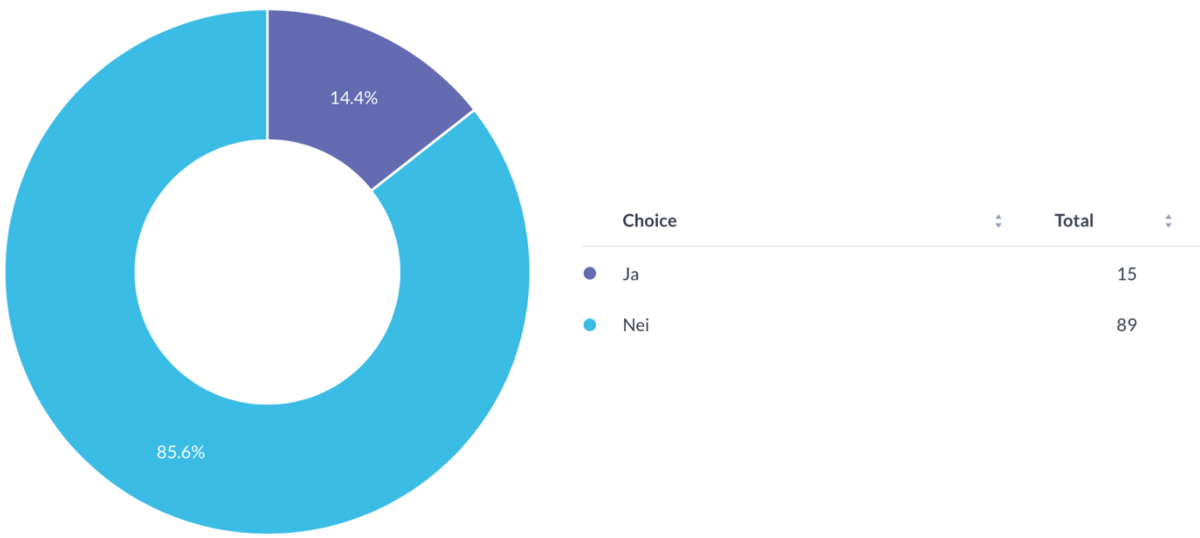


Figure 67: Q10. Would you avoid using flight for your climate action?

Q11. Some parties want to increase carbon tax, which causes higher price on gasoline, flight tickets etc

Would you support it? (Figure 68)

Very supportive

Supportive

Neutral

Against

Very against

Do not know

Explanation and motive: How sensitive to tax increase will be identified. The reaction of participants, actively taking climate actions, may be able to be seen.

Result:

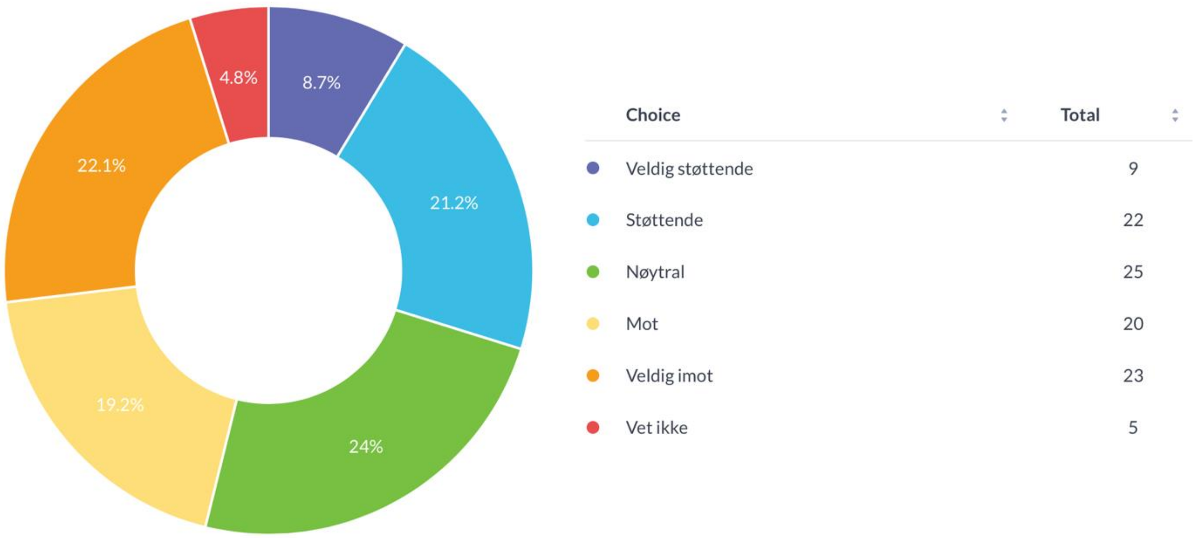


Figure 68: Q11. Some parties want to increase carbon tax, which causes higher price on gasoline, flight tickets etc. Would you support it?

Q12. Norway already produces its 96% of electricity by hydro power.

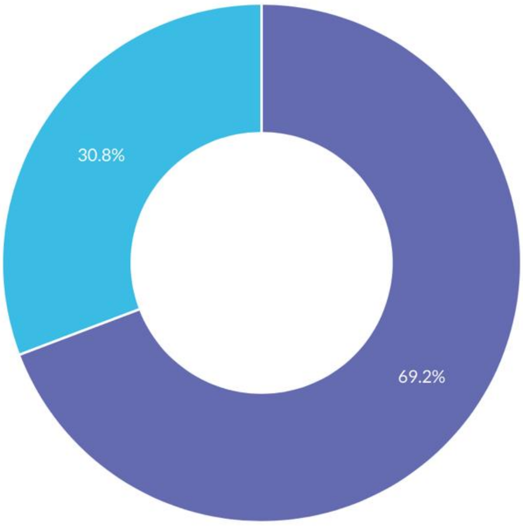
Do you think Norway should invest to develop other renewable energy rather than hydro power? (Figure 69)

Yes: why not?

No: use money for something else

Explanation and motive: Participants chose ‘Yes: why not?’ support the further development and investment into renewable energy in Norway.

Result:



Choice	Total
Ja - hvorfor ikke?	72
Nei - bruk pengene til noe annet	32

Figure 69: Q12.Norway already produces its 96% of electricity by hydro power. Do you think Norway should invest to develop other renewable energy rather than hydro power?

Q13. There are ongoing projects that making existing offshore fields electrified by connecting to onshore with power cable and offshore wind power. Equinor received 2.5 billion NOK from state-owned investment company for those projects. What is your thought when you hear it? (Figure 70)

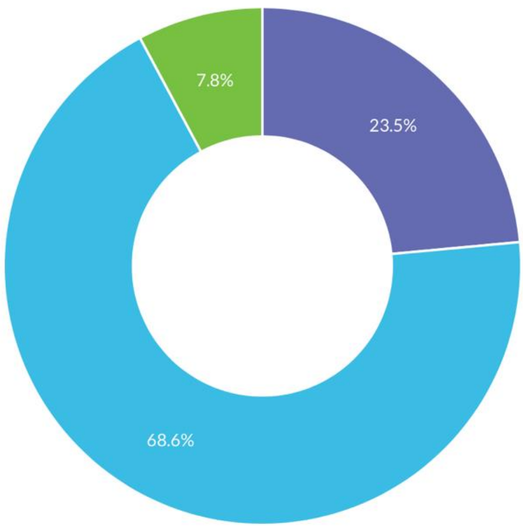
It is too much. Have not they got enough?

That is a great move

The government should support more

Explanation and motive: It is indicated that participants answered ‘That is a great move’ and ‘The government should support more’ show the support to the government expenditure to such project. Further financial support from the government may be needed to replace the gas turbines on Norwegian Continental Shelf. Hence, participants said ‘It is too much. Have not they got enough?’ may believe that further financial support from government is not necessary.

Result:



Choice	Total
Det er for mye. Får de ikke nok?	24
Det er et flott grep	70
Regjeringen bør støtte mer	8

Figure 70: Q13.There are ongoing projects that making existing offshore fields electrified connecting to onshore with power cable and offshore wind power. Equinor received 2.5 billion NOK from state-owned investment company for those projects. What is your thought when you hear it?

Q14. Power company must charge 1 øre per kWh from customer, which finances state-owned investment company, Enova. They invest renewable power and environment projects. Did you know about it? (Figure 71)

Yes

No

Explanation and motive: To identify the awareness of Enova tax.

Result:

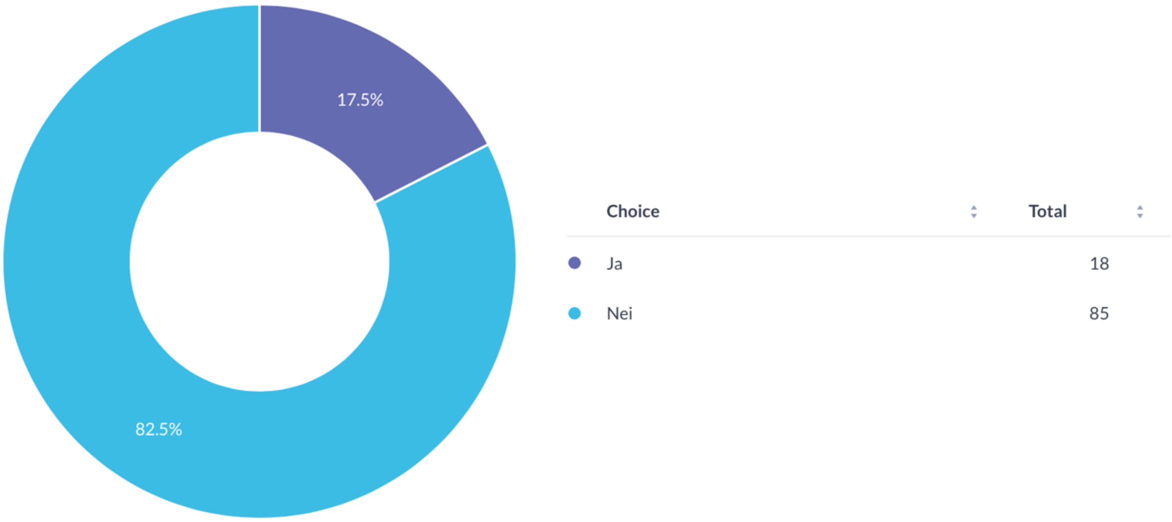


Figure 71: Q14. Power company must charge 1 øre per kWh from customer, which finances state-owned investment company, Enova. They invest renewable power and environment projects. Did you know about it?

Q15. What is your thought about it? (Figure 72)

That is great, I support it

That is good, but should be less

I do not like it

Explanation and motive: It can be said that participants, answered ‘That is great, I support it’ and ‘Thai is good, but should be less’, are willing to contribute to the fund of renewable energy. It is also indicated that participants chose ‘I do not like it’ would not like to contribute to such fund.

Result:

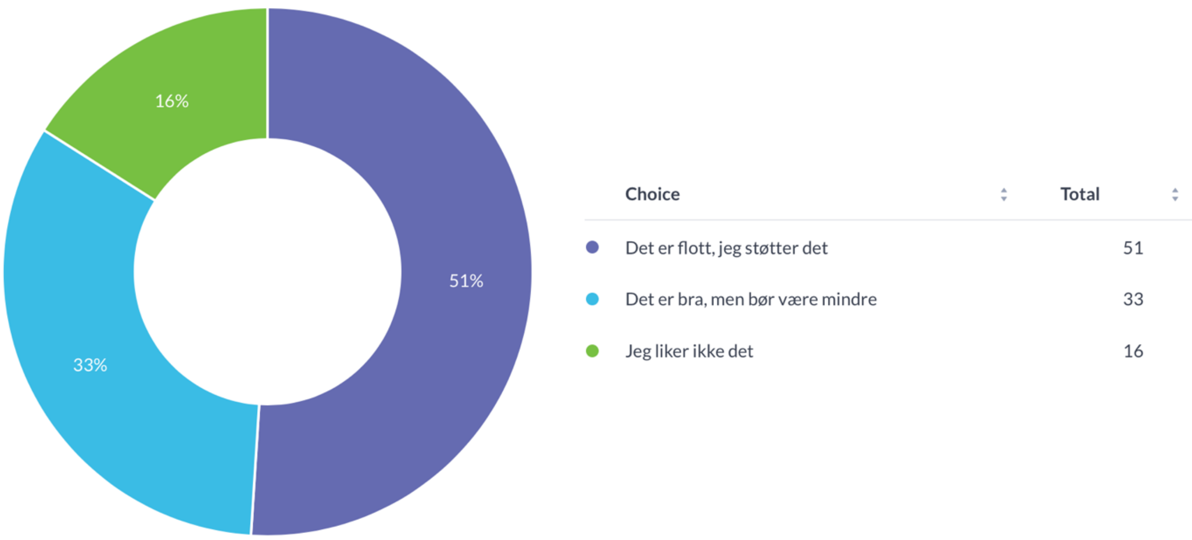


Figure 72: Q15. What is your thought about it?

About you:

Q16. Age (Figure 73)

Under 18

18-19

20-24

45-66

67-79

Over 80

Explanation and motive: This categorization of age group was followed to the categorization of election data of Statistics Norway. Whether tendency and difference exist among each age group may be able to be seen.

Result:

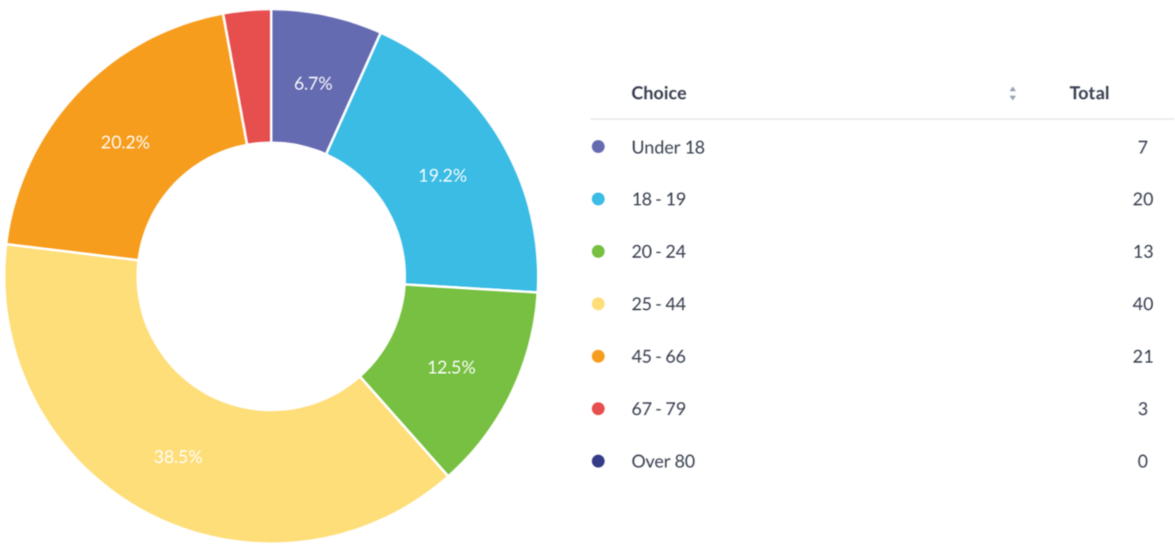


Figure 73: Q16. Age

Q17. Do you vote in general election in Norway? (Figure 74)

Yes: always

Yes: sometimes

Yes: rarely

No

I do not have a vote

Explanation and motive: Participants answered ‘No’ and ‘I do not have a vote’ to this question, have considerably less influence on politics in Norway.

Result:

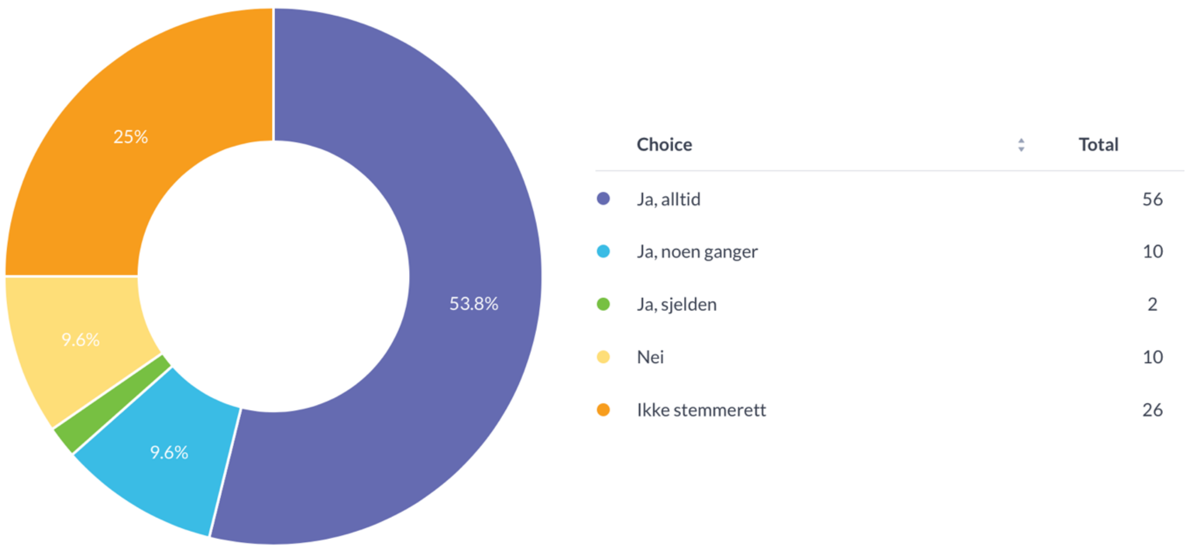


Figure 74: Q17. Do you vote in general election in Norway?

Q18. Do you have a vote to local municipality election in Norway? (Figure 75)

Yes: always

Yes: sometimes

Yes: rarely

No

I do not have a vote

Explanation and motive: Participants answered 'No' and 'I do not have a vote' to this question, have considerably less influence to politics in Norway.

Result:

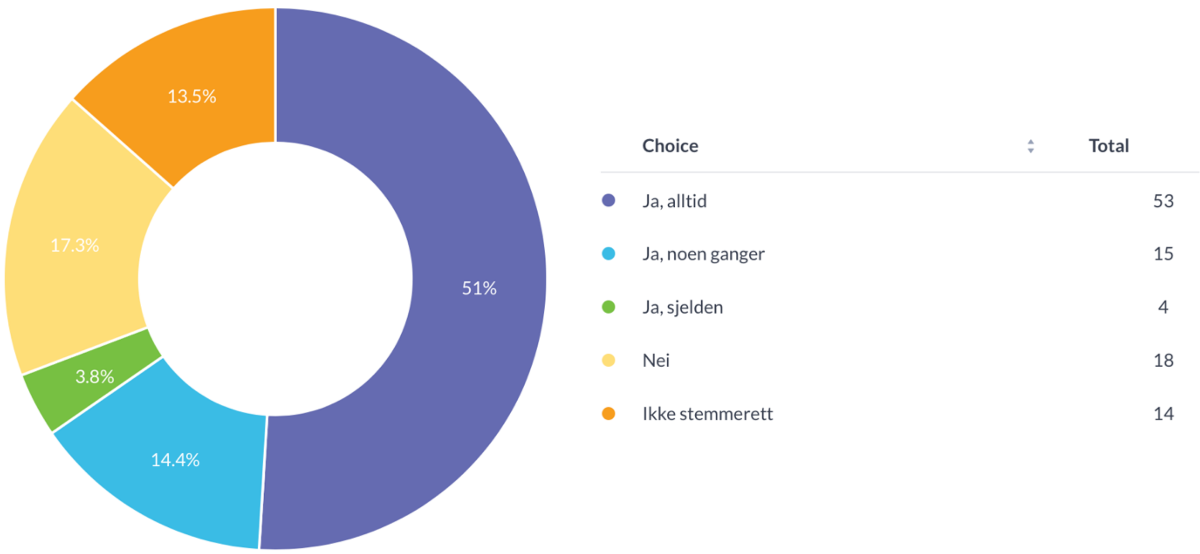


Figure 75: Q18. Do you have a vote to local municipality election in Norway?

Q19. Which party do you support? (Figure 76)

Arbeiderpartiet (Labor party)

Høyre (Conservertive party)

Fremskrittspartiet (Progress party)

Senterpartiet (Center party)

Sosialistisk Venstreparti (Socialist Left party)

Venstre (Liberal party)

Kristelig Folkeparti (Christian Democratic party)

Miljøpartiet De Grønne (Green party)

Rødt (Red party)

I do not have supporting party

I do not want to answer

Others ( )

Explanation and motive: Whether tendency and difference exist among each political party supporters may be able to be seen.

Result:

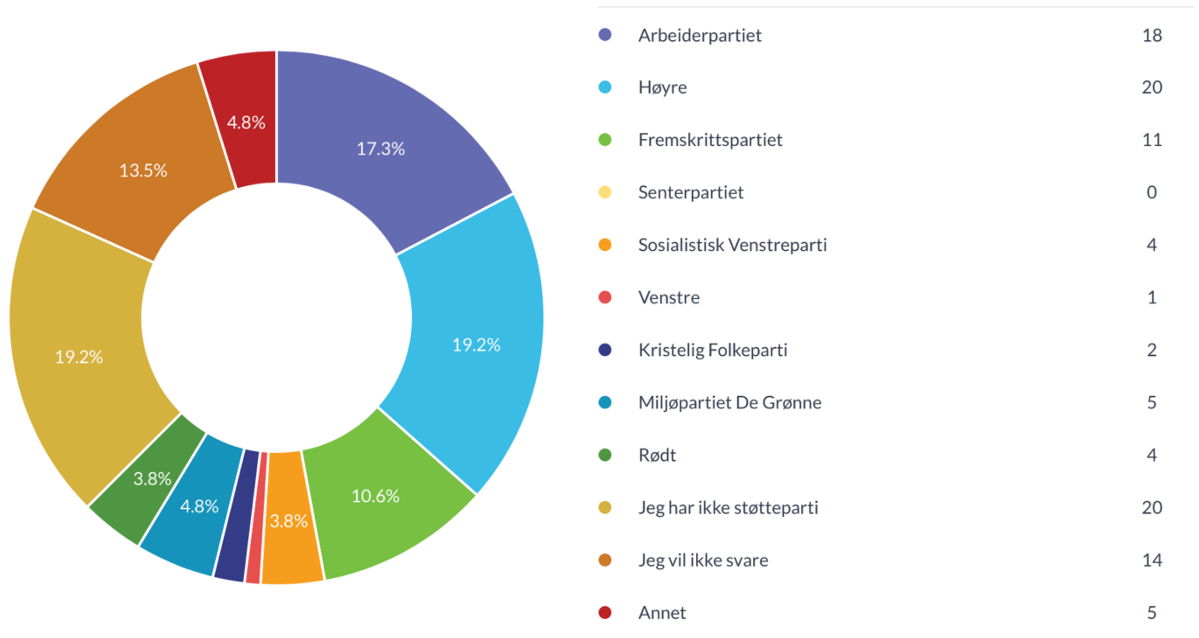


Figure 76: Q19. Which party do you support?

Q20. How important energy and environment is for you when you vote? (Figure 77)

1st priority
2nd - 3rd priority
4th - 5th priority
I will consider, but not so important
I do not consider

Explanation and motive: This result shows how important energy and environment policy of each party is when participants vote. Higher priority, 1st to 3rd priority, means strong interests in energy and environment which influence their voting behavior.

Result:

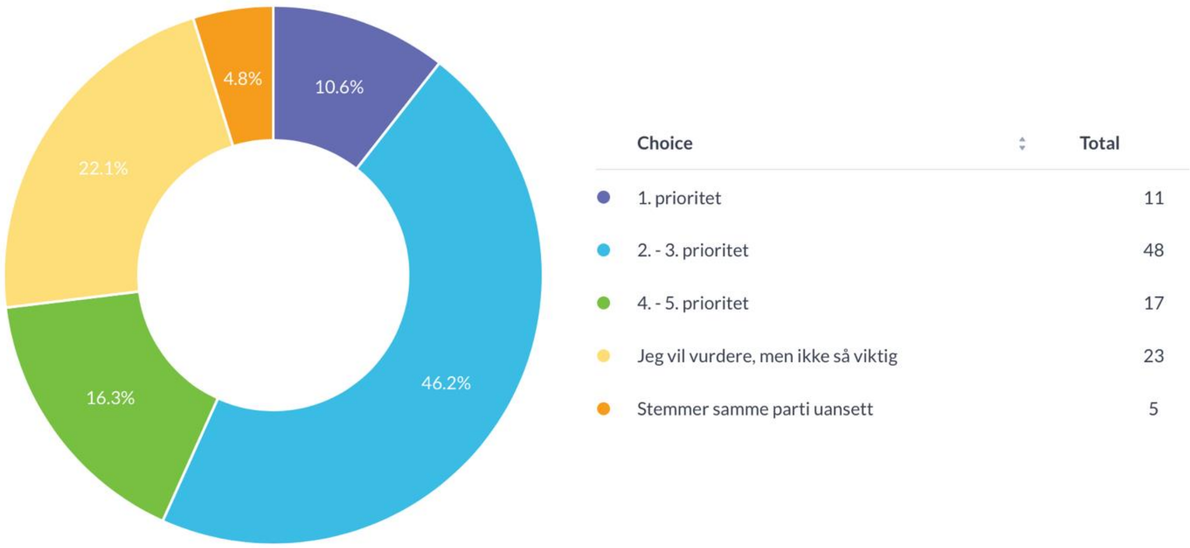


Figure 77: Q20. How important energy and environment is for you when you vote?

10.4.1.4 Validity of the survey

Supporting political party was asked in Q19. Based on the answers, the bar chart was created as Figure 78. In addition, national poll for general election was conducted by Norfakta in July 2020. (Poll of polls, 2020) (Figure 79) These two results are compared below.

The survey for this thesis

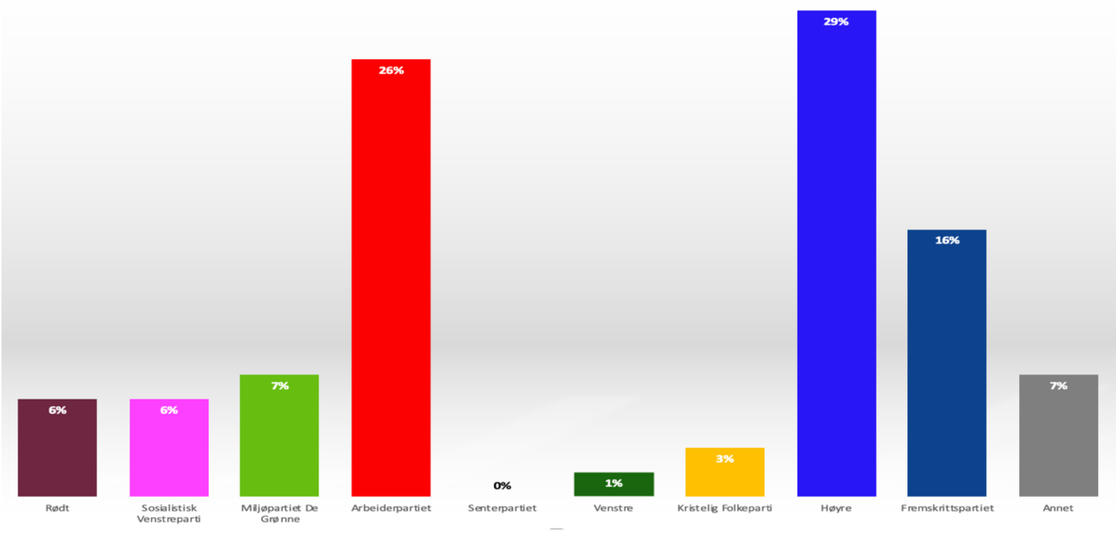


Figure 78: Participants' supporting parties

Norfakta for Nationen og Klassekampen 11. juli 2020

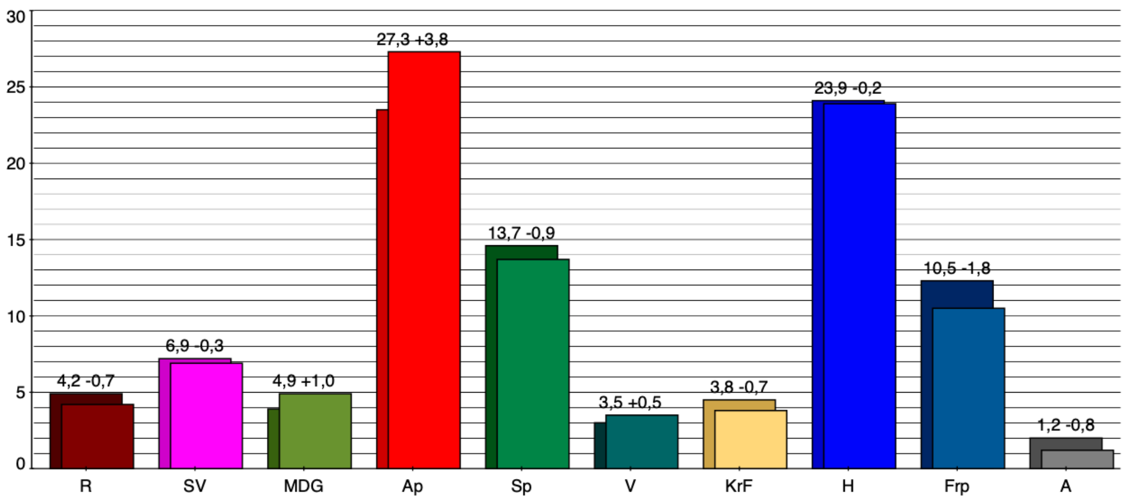


Figure 79: The result of poll for general election in July, 2020 (Norfakta for Nationen og Klassekampen, 2020)

It can be indicated that participants, who are related farming industry, may be absent in the participants of this survey since 0% support to the Centre Party. It can be a limitation of this survey result. However, apart from the supporting rate to Centre Party (Sp), it seems these two charts are almost identical. Thus, it can be said that participants of this survey are well mixed and well represented of Norwegian citizens and the residents of Norway.

10.4.2 Chapter discussion and analysis

The key questions to identify whether participants are likely to be against to the replacing gas turbine on Norwegian Continental Shelf are Q1, Q4, Q5, Q9, Q10 and Q13. Regarding to Q9 and Q10, whether participants answered ‘Yes’ in both questions are considered as they are against. In addition, participants answered ‘Against’ and ‘Very against’ in Q1, ‘Yes: immediately’ in Q4, ‘Yes: immediately’ and ‘No’ in Q5 and ‘It is too much. Have not they got enough’ in Q13 are considered as they are against this project. Participants fit these criteria in more than 3 questions will be considered as they are strongly against to the project. Moreover, participants fit these criteria in more than 2 questions, they will be considered as relatively against the project. Based on these criteria, two participants; #8 and #75, are strongly against while eight participants; #48, #51, #66, #73, #76, #81, #86 and #102, are relatively against. Although participants #51 and #76 may be against the project, it can be indicated that they are strongly supportive of the oil and gas extraction and less interest in renewable energy based on their answers in Q1 and Q5. Therefore, there may be different motive to say ‘No’ to project comparing to other participants who are against the project. These two participants support Progress Party while other participants, who may say ‘No’ to the project, support Red (2), Green Party (2) and Labor Party (1). One participant did not want to tell the supporting party while the other two stated that they do not have supporting party.

On the other hands, Q1, Q5, Q12, Q13 and Q15 were selected to identify the ratio of potential supportiveness to the green offshore project. As they were mentioned in explanation and motive of each question, participants answered ‘Very supportive’ and ‘Supportive’ in Q1, ‘Yes: but gradually and slowly’ and ‘Yes: gradually but with speed’ in Q5, ‘Yes: why not?’ in Q12, ‘That is a great move’ and ‘The government should support more’ in Q13 and ‘That is great, I support it’ in Q15 showed their supports to oil and gas extraction and development of renewable energy. Since the replacing gas turbine at offshore platforms is transitional co-utilize project, it can be said that participants who support both oil and gas extraction and the development of renewable energy may be supportive of such transitional project. Participants fit these criteria in all 5 questions will be considered as they are strongly supportive while participants fit these criteria in 4 questions will be considered as they are relatively supportive. Based on these criteria, eighteen participants; #5, #6, #7, #13, #16, #19, #22, #35, #46, #57, #60, #65, #68, #83, #87, #93, #101 and #103 can be considered as they are strongly supportive of the green offshore project. In addition, thirty seven participants; #9, #10, #11, #12, #14, #17, #20, #21, #23, #27, #29, #31, #37, #38, #39, #42, #44, #45, #52, #53, #54, #58, #63, #69, #78, #79, #80, #82, #84, #85, #88, #90, #91, #100, #101, #104 and #105, can be considered as they are relatively supportive of the project. The results show high percentage of project acceptance by Conservative Party supporters and Socialist Left Party supporters since 75% of Conservative Party supporters (15 of 20) and 75% of Socialist Left Party supporters (3 of 4) may support the project.

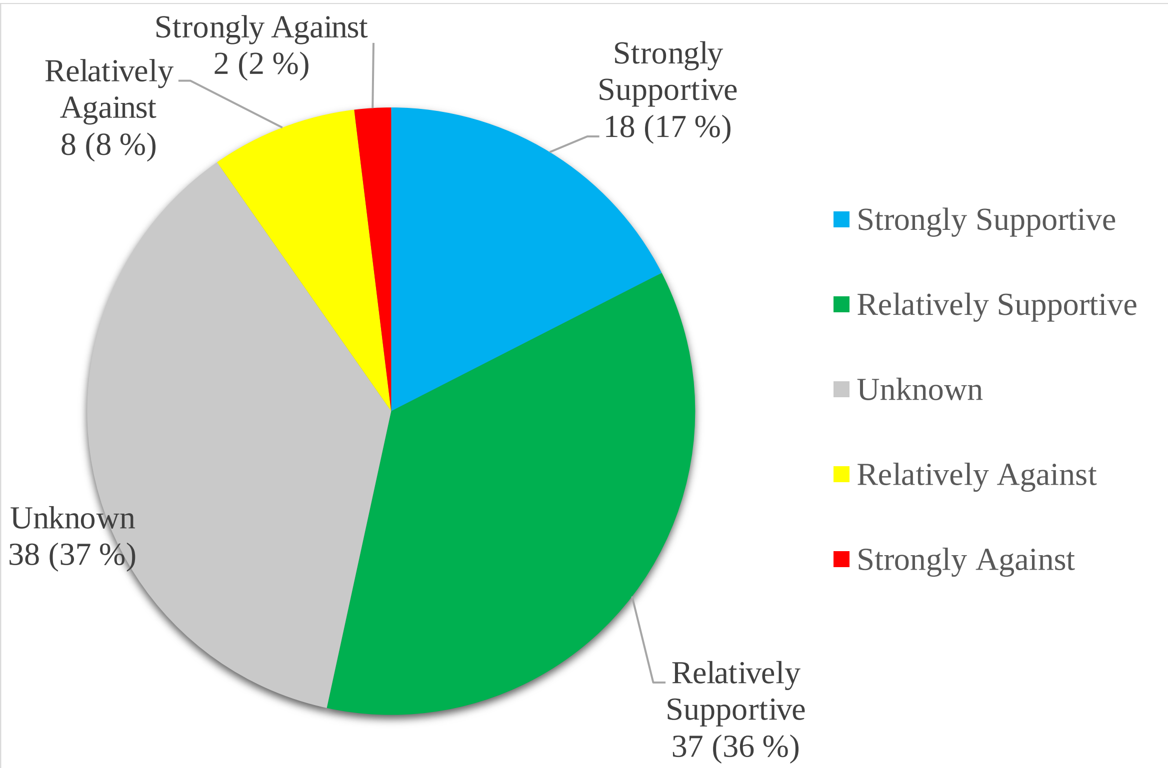


Figure 80: Estimated social supporting rate of electrification of offshore fields with renewable energy

Figure 80 shows the ratio of potential support versus against to the project. As it can be seen, potential 'support' is 53%, 17% 'Strongly supportive' and 36% 'Relatively supportive'. On the other hands, potential ‘against’ is only 10%, 2% ‘Strongly against’ and 8% ‘Relatively against’.

This rate can be changed where the offshore fields and offshore wind turbines are located. Answers for question 2 and 3 and may help to understand. In question 2, it was asked whether participants are supportive or against of more oil and gas extraction in Norway. Moreover, in question 3, it was asked whether participants are supportive or against of oil and gas extraction in area like Lofoten, rich nature and environment. The total of 60 participants chose ‘very supportive’ or ‘supportive’ in question 2 while 16 participants answered ‘against’ or ‘very against’. However, in question 3, 26 participants chose ‘very supportive’ or ‘supportive’ while 47 participants answered ‘against’ or ‘very against’. Based on these answers, it can be indicated that the society believes that protecting nature can be more important than energy. As a result, where offshore fields and offshore wind farms are located can affect social acceptance for the project.

Some limitations of the survey need to be noted. Firstly, majority of respondents reside in Stavanger, which is oil capital of Norway; thus, the result may show favor to oil and gas industry. Secondly, although sample seems random, people in some industry, such as farming, may be absent in the survey since there was 0% support to Sp. Thirdly, there are only few elderlies participated to the survey. Fourthly, 39 participants’ acceptance of the project still remains unknown. Lastly, another limitation of this analysis was that which method of electrification of offshore fields is more supportive or against than others could not be identified. In order to increase the response rate, each question needed to be simplified. Since electrification of offshore fields can involve several technologies; thus, explaining each technology would have been essential to analyze supportiveness to each solution. Group discussion or on street interview may have been more ideal methods since the information of each technology can be briefly explained by a conductor or an interviewer. Unfortunately, these methods could not be selected due to COVID 19 crisis; hence, the analysis of social acceptance in this paper has limitation regarding to specificness.

Although there are some limitations of the survey, and 37% of participants’ acceptance of the project could not be discovered, it can be said that the result of 53% of potential acceptance means that majority can be supportive. Therefore, the green offshore project can be feasible socially.

11 Comprehensive Discussion of feasibility of offshore green fields

In the end of each chapter of technological analysis, economic analysis, political analysis and social analysis, the results were discussed and analyzed previously. The feasibility of green offshore fields in terms of each factor was assessed; however, it is yet lacking comprehensive discussion and analysis of collected data and results. Therefore, in this chapter, it will be discussed how PEST factors interferes each other, its limitations, advantages and disadvantages by using Multi-Level Perspective theory, particularly transformation pathway and reconfiguration pathway of transition pathways. In addition, it will be concluded with a recommendation.

Three possibilities for electrification of offshore fields were discussed in this paper; electrification with power cables from shore, electrification with offshore wind power and electrification with offshore wind power with hydrogen storage. Each method will be analyzed and assessed based on PEST factors whether full electrification can be achieved by those technologies.

Firstly, electrification with power cables from shore can be analyzed with transformation pathway. As it was mentioned, Multi-Level Perspective received critics regarding to a lack of agency; thus, Langhelle et al (2017) added political landscape into Multi-Level Perspective. Similarly, agency is lacking in transformation pathway, political landscape was added into the original transformation pathway. In addition, economic factor such as cost of technology is absent in this pathway. However, in order to break through the regime’s barrier, cost efficiency or the potential of cost efficiency can be a significant factor for niche technology. Thus, cost efficiency potential was added as a requirement for niche technology to be a part of the regime. It is illustrated in Figure 81.

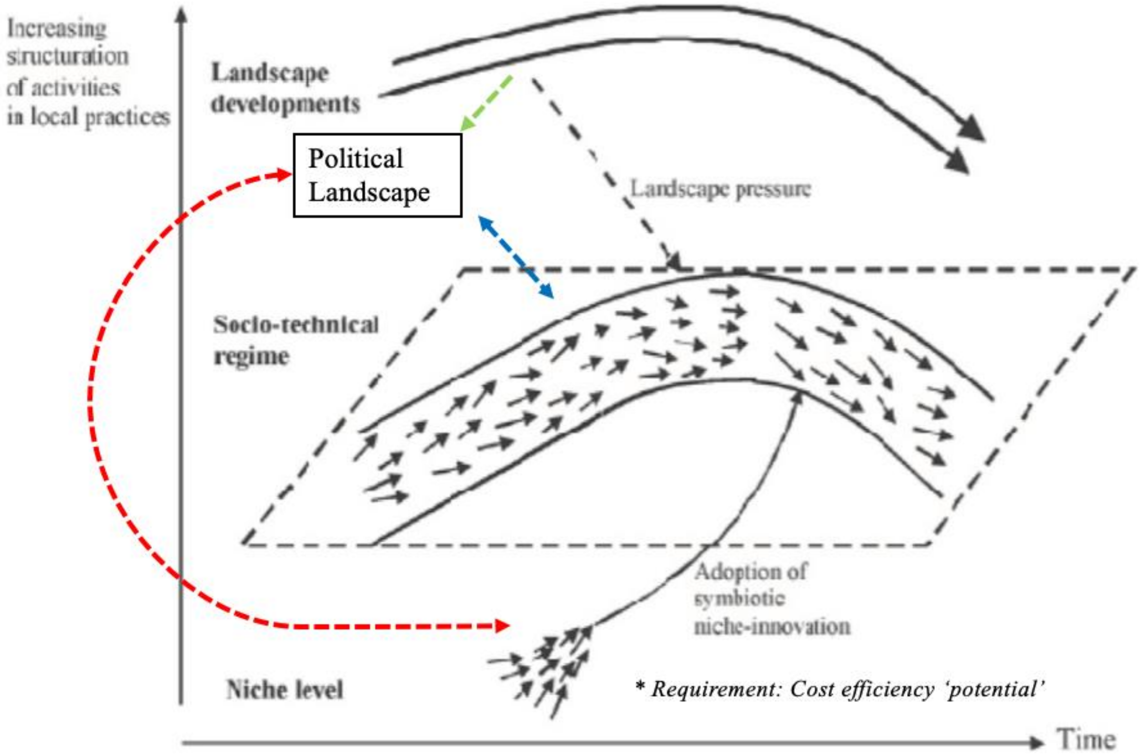


Figure 81: Modified Transformation Pathway

This pathway was selected because the landscape pressure such as climate change is yet moderate, and oil and gas extraction industry and its business activities in Norway are not affected significantly. As it was mentioned in the introduction, the volume of oil and gas extraction has not been decreased. (Norwegian Petroleum, 2020) Therefore, the current regime of oil and gas industry remains steady. However, the landscape pressure on political landscape has been increasing (green arrow in Figure 81), and pressure from political landscape to regime (blue arrow in Figure 81) has also increasing relatively. This can be seen by increase in carbon tax, EU's Green New Deal program and social protest as a climate action. Political landscape also influences on niche technology, the submarine cables in this case. (red arrow in Figure 81) Despite the energy loss of 7% to 10% by transmitting electricity with submarine high voltage cables in Norway (EU, 2016), it can be said that technology is mature. Thus, in order to handle the pressure from socio-technical landscape and political landscape, the regime added the submarine cables into its system. The cost of full electrification of all offshore fields with shore power was estimated as 54.1 billion NOK. By electrifying with shore power, generated with hydro power on land, 7 billion NOK of carbon tax can be reduced. As a result, electrification with shore power can yield profit within 8 years. This solution seems cheapest out of three electrification methods discussed in this paper; however, maintenance cost including electricity bill was not considered in this cost estimate, and it may be one of the main limitations. Moreover, it seems that this method is the most popular method as well since many fields are already electrified with shore power and planned to be electrified with shore power. (Norwegian Petroleum Directorate, 2020) Politically, it could be seen that Red Party, Socialist Left Party and Green Party are against electrification of offshore fields with renewable energy; however, it seemed that they are supportive that existing offshore fields to be connected with shore power before they are phased out. Hence, it could be said that this method was the only method out of three that there is a consensus in Norwegian politics. In Norwegian society, it seems majority of citizens is supportive of continuing oil and gas extraction or even expanding extraction as well as development of renewable energy based on the survey result. In the chapter of social factor, the potential social support of electrification of offshore fields of all three solutions was estimated as 53%. However, this percentage may decrease if the fields are located in the area like Lofoten.

As it was discussed, its mature technology, cost, consensus in Norwegian politics and social acceptance, it seems that connecting offshore fields with shore power have many advantages, and it may be the most feasible method. However, there is also a number of limitation and disadvantages of this method. Firstly, in order to achieve green offshore fields, the power from shore needs to be generated by renewable energy such as hydro power. Previously, it was discussed that Norway has enough capacity to supply the power demand of offshore fields if Norway stops exporting power to neighbor countries. However, those importers need to find other power sources, highly likely fossil fuel sources, to fill the gap of demand and supply of power. As Riboldi et al (2019) researched, electrification of offshore fields on NCS can cause the increase of CO_2 emission in other countries. The CO_2 emission of Norway may decrease by electrification with shore power; however, it does not change CO_2 emission regionally and globally. That can be one of the most significant disadvantages of electrification of offshore fields with shore power. Moreover, the location of hydro power plants was not accounted into the consideration. If hydro power plant is distant from coast, the energy loss can be significant. Secondly, although it may seem there is political consensus in Norwegian politics in terms of electrification of offshore fields with shore power, Red Party, Green Party and Socialist Left Party have different perspectives in terms of further development of oil and gas extraction. Thus, the conflict between the parties, are against continuing oil and gas extraction, and the other parties, which are willing to continue oil and gas extraction, may appear more visibly around 2030 to 2040 when Red Party and Green Party wish the oil and gas extraction to be phased out. Another disadvantage of this method can be its inflexibility in the future. After oil and gas extraction is outdated or phased out, the submarine cables need to be collected, and the cables, which connected offshore fields and shore, do not yield any more profit or assist to reduce tax. Despite these disadvantages, based on the analysis of each factor, it can be said that the regime, oil and gas industry, can add the technology of electrification with shore power into itself, in other words, the full electrification with shore power is feasible.

Reconfiguration pathway can describe well about the transforming offshore fields into green offshore fields with offshore wind and hydrogen storage. Similar to the transformation pathway, reconfiguration pathway is also lacking political landscape and economic factor; hence, the reconfiguration pathway was modified by adding both political landscape and a requirement to niche technology to break through, which is the potential of cost efficiency. This transition can be illustrated as Figure 82.

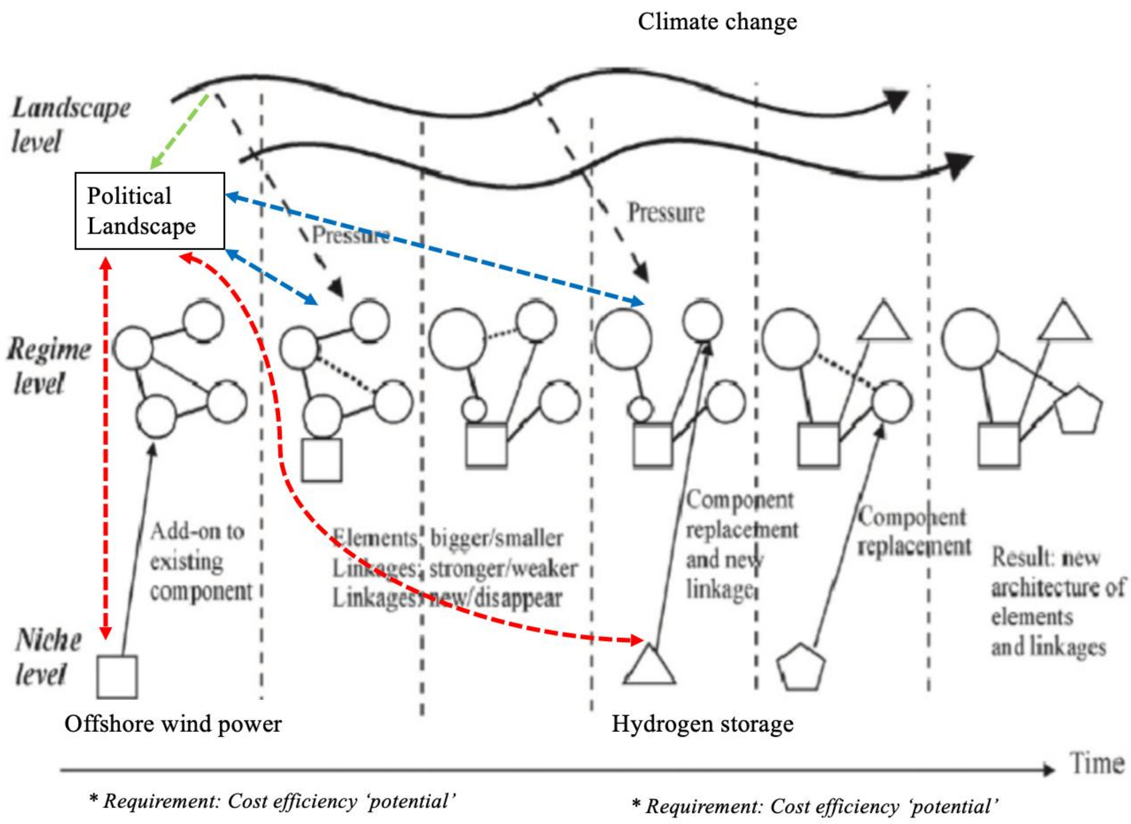


Figure 82: Modified Reconfiguration Pathway

In this pathway, the pressure from landscape and political landscape are more than the pressure in transformation pathway. Landscape such as climate change, has pressed political landscape; thus, political agencies signed Paris Agreement and promote European New Green Deal (green dot arrow Figure 82). Through Paris Agreement, EU's European Green Deal and global climate demo in 2019, it can be said that the political and societal interest in climate change has been increasing. It can be indicated that these political (blue dot arrow in Figure 82) and societal interest in climate change can also lead pressing energy industry, especially oil and gas industry, and shake its stability. Therefore, more drastic change may be required to continue their business activities while reducing greenhouse gas emission. Offshore wind power can have a significant role in this transition. In the Figure 82, square shape object at niche level represents offshore wind power. Offshore wind power was added onto existing components of the system of oil and gas extraction. This can be seen in the Hywind Tampen project, which is that offshore wind power technology has been developed and deployed to supply electricity to Snorre and Gulfaks fields. (Equinor) As it was pointed out, nearly half of investment of Hywind Tampen project was funded by ENOVA, governmental funding organization for renewable energy. (ENOVA, 2019) This is described by the red dot arrow, connecting political landscape and offshore wind power in Figure 82. Previously, it was estimated that if offshore wind turbines, which can supply power to entire offshore fields, were deployed, the cost of installation of offshore wind turbines would be 118 to 152 billion NOK, which is about double to triple the cost of electrification with shore power. Thus, political support is important in the beginning in order to be competitive against submarine cables. However, offshore wind power has significant advantage over submarine cables, which is that the turbines can continue generating power even if the offshore fields are outdated. In addition, offshore wind power, especially floating offshore wind power, is relatively newly developing technology; hence, such technology and know-how, which accumulated through the experience on Norwegian Continental Shelf, can be export items in the future. Politically, as it was discussed, Labor Party, Conservative Party and Progress Party showed their support of offshore wind power in the survey. These three parties currently hold total of 71% of seats at Norwegian Parliament. Based on parties' programs, it was analyzed that Centre Party, Liberal Party and Christian Democratic Party can be supportive of electrification with offshore wind power. If their seats were added, 91% of member of parliament may support. Since political support has significant role for offshore wind power, this percentage of support affects its feasibility of electrification with offshore wind power. As it was mentioned, even if majority of party may support this technology, they may have their political goal and priority; hence, this percentage can be lower in reality. In addition, although only few small parties such as Red Party and Green Party are against to electrify offshore fields with offshore wind power, a single vote can possibly decide whether the bill and policy passes at parliament or not. Social acceptance of electrification of offshore fields was discussed previously, and it was estimated as 53%.

One of the disadvantages of this technology is that generated power cannot be stored. Similar to other renewable energy, offshore wind power fully depends on wind and its speed. Thus, supply may not correspond demand. Due to its inflexibility of power generation, gas turbines will probably remain as secondary power generation source. Despite all advantages and feasibility in each factor, it can be concluded that offshore wind itself cannot replace gas turbines due to such disadvantage. Hydrogen generation and storage can solve the issue of offshore wind power. Regime reforms itself by adding on or replace components in Figure 82, second niche technology, added into the regime, is hydrogen. Since landscape and political landscape continue pressing regime, further change is needed within regime. In this paper, a number of hydrogen production methods were discussed, and it was concluded that electrolysis is the most environmental and suitable technology for hydrogen production with wind power at offshore fields. It is because PEM electrolyzer can split water to hydrogen and oxygen by using electricity. (U.S. Department fo Energy, n.d.) It was previously discussed that produced hydrogen can be stored in the tower of wind turbines, on the seabed, on the floater or in the floater. Produced and stored hydrogen can be used to generate electricity with fuel cell, which uses chemical reaction of combining hydrogen and oxygen and emits water. (U.S. Department fo Energy, 2015) As it was discussed, electrolyzer is almost reversed fuel cell. Hence, it could be said that reversible fuel cell, which is combined technology of electrolyzer and fuel cell, is technologically feasible. (Blue Terra, n.d.) The current efficiency rate of a cycle, hydrogen production – electricity production, was estimated as 48%. The size of each unit was assessed, and the result showed that both units are compact enough to be installed in the tower of wind turbines. The significant technical advantage is that if the hydrogen tank becomes full, hydrogen can be injected into natural gas pipeline since the gas pipeline does not require any modification up to 20 vol% of hydrogen in natural gas. It can utilize existing infrastructure. Furthermore, hydrogen injected natural gas emit less CO_2; hence, it can be said that it is cleaner natural gas. In offshore setting, hydrogen can be used for shipping such as tankers if they are compatible with hydrogen. The cost of reversible fuel cell was estimated as 4.8 billion NOK to 12 billion NOK for 334 of 8MW wind turbines. In addition, it was estimated that 2.28 billion NOK to 4.6 billion NOK for compressor of hydrogen These costs will be additional cost to offshore wind turbines, which were estimated as 118 billion NOK to 152 billion NOK. As a result, it can be estimated that the total of 125 billion NOK to 178.6 billion NOK is needed for electrification with offshore wind power and hydrogen storage. Similar to the previous discussion of offshore wind power, political support can be a key to succeed. In addition to ENOVA, EU has estimated to invest 11 trillion EUR, which is equivalent to 121 trillion NOK based on currency rate of 1EUR = 11 NOK, 18th May 2020. (European Comission, 2020) This innovative technology can possibly catch the attention of EU since there are a number of countries have onshore wind turbines, which they can possibly connect to reversible fuel cell. Politically, only Conservative Party clearly stated that they are willing to support offshore hydrogen storage financially as the respondent answered the question as "as there is no energy storage in hydrogen offshore now, it must necessarily be 'Yes, (the party is willing to support financially to hydrogen storage) extensively or more than now' if we support this". Progress Party showed their support as well; however, it did not specify how much they are supportive. Labor Party, on the other hand, stated that "hydrogen production will / should be used for, for example, green shipping, the process industry or sales to the European power market. Not to make offshore fields green." This response indicates that they are not supportive of offshore hydrogen storage. As it was discussed, Red Party, Green Party and Socialist Left Party are against the electrification of fields with offshore wind; thus, it is likely that they are against electrification of fields with offshore wind and hydrogen storage as well. Hydrogen was not discussed much in the parties' programs of Centre Party, Liberal Party and Christian Democratic Party. Hence, it is difficult to determine whether they are supportive or not; however, it seems that they are not against continuing oil and gas extraction as long as it does not harm Norwegian nature. Therefore, they may support offshore hydrogen storage. The number of seats of the parties, potentially supportive of offshore hydrogen storage, are 71 seats Conservative Party and Progress Party. If Centre Party, Liberal Party and Christian Democratic Party include, 35 additional seats at parliament can be supportive. The total of 106 seats at the parliament; hence, 63% of representative can be supportive of electrification of offshore fields with offshore wind power and hydrogen storage. However, since it was not clearly identified perspectives of Centre Party, Liberal Party and Christian Democratic Party regarding offshore hydrogen storage, political feasibility may not be as high as offshore wind itself. The estimated social acceptance of electrification offshore fields with renewable energy was 53%; hence, such acceptance will be used here too. Overall, technologically, it can be said that reversible fuel cell and hydrogen storage can be combined with offshore wind turbines. The cost remains as an issue; however, public funds from ENOVA and EU, can improve economic feasibility of offshore hydrogen storage. Politically, it seems it holds supports from majority representatives at parliament; however, this support is not as solid as support of offshore wind. Through the discussions at committee and parliament, if more parties become aware of the advantages such as injection of hydrogen into natural gas, political support may become more solid.

One of the limitations of this analysis is that it is lacking ‘speed’. It means that ‘how quickly’ full electrification with each technology can be completed is missing. As most political parties answered as electrification should be started ‘as soon as it can be’; however, there was no clear answers of time frame for completion of electrification. It can be a significant disadvantage of this analysis.

Based on the analysis of this paper; technologies of submarine cables, offshore wind, reversible fuel cell and hydrogen storage, are ready; the cost of installation of those technologies can be economical; political support from vast majority of representatives at parliament including financial support with public funds; and social acceptance of continuing oil and gas extraction and electrification of offshore fields. As a result, it can be concluded as the full electrification of offshore fields is feasible with shore power and offshore wind power with hydrogen storage.

12 Recommendation

At offshore fields, energy mix is important that each field receives power from various sources and not only one. It is because problems may occur, for example; the blackout may happen on shore, there may be no wind for weeks, some technical failures occur to wind turbines and reversible fuel cell. If the offshore fields rely on power from single source, when such source stopped functioning, all activities need to be stopped, which can cost extensively for oil and gas companies. As a result, in order to spread such risks, it can be recommended to implement all technologies for electrification of offshore fields; cables connecting to shore power, offshore wind power and hydrogen storage. Eskeland, representative of Conservative Party at parliament, also stated that “not an ‘either / or’ but ‘both / and’”. If fields are located close to shore, and large hydro power plants are nearby, electrification with shore power would be the most suitable. If the fields are far from shore but gale can be seen in that location, offshore wind with hydrogen storage would be the most suitable. However, offshore wind with hydrogen storage can be used a backup power in the former case while submarine cables can connect the fields to another wind farms as a backup source in the latter case. Excessed power can be converted to hydrogen to be stored, injected into pipeline or supplied hydrogen to ships. By utilizing all technologies, the risks can be avoided or mitigated. In addition, it can possibly lead to eliminate backup gas turbines from the offshore platforms. Many fields can be electrified with shore power; thus, offshore wind turbines with hydrogen storage will be deployed where they are needed. As a result, the total number of required wind turbines with hydrogen storage would be decreased; hence, total cost can also be reduced. While reducing the cost of offshore wind with hydrogen storage, such technologies and know-how can be developed further in order to export the technology and system in the future. Technological and economic factors are two key factors in order to assess the feasibility of green offshore fields.

13 Conclusion

Oil and gas extraction have supported Norwegian economy since the discovery of oil and gas on Norwegian Continental Shelf. At the same time, greenhouse gas emission has also been increased through the extraction activities. Today, despite 95% of power is produced by hydro power within the country, the greenhouse gas emission has remained high. (iha - international hydropower association, 2017) As Equinor stated, 27.6% of nationwide greenhouse gas emission in 2018 came from oil and gas production activities such as gas turbine and flaring. (Statistics Norway, 2020) Moreover 84.6% of greenhouse gas emission on Norwegian Continental Shelf was caused by using gas turbines at offshore fields. (Norwegian Petroleum Directorate, 2019) As it was discussed, in nature of oil and gas extraction, it is nearly impossible to eliminate greenhouse gas emission completely at offshore fields such as flaring for safety purpose. (Oil & Gas UK, 2018) Electricity, which is consumed on Norwegian Continental Shelf, can be generated by renewable energy, particularly offshore wind. Continuing oil and gas extraction with clean power can be an important mission for Norway to continue growing its economy while reducing greenhouse gas emission drastically. Thus, in this paper, it was assessed the feasibility of full electrification of offshore fields with renewable energy, which can eliminate gas turbines from Norwegian Continental Shelf. Three methods of electrification of offshore fields were assessed; electrification with shore power, electrification with offshore wind and electrification with offshore wind and hydrogen storage. The feasibility of each method was examined in terms of technological, economic, political and social factors. Comprehensive discussions were added in the end. Firstly, electrification with shore power is currently the most popular method since many fields are already electrified and planned to be electrified. Economically, the estimate cost of full electrification was 54.1 billion NOK, which is the most reasonable out of three options. Politically, it was indicated that there is political consensus on this technology. Socially, 53% people can potentially support of full electrification project. Hence, it was concluded as the full electrification with shore power is feasible. Secondly, offshore wind technology was assessed. Although floating offshore wind power is relatively newly developed, it could be said that technology is mature enough for large scale deployment. Economically, on the other hands, the cost of installation was estimated 118 to 152 billion NOK, which is twice to three times more expensive than estimated cable cost. However, offshore wind can continue generating power after offshore fields are outdated or phased out; thus, such investment can expect return longer period. Politically, Red Party, Green Party and Socialist Left Party do not wish continuing oil and gas extraction in the future; thus, it was indicated that they do not support electrification with offshore wind. However, Labor Party, Conservative Party and Progress Party stated to support continuing oil and gas extraction as well as electrification with offshore wind. Three parties hold 71% of representatives at parliament; hence, electrification of wind power can be feasible politically. Potential social acceptance was estimated as 53%. Although it seems the full electrification of offshore fields with offshore wind power is technologically, economically, politically and socially feasible, the facts that wind turbine fully relies on wind and it is not flexible can be a deal breaker for full electrification of offshore fields. However, hydrogen production and storage can supplement the offshore wind power and its disadvantage. Hydrogen can be produced from water with electrolyzer, which consumes electricity for the process. Produced and stored hydrogen can generate electricity with fuel cell. Electrolyzer is almost reversed system of fuel cell; hence, combined system of electrolyzer and fuel cell is called reversible fuel cell. The size of these units can be small enough to implement in the tower of offshore wind turbines, which have significant abundant space inside. Economically, the cost of reversible fuel cell for 334 of 8MW wind turbines was estimated as 4.8 billion NOK to 12 billion NOK. In addition, the cost of compressor of hydrogen was estimated as 2.28 billion NOK to 4.6 billion NOK. With estimated cost of offshore wind turbines, total estimated cost of wind turbines with hydrogen storage was 125 billion NOK to 178.6 billion NOK. This innovative technology may attract public funds of EU and Norway, such as ENOVA, to invest to the project. Political support via public funds may be significant for this technology due to its high cost. Politically, it was analyzed that Conservative Party and Progress Party can be supportive; however, Labor Party stated they are against to use hydrogen at offshore fields. The total 42 % of representatives at parliament can be supportive, which is not majority yet. However, if two of Centre Party, Liberal Party and Christian Democratic Party are supportive of this solution, it can achieve the majority support at parliament. It can be said that it is politically feasible; however, electrification with shore power has more solid support than offshore wind with hydrogen storage. As a result, it can be said that the full electrification of offshore fields with offshore wind and hydrogen storage is feasible; however, there are few 'if' exist. To sum up, it can be said that is feasible that offshore fields on Norwegian Continental Shelf can be fully electrified with shore power and / or offshore wind power with hydrogen storage. The author recommends utilizing all technologies; submarine cables, offshore wind and hydrogen storage for the risk hedge and further development of future export system.

14 Bibliography

ABB. (2016). *ABB Power Systems Offshore wind connection.* Hentet April 2020 fra https://new.abb.com/docs/librariesprovider46/pw2016/seminars/r206-en-abb_offshore_wind_connection_by_hvdc_reformated.pdf?sfvrsn=2

ABB. (u.d.). *Electrification of petroleum installations Commercial justifiable and necessary for the climate*. Hentet May 2020 fra https://new.abb.com/docs/librariesprovider50/om-oss---barekraftig-utvikling/electrification-of-petroleum-installations-highresolution.pdf?sfvrsn=2

Air Liquide. (u.d.). *Storing Hydrogen*. Hentet April 2020 fra https://energies.airliquide.com/resources-planet-hydrogen/how-hydrogen-stored

Aker Kværner Engineering and Technology. (2008, 1). *Kraft fra land til norsk sokkel*. Hentet May 2020 fra http://publikasjoner.nve.no/diverse/2008/kraftfralandtilnorsksokkel2008.pdf

Aker Solutions. (2017, 12 21). *Yme new development, High level evaluation of electrification alternative*. Hentet May 2020 fra https://www.repsol.no/imagenes/repsolpornr/no/Yme_new_development_high_level_evaluation_electrification_alternative_tcm89-122718.pdf

Alshehri, F., García Suárez, V., Torres, J. L., Perilla, A., & Van der Meijden, M. (2019, 4 4). *Modelling and evaluation of PEM hydrogen technologies for frequency ancillary services in future multi-energy sustainable power systems.* Hentet May 2020 fra National Center for Biotechnology Information: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6451170/

Arbeiderpartiet. (2017). *Arbeiderpartiets partiprogram 2017-2021.* Hentet June 2020 fra https://res.cloudinary.com/arbeiderpartiet/image/upload/v1/ievv_filestore/712bd5b874e24958b84c14fbef5b1a98afbfc8ae1e464cac9bcad06f24f2a85f

Australian Bureau of Statistics. (2018, 8 30). *Sample Size Calculator*. Hentet July 2020 fra https://www.abs.gov.au/websitedbs/D3310114.nsf/home/Sample+Size+Calculator

Ballari, A., & Østensen, J. S. (2013, 6 3). *Electrification of the Utsira formation: Electric System Requirements for a Power Distribution Platform.* Hentet October 2019 fra https://uia.brage.unit.no/uia-xmlui/bitstream/handle/11250/136731/Østensen%2C%20Jan%20Sola%20og%20Ballari%2C%20Anders%20Oppgave.pdf?sequence=1&isAllowed=y

BBC. (2019, 4 24). *Greta Thunberg: Calls for action on climate change in a speech to MPs*. Hentet July 2020 fra https://www.bbc.co.uk/newsround/48012795

Beerenberg. (2020, 1 30). *REBUILDING THE YME FIELD*. Hentet May 2020 fra https://www.beerenberg.com/en/About-Beerenberg/News/Rebuilding-the-YME-field

Berger. (2017). *Development of Business Cases for Fuel Cells and Hydrogen Applications for Regions and Cities.* Hentet May 2020 fra https://www.fch.europa.eu/sites/default/files/FCH%20Docs/171121_FCH2JU_Application-Package_WG5_P2H_Green%20hydrogen%20%28ID%202910583%29%20%28ID%202911641%29.pdf

Bjerkem, J. (2016, 11 2). The Norwegian Progress Party: an established populist party. *European View, 15*, 233-243. Hentet fra https://link.springer.com/article/10.1007/s12290-016-0404-8

Blue Terra. (u.d.). *Reversible fuel cell (RFC) and hydrogen storage*. Hentet May 2020 fra Blue Terra Energy Experts: https://blueterra.nl/en/project/reversible-fuel-cell-and-hydrogen-storage/

Borchardt, K.-D. (2010). *The ABC of European Union law.* Luxembourg: Publications Office of the European Union.
Brenna, A. L. (2020, 3 3). *- For CO2-utslipp på sokkelen betaler vi i dag 730 kroner per tonn*. Hentet May 2020 fra https://enerwe.no/equinor-klima-klimakvote/for-co2-utslipp-pa-sokkelen-betaler-vi-i-dag-730-kroner-per-tonn/356352
Bru, T. (2020, 5 4). *Havvindelige visjoner!* Hentet June 2020 fra Government Norway: https://www.regjeringen.no/no/aktuelt/havvindelige-visjoner/id2700883/
Bru, T. (2020, 6 12). *Åpning av områder for havvind*. Hentet June 2020 fra Government Norway: https://www.regjeringen.no/no/aktuelt/apning-for-omrader-av-havvind/id2706059/
Bruseth, O. (2019, 12 8). *Uttalelse: Venstre vil ha en helhetlig strategi for havvind*. Hentet June 2020 fra Venstre: https://www.venstre.no/artikkel/2019/12/08/uttalelse-venstre-vil-ha-en-helhetlig-strategi-for-havvind/
Bureau of Democracy, Human Rights and Labor of United States. (2017). *NORWAY.* Hentet May 2020 fra https://2009-2017.state.gov/documents/organization/186600.pdf
Carbon Trust. (2014). *Appraisal of the Offshore Wind Industry in Japan.* Carbon Trust, London.
Center for Electrochemical Energy Storage. (u.d.). *Reversible Fuel/Electrolysis Cells*. Hentet May 2020 fra https://cees-www.mit.edu/index.php
Claase, M. (2012). *Optimizing feasibility studies: Based on a Grounded Theory type comparison of feasibility design research.* Hentet November 2019 fra https://essay.utwente.nl/61979/1/BACHELOR_THESIS_Marcella_Claase.pdf
Conoco Phillips. (u.d.). *Eldfisk*. Hentet May 2020 fra http://www.conocophillips.no/nn/vare-norske-operasjoner/ekofisk-omradet/eldfisk/
Container Container. (u.d.). *Container dimensions by type*. Hentet May 2020 fra https://www.containercontainer.com/shipping-container-dimensions/
Department for Business, Energy & Industrial Strategy of UK. (2020, 3 26). *2019 UK greenhouse gas emissions, provisional figures*. Hentet April 2020 fra https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/875485/2019_UK_greenhouse_gas_emissions_provisional_figures_statistical_release.pdf
Driel, H. v., & Schot, J. (2005). Radical Innovation as a Multilevel Process: Introducing Floating Grain Elevators in the Port of Rotterdam. *Technology and Culture, 46*(1), 51-76.
Dunn, S. (2002, 3 10). *Hydrogen in History*. Hentet January 2020 fra The Globalist: https://www.theglobalist.com/hydrogen-in-history/
EIB - European Investment Bank. (u.d.). *Climate action*. Hentet May 2020 fra https://www.eib.org/en/about/priorities/climate-and-environment/climate-action/index.htm
Energids.be. (u.d.). *How is gas consumption calculated?* Hentet June 2020 fra https://www.energuide.be/en/questions-answers/how-is-gas-consumption-calculated/24/
English, T. (2020, 6 8). *Henry Cavendish and The Revolutionary Discovery of Hydrogen*. Hentet July 2020 fra Interesting Engineering: https://interestingengineering.com/henry-cavendish-and-the-revolutionary-discovery-of-hydrogen
ENOVA. (2018, 5 2). *About Enova*. Hentet June 2020 fra https://www.enova.no/about-enova/
ENOVA. (2019). *Annual Report 2019.* Hentet May 2020 fra https://www.enova.no/download?objectPath=/upload_images/CE63635DD03C4B04A84297FBE8C62DF4.pdf

ENOVA. (u.d.). *Hywind Tampen*. Hentet May 2020 fra https://www.enova.no/om-enova/om-organisasjonen/teknologiporteföljen/hywind-tampen/
Equinor. (2015, 4 17). *Statoil committed to end routine flaring by 2030*. Hentet April 2020 fra https://www.equinor.com/en/news/2015/04/17/article.html
Equinor. (2015). *Johan Sverdrup Field Power solutions*. Hentet May 2020 fra https://www.regjeringen.no/globalassets/upload/oed/pdf_filer_2/utsira/kraft.pdf
Equinor. (2018, 10 5). *Letter of award for power cables for Johan Sverdrup phase 2*. Hentet May 2020 fra https://www.equinor.com/en/news/2018-10-04-johan-sverdrup-power-cables-phase2.html
Equinor. (2018, 10 9). *Johan Sverdrup powered from shore.* Hentet April 2020 fra https://www.equinor.com/en/news/2018-10-09-johan-sverdrup-powered-shore.html
Equinor. (2019, 10 31). *Equinor awarding Hywind Tampen contracts worth NOK 3.3 billion*. Hentet June 2020 fra https://www.equinor.com/en/news/2019-10-31-hywind-tampen.html
Equinor. (2019, 11 28). *Equinor and ORE Catapult collaborating to share Hywind Scotland operational data*. Hentet May 2020 fra https://www.equinor.com/en/news/2019-11-28-hywind-scotland-data.html
Equinor. (2020, 1 16). *Tildeler kontrakt for elektrifisering av Troll B og Troll C*. Hentet May 2020 fra https://www.equinor.com/no/news/2020-01-15-troll-electrification.html
Equinor. (2020, 6 9). *Sleipner field centre to be partly electrified*. Hentet April 2020 fra https://www.equinor.com/en/news/2020-06-09-sleipner-partly-electrified.html
Equinor. (u.d.). *BRAGE*. Hentet May 2020 fra https://www.norskpetroleum.no/en/facts/field/brage/
Equinor. (u.d.). *Facts about the Johan Sverdrup field*. Hentet May 2020 fra https://www.equinor.com/en/what-we-do/johan-sverdrup/johan-sverdrup-facts.html
Equinor. (u.d.). *Goliat*. Hentet May 2020 fra https://www.equinor.com/en/what-we-do/partner-operated-fields-in-norway/goliat.html
Equinor. (u.d.). *Grane*. Hentet May 2020 fra https://www.equinor.com/no/what-we-do/norwegian-continental-shelf-platforms/grane.html
Equinor. (u.d.). *Gullfaks*. Hentet May 2020 fra https://www.equinor.com/en/what-we-do/norwegian-continental-shelf-platforms/gullfaks.html
Equinor. (u.d.). Hentet May 2020 fra https://www.equinor.com/en/what-we-do/norwegian-continental-shelf-platforms/gullfaks.html
Equinor. (u.d.). *Here's the secret that can give Norwegian oil production the lowest emissions in the world*. Hentet April 2020 fra https://www.equinor.com/en/magazine/electrification-of-oil-and-gas-platforms.html
Equinor. (u.d.). *Hywind Tampen: the world's first renewable power for offshore oil and gas.* Hentet June 2020 fra https://www.equinor.com/en/what-we-do/hywind-tampen.html
Equinor. (u.d.). *Skrav*. Hentet May 2020 fra https://www.equinor.com/en/what-we-do/partner-operated-fields-in-norway/skarv.html
Equinor. (u.d.). *Statoil to build the world's first floating wind farm: Hywind Scotland*. Hentet May 2020 fra https://www.equinor.com/en/news/hywindscotland.html
Equinor. (u.d.). *The Oseberg Area*. Hentet May 2020 fra https://www.equinor.com/en/what-we-do/norwegian-continental-shelf-platforms/oseberg.html
Equinor. (u.d.). *Troll*. Hentet May 2020 fra https://www.equinor.com/en/what-we-do/norwegian-continental-shelf-platforms/troll.html
Equinor. (u.d.). *Visund*. Hentet May 2020 fra https://www.equinor.com/no/what-we-do/norwegian-continental-shelf-platforms/visund.html

ETN Global. (2020, January). *HYDROGEN GAS TURBINE.* Hentet January 2020 fra https://etn.global/wp-content/uploads/2020/01/ETN-Hydrogen-Gas-Turbines-report.pdf
EU. (2016, 10). *Grid Loss Reduction.* Hentet April 2020 fra Sustainable Energy Handbook: https://europa.eu/capacity4dev/file/31680/download?token=VOPD4lAh
European Comission. (2019, 12 11). *The European Green Deal: COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE EUROPEAN COUNCIL, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS*. Hentet May 2020 fra https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf
European Comission. (2020, January). *Investing in a Climate-Neutral and Circular Economy: The European Green Deal.* Hentet June 2020 fra https://ec.europa.eu/commission/presscorner/api/files/attachment/860667/Investing_clim ate_neutral_circular_economy_en.pdf.pdf
European Comission. (u.d.). *Innovation Fund*. Hentet May 2020 fra https://ec.europa.eu/clima/policies/innovation-fund_en
Fremskrittspartiet. (2017). *Prinsipp- og handlingsprogram: prinsipp- og handlingsprogram 2017 - 2021.* Hentet June 2020 fra https://fb.st/fisl56
Fremskrittspartiet. (2019, 7). *Landsmøtet: 7/19.* Hentet June 2020 fra https://www.frp.no/~/media/02-dokumenter/landsmøte/2019/redaksjonskomiteens-innstilling.pdf?la=nb-no
Fremskrittspartiet. (u.d.). *Klima og miljø*. Hentet June 2020 fra https://www.frp.no/internt/regjeringsplattform/klima-og-miljo
Frøde, T. (2018, 2 19). *Kabelen skal gjøre Johan Sverdrup-feltet mer «klimavennlig». Nå vil de ha slike anlegg langs hele kysten*. Hentet May 2020 fra https://www.tu.no/artikler/kabelen-skal-gjore-johan-sverdrup-feltet-mer-klimavennlig-na-vil-de-ha-slike-anlegg-langs-hele-kysten-br/429944
Froese, M. (2016, 9 29). *Atkins helps design world's first multi-turbine floating offshore wind platform*. Hentet May 2020 fra Windpower: https://www.windpowerengineering.com/atkins-helps-design-worlds-first-multi-turbine-floating-offshore-wind-platform/
Fruchart, D. (2013). Hydrogen Storage. I Y. Brunet, *Energy Storage.* London: Wiley.
Fuel Cell & Hydrogen Energy Association. (u.d.). *Fuel Cell Basics*. Hentet April 2020 fra FCHEA: http://www.fchea.org/fuelcells
Gänzle, S., & Henökl, T. (2018). From 'Awkward Partner' to 'Awkward Partnership'? Explaining Norway's Paradoxical Relations with the European Union. I M. McCallion, & A. Brianson (Warleigh-Lack), *Nordic States and European Integration. Awkward Partners in the North?* (ss. 79-102). Palgrave Macmillan.
GCE NODE. (2018, 9 8). *Visited Equinor's Hywind turbine*. Hentet February 2020 fra https://gcenode.no/news/visited-equinors-hywind-turbine/
GE. (u.d.). *Haliade X Offshore Turbines*. Hentet February 2020 fra GE Renewable Energy: https://www.ge.com/renewableenergy/wind-energy/offshore-wind/haliade-x-offshore-turbine
GE. (u.d.). *HYDROGEN AND CO2 EMISSIONS CALCULATOR*. Hentet May 2020 fra https://www.ge.com/power/gas/fuel-capability/hydrogen-fueled-gas-turbines
Geels, F. W. (2002). Technological Transitions as Evolutionary Reconfiguration Processes: Multi-1evel Perspective and a Case-study. *Research Policy, 31*(8-9), 1259-1263.
Geels, F. W. (2002). Understanding the Dynamics of Technological Transitions, A Co-evolutionary and Socio-technical Analysis.

Geels, F. W. (2004). From Sectoral Systems of Innovation to socio-technical Systems: Insights about Dynamics and Change from Sociology and Institutional Theory. *Research Policy, 33*(6-7), 912.

Geels, F. W. (2011, June). The multi-level perspective on sustainability transitions: Responses to seven criticisms. *Environmental Innovation and Societal Transitions, 1*(1), 24-40.

Geels, F. W., & Schot, J. (2007). Typology of Sociotechnical Transition Pathways. *Research Policy, 36*(3), 405-412.

Gheorghe, A., & Muresan , L. (2011). *Energy Security: International and Local Issues, Theoretical Perspectives, and Critical Energy Infrastructures.* Springer.

Government Norway. (2012, 12). *Official Norwegian Reports NOU 2012: 2 : Outside and Inside : Norway's agreements with the European Union.* Hentet July 2020 fra https://www.regjeringen.no/globalassets/upload/ud/vedlegg/eu/nou2012_2_chapter27.pdf

Government Norway. (2013, 11 28). *Erna Solberg.* Hentet June 2020 fra https://www.regjeringen.no/en/the-government/previous-governments/historiske-artikler/offices/prime-minister-since-1814/erna-solberg/id746813/

Government Norway. (2015, 4). *norway and the eu - partners for europe.* Hentet June 2020 fra https://www.regjeringen.no/globalassets/departementene/ud/vedlegg/europapolitikk/norway_eu.pdf

Government Norway. (2017, 725). *How is Norway governed?* Hentet June 2020 fra https://www.regjeringen.no/en/the-government/the-government-at-work1/the-government-at-work1/id2564958/

Government Norway. (2018, 1 17). *Endringer i arbeidsdelingen mellom departementene*. Hentet June 2020 fra https://www.regjeringen.no/no/aktuelt/endringer-i-departementene/id2586727/

Government Norway. (u.d.). *ENOVA*. Hentet May 2020 fra https://www.regjeringen.no/en/dep/kld/organisation/Subordinate-agencies/enova/id2599611/

Grin, J., Rotmans, J., & Schot, J. (2010). *Transitions to Sustainable Development: New Directions in the Study of Long Term Transformative Change.* New York: Routledge.

GRTgaz. (2019, 6). *Technical and economic conditions for injecting hydrogen into natural gas networks.* Hentet April 2020 fra https://www.grtgaz.com/fileadmin/plaquettes/en/2019/Technical-economic-conditions-for-injecting-hydrogen-into-natural-gas-networks-report2019.pdf

Haeseldonckx, D., & D'haeseleer , W. (2006, July-August). The use of the natural-gas pipeline infrastructure for hydrogen transport in a changing market structure. *International Journal of Hydrogen Energy, 32*(10-11), 1381-1386.

Hardy, S., Van Brusselen, K., Hendrix, S., Van Hertem, D., & Ergun, H. (2019). *Techno-Economic Analysis of HVAC, HVDC and OFAC Offshore Wind Power Connections*. Hentet May 2020 fra https://lirias.kuleuven.be/retrieve/549052

Harrabin, R. (2020, 1 2). *Climate change hope for hydrogen fuel*. Hentet April 2020 fra BBC: https://www.bbc.com/news/science-environment-50873047

Harris, G., & Stone, G. (1990). *Vertically Constructed and Installed Jacket for the Gyda Field.* Hentet May 2020 fra One Petro: https://www.onepetro.org/conference-paper/OTC-6396-MS

Hass, J. L., Haugen, J. Å., Nielsen, V. O., Aalandslid, V., Choudhury, R., & Kiøsterud, E. C. (2017). *Oil and Gas statistics*. Hentet January 2020 fra Statistics Norway: https://www.ssb.no/energi-og-industri/artikler-og-publikasjoner/_attachment/311820?_ts=15c9b48c6e8

Haugan, B. (2019, 11 11). *Ap vil brenne av klimamilliarder – lover å ikke øke skattene for vanlige folk*. Hentet June 2020 fra https://www.vg.no/nyheter/innenriks/i/Xg3BAx/ap-vil-brenne-av-klimamilliarder-lover-aa-ikke-oeke-skattene-for-vanlige-folk

Hitachi. (u.d.). *Blade and Tower*. Hentet February 2020 fra Wind Turbines: http://www.hitachi.com/products/energy/wind/products/htw2000_80/blade/index.html

Hofstrand, D., & Mary, H.-C. (2020, 7). *What is Feasibility Study?* Hentet July 2020 fra Iowa State University: Extension and Outreach: https://www.extension.iastate.edu/agdm/wholefarm/html/c5-65.html

Holter, M. (2019, 10 11). *Record-Large Floating Wind Farm Set for Norway*. Hentet May 2020 fra https://www.bloomberg.com/news/articles/2019-10-11/equinor-goes-ahead-with-550-million-subsidized-floating-wind

Hovland, K. M. (2019, 5 2). *Forslag til helgens landsmøte i Frp: Vil stanse vindkraft på land.* Hentet June 2020 fra E24: https://e24.no/olje-og-energi/i/MR5goB/forslag-til-helgens-landsmoete-i-frp-vil-stanse-vindkraft-paa-land

Hovland, K. M. (2020, 4 16). *Vil heller satse grønt enn å utsette oljeskatt: SV vil fremskynde oljeinvesteringer*. Hentet June 2020 fra E24: https://e24.no/den-groenne-oekonomien/i/70OAP3/vil-heller-satse-groent-enn-aa-utsette-oljeskatt-sv-vil-fremskynde-oljeinvesteringer

Høyre. (2017). *Vi tror på Norge: Høyres program for 2017-2021*. Hentet June 2020 fra https://hoyre.no/-/media/dokumenter/programmer/program_2017-2021.pdf?la=nb-no&hash=052243014C61464348130277AEC31899B4967F63

Hydrogen Europe. (u.d.). *Hydrogen Basics*. Hentet January 2020 fra Hydrogen Europe: https://hydrogeneurope.eu/hydrogen-basics-0

Hydrogen Europe. (u.d.). *Hydrogen Storage*. Hentet January 2020 fra Hydrogen Europe: https://hydrogeneurope.eu/hydrogen-storage

Hydrogen Europe. (u.d.). *Hydrogen Transport & Distribution*. Hentet May 2020 fra https://hydrogeneurope.eu/hydrogen-transport-distribution

Hydrogenics. (2018, 6). *"RENEWABLE HYDROGEN: THE MISSING LINK BETWEEN THE POWER, GAS, INDUSTRY AND TRANSPORT SECTORS"*. Hentet May 2020 fra https://hydrogeneurope.eu/sites/default/files/2018-06/2018-06_Hydrogenics_Company%20presentation.compressed.pdf

HYGRO. (u.d.). *DUWAAL: 'From wind to wheel' project*. Hentet May 2020 fra https://hy-gro.net/en/duwaal

IEA. (2014, 4). *Electricity Transmission and Distribution*. Hentet April 2020 fra ETSAP: https://iea-etsap.org/E-TechDS/PDF/E12_el-t&d_KV_Apr2014_GSOK.pdf

IEA. (2019, 6). *The Future of Hydrogen.* Hentet January 2020 fra https://www.iea.org/reports/the-future-of-hydrogen

iha - international hydropower association. (2017, 5). *Norway*. Hentet May 2020 fra https://www.hydropower.org/country-profiles/norway

IRENA - International Renewable Energy Agency. (2016, March). *Wind Power: Technology brief.* Hentet February 2020 fra https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2016/IRENA-ETSAP_Tech_Brief_Wind_Power_E07.pdf

IRENA - International Renewable Energy Agency. (2018, September). *HYDROGEN FROM RENEWABLE POWER: TECHNOLOGY OUTLOOK FOR THE ENERGY TRANSITION.* Hentet 2020 January fra https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Sep/IRENA_Hydrogen_from_renewable_power_2018.pdf

IRENA - International Renewable Energy Agency. (2019, October). *FUTURE OF WIND: Deployment, investment, technology, grid integration and socio-economic aspects.*

Hentet February 2020 fra https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Oct/IRENA_Future_of_wind_2019.pdf
ITM Power. (2020, 4 6). *ITM Power and Ørsted: Wind Turbine Electrolyser Integration.* Hentet May 2020 fra ITM Power Energy Storage Clean Fuel: https://www.itm-power.com/news/wind-turbine-electrolyser-integraion
Jebrin, A. H. (2017, 9 18). The Theoretical Strategic Approach in the Feasibility Study. *Journal of Economics, Management and Trade, 19*(2), 1-14.
Kenton, W. (2020, 7 1). *Feasibility Study*. (A. Drury, Redaktør) Hentet November 2019 fra Investopedia: https://www.investopedia.com/terms/f/feasibility-study.asp
Kikuchi, Y., & Ishihara, T. (2019, 1 17). *Upscaling and levelized cost of energy for offshore wind turbines supported by semi-submersible floating platforms*. Hentet May 2020 fra https://www.sintef.no/globalassets/project/eera-deepwind-2019/presentations/e2_yukakikuchi20190117r.pdf/
Kristelig Folkeparti. (2017). *KrFs stortingsprogram 2017-2021: Det handler om mennesker*. Hentet June 2020 fra https://www.krf.no/globalassets/vedlegg/politiske-dokumenter/politisk-program/stortingsprogram-krf-2017-2021.pdf
Kristelig Folkeparti. (u.d.). *KrF in other languages*. Hentet June 2020 fra https://www.krf.no/politikk/in-other-languages/
Kumar, S. S., & Himabindu, V. (2019, December). Hydrogen production by PEM water electrolysis – A review. *Materials Science for Energy Technologies, 2*(3), 442-454.
Langhelle, O., Kern, F., & Meadowcroft, J. (2017). The political landscape as a distinct and separate landscape.
LaNier, M. W. (2005, 1). *LWST Phase I Project Conceptual Design Study: Evaluation of Design and Construction Approaches for Economical Hybrid Steel/Concrete Wind Turbine Towers*. Hentet February 2020 fra National Renewable Energy Laboratory: https://www.nrel.gov/docs/fy05osti/36777.pdf
Lantz, E., Roberts, O., Nunemaker, J., DeMeo, E., Dykes, K., & Scott, G. (2019, May). *Increasing Wind Turbine Tower Heights: Opportunities and Challenges.* Hentet February 2020 fra https://www.nrel.gov/docs/fy19osti/73629.pdf
Laville, S., & Watts, J. (2019, 9 21). *Across the globe, millions join biggest climate protest ever*. Hentet July 2020 fra The Guardian: https://www.theguardian.com/environment/2019/sep/21/across-the-globe-millions-join-biggest-climate-protest-ever
Lee, A. (2019, 6 7). *'Deep Purple' seabed hydrogen storage for offshore wind plan.* Hentet April 2020 fra RECHARGE: https://www.rechargenews.com/wind/deep-purple-seabed-hydrogen-storage-for-offshore-wind-plan/2-1-617947
Lie, Ø. (2013, 6 24). *Siemens leverer landanlegget til Martin Linge*. Hentet May 2020 fra https://e24.no/olje-og-energi/i/oRgQng/siemens-leverer-landanlegget-til-martin-linge
Lie, Ø. (2014, 5 2). *Øker kostnaden på elektrifisering fra 6,5 til 13,2 milliarder*. Hentet May 2020 fra https://www.tu.no/artikler/oker-kostnaden-pa-elektrifisering-fra-6-5-til-13-2-milliarder/231401
Mazzetti, M. J. (2013, 5). *Offshore Energy Efficiency Technologies*. Hentet May 2020 fra https://www.sintef.no/globalassets/project/effort/effort-presentation-at-the-otc-conference-houston-may-6-2013.pdf/
Mazzetti, M. J., Nekså, P., Walnum, H. T., & Hemmingsen, A. T. (2014, 2). *Energy-Efficient Technologies for Reduction of Offshore CO2 Emmissions*. Hentet May 2020 fra https://pubs.spe.org/media/filer_public/21/e3/21e3c337-7bf1-4d6d-9958-90a1730c437a/20_pr169811.pdf

Melaina, M. W., Antonia, O., & Penev, M. (2013, 3). *Blending Hydrogen into Natural Gas Pipeline Networks: A Review of Key Issues.* Hentet April 2020 fra National Renewable Energy Laboratory - NREL: https://www.nrel.gov/docs/fy13osti/51995.pdf

Miljøpartiet De Grønne. (2017). *TA VARE PÅ FRAMTIDA: ARBEIDSPROGRAM 2017-2021*. Hentet June 2020 fra https://d3n8a8pro7vhmx.cloudfront.net/mdg/pages/309/attachments/original/1548161094/Arbeidsprogram-2018.pdf?1548161094

Miljøpartiet De Grønne. (u.d.). *Fornybar energi*. Hentet June 2020 fra https://www.mdg.no/fornybar_energi

Miljøpartiet De Grønne. (u.d.). *Utfasing av oljen*. Hentet June 2020 fra https://www.mdg.no/utfasing_av_oljen

Mokyr, J. (1990). *The Lever of Riches: Technological Creativity and Economic Progress.* New York: Oxford University Press.

Momota, K. (2015, 5 12). *川崎市と東芝の水素戦略に見る「水素社会」の現状*. Hentet May 2020 fra Diamond online: https://diamond.jp/articles/-/71252?page=2

Multiconsult. (u.d.). *Gullfaks Platforms*. Hentet May 2020 fra https://www.multiconsultgroup.com/projects/gullfaks-platforms/

Murray, J. (2020, 1 24). *Zero-carbon hydrogen injected into gas grid for first time in groundbreaking UK trial*. Hentet April 2020 fra Gurdian.

NASA. (u.d.). *Do scientists agree on climate change?* Hentet January 2020 fra Global Climate Change : https://climate.nasa.gov/faq/17/do-scientists-agree-on-climate-change/

NASA. (u.d.). *Scientific Consensus: Earth's Climate is Warming*. Hentet January 2020 fra Global Climate Change: https://climate.nasa.gov/scientific-consensus/

NASA. (u.d.). *The Effects of Climate Change*. Hentet January 2020 fra Global Climate Change: https://climate.nasa.gov/effects/

National Renewable Energy Laboratory - NREL. (2014, 5). *Hydrogen Station Compression, Storage, and Dispensing Technical Status and Costs*. Hentet May 2020 fra https://www.hydrogen.energy.gov/pdfs/58564.pdf

National Renewable Energy Laboratory - NREL. (u.d.). *Wind-to-Hydrogen Project.* Hentet May 2020 fra NREL Transforming ENERGY: https://www.nrel.gov/hydrogen/wind-to-hydrogen.html

National Renewable Energy Laboratory (NREL). (u.d.). *Hydrogen Basics*. Hentet January 2020 fra NREL: Research: https://www.nrel.gov/research/eds-hydrogen.html

Naturvernforbundet. (2019, 9 20). *Global klimastreik / Global climate strike*. Hentet July 2020 fra https://naturvernforbundet.no/arrangementer/global-klimastreik-global-climate-strike- article39606-198.html

Neill, S., & Hashemi, M. (2018). Offshore Wind. I S. Neill, & M. R. Hashemi, *Fundamentals of Ocean Renewable Energy* (ss. 83-106). Academic Press.

Nel. (2017, 9). *Nel ASA: Company Presentation.* Hentet May 2020 fra https://mb.cision.com/Public/115/2355720/8f82f7e1d020b482.pdf

Nel. (2020, 1). *Nel ASA: company presentation.* Hentet May 2020 fra https://nelhydrogen.com/wp-content/uploads/2020/02/Company-presentation-2020.pdf

Nikkei BP. (u.d.). *東芝の水素コア技術がつくる　２０２０年　日本の水素社会*. Hentet May 2020 fra ”明日”をつむぐ　テクノロジー SPECIAL: https://special.nikkeibp.co.jp/atclh/tomorrowtech/h2one/

Nohlen, D., & Stöver, P. (2010). *Elections in Europe: A Data Handbook.* Nomos.

Norfakta for Nationen og Klassekampen. (2020, 7 11). *Norfakta for Nationen og Klassekampen 11. juli 2020*. Hentet July 2020 fra Poll of polls: http://www.pollofpolls.no/?cmd=Maling&gallupid=4150

Norsk Klima Service Senter. (u.d.). *Observasjoner og værstatistikk*. Hentet May 2020 fra https://seklima.met.no/observations/

Norsk Klima Service Senter. (u.d.). *Observasjoner og værstatistikk*. Hentet May 2020 fra https://seklima.met.no/observations/

Norsk Oljemuseum. (2016). *Oil and gas fields in Norway: industrial heritage plan.* Hentet May 2020 fra https://www.norskolje.museum.no/wp-content/uploads/2016/02/3467_d58f935e384345e59f32d406aaebfa10.pdf

North Sea Region. (u.d.). *Existing offshore linear energy infrastructure and grid connections*. Hentet April 2020 fra NorthSEE: https://northsearegion.eu/northsee/e-energy/existing-offshore-linear-energy-infrastructure-and-grid-connections/

Norton, L. P. (2020, 1 30). *13 ESG Investing Trends to Watch for in 2020*. Hentet May 2020 fra https://www.barrons.com/articles/13-esg-investing-trends-to-watch-for-in-2020-51580385602

Norwegian Environment Agency. (2010, 2 15). *Klimakur 2020: Sektoriell tiltaksanalyse petroleumssektoren.* Hentet March 2020 fra https://www.npd.no/globalassets/norsk/3-publikasjoner/rapporter/pdf/klimakur-endelig-rapport.pdf

Norwegian Environment Agency. (u.d.). *Carbon units*. Hentet May 2020 fra https://www.norskeutslipp.no/en/Components/Climate-quotes/Quote-pollutants/?ComponentType=kvoteutslipp&ComponentPageID=1103&SectorID=700

Norwegian Environment Agency. (u.d.). *Offshore Petroleum industry: Facilities*. Hentet March 2020 fra https://www.norskeutslipp.no/en/Lists/Overview-facility/?SectorID=700

Norwegian Petroleum Directorate. (2006). *Pipelines and land facilities.* Hentet May 2020 fra https://www.regjeringen.no/globalassets/upload/kilde/oed/bro/2002/0006/ddd/pdfv/152181-facts_17.pdf

Norwegian Petroleum Directorate. (2019, 9 27). *Resource Report Discoveries and Fields 2019.* Hentet January 2020 fra https://www.npd.no/globalassets/1-npd/publikasjoner/ressursrapport-2019/resource-report-2019.pdf

Norwegian Petroleum Directorate. (2019). *Map of the NCS 2019*. Hentet May 2020 fra https://www.npd.no/globalassets/1-npd/publikasjoner/sokkelkartet_2019_200.png

Norwegian Petroleum Directorate. (2020, 6 26). *Almost half of Norwegian petroleum production will soon be run on power from shore.* Hentet June 2020 fra https://www.npd.no/en/facts/news/general-news/2020/almost-half-of-norwegian-petroleum-production-will-soon-be-run-on-power-from-shore/

Norwegian Petroleum. (2020, 5 12). *Production Forecasts*. Hentet May 2020 fra https://www.norskpetroleum.no/en/production-and-exports/production-forecasts/

Norwegian Petroleum. (u.d.). *ALVHEIM*. Hentet May 2020 fra https://www.norskpetroleum.no/en/facts/field/alvheim/

Norwegian Petroleum. (u.d.). *CARBON CAPTURE AND STORAGE*. Hentet June 2020 fra https://www.norskpetroleum.no/en/environment-and-technology/carbon-capture-and-storage/

Norwegian Petroleum. (u.d.). *GJØA*. Hentet May 2020 fra https://www.norskpetroleum.no/fakta/felt/gjoa/

Norwegian Petroleum. (u.d.). *Heidrun*. Hentet May 2020 fra https://www.norskpetroleum.no/en/facts/field/heidrun/

Norwegian Petroleum. (u.d.). *JOTUN*. Hentet May 2020 fra https://www.norskpetroleum.no/en/facts/field/jotun/

Norwegian Petroleum. (u.d.). *KRISTIN*. Hentet fra https://www.norskpetroleum.no/en/facts/field/kristin/
Norwegian Petroleum. (u.d.). *KVITEBJØRN*. Hentet May 2020 fra https://www.norskpetroleum.no/fakta/felt/kvitebjorn/
Norwegian Petroleum. (u.d.). *VESLEFRIKK*. Hentet May 2020 fra https://www.norskpetroleum.no/en/facts/field/veslefrikk/
Nossen, K. (2020, 6 8). *Slik vil Høyre skape en grønn fremtid*. Hentet June 2020 fra https://hoyre.no/aktuelt/nyheter/2020/slik-vil-hoyre-skape-en-gronn-fremtid/
NVE - Norges vassdrags- og energidirektorat. (2018, 10 29). *Energy Consumption in Norway*. Hentet May 2020 fra https://www.nve.no/energy-consumption-and-efficiency/energy-consumption-in-norway/?ref=mainmenu
Oil & Gas UK. (2018). *ENVIRONMENT REPORT 2018.* Hentet April 2020 fra https://oilandgasuk.co.uk/wp-content/uploads/2019/05/OGUK-Environment-Report-2018.pdf
Oil and Gas Journal. (2015, 3 18). *Knarr field oil flow starts offshore Norway*. Hentet May 2020 fra https://www.ogj.com/drilling-production/production-operations/field-start-ups/article/17244885/knarr-field-oil-flow-starts-offshore-norway
One Petro. (1990). *Vertically Constructed and Installed Jacket for the Gyda Field*. Hentet May 2020 fra https://www.onepetro.org/conference-paper/OTC-6396-MS
Overland, J.-A. (2019, 8 27). *Hva står de politiske partiene for?* Hentet June 2020 fra NASJONAL DIGITAL LÆRINGSARENA - ndla: https://ndla.no/subjects/subject:3/topic:1:168542/topic:1:173292/resource:1:11473
PGNiG. (u.d.). *Skrav*. Hentet May 2020 fra http://norway.pgnig.pl/skarv
POWER. (2009, 11 30). *Top Plants: Hywind Floating Wind Turbine, North Sea, Norway*. Hentet May 2020 fra https://www.powermag.com/top-plants-hywind-floating-wind-turbine-north-sea-norway/
Quest Floating Wind Energy. (2018, 6). *Hywind Scotland.* Hentet February 2020 fra https://questfwe.com/wp-content/uploads/2018/07/Hywind-Scotland.pdf
Quest Floating Wind Energy. (2018). *Hywind Tampen.* Hentet February 2020 fra https://questfwe.com/wp-content/uploads/2018/08/Hywind-Tampen.pdf
Riboldi, L., Völler, S., Korpås, M., & Nord, L. O. (2019, 6 2). An Integrated Assessment of the Environmental and Economic Impact of Offshore Oil Platform Electrification. *Energies, 12(11)*, 2114.
Ritchie, H., & Roser, M. (2017). *CO_2 and Greenhouse Gas Emissions.* Hentet January 2020 fra Our World in Data: https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions
Rød UNGDOM. (u.d.). *Elektrifisering av sokkelen.* Hentet June 2020 fra https://rødungdom.no/elektrifisering-av-sokkelen
Rødt. (2017). *Rødts arbeidsprogram 2017 - 2021.* Hentet June 2020 fra https://roedt.no/fil/LA5zSofUOP0i_SYlqIMfHPG4JPOQi5lt0QPxO.pdf?dl=
Rystad Energy. (2019, 12 6). *40% of Norway's offshore production electrified by 2025.* Hentet April 2020 fra https://www.rystadenergy.com/newsevents/news/press-releases/40-percent-of-norways-offshore-production-electrified-by-2025/
Sammut-Bonnici, T., & Galea, D. (2015). *PEST analysis.* Hentet December 2019 fra https://www.um.edu.mt/library/oar/bitstream/123456789/21816/1/sammut-bonnici%20pest.pdf
Senterpartiet. (2017). *Prinsipp- og handlingsprogram 2017-2021*. Hentet June 2020 fra https://www.senterpartiet.no/Om%20SP/arkivert/valg-2017/senterpartiets-program-2017- 2021/_/attachment/download/df68f6c1-ca08-4256-8869-

5e2ee74f0244:1ed84364ef72b0e81728676718cb39d2a6ef84c1/Senterpartiets%20program %202017-2021%20-%20nynorsk.pdf
Senterpartiet. (2019). *Sak 9/19 RESOLUSJONER: INNKOMNE RESOLUSJONSFORSLAG.* Hentet June 2020 fra https://www.senterpartiet.no/landsmote-2019/sakspapir/_/attachment/download/22ca0ff6-4b90-4841-97fd-2ba265284d72:d7a3b49d70fd65ae6f2d237ebf01807364e1b124/LMsak0919%20RESOLUSJO NER%20(Innkomne%20forslag)-kopi.pdf
Shell. (u.d.). *Ormen Lange*. Hentet May 2020 fra https://www.shell.no/about-us/projects-and-sites/ormen-lange.html
Siemens Gamesa. (u.d.). *SG 14-222 DD*. Hentet February 2020 fra Siemens Gamesa Renewable Energy: https://www.siemensgamesa.com/en-int/products-and-services/offshore/wind-turbine-sg-14-222-dd
Siemens Gamesa. (u.d.). *Wind turbine SG 11.0-200 DD*. Hentet February 2020 fra Siemens Gamesa Renewable Energy: https://www.siemensgamesa.com/en-int/products-and-services/offshore/wind-turbine-sg-11-0-200-dd
Siemens Gamesa. (u.d.). *Wind turbine SG 8.0-167 DD*. Hentet February 2020 fra Siemens Gamesa Renewable Energy: https://www.siemensgamesa.com/en-int/products-and-services/offshore/wind-turbine-sg-8-0-167-dd
Siemens. (2016, 10 26). *Electrolyzer technology – the Siemens view.* Hentet May 2020 fra http://www.scandinavianhydrogen.org/wp-content/uploads/2016/11/2_Manfred-Waidhas.pdf
Snieckus, D. (2019, 5 28). *Will floating wind power help Big Oil crack its 'Kinder Egg'?* Hentet April 2020 fra RECHARGE: https://www.rechargenews.com/transition/will-floating-wind-power-help-big-oil-crack-its-kinder-egg-/2-1-605714
Sosialistisk Venstreparti. (2017). *SVs arbeidsprogram 2017-2021.* Hentet June 2020 fra https://www.sv.no/wp-content/uploads/2013/12/170816_Arbeidsprogram-2017-2021.pdf
Statistics Norway. (2014). *Energy consumption in households, 2012*. Hentet May 2020 fra https://www.ssb.no/en/energi-og-industri/statistikker/husenergi/hvert-3-aar/2014-07-14
Statistics Norway. (2020, 2 27). *Population*. Hentet July 2020 fra https://www.ssb.no/en/befolkning/statistikker/folkemengde/aar-per-1-januar
Statistics Norway. (2020, 3 9). *Immigrants and Norwegian-born to immigrant parents*. Hentet July 2020 fra https://www.ssb.no/en/befolkning/statistikker/innvbef
Statistics Norway. (2020, June 8). *Emissions to air.* Hentet June 2020 fra https://www.ssb.no/en/klimagassn
Statistics Norway. (2020). *Production and consumption of energy, energy balance and energy account*. Hentet May 2020 fra https://www.ssb.no/en/energi-og-industri/statistikker/energibalanse
Statistics Norway. (u.d.). *Enova-avgiften.* Hentet June 2020 fra https://www.ssb.no/ajax/ordforklaring?key=284918&sprak=no
Store Norske Leksikon. (u.d.). *Åsgard - petroleumsfelt*. Hentet May 2020 fra https://snl.no/Åsgard_-_petroleumsfelt
Store Norske Leksikon. (u.d.). *Ekofisk*. Hentet May 2020 fra https://snl.no/Ekofisk
Stortinget. (2015). *THE NORWEGIAN PARLIAMENT.* Hentet June 2020 fra https://www.stortinget.no/globalassets/pdf/hovedbrosjyre-div-spraak/stortingetnorgesnasjonalforsamling_eng_web.pdf
Survey Monkey. (u.d.). *Survey Sample Size*. Hentet July 2020 fra https://www.surveymonkey.com/mp/sample-size/

Tangerås, B.-T., & Tveiten, Å. S. (2018, 12 13). *Hywind Tampen, project NPV calculation. With and without subsidies.* Hentet October 2019 fra https://uis.brage.unit.no/uis-xmlui/bitstream/handle/11250/2587180/Tangeraas_Bjoern-Tore.Tveiten_Aasmund_Sandvik.pdf?sequence=1&isAllowed=y

Taraldsen, L. (2014, 2 3). *ODs elektrifiserings-anslag: 421 kroner per tonn CO2. Statoil: 2000 kroner*. Hentet May 2020 fra https://www.tu.no/artikler/ods-elektrifiserings-anslag-421-kroner-per-tonn-co2-statoil-2000-kroner/231352

Tembhurne, S., Nandjou, F., & Haussener, S. (2019, May). A thermally synergistic photo-electrochemical hydrogen generator operating under concentrated solar irradiation. *Nature Energy*.

The World Bank. (u.d.). *Zero Routine Flaring by 2030*. Hentet April 2020 fra https://www.worldbank.org/en/programs/zero-routine-flaring-by-2030

Thomas, D. (2019, 2 21). *STATE OF PLAY AND DEVELOPMENTS OF POWER-TO-HYDROGEN TECHNOLOGIES*. Hentet May 2020 fra HYDROGENICS: https://etipwind.eu/wp-content/uploads/A2-Hydrogenics_v2.pdf

Toshiba. (2019, 10 30). *Toshiba's H2One™ Selected to Support Singapore's Research Efforts in Energy Sustainability*. Hentet May 2020 fra https://www.toshiba-energy.com/en/info/info2019_1030.htm

U.S. Department fo Energy. (2015, November). *FUEL CELL TECHNOLOGIES OFFICE: Fuel Cells.* Hentet January 2020 fra Office of Energy Efficiency & Renewable Energy: https://www.energy.gov/sites/prod/files/2015/11/f27/fcto_fuel_cells_fact_sheet.pdf

U.S. Department fo Energy. (u.d.). *Hydrogen Production Processes*. Hentet January 2020 fra Office of Energy Efficiency & Renewable Energy: https://www.energy.gov/eere/fuelcells/hydrogen-production-processes

U.S. Department fo Energy. (u.d.). *Hydrogen Production: Biomass Gasification*. Hentet January 2020 fra Office of Energy Efficiency & Renewable Energy: https://www.energy.gov/eere/fuelcells/hydrogen-production-biomass-gasification

U.S. Department fo Energy. (u.d.). *Hydrogen Production: Coal Gasification*. Hentet January 2020 fra Office of Energy Efficiency & Renewable Energy: https://www.energy.gov/eere/fuelcells/hydrogen-production-coal-gasification

U.S. Department fo Energy. (u.d.). *Hydrogen Production: Electrolysis*. Hentet January 2020 fra Office of Energy Efficiency & Renewable Energy: https://www.energy.gov/eere/fuelcells/hydrogen-production-electrolysis

U.S. Department fo Energy. (u.d.). *Hydrogen Production: Natural Gas Reforming*. Hentet January 2020 fra Office of Energy Efficiency & Renewable Energy: https://www.energy.gov/eere/fuelcells/hydrogen-production-natural-gas-reforming

U.S. Department fo Energy. (u.d.). *Hydrogen Production: Photoelectrochemical Water Splitting*. Hentet January 2020 fra Office of Energy Efficiency & Renewable Energy: https://www.energy.gov/eere/fuelcells/hydrogen-production-photoelectrochemical-water-splitting

U.S. Department fo Energy. (u.d.). *Hydrogen Production: Thermochemical Water Splitting*. Hentet January 2020 fra Office of Energy Efficiency & Renewable Energy: https://www.energy.gov/eere/fuelcells/hydrogen-production-thermochemical-water-splitting

U.S. Department fo Energy. (u.d.). *Hydrogen Storage*. Hentet April 2020 fra Office of Energy Efficiency & Renewable Energy: https://www.energy.gov/eere/fuelcells/hydrogen-storage

U.S. Department of Energy. (u.d.). *Hydrogen Storage*. Hentet January 2020 fra Office of Energy Efficiency & Renewable Energy: https://www.energy.gov/eere/fuelcells/hydrogen-storage

Ulsund, R. (2009, 6). *Offshore Power Transmission: Submarine high voltage transmission alternatives*. Hentet May 2020 fra https://core.ac.uk/download/pdf/30814499.pdf

United Nations Framework Convention on Climate Change. (2015, 12 13). *Historic Paris Agreement on Climate Change: 195 Nations Set Path to Keep Temperature Rise Well Below 2 Degrees Celsius*. Hentet January 2020 fra United Nations Climate Change: https://cop23.unfccc.int/news/finale-cop21

United Nations Framework Convention on Climate Change. (u.d.). *The Paris Agreement*. Hentet January 2020 fra United Nations Climate Change: https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

Valg. (2013, 10 7). *Parliamentary election: 2013*. Hentet June 2020 fra https://www.valgresultat.no/?type=st&year=2013

Valg. (2018, 2 26). *Parliamentary election: 2017*. Hentet 6 2020 fra https://www.valgresultat.no/?type=st&year=2017

Varadhan, P., Fu, H.-C., Kao, Y.-C., Horng, R.-H., & He, J.-H. (2019, November). An efficient and stable photoelectrochemical system with 9% solar-to-hydrogen conversion efficiency via InGaP/GaAs double junction. *Nature Communications, 10*(5282).

Venstre. (2017). *På lag med framtida: Venstres stortingsvalgprogram 2017-2021*. Hentet June 2020 fra https://www.venstre.no/assets/Stortingsvalgprogram-2017-web.pdf

Wind Europe. (2018, 2). *Wind energy in Europe in 2018.* Hentet May 2020 fra https://windeurope.org/wp-content/uploads/files/about-wind/statistics/WindEurope-Annual-Statistics-2018.pdf

World Commission on Environment and Development. (1987). *"Our common future".* New York: Oxford University Press.

World Steel Association. (2012). *Steel SolutionS in the green economy: Wind Turbines.* Hentet February 2020 fra https://www.worldsteel.org/en/dam/jcr:41f65ea2-7447-4489-8ba7-9c87e3975aab/Steel+solutions+in+the+green+economy:+Wind+turbines.pdf

Yao, T. (2020, 7 22). *Toshiba's megawatt fuel cells have enough juice to power a factory*. Hentet July 2020 fra Nikkei Asian Review: https://asia.nikkei.com/Business/Companies/Toshiba-s-megawatt-fuel-cells-have-enough-juice-to-power-a-factory

Zipp, K. (2012, 3 5). *Long overdue: A national standard for wind tower service lifts*. Hentet January 2020 fra Windpower: https://www.windpowerengineering.com/long-overdue-a-national-standard-for-wind-tower-service-lifts/

15 *Appendices*

1. Estimated energy consumption of each field in NCS (Page 1)

2018 - Facilities	Energy use : Diesel (in tonn)	Energy use : Natural gas (in m3)	Emissions in CO2 equivalent (in tonn)	Capacity required (in MW)	Generated electricity by natural gas (in kWh)
Alve					
Alvheim	10 389,53	74 919 891,48	232 099,00	50	218 354 663,40
Atla				-	-
Balder	19 111,10	12 026 168,60	140 730,00	8	35 050 371,07
Brage	1 516,36	69 602 546,00	190 451,00	46	202 857 214,60
Brynhild	23,09		73,00	-	-
Bøyla	5 615,21			-	-
Draugen	12 433,58	44 296 911,25	192 172,00	29	129 103 726,06
Draupner			13 654,00	-	-
Dvalin				-	-
Edvard Greig	1 984,29	88 460 929,03	293 660,00	59	257 820 132,96
Ekofisk	10 880,31	256 741 942,78	906 378,00	171	748 276 584,35
Eldfisk	5 784,26	100 711 408,07		67	293 524 258,72
Embla	38,13			-	-
Fram	400,14			-	-
Gaupe				-	-
Gina Krog	11 224,02	41 188 703,98	145 008,00	27	120 044 829,43
Gjøa	266,12	50 417 864,59	118 064,00	34	146 943 296,83
Glitne				-	-
Goliat	7 830,15	9 394 176,55	69 038,00	6	27 379 407,76
Grane	1 528,74	86 186 684,57	212 275,00	57	251 191 828,06
Gudrun	3,10			-	-
Gullfaks	1 390,43	395 999 295,78	930 679,00	264	1 154 143 328,68
Gullfaks Sør	4 992,35			-	-
Gungne				-	-
Gyda	939,30	10 106 914,86	32 519,00	7	29 456 689,65
Heidrun	10 636,52	128 329 594,00	353 622,00	85	374 017 697,42
Heimdal	1 589,36	58 210 430,00	135 627,00	39	169 654 795,25
Hod	161,10			-	-
Huldra				-	-
Ivar Aasen	3 492,59		36 323,00	-	-
Jette				-	-
Johan Sverdrup			40 312,00	-	-
Jotun	5 175,32	33 077 825,92	129 645,00	22	96 405 606,07
Knarr	4 324,68	36 989 059,64	141 919,00	25	107 804 930,14
Kristin	187,37	133 972 247,21	352 513,00	89	390 463 258,38
Kvitebjørn	833,53	84 654 086,93	194 177,00	56	246 725 059,15
Maria			12 120,00	-	-
Martin Linge	8 981,95		28 453,00	-	-
Maruk				-	-
Mikkel				-	-
Morvin	125,69			-	-
Njord	29,07		92,00	-	-
Norne	1 911,99	139 927 447,69	336 899,00	93	407 819 741,02

Source: (Norwegian Environment Agency, n.d.)

2. Estimated energy consumption of each field in NCS (Page 2)

2018 - Facilities	Energy use : Diesel (in tonn)	Energy use : Natural gas (in m3)	Emissions in CO2 equivalent (in tonn)	Capacity required (in MW)	Generated electricity by natural gas (in kWh)
Ormen Lange			1 240,00	-	-
Ormen Lange	387,32			-	-
Oseberg	8 414,74	344 714 705,93	1 119 612,00	229	1 004 673 953,68
Oseberg Sør	3 490,97	63 680 493,08		42	185 597 340,80
Oseberg Øst	5 492,52	31 423 586,05		21	91 584 309,84
Oselvar				-	-
Rev				-	-
Sigyn				-	-
Skarv	1 793,79	162 109 866,51	368 811,00	108	472 470 590,07
Skirne				-	-
Skuld				-	-
Sleipner Vest	1 446,66	112 632 169,93	808 956,00	75	328 267 420,94
Sleipner Øst	1 293,77	211 962 264,28		141	617 765 829,03
Snorre	3 585,61	136 177 168,40	459 213,00	91	396 889 520,01
Snøhvit	2 092,19			-	-
Solveig				-	-
Statfjord	4 732,12	282 288 647,08	817 594,00	188	822 732 672,16
Statfjord Nord	64,13			-	-
Statfjord Øst				-	-
Svalin				-	-
Sygna	209,48			-	-
Tambar	1 985,48			-	-
Tor	953,50			-	-
Tordis	112,01			-	-
Troll	34 442,54	272 130 492,00		181	793 126 642,44
Troll A			7 310,00	-	-
Troll Vest (Troll B og C)			687 347,00	-	-
Tune				-	-
Tyrihans	3 602,12			-	-
Ula	2 613,31	63 123 941,48	214 187,00	42	183 975 266,41
Urd				-	-
Vale				-	-
Valemon	726,99		3 324,00	-	-
Valhall	3 360,77		19 573,00	-	-
Varg	399,67		1 264,00	-	-
Vega				-	-
Veslefrikk	5 659,03	35 135 436,65	120 298,00	23	102 402 530,11
Vigdis	358,67			-	-
Vilje				-	-
Visund	4 640,97	107 029 170,26	263 199,00	71	311 937 430,56
Volund				-	-
Volve				-	-
Yme	648,69		2 106,00	-	-
Yttergryta				-	-
Åsgard	14 163,84	336 885 009,19	916 575,00	224	981 854 235,68
Aasta Hansteen			68 079,00	-	-

Source: (Norwegian Environment Agency, n.d.)

3. Estimated energy consumption of each group in NCS (Page 3)

				Capacity required (in MW)	Generated electricity by natural gas (in kWh)
Total	240 470,27	4 014 507 079,77	11 117 190,00	2 672	11 700 315 160,75
A	25 970,97	1 043 137 428,09	2 810 105,00	694	3 040 232 940,71
B	5 170,88	322 548 356,59	293 660,00	215	940 069 939,27
C	33 555,57	544 556 767,71	1 458 814,00	362	1 587 115 349,04
D	262 120,80	264 421 000,57	13 303 523,00	176	770 657 263,85
E	275 314,38	454 244 067,22	13 046 670,00	302	1 323 898 212,35
F	26 739,25	430 684 207,19	1 172 730,00	287	1 255 232 799,13
G	4 640,97	-	263 199,00	-	-
H	81 493,07	945 521 075,85	5 606 329,00	629	2 755 729 248,63
I	387,32	-	1 240,00	-	-
J	4 735,22	9 394 176,55	817 594,00	6	27 379 407,76

Source: (Norwegian Environment Agency, n.d.)

4. Estimated energy consumption and the distance to neighbor field in NCS (Page 1: Group A - D)

2018	Energy use : Diesel (in tonn)	Energy use : Natural gas (in m3)	Emissions in CO2 equivalent (in tonn)	Capacity required (in MW)	Generated electricity by natural gas (in kWh)	Distance from shore (in km)	Distance from hub or neigbout field (in km)	Distance from which field	Capacity required to carry over (in MW)
Group A									
Gullfaks (Hub)	1 390,43	395 999 295,78	930 679,00	264	1 154 143 328,68	160			695
Gullfaks Sør	4 992,35			-	-				
Knarr	4 324,68	36 989 059,64	141 919,00	25	107 804 930,14		22	Gullfaks	25
Kvitebjørn	833,53	84 654 086,93	194 177,00	56	246 725 059,15		15	Gullfaks	56
Snorre	3 585,61	136 177 168,40	459 213,00	91	396 889 520,01		35	Gullfaks	91
Statfjord	4 732,12	282 288 647,08	817 594,00	188	822 732 672,16		11	Gullfaks	188
Statfjord Nord	64,13			-	-				
Statfjord Øst				-	-				
Sygna	209,48			-	-				
Tordis	112,01			-	-				
Valemon	726,99		3 324,00	-	-				
Vigdis	358,67			-	-				
Visund	4 640,97	107 029 170,26	263 199,00	71	311 937 430,56		22	Gullfaks	71
Group B									
Fram	400,14			-	-				
Gjøa	266,12	50 417 864,59	118 064,00	34	146 943 296,83	50			34
Troll	34 442,54	272 130 492,00		181	793 126 642,44				181
Troll A (Hub)			7 310,00	-	-	65			
Troll Vest (Troll B og C)			687 347,00	-	-	97			
Vega				-	-				
Group C									
Brage	1 516,36	69 602 546,00	190 451,00	46	202 857 214,60		10	Oseberg	46
Huldra				-	-				
Martin Linge	8 981,95		28 453,00	-	-				
Oseberg (Hub)	8 414,74	344 714 705,93	1 119 612,00	229	1 004 673 953,68	130			362
Oseberg Sør	3 490,97	63 680 493,08		42	185 597 340,80		13	Oseberg	42
Oseberg Øst	5 492,52	31 423 586,05		21	91 584 309,84		25	Oseberg	21
Tune				-	-				
Veslefrikk	5 659,03	35 135 436,65	120 298,00	23	102 402 530,11		30	Oseberg	23
Group D									-
Alvheim	10 389,53	74 919 891,48	232 099,00	50	218 354 663,40		10	Heimdal	50
Atla				-	-				
Balder	19 111,10	12 026 168,60	140 730,00	8	35 050 371,07		10	Grane	8
Bøyla	5 615,21			-	-				
Grane (Hub)	1 528,74	86 186 684,57	212 275,00	57	251 191 828,06	185			176
Heimdal	1 589,36	58 210 430,00	135 627,00	39	169 654 795,25		20	Jotun	39
Jette				-	-				
Jotun	5 175,32	33 077 825,92	129 645,00	22	96 405 606,07		25	Balder	111
Skirne				-	-				
Svalin				-	-				
Vale				-	-				
Vilje				-	-				
Volund				-	-				

Source: (Norwegian Environment Agency, n.d.)

5. Estimated energy consumption and the distance to neighbor field in NCS (Page 2: Group E - J)

2018	Energy use : Diesel (in tonn)	Energy use : Natural gas (in m3)	Emissions in CO2 equivalent (in tonn)	Capacity required (in MW)	Generated electricity by natural gas (in kWh)	Distance from shore (in km)	Distance from hub or neigbout field (in km)	Distance from which field	Capacity required to carry over (in MW)
Group E									
Draupner			13 654,00	-	-				
Edvard Greig	1 984,29	88 460 929,03	293 660,00	59	257 820 132,96				
Gaupe				-	-				
Gina Krog	11 224,02	41 188 703,98	145 008,00	27	120 044 829,43				
Glitne				-	-				
Gudrun	3,10			-	-				
Gungne				-	-				
Ivar Aasen	3 492,59		36 323,00	-	-				
Johan Sverdrup (Hub)			40 312,00	-	-	140			
Rev				-	-				
Sigyn				-	-				
Sleipner Vest	1 446,66	112 632 169,93	808 956,00	75	328 267 420,94				
Sleipner Øst	1 293,77	211 962 264,28		141	617 765 829,03				
Solveig				-	-				
Varg	399,67		1 264,00	-	-				
Volve				-	-				
Group F									
Brynhild	23,09		73,00	-	-				
Ekofisk (Hub)	10 880,31	256 741 942,78	906 378,00	171	748 276 584,35	290			287
Eldfisk	5 784,26	100 711 408,07		67	293 524 258,72		16	Ekofisk	67
Embla	38,13			-	-				
Gyda	939,30	10 106 914,86	32 519,00	7	29 456 689,65		43	Ekofisk	49
Hod	161,10			-	-				
Oselvar				-	-				
Tambar	1 985,48			-	-				
Tor	953,50			-	-				
Ula	2 613,31	63 123 941,48	214 187,00	42	183 975 266,41		28	Gyda	42
Valhall	3 360,77		19 573,00	-	-				
Group G									
Yme (Hub)	648,69		2 106,00	-	-	110			
Group H									
Alve									
Draugen (Hub)	12 433,58	44 296 911,25	192 172,00	29	129 103 726,06	150			629
Dvalin				-	-				
Heidrun	10 636,52	128 329 594,00	353 622,00	85	374 017 697,42		35	Åsgard	286
Kristin	187,37	133 972 247,21	352 513,00	89	390 463 258,38		10	Åsgard	89
Maria			12 120,00	-	-				
Maruk				-	-				
Mikkel				-	-				
Morvin	125,69			-	-				
Njord	29,07		92,00	-	-				
Norne	1 911,99	139 927 447,69	336 899,00	93	407 819 741,02		35	Skarv	93
Skarv	1 793,79	162 109 866,51	368 811,00	108	472 470 590,07		45	Heidrum	201
Skuld				-	-				
Tyrihans	3 602,12			-	-				
Urd				-	-				
Yttergryta				-	-				
Åsgard	14 163,84	336 885 009,19	916 575,00	224	981 854 235,68		75	Draugen	600
Aasta Hansteen			68 079,00	-	-				
Group I									
Ormen Lange (Hub)			1 240,00	-	-	120			
Ormen Lange	387,32			-	-				
Group J									
Goilat (Hub)	7 830,15	9 394 176,55	69 038,00	6	27 379 407,76	85			6
Snøhvit	2 092,19			-	-				
Total	**240 470,27**	**4 014 507 079,77**	**11 117 190,00**	**2 672**	**11 700 315 160,74**				

Source: (Norwegian Environment Agency, n.d.)

6. The data of wind speed at Ekofisk (Page 1)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Ekofisk	SN76920	24.07.2019	9,8	7,8
Ekofisk	SN76920	25.07.2019	10,8	6,7
Ekofisk	SN76920	26.07.2019	14,9	10,4
Ekofisk	SN76920	27.07.2019	11,8	8,5
Ekofisk	SN76920	28.07.2019	8,2	6,2
Ekofisk	SN76920	29.07.2019	7,2	6,1
Ekofisk	SN76920	30.07.2019	6,7	4,8
Ekofisk	SN76920	31.07.2019	7,7	6,3
Ekofisk	SN76920	01.08.2019	6,2	5,5
Ekofisk	SN76920	02.08.2019	7,7	6,8
Ekofisk	SN76920	03.08.2019	6,7	5,6
Ekofisk	SN76920	04.08.2019	4,1	3
Ekofisk	SN76920	05.08.2019	7,2	5,7
Ekofisk	SN76920	06.08.2019	7,7	6,7
Ekofisk	SN76920	07.08.2019	8,7	6,7
Ekofisk	SN76920	08.08.2019	11,3	8,2
Ekofisk	SN76920	09.08.2019	11,8	7,2
Ekofisk	SN76920	10.08.2019	11,8	9,6
Ekofisk	SN76920	11.08.2019	12,9	7,2
Ekofisk	SN76920	12.08.2019	8,2	6,6
Ekofisk	SN76920	13.08.2019	12,9	7,9
Ekofisk	SN76920	14.08.2019	12,9	8
Ekofisk	SN76920	15.08.2019	11,3	8,2
Ekofisk	SN76920	16.08.2019	12,9	9,6
Ekofisk	SN76920	17.08.2019	10,3	8,8
Ekofisk	SN76920	18.08.2019	10,3	8,5
Ekofisk	SN76920	19.08.2019	11,3	9,8
Ekofisk	SN76920	20.08.2019	7,7	6,1
Ekofisk	SN76920	21.08.2019	7,5	5,5
Ekofisk	SN76920	22.08.2019	10,3	9,3
Ekofisk	SN76920	23.08.2019	11,8	8,9
Ekofisk	SN76920	24.08.2019	7,7	7,1
Ekofisk	SN76920	25.08.2019	5,7	4,7
Ekofisk	SN76920	26.08.2019	6,7	5,7
Ekofisk	SN76920	27.08.2019	7,7	6,6
Ekofisk	SN76920	28.08.2019	8,7	6,1
Ekofisk	SN76920	29.08.2019	10,3	7,8
Ekofisk	SN76920	30.08.2019	12,3	10,5
Ekofisk	SN76920	31.08.2019	10,8	9,5
Ekofisk	SN76920	01.09.2019	9,3	7,6
Ekofisk	SN76920	02.09.2019	9,8	7,9
Ekofisk	SN76920	03.09.2019	13,4	7
Ekofisk	SN76920	04.09.2019	8,7	7,4
Ekofisk	SN76920	05.09.2019	15,4	11,5
Ekofisk	SN76920	06.09.2019	13,4	10,1
Ekofisk	SN76920	07.09.2019	13,4	10,7
Ekofisk	SN76920	08.09.2019	9,8	6,7
Ekofisk	SN76920	09.09.2019	4,6	2,8
Ekofisk	SN76920	10.09.2019	7,2	4
Ekofisk	SN76920	11.09.2019	13,9	11,3
Ekofisk	SN76920	12.09.2019	9,3	8
Ekofisk	SN76920	13.09.2019	9,8	8,8
Ekofisk	SN76920	14.09.2019	14,9	10,4
Ekofisk	SN76920	15.09.2019	14,9	13,6
Ekofisk	SN76920	16.09.2019	12,9	9,6
Ekofisk	SN76920	17.09.2019	13,9	12,4
Ekofisk	SN76920	18.09.2019	8,2	6,9
Ekofisk	SN76920	19.09.2019	4,6	3,7
Ekofisk	SN76920	20.09.2019	5,7	2,7
Ekofisk	SN76920	21.09.2019	7,7	5
Ekofisk	SN76920	22.09.2019	10,3	9,3

Source: (Norsk Klima Service Senter, n.d.)

7. The data of wind speed at Ekofisk (Page 2)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Ekofisk	SN76920	23.09.2019	10,8	7,1
Ekofisk	SN76920	24.09.2019	11,3	9,4
Ekofisk	SN76920	25.09.2019	11,3	10
Ekofisk	SN76920	26.09.2019	13,9	10,9
Ekofisk	SN76920	27.09.2019	7,7	6,5
Ekofisk	SN76920	28.09.2019	11,3	9,5
Ekofisk	SN76920	29.09.2019	11,8	6,1
Ekofisk	SN76920	30.09.2019	12,9	8,5
Ekofisk	SN76920	01.10.2019	7,9	5,7
Ekofisk	SN76920	02.10.2019	10,6	9
Ekofisk	SN76920	03.10.2019	8,9	8,6
Ekofisk	SN76920	04.10.2019	11	9,4
Ekofisk	SN76920	05.10.2019	12,3	11,8
Ekofisk	SN76920	06.10.2019	13	11,2
Ekofisk	SN76920	07.10.2019	12,3	10,1
Ekofisk	SN76920	08.10.2019	12,3	9,9
Ekofisk	SN76920	09.10.2019	12,3	10,6
Ekofisk	SN76920	10.10.2019	11,3	9,8
Ekofisk	SN76920	11.10.2019	12,3	11,5
Ekofisk	SN76920	12.10.2019	12,9	10,9
Ekofisk	SN76920	13.10.2019	12,9	6,9
Ekofisk	SN76920	14.10.2019	7,7	4,7
Ekofisk	SN76920	15.10.2019	11,8	8,9
Ekofisk	SN76920	16.10.2019	9,3	7,1
Ekofisk	SN76920	17.10.2019	9,3	6,8
Ekofisk	SN76920	18.10.2019	8,2	6,4
Ekofisk	SN76920	19.10.2019	8,2	4,6
Ekofisk	SN76920	20.10.2019	7,7	4,1
Ekofisk	SN76920	21.10.2019	6,7	4,2
Ekofisk	SN76920	22.10.2019	10,8	9,4
Ekofisk	SN76920	23.10.2019	9,8	9,3
Ekofisk	SN76920	24.10.2019	9,3	6,1
Ekofisk	SN76920	25.10.2019	9,8	6,6
Ekofisk	SN76920	26.10.2019	9,8	6,4
Ekofisk	SN76920	27.10.2019	18	14,2
Ekofisk	SN76920	28.10.2019	10,3	8
Ekofisk	SN76920	29.10.2019	6,7	4,6
Ekofisk	SN76920	30.10.2019	3,1	2
Ekofisk	SN76920	31.10.2019	6,7	3,9
Ekofisk	SN76920	01.11.2019	10,3	8,2
Ekofisk	SN76920	02.11.2019	14,4	9,8
Ekofisk	SN76920	03.11.2019	8,7	6,7
Ekofisk	SN76920	04.11.2019	16,5	12,9
Ekofisk	SN76920	05.11.2019	14,9	8,7
Ekofisk	SN76920	06.11.2019	5,1	3,1
Ekofisk	SN76920	07.11.2019	9,3	7,5
Ekofisk	SN76920	08.11.2019	12,9	9,3
Ekofisk	SN76920	09.11.2019	7,7	5,6
Ekofisk	SN76920	10.11.2019	8,7	6,1
Ekofisk	SN76920	11.11.2019	11,8	6,2
Ekofisk	SN76920	12.11.2019	9,3	5,5
Ekofisk	SN76920	13.11.2019	5,7	3,1
Ekofisk	SN76920	14.11.2019	6,7	4
Ekofisk	SN76920	15.11.2019	13,9	10,6
Ekofisk	SN76920	16.11.2019	11,3	9,4
Ekofisk	SN76920	17.11.2019	6,7	4,9
Ekofisk	SN76920	18.11.2019	12,3	10,3
Ekofisk	SN76920	19.11.2019	12,3	8,2
Ekofisk	SN76920	20.11.2019	7,2	5,2
Ekofisk	SN76920	21.11.2019	9,3	5,2
Ekofisk	SN76920	22.11.2019	8,2	6,6
Ekofisk	SN76920	23.11.2019	12,9	10,4

Source: (Norsk Klima Service Senter, n.d.)

8. The data of wind speed at Ekofisk (Page 3)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Ekofisk	SN76920	24.11.2019	11,8	10,5
Ekofisk	SN76920	25.11.2019	9,8	7,9
Ekofisk	SN76920	26.11.2019	9,8	7,9
Ekofisk	SN76920	27.11.2019	9,8	7,5
Ekofisk	SN76920	28.11.2019	16,5	12,5
Ekofisk	SN76920	29.11.2019	15,4	10,7
Ekofisk	SN76920	30.11.2019	8,7	5,8
Ekofisk	SN76920	01.12.2019	10,3	6
Ekofisk	SN76920	02.12.2019	8,2	6,5
Ekofisk	SN76920	03.12.2019	8,7	7,5
Ekofisk	SN76920	04.12.2019	11,8	9,1
Ekofisk	SN76920	05.12.2019	18	13,6
Ekofisk	SN76920	06.12.2019	17,5	11,1
Ekofisk	SN76920	07.12.2019	10,8	8,1
Ekofisk	SN76920	08.12.2019	17	15,3
Ekofisk	SN76920	09.12.2019	15,9	12,2
Ekofisk	SN76920	10.12.2019	19	13,5
Ekofisk	SN76920	11.12.2019	14,4	11,9
Ekofisk	SN76920	12.12.2019	13,4	9,4
Ekofisk	SN76920	13.12.2019	16,5	12,4
Ekofisk	SN76920	14.12.2019	16,5	7,7
Ekofisk	SN76920	15.12.2019	11,8	7,7
Ekofisk	SN76920	16.12.2019	10,3	9,7
Ekofisk	SN76920	17.12.2019	7,8	5,9
Ekofisk	SN76920	18.12.2019	10,3	8
Ekofisk	SN76920	19.12.2019	13,4	11,5
Ekofisk	SN76920	20.12.2019	15,4	11,7
Ekofisk	SN76920	21.12.2019	10,3	8,8
Ekofisk	SN76920	22.12.2019	7,7	5,3
Ekofisk	SN76920	23.12.2019	8,7	4,7
Ekofisk	SN76920	24.12.2019	7,2	4,9
Ekofisk	SN76920	25.12.2019	7,7	6,2
Ekofisk	SN76920	26.12.2019	5,7	3,2
Ekofisk	SN76920	27.12.2019	10,8	8,1
Ekofisk	SN76920	28.12.2019	12,3	11,9
Ekofisk	SN76920	29.12.2019	12,9	10,7
Ekofisk	SN76920	30.12.2019	12,9	11,8
Ekofisk	SN76920	31.12.2019	13,4	7,3
Ekofisk	SN76920	01.01.2020	11,3	10,3
Ekofisk	SN76920	02.01.2020	14,9	13,5
Ekofisk	SN76920	03.01.2020	14,9	13
Ekofisk	SN76920	04.01.2020	15,9	9,7
Ekofisk	SN76920	05.01.2020	10,8	9,7
Ekofisk	SN76920	06.01.2020	12,9	10,9
Ekofisk	SN76920	07.01.2020	15,9	12,1
Ekofisk	SN76920	08.01.2020	16,5	12,7
Ekofisk	SN76920	09.01.2020	10,8	7
Ekofisk	SN76920	10.01.2020	10,3	6,6
Ekofisk	SN76920	11.01.2020	17,5	15,7
Ekofisk	SN76920	12.01.2020	12,3	8,1
Ekofisk	SN76920	13.01.2020	18,5	11,6
Ekofisk	SN76920	14.01.2020	14,9	12,1
Ekofisk	SN76920	15.01.2020	17,5	13,4
Ekofisk	SN76920	16.01.2020	15,9	12,6
Ekofisk	SN76920	17.01.2020	14,9	8,4
Ekofisk	SN76920	18.01.2020	13,9	11,8
Ekofisk	SN76920	19.01.2020	11,8	8,9
Ekofisk	SN76920	20.01.2020	10,8	10,4
Ekofisk	SN76920	21.01.2020	11,3	7,5
Ekofisk	SN76920	22.01.2020	7,2	4,6
Ekofisk	SN76920	23.01.2020	9,8	7,5
Ekofisk	SN76920	24.01.2020	8,7	6,5

Source: (Norsk Klima Service Senter, n.d.)

9. The data of wind speed at Ekofisk (Page 4)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Ekofisk	SN76920	25.01.2020	11,3	7,9
Ekofisk	SN76920	26.01.2020	11,8	10,7
Ekofisk	SN76920	27.01.2020	10,8	6,8
Ekofisk	SN76920	28.01.2020	11,3	6,8
Ekofisk	SN76920	29.01.2020	12,9	10,7
Ekofisk	SN76920	30.01.2020	17,5	12,7
Ekofisk	SN76920	31.01.2020	14,9	11,1
Ekofisk	SN76920	01.02.2020	15,4	13,6
Ekofisk	SN76920	02.02.2020	12,3	5,4
Ekofisk	SN76920	03.02.2020	15,9	11,5
Ekofisk	SN76920	04.02.2020	14,4	9,4
Ekofisk	SN76920	05.02.2020	8,7	7,1
Ekofisk	SN76920	06.02.2020	7,2	5,2
Ekofisk	SN76920	07.02.2020	13,4	8,3
Ekofisk	SN76920	08.02.2020	14,2	11,8
Ekofisk	SN76920	09.02.2020	21,6	19
Ekofisk	SN76920	10.02.2020	17,5	16,5
Ekofisk	SN76920	11.02.2020	18,5	17,3
Ekofisk	SN76920	12.02.2020	18,5	16,6
Ekofisk	SN76920	13.02.2020	10,3	8,3
Ekofisk	SN76920	14.02.2020	14,4	8,2
Ekofisk	SN76920	15.02.2020	20,1	12,4
Ekofisk	SN76920	16.02.2020	18	15,3
Ekofisk	SN76920	17.02.2020	21,1	17,8
Ekofisk	SN76920	18.02.2020	15,4	13,2
Ekofisk	SN76920	19.02.2020	13,4	11,3
Ekofisk	SN76920	20.02.2020	15,9	12,7
Ekofisk	SN76920	21.02.2020	16,5	15,8
Ekofisk	SN76920	22.02.2020	20,6	18,9
Ekofisk	SN76920	23.02.2020	20,1	14,7
Ekofisk	SN76920	24.02.2020	13,4	8,4
Ekofisk	SN76920	25.02.2020	14,4	5,8
Ekofisk	SN76920	26.02.2020	10,3	4,7
Ekofisk	SN76920	27.02.2020	9,8	6,6
Ekofisk	SN76920	28.02.2020	14,9	11,4
Ekofisk	SN76920	29.02.2020	13,9	10,8
Ekofisk	SN76920	01.03.2020	17,5	16,3
Ekofisk	SN76920	02.03.2020	12,9	8,2
Ekofisk	SN76920	03.03.2020	7,2	4,5
Ekofisk	SN76920	04.03.2020	12,3	6,4
Ekofisk	SN76920	05.03.2020	3,6	2,1
Ekofisk	SN76920	06.03.2020	5,1	3,1
Ekofisk	SN76920	07.03.2020	13,9	9,3
Ekofisk	SN76920	08.03.2020	14,4	12
Ekofisk	SN76920	09.03.2020	9,8	7
Ekofisk	SN76920	10.03.2020	13,4	11,1
Ekofisk	SN76920	11.03.2020	14,4	12,3
Ekofisk	SN76920	12.03.2020	17	13,4
Ekofisk	SN76920	13.03.2020	12,9	8,6
Ekofisk	SN76920	14.03.2020	13,9	9,7
Ekofisk	SN76920	15.03.2020	14,4	12
Ekofisk	SN76920	16.03.2020	12,9	7,8
Ekofisk	SN76920	17.03.2020	12,9	10
Ekofisk	SN76920	18.03.2020	15,9	9,1
Ekofisk	SN76920	19.03.2020	9,3	6,9
Ekofisk	SN76920	20.03.2020	7,7	6,7
Ekofisk	SN76920	21.03.2020	9,3	5,9
Ekofisk	SN76920	22.03.2020	11,8	9,8
Ekofisk	SN76920	23.03.2020	13,9	12
Ekofisk	SN76920	24.03.2020	13,9	12,7
Ekofisk	SN76920	25.03.2020	12,3	10,2
Ekofisk	SN76920	26.03.2020	6,7	3,5

Source: (Norsk Klima Service Senter, n.d.)

10. The data of wind speed at Ekofisk (Page 5)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Ekofisk	SN76920	27.03.2020	7,2	3
Ekofisk	SN76920	28.03.2020	17,5	11,9
Ekofisk	SN76920	29.03.2020	16,5	11,3
Ekofisk	SN76920	30.03.2020	10,8	9,3
Ekofisk	SN76920	31.03.2020	10,3	6,6
Ekofisk	SN76920	01.04.2020	11,3	10,1
Ekofisk	SN76920	02.04.2020	18	14,1
Ekofisk	SN76920	03.04.2020	11,8	7,8
Ekofisk	SN76920	04.04.2020	8,5	7
Ekofisk	SN76920	05.04.2020	14,9	11
Ekofisk	SN76920	06.04.2020	13,4	10,6
Ekofisk	SN76920	07.04.2020	9,8	7,1
Ekofisk	SN76920	08.04.2020	10,8	8,4
Ekofisk	SN76920	09.04.2020	8,2	4,7
Ekofisk	SN76920	10.04.2020	8,7	4,2
Ekofisk	SN76920	11.04.2020	11,3	9,5
Ekofisk	SN76920	12.04.2020	11,8	8
Ekofisk	SN76920	13.04.2020	14,9	11,3
Ekofisk	SN76920	14.04.2020	9,3	7,5
Ekofisk	SN76920	15.04.2020	7,7	5,5
Ekofisk	SN76920	16.04.2020	9,3	6
Ekofisk	SN76920	17.04.2020	7,2	6,5
Ekofisk	SN76920	18.04.2020	6,2	4,7
Ekofisk	SN76920	19.04.2020	6,2	5,5
Ekofisk	SN76920	20.04.2020	8,7	5,1
Ekofisk	SN76920	21.04.2020	8,7	7,9
Ekofisk	SN76920	22.04.2020	7,7	6,5
Ekofisk	SN76920	23.04.2020	6,2	4,5
Ekofisk	SN76920	24.04.2020	9,3	7,7
Ekofisk	SN76920	25.04.2020	6,7	5,1
Ekofisk	SN76920	26.04.2020	7,7	4,8
Ekofisk	SN76920	27.04.2020	6,2	4,5
Ekofisk	SN76920	28.04.2020	5,1	2,9
Ekofisk	SN76920	29.04.2020	4,6	2,8
Ekofisk	SN76920	30.04.2020	7,2	5,5
Ekofisk	SN76920	01.05.2020	8,2	4,4
Ekofisk	SN76920	02.05.2020	6,2	4,1
Ekofisk	SN76920	03.05.2020	5,1	3,9
Ekofisk	SN76920	04.05.2020	6,7	5,4
Ekofisk	SN76920	05.05.2020	6,2	4,2
Ekofisk	SN76920	06.05.2020	7,7	5,5
Ekofisk	SN76920	07.05.2020	7,2	5,2
Ekofisk	SN76920	08.05.2020	9,8	4,6
Ekofisk	SN76920	09.05.2020	6,7	3
Ekofisk	SN76920	10.05.2020	14,4	12,2
Ekofisk	SN76920	11.05.2020	12,3	10,1
Ekofisk	SN76920	12.05.2020	9,8	6,9
Ekofisk	SN76920	13.05.2020	9,8	7,5
Ekofisk	SN76920	14.05.2020	10,8	8,2
Ekofisk	SN76920	15.05.2020	11,3	10,4
Ekofisk	SN76920	16.05.2020	11,3	9,8
Ekofisk	SN76920	17.05.2020	9,8	8,2
Ekofisk	SN76920	18.05.2020	9,8	7,4
Ekofisk	SN76920	19.05.2020	6,7	3
Ekofisk	SN76920	20.05.2020	6,7	4,4
Ekofisk	SN76920	21.05.2020	10,8	8
Ekofisk	SN76920	22.05.2020	11,3	9,7
Ekofisk	SN76920	23.05.2020	15,4	13,2
Ekofisk	SN76920	24.05.2020	14,9	12,1
Ekofisk	SN76920	25.05.2020	7,5	5,1
Ekofisk	SN76920	26.05.2020	8,7	5
Ekofisk	SN76920	27.05.2020	3,6	2

Source: (Norsk Klima Service Senter, n.d.)

11. The data of wind speed at Ekofisk (Page 6)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Ekofisk	SN76920	28.05.2020	5,1	2,4
Ekofisk	SN76920	29.05.2020	4,6	2,7
Ekofisk	SN76920	30.05.2020	6,7	3,8
Ekofisk	SN76920	31.05.2020	8,7	6,6
Ekofisk	SN76920	01.06.2020	4,1	3
Ekofisk	SN76920	02.06.2020	3,6	1,7
Ekofisk	SN76920	03.06.2020	9,3	5
Ekofisk	SN76920	04.06.2020	9,3	7,8
Ekofisk	SN76920	05.06.2020	10,3	8,5
Ekofisk	SN76920	06.06.2020	7,2	4,5
Ekofisk	SN76920	07.06.2020	11,3	5,3
Ekofisk	SN76920	08.06.2020	9,3	7,5
Ekofisk	SN76920	09.06.2020	5,7	3,4
Ekofisk	SN76920	10.06.2020	5,7	3,5
Ekofisk	SN76920	11.06.2020	13,9	10,5
Ekofisk	SN76920	12.06.2020	12,9	10,1
Ekofisk	SN76920	13.06.2020	10,3	8,6
Ekofisk	SN76920	14.06.2020	9,8	8,5
Ekofisk	SN76920	15.06.2020	8,7	6,1
Ekofisk	SN76920	16.06.2020	5,1	3,9
Ekofisk	SN76920	17.06.2020	4,1	2,5
Ekofisk	SN76920	18.06.2020	5,7	4,3
Ekofisk	SN76920	19.06.2020	4,6	3,7
Ekofisk	SN76920	20.06.2020	6,2	5,1
Ekofisk	SN76920	21.06.2020	8,7	7,5
Ekofisk	SN76920	22.06.2020	8,7	6,7
Ekofisk	SN76920	23.06.2020	9,3	6,3
Ekofisk	SN76920	24.06.2020	7,2	6,2
Ekofisk	SN76920	25.06.2020	9,8	7,3
Ekofisk	SN76920	26.06.2020	10,3	9,1
Ekofisk	SN76920	27.06.2020	10,8	9,6
Ekofisk	SN76920	28.06.2020	13,4	11,3
Ekofisk	SN76920	29.06.2020	13,4	11,6
Ekofisk	SN76920	30.06.2020	10,8	9
Ekofisk	SN76920	01.07.2020	7,7	4,8
Ekofisk	SN76920	02.07.2020	5,1	4,5
Ekofisk	SN76920	03.07.2020	11,3	8,1
Ekofisk	SN76920	04.07.2020	10,8	5,4
Ekofisk	SN76920	05.07.2020	17	12,4
Ekofisk	SN76920	06.07.2020	12,9	11,3
Ekofisk	SN76920	07.07.2020	10,8	9
Ekofisk	SN76920	08.07.2020	6,2	4,7
Ekofisk	SN76920	09.07.2020	4,1	3
Ekofisk	SN76920	10.07.2020	7,7	5,8
Ekofisk	SN76920	11.07.2020	8,7	7,2
Ekofisk	SN76920	12.07.2020	7,7	5,6
Ekofisk	SN76920	13.07.2020	8,2	6,9
Ekofisk	SN76920	14.07.2020	8,2	6,6
Ekofisk	SN76920	15.07.2020	5,7	4,3
Ekofisk	SN76920	16.07.2020	4,6	3
Ekofisk	SN76920	17.07.2020	7,7	7
Ekofisk	SN76920	18.07.2020	9,3	6,7
Ekofisk	SN76920	19.07.2020	5,7	4,2
Ekofisk	SN76920	20.07.2020	5,1	4,4
Ekofisk	SN76920	21.07.2020	6,5	4,1
Ekofisk	SN76920	22.07.2020	6,7	4,6
Ekofisk	SN76920	23.07.2020	7,2	4,4
Data valid for 24.07.2020 (CC BY 4.0), The Norwegian Meteorological Institute (MET Norway)				

Source: (Norsk Klima Service Senter, n.d.)

12. The data of wind speed at Gullfaks C (Page 1)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Gullfaks C	SN76923	23.07.2019	8,7	6,4
Gullfaks C	SN76923	24.07.2019	12,9	10,9
Gullfaks C	SN76923	25.07.2019	10,3	6,7
Gullfaks C	SN76923	26.07.2019	12,9	11
Gullfaks C	SN76923	27.07.2019	10,3	7,7
Gullfaks C	SN76923	28.07.2019	14,4	9,3
Gullfaks C	SN76923	29.07.2019	7,2	5
Gullfaks C	SN76923	30.07.2019	10,3	5
Gullfaks C	SN76923	31.07.2019	6,2	4,4
Gullfaks C	SN76923	01.08.2019	4,1	2,4
Gullfaks C	SN76923	02.08.2019	9,8	7,2
Gullfaks C	SN76923	03.08.2019	9,3	8,5
Gullfaks C	SN76923	04.08.2019	7,7	6,9
Gullfaks C	SN76923	05.08.2019	5,1	3,1
Gullfaks C	SN76923	06.08.2019	6,7	5,2
Gullfaks C	SN76923	07.08.2019	7,2	5
Gullfaks C	SN76923	08.08.2019	9,8	8,6
Gullfaks C	SN76923	09.08.2019	8,7	7,4
Gullfaks C	SN76923	10.08.2019	10,3	7,5
Gullfaks C	SN76923	11.08.2019	12,3	6,6
Gullfaks C	SN76923	12.08.2019	9,3	8
Gullfaks C	SN76923	13.08.2019	6,7	5,2
Gullfaks C	SN76923	14.08.2019	4,1	2,8
Gullfaks C	SN76923	15.08.2019	11,3	8
Gullfaks C	SN76923	16.08.2019	13,9	9,7
Gullfaks C	SN76923	17.08.2019	13,4	8,4
Gullfaks C	SN76923	18.08.2019	11,3	9,7
Gullfaks C	SN76923	19.08.2019	10,3	6,9
Gullfaks C	SN76923	20.08.2019	8,7	6,7
Gullfaks C	SN76923	21.08.2019	10,3	6,8
Gullfaks C	SN76923	22.08.2019	11,3	7,7
Gullfaks C	SN76923	23.08.2019	7,2	6,1
Gullfaks C	SN76923	24.08.2019	11,3	9,3
Gullfaks C	SN76923	25.08.2019	9,8	6,2
Gullfaks C	SN76923	26.08.2019	11,8	9,3
Gullfaks C	SN76923	27.08.2019	8,2	7
Gullfaks C	SN76923	28.08.2019	12,3	9,8
Gullfaks C	SN76923	29.08.2019	12,9	8
Gullfaks C	SN76923	30.08.2019	11,3	9,3
Gullfaks C	SN76923	31.08.2019	17,5	9,6
Gullfaks C	SN76923	01.09.2019	15,7	10,3
Gullfaks C	SN76923	02.09.2019	8,7	5,9
Gullfaks C	SN76923	03.09.2019	7,7	5,5
Gullfaks C	SN76923	04.09.2019	11,8	8,1
Gullfaks C	SN76923	05.09.2019	12,9	8,4
Gullfaks C	SN76923	06.09.2019	10,8	6,5
Gullfaks C	SN76923	07.09.2019	9,8	8,2
Gullfaks C	SN76923	08.09.2019	6,7	3,7
Gullfaks C	SN76923	09.09.2019	8,2	7,1
Gullfaks C	SN76923	10.09.2019	10,8	4,7
Gullfaks C	SN76923	11.09.2019	16,5	11,4
Gullfaks C	SN76923	12.09.2019	10,8	8,8
Gullfaks C	SN76923	13.09.2019	11,8	10,5
Gullfaks C	SN76923	14.09.2019	18	12,5
Gullfaks C	SN76923	15.09.2019	18,5	16,5
Gullfaks C	SN76923	16.09.2019	9,8	8,6
Gullfaks C	SN76923	17.09.2019	12,3	10,6
Gullfaks C	SN76923	18.09.2019	11,3	7,5
Gullfaks C	SN76923	19.09.2019	8,7	5,8
Gullfaks C	SN76923	20.09.2019	9,3	7,1
Gullfaks C	SN76923	21.09.2019	10,3	7,7
Gullfaks C	SN76923	22.09.2019	11,3	6,9

Source: (Norsk Klima Service Senter, n.d.)

13. The data of wind speed at Gullfaks C (Page 2)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Gullfaks C	SN76923	23.09.2019	8,2	7,2
Gullfaks C	SN76923	24.09.2019	10,3	7,6
Gullfaks C	SN76923	25.09.2019	6,7	5,3
Gullfaks C	SN76923	26.09.2019	11,8	10
Gullfaks C	SN76923	27.09.2019	15,9	10,1
Gullfaks C	SN76923	28.09.2019	9,8	6,9
Gullfaks C	SN76923	29.09.2019	12,3	7,6
Gullfaks C	SN76923	30.09.2019	14,9	12,2
Gullfaks C	SN76923	01.10.2019	11,3	9,8
Gullfaks C	SN76923	02.10.2019	8,8	8,5
Gullfaks C	SN76923	03.10.2019	8,1	7,8
Gullfaks C	SN76923	04.10.2019	7,4	7,1
Gullfaks C	SN76923	05.10.2019	6,7	6,4
Gullfaks C	SN76923	06.10.2019	6	5,2
Gullfaks C	SN76923	07.10.2019	16,5	11,6
Gullfaks C	SN76923	08.10.2019	14,9	7,5
Gullfaks C	SN76923	09.10.2019	9,3	8,2
Gullfaks C	SN76923	10.10.2019	9,8	9
Gullfaks C	SN76923	11.10.2019	7,7	6,1
Gullfaks C	SN76923	12.10.2019	5,7	3,4
Gullfaks C	SN76923	13.10.2019	4,6	3,7
Gullfaks C	SN76923	14.10.2019	4,6	3,2
Gullfaks C	SN76923	15.10.2019	9,3	6,8
Gullfaks C	SN76923	16.10.2019	13,4	9,3
Gullfaks C	SN76923	17.10.2019	11,3	8,8
Gullfaks C	SN76923	18.10.2019	5,7	4,3
Gullfaks C	SN76923	19.10.2019	16,5	13,2
Gullfaks C	SN76923	20.10.2019	11,8	9,8
Gullfaks C	SN76923	21.10.2019	15,9	8,4
Gullfaks C	SN76923	22.10.2019	18,5	8,7
Gullfaks C	SN76923	23.10.2019	12,3	11,3
Gullfaks C	SN76923	24.10.2019	15,4	11,8
Gullfaks C	SN76923	25.10.2019	15,4	13,1
Gullfaks C	SN76923	26.10.2019	12,9	10,5
Gullfaks C	SN76923	27.10.2019	10,8	5,9
Gullfaks C	SN76923	28.10.2019	8,7	7,6
Gullfaks C	SN76923	29.10.2019	8,2	5
Gullfaks C	SN76923	30.10.2019	7,7	6,6
Gullfaks C	SN76923	31.10.2019	9,3	6,1
Gullfaks C	SN76923	01.11.2019	10,8	8,2
Gullfaks C	SN76923	02.11.2019	16,5	11,5
Gullfaks C	SN76923	03.11.2019	15,9	9,9
Gullfaks C	SN76923	04.11.2019	11,8	8,4
Gullfaks C	SN76923	05.11.2019	11,8	10,2
Gullfaks C	SN76923	06.11.2019	8,7	5,8
Gullfaks C	SN76923	07.11.2019	8,7	7,4
Gullfaks C	SN76923	08.11.2019	7,7	6,8
Gullfaks C	SN76923	09.11.2019	11,8	9,5
Gullfaks C	SN76923	10.11.2019	12,3	7,8
Gullfaks C	SN76923	11.11.2019	7,7	5,5
Gullfaks C	SN76923	12.11.2019	10,3	8,4
Gullfaks C	SN76923	13.11.2019	9,3	6,3
Gullfaks C	SN76923	14.11.2019	8,2	4,8
Gullfaks C	SN76923	15.11.2019	5,1	3,9
Gullfaks C	SN76923	16.11.2019	5,7	5,2
Gullfaks C	SN76923	17.11.2019	6,6	6,2
Gullfaks C	SN76923	18.11.2019	8,2	7,2
Gullfaks C	SN76923	19.11.2019	6,7	5
Gullfaks C	SN76923	20.11.2019	9,8	7,6
Gullfaks C	SN76923	21.11.2019	8,2	5,7
Gullfaks C	SN76923	22.11.2019	7,7	6,3
Gullfaks C	SN76923	23.11.2019	8,7	6,5

Source: (Norsk Klima Service Senter, n.d.)

14. The data of wind speed at Gullfaks C (Page 3)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Gullfaks C	SN76923	24.11.2019	6,7	4,6
Gullfaks C	SN76923	25.11.2019	7,7	6
Gullfaks C	SN76923	26.11.2019	10,3	5,7
Gullfaks C	SN76923	27.11.2019	12,9	9,7
Gullfaks C	SN76923	28.11.2019	15,4	13,8
Gullfaks C	SN76923	29.11.2019	12,3	9,9
Gullfaks C	SN76923	30.11.2019	8,2	5,7
Gullfaks C	SN76923	01.12.2019	9,3	7,9
Gullfaks C	SN76923	02.12.2019	9,3	6,4
Gullfaks C	SN76923	03.12.2019	12,9	10,7
Gullfaks C	SN76923	04.12.2019	14,9	11,9
Gullfaks C	SN76923	05.12.2019	18	12,4
Gullfaks C	SN76923	06.12.2019	9,3	7
Gullfaks C	SN76923	07.12.2019	11,8	7,3
Gullfaks C	SN76923	08.12.2019	17,5	13,8
Gullfaks C	SN76923	09.12.2019	18,5	14
Gullfaks C	SN76923	10.12.2019	23,1	15,2
Gullfaks C	SN76923	11.12.2019	19,5	16,9
Gullfaks C	SN76923	12.12.2019	16,5	13,5
Gullfaks C	SN76923	13.12.2019	15,9	11
Gullfaks C	SN76923	14.12.2019	13,4	12,3
Gullfaks C	SN76923	15.12.2019	6,7	4,2
Gullfaks C	SN76923	16.12.2019	8,2	4,9
Gullfaks C	SN76923	17.12.2019	3,1	2
Gullfaks C	SN76923	18.12.2019	7,2	3,4
Gullfaks C	SN76923	19.12.2019	15,9	12,6
Gullfaks C	SN76923	20.12.2019	12,9	10,7
Gullfaks C	SN76923	21.12.2019	18,5	13,2
Gullfaks C	SN76923	22.12.2019	10,8	9,7
Gullfaks C	SN76923	23.12.2019	7,2	4,6
Gullfaks C	SN76923	24.12.2019	2,6	1,8
Gullfaks C	SN76923	25.12.2019	6,2	5
Gullfaks C	SN76923	26.12.2019	3,6	2,6
Gullfaks C	SN76923	27.12.2019	17	11,4
Gullfaks C	SN76923	28.12.2019	15,9	13,2
Gullfaks C	SN76923	29.12.2019	17	14,2
Gullfaks C	SN76923	30.12.2019	14,4	13,3
Gullfaks C	SN76923	31.12.2019	13,9	9,9
Gullfaks C	SN76923	01.01.2020	13,9	12,5
Gullfaks C	SN76923	02.01.2020	16,5	14,7
Gullfaks C	SN76923	03.01.2020	18	15,7
Gullfaks C	SN76923	04.01.2020	15,4	9,9
Gullfaks C	SN76923	05.01.2020	14,4	12,3
Gullfaks C	SN76923	06.01.2020	18,5	12,9
Gullfaks C	SN76923	07.01.2020	18,5	15
Gullfaks C	SN76923	08.01.2020	18	15,3
Gullfaks C	SN76923	09.01.2020	8,7	6,4
Gullfaks C	SN76923	10.01.2020	19	10
Gullfaks C	SN76923	11.01.2020	17,5	13,7
Gullfaks C	SN76923	12.01.2020	14,9	12,3
Gullfaks C	SN76923	13.01.2020	21,1	15,2
Gullfaks C	SN76923	14.01.2020	23,1	14,8
Gullfaks C	SN76923	15.01.2020	16,5	14
Gullfaks C	SN76923	16.01.2020	15,4	12,7
Gullfaks C	SN76923	17.01.2020	17	13,3
Gullfaks C	SN76923	18.01.2020	17	13,6
Gullfaks C	SN76923	19.01.2020	14,9	10,2
Gullfaks C	SN76923	20.01.2020	17,5	14,2
Gullfaks C	SN76923	21.01.2020	11,8	10,1
Gullfaks C	SN76923	22.01.2020	11,3	6,7
Gullfaks C	SN76923	23.01.2020	14,4	11,7
Gullfaks C	SN76923	24.01.2020	12,9	10,3

Source: (Norsk Klima Service Senter, n.d.)

15. The data of wind speed at Gullfaks C (Page 4)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Gullfaks C	SN76923	25.01.2020	12,3	10,2
Gullfaks C	SN76923	26.01.2020	12,9	9,6
Gullfaks C	SN76923	27.01.2020	11,8	7,8
Gullfaks C	SN76923	28.01.2020	11,3	6,5
Gullfaks C	SN76923	29.01.2020	5,1	2,2
Gullfaks C	SN76923	30.01.2020	13,4	8,7
Gullfaks C	SN76923	31.01.2020	13,4	8,9
Gullfaks C	SN76923	01.02.2020	11,8	8,1
Gullfaks C	SN76923	02.02.2020	10,8	5,7
Gullfaks C	SN76923	03.02.2020	13,9	8,5
Gullfaks C	SN76923	04.02.2020	12,3	8,6
Gullfaks C	SN76923	05.02.2020	12,9	10,3
Gullfaks C	SN76923	06.02.2020	10,3	8,1
Gullfaks C	SN76923	07.02.2020	14,9	11,5
Gullfaks C	SN76923	08.02.2020	19,5	16,3
Gullfaks C	SN76923	09.02.2020	23,1	9,3
Gullfaks C	SN76923	10.02.2020	13,9	9,6
Gullfaks C	SN76923	11.02.2020	10,8	7,5
Gullfaks C	SN76923	12.02.2020	12,3	10,8
Gullfaks C	SN76923	13.02.2020	8,7	4,3
Gullfaks C	SN76923	14.02.2020	18,5	9,7
Gullfaks C	SN76923	15.02.2020	18,5	14,9
Gullfaks C	SN76923	16.02.2020	17,5	15,4
Gullfaks C	SN76923	17.02.2020	17,5	13,9
Gullfaks C	SN76923	18.02.2020	12,9	10,1
Gullfaks C	SN76923	19.02.2020	12,3	5,7
Gullfaks C	SN76923	20.02.2020	17	11,6
Gullfaks C	SN76923	21.02.2020	20,6	14,8
Gullfaks C	SN76923	22.02.2020	17	13,2
Gullfaks C	SN76923	23.02.2020	8,2	6,5
Gullfaks C	SN76923	24.02.2020	7	4,6
Gullfaks C	SN76923	25.02.2020	9,3	6,5
Gullfaks C	SN76923	26.02.2020	8,2	6,4
Gullfaks C	SN76923	27.02.2020	7,7	5,6
Gullfaks C	SN76923	28.02.2020	11,3	6,4
Gullfaks C	SN76923	29.02.2020	14,9	13,4
Gullfaks C	SN76923	01.03.2020	12,3	10
Gullfaks C	SN76923	02.03.2020	14,4	10,4
Gullfaks C	SN76923	03.03.2020	11,8	10,4
Gullfaks C	SN76923	04.03.2020	7,2	4,6
Gullfaks C	SN76923	05.03.2020	7,2	5,9
Gullfaks C	SN76923	06.03.2020	7,2	4,9
Gullfaks C	SN76923	07.03.2020	17,5	11,3
Gullfaks C	SN76923	08.03.2020	13,9	9,8
Gullfaks C	SN76923	09.03.2020	10,8	7,5
Gullfaks C	SN76923	10.03.2020	14,9	11,5
Gullfaks C	SN76923	11.03.2020	18	14,3
Gullfaks C	SN76923	12.03.2020	17,5	11,2
Gullfaks C	SN76923	13.03.2020	13,4	8,4
Gullfaks C	SN76923	14.03.2020	16,5	13,4
Gullfaks C	SN76923	15.03.2020	12,3	9,2
Gullfaks C	SN76923	16.03.2020	15,9	9,4
Gullfaks C	SN76923	17.03.2020	15,4	13
Gullfaks C	SN76923	18.03.2020	12,3	10,2
Gullfaks C	SN76923	19.03.2020	9,3	6
Gullfaks C	SN76923	20.03.2020	7,7	4,9
Gullfaks C	SN76923	21.03.2020	11,3	5,5
Gullfaks C	SN76923	22.03.2020	14,9	13,5
Gullfaks C	SN76923	23.03.2020	18,5	16,9
Gullfaks C	SN76923	24.03.2020	17	14,2
Gullfaks C	SN76923	25.03.2020	14,9	7
Gullfaks C	SN76923	26.03.2020	7,2	5,5

Source: (Norsk Klima Service Senter, n.d.)

16. The data of wind speed at Gullfaks C (Page 5)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Gullfaks C	SN76923	27.03.2020	10,8	7,1
Gullfaks C	SN76923	28.03.2020	13,4	11,5
Gullfaks C	SN76923	29.03.2020	12,3	9,3
Gullfaks C	SN76923	30.03.2020	13,4	7
Gullfaks C	SN76923	31.03.2020	9,8	7,7
Gullfaks C	SN76923	01.04.2020	13,4	10,7
Gullfaks C	SN76923	02.04.2020	18	14,5
Gullfaks C	SN76923	03.04.2020	14,4	8,2
Gullfaks C	SN76923	04.04.2020	12,3	6,5
Gullfaks C	SN76923	05.04.2020	15,9	12,5
Gullfaks C	SN76923	06.04.2020	19	14,3
Gullfaks C	SN76923	07.04.2020	12,9	10,6
Gullfaks C	SN76923	08.04.2020	12,3	10,1
Gullfaks C	SN76923	09.04.2020	9,8	5,8
Gullfaks C	SN76923	10.04.2020	7,7	5,4
Gullfaks C	SN76923	11.04.2020	11,8	9,8
Gullfaks C	SN76923	12.04.2020	15,4	13,5
Gullfaks C	SN76923	13.04.2020	14,9	10,6
Gullfaks C	SN76923	14.04.2020	11,8	9,7
Gullfaks C	SN76923	15.04.2020	14,4	12
Gullfaks C	SN76923	16.04.2020	9,8	6,8
Gullfaks C	SN76923	17.04.2020	4,1	2,9
Gullfaks C	SN76923	18.04.2020	5,1	4,1
Gullfaks C	SN76923	19.04.2020	4,6	2,6
Gullfaks C	SN76923	20.04.2020	3,6	2,6
Gullfaks C	SN76923	21.04.2020	3,1	0,8
Gullfaks C	SN76923	22.04.2020	3,6	1,8
Gullfaks C	SN76923	23.04.2020	6,7	4,4
Gullfaks C	SN76923	24.04.2020	8,7	7,3
Gullfaks C	SN76923	25.04.2020	6,2	5,1
Gullfaks C	SN76923	26.04.2020	9,3	4,3
Gullfaks C	SN76923	27.04.2020	14,4	13,1
Gullfaks C	SN76923	28.04.2020	11,8	8,6
Gullfaks C	SN76923	29.04.2020	8,2	5,4
Gullfaks C	SN76923	30.04.2020	11,3	7,8
Gullfaks C	SN76923	01.05.2020	6,2	4
Gullfaks C	SN76923	02.05.2020	6,7	5,1
Gullfaks C	SN76923	03.05.2020	6,7	5,5
Gullfaks C	SN76923	04.05.2020	7,7	5
Gullfaks C	SN76923	05.05.2020	9,3	7,4
Gullfaks C	SN76923	06.05.2020	8,7	6
Gullfaks C	SN76923	07.05.2020	9,3	5,3
Gullfaks C	SN76923	08.05.2020	8,7	6
Gullfaks C	SN76923	09.05.2020	10,8	7,2
Gullfaks C	SN76923	10.05.2020	12,9	10,6
Gullfaks C	SN76923	11.05.2020	12,3	10
Gullfaks C	SN76923	12.05.2020	12,3	9,4
Gullfaks C	SN76923	13.05.2020	7,2	6,4
Gullfaks C	SN76923	14.05.2020	6,7	4,1
Gullfaks C	SN76923	15.05.2020	11,8	7,9
Gullfaks C	SN76923	16.05.2020	14,4	12,5
Gullfaks C	SN76923	17.05.2020	11,3	8,4
Gullfaks C	SN76923	18.05.2020	4,1	2,7
Gullfaks C	SN76923	19.05.2020	3,1	2,1
Gullfaks C	SN76923	20.05.2020	6,7	4,6
Gullfaks C	SN76923	21.05.2020	10,3	9,3
Gullfaks C	SN76923	22.05.2020	15,4	12,7
Gullfaks C	SN76923	23.05.2020	14,4	12
Gullfaks C	SN76923	24.05.2020	9,8	6,6
Gullfaks C	SN76923	25.05.2020	11,3	7,2
Gullfaks C	SN76923	26.05.2020	8,7	7,8
Gullfaks C	SN76923	27.05.2020	8,7	7,3

Source: (Norsk Klima Service Senter, n.d.)

17. The data of wind speed at Gullfaks C (Page 6)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Gullfaks C	SN76923	28.05.2020	6,7	5,4
Gullfaks C	SN76923	29.05.2020	5,7	4,4
Gullfaks C	SN76923	30.05.2020	3,9	3,1
Gullfaks C	SN76923	31.05.2020	3,1	2,1
Gullfaks C	SN76923	01.06.2020	6,7	5,5
Gullfaks C	SN76923	02.06.2020	9,8	4,7
Gullfaks C	SN76923	03.06.2020	14,4	12
Gullfaks C	SN76923	04.06.2020	10,8	7,1
Gullfaks C	SN76923	05.06.2020	13,4	8,6
Gullfaks C	SN76923	06.06.2020	11,8	7,1
Gullfaks C	SN76923	07.06.2020	12,3	10,9
Gullfaks C	SN76923	08.06.2020	9,3	8,3
Gullfaks C	SN76923	09.06.2020	7,2	5
Gullfaks C	SN76923	10.06.2020	4,1	2,3
Gullfaks C	SN76923	11.06.2020	8,7	7,5
Gullfaks C	SN76923	12.06.2020	9,8	7,3
Gullfaks C	SN76923	13.06.2020	9,3	6,1
Gullfaks C	SN76923	14.06.2020	9,8	6,1
Gullfaks C	SN76923	15.06.2020	7,2	3,1
Gullfaks C	SN76923	16.06.2020	7,2	4,4
Gullfaks C	SN76923	17.06.2020	4,1	3,2
Gullfaks C	SN76923	18.06.2020	6,7	4,6
Gullfaks C	SN76923	19.06.2020	5,7	3,4
Gullfaks C	SN76923	20.06.2020	5,1	3,1
Gullfaks C	SN76923	21.06.2020	9,8	6,9
Gullfaks C	SN76923	22.06.2020	11,8	6,5
Gullfaks C	SN76923	23.06.2020	14,9	7,1
Gullfaks C	SN76923	24.06.2020	14,9	10
Gullfaks C	SN76923	25.06.2020	3,6	2,4
Gullfaks C	SN76923	26.06.2020	9,3	7,7
Gullfaks C	SN76923	27.06.2020	10,3	8,9
Gullfaks C	SN76923	28.06.2020	11,3	9,8
Gullfaks C	SN76923	29.06.2020	10,3	8,3
Gullfaks C	SN76923	30.06.2020	11,3	9
Gullfaks C	SN76923	01.07.2020	10,8	8
Gullfaks C	SN76923	02.07.2020	7,7	5,9
Gullfaks C	SN76923	03.07.2020	6,2	3,4
Gullfaks C	SN76923	04.07.2020	3,6	2,4
Gullfaks C	SN76923	05.07.2020	11,8	6,9
Gullfaks C	SN76923	06.07.2020	17	11,2
Gullfaks C	SN76923	07.07.2020	7,2	6,3
Gullfaks C	SN76923	08.07.2020	9,3	7,5
Gullfaks C	SN76923	09.07.2020	6,2	5
Gullfaks C	SN76923	10.07.2020	5,7	4,6
Gullfaks C	SN76923	11.07.2020	8,7	6,7
Gullfaks C	SN76923	12.07.2020	8,2	5,1
Gullfaks C	SN76923	13.07.2020	8,2	5,1
Gullfaks C	SN76923	14.07.2020	4,6	2,5
Gullfaks C	SN76923	15.07.2020	2,6	1,5
Gullfaks C	SN76923	16.07.2020	11,3	7,3
Gullfaks C	SN76923	17.07.2020	9,3	7,7
Gullfaks C	SN76923	18.07.2020	12,2	8,7
Gullfaks C	SN76923	19.07.2020	9,8	6,5
Gullfaks C	SN76923	20.07.2020	7,2	5,9
Gullfaks C	SN76923	21.07.2020	6,2	4,4
Gullfaks C	SN76923	22.07.2020	3,6	2,1
Gullfaks C	SN76923	23.07.2020	5,7	3,9
Data valid for 23.07.2020 (CC BY 4.0), The Norwegian Meteorological Institute (MET Norway)				

Source: (Norsk Klima Service Senter, n.d.)

18. The data of wind speed at Heimdal (Page 1)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Heimdal	SN76932	23.07.2019	7,7	6,2
Heimdal	SN76932	24.07.2019	9,8	5,6
Heimdal	SN76932	25.07.2019	9,3	6,7
Heimdal	SN76932	26.07.2019	12,3	8,8
Heimdal	SN76932	27.07.2019	10,3	7,1
Heimdal	SN76932	28.07.2019	10,8	7,4
Heimdal	SN76932	29.07.2019	7,7	5,6
Heimdal	SN76932	30.07.2019	5,1	3,8
Heimdal	SN76932	31.07.2019	8,2	6
Heimdal	SN76932	01.08.2019	4,1	3,2
Heimdal	SN76932	02.08.2019	9,3	6,6
Heimdal	SN76932	03.08.2019	8,2	7,4
Heimdal	SN76932	04.08.2019	5,1	4,4
Heimdal	SN76932	05.08.2019	6,2	2,7
Heimdal	SN76932	06.08.2019	6,2	3,7
Heimdal	SN76932	07.08.2019	4,6	1,9
Heimdal	SN76932	08.08.2019	8,2	6,8
Heimdal	SN76932	09.08.2019	8,7	5,3
Heimdal	SN76932	10.08.2019	9,3	4,7
Heimdal	SN76932	11.08.2019	9,3	4,6
Heimdal	SN76932	12.08.2019	10,8	8,5
Heimdal	SN76932	13.08.2019	6,7	5,1
Heimdal	SN76932	14.08.2019	5,1	3,6
Heimdal	SN76932	15.08.2019	11,3	8,6
Heimdal	SN76932	16.08.2019	7,7	6,7
Heimdal	SN76932	17.08.2019	11,3	7,3
Heimdal	SN76932	18.08.2019	12,3	10,4
Heimdal	SN76932	19.08.2019	10,8	9,5
Heimdal	SN76932	20.08.2019	9,3	7,7
Heimdal	SN76932	21.08.2019	6,7	4,8
Heimdal	SN76932	22.08.2019	12,9	8,8
Heimdal	SN76932	23.08.2019	11,3	7,3
Heimdal	SN76932	24.08.2019	9,3	7,2
Heimdal	SN76932	25.08.2019	8,2	4,7
Heimdal	SN76932	26.08.2019	9,3	7,5
Heimdal	SN76932	27.08.2019	7,2	5,3
Heimdal	SN76932	28.08.2019	9,3	7,2
Heimdal	SN76932	29.08.2019	11,8	8,4
Heimdal	SN76932	30.08.2019	14,4	12,4
Heimdal	SN76932	02.09.2019	10,8	6,6
Heimdal	SN76932	03.09.2019	9,3	5,3
Heimdal	SN76932	04.09.2019	8,7	5,8
Heimdal	SN76932	05.09.2019	13,4	10,4
Heimdal	SN76932	06.09.2019	11,3	7,3
Heimdal	SN76932	07.09.2019	11,3	9,9
Heimdal	SN76932	08.09.2019	6,2	3,2
Heimdal	SN76932	09.09.2019	7,2	4,7
Heimdal	SN76932	10.09.2019	11,8	4,1
Heimdal	SN76932	11.09.2019	15,4	11,1
Heimdal	SN76932	12.09.2019	11,8	10,4
Heimdal	SN76932	13.09.2019	11,8	11,3
Heimdal	SN76932	14.09.2019	18	12,7
Heimdal	SN76932	15.09.2019	21,6	16,3
Heimdal	SN76932	16.09.2019	13,4	10,6
Heimdal	SN76932	17.09.2019	14,9	12,5
Heimdal	SN76932	18.09.2019	10,8	8
Heimdal	SN76932	19.09.2019	8,7	6
Heimdal	SN76932	20.09.2019	7,7	5,4
Heimdal	SN76932	21.09.2019	6,7	4,9
Heimdal	SN76932	22.09.2019	8,7	6,4

Source: (Norsk Klima Service Senter, n.d.)

19. The data of wind speed at Heimdal (Page 2)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Heimdal	SN76932	23.09.2019	12,3	10
Heimdal	SN76932	24.09.2019	10,8	9,1
Heimdal	SN76932	25.09.2019	10,8	8,2
Heimdal	SN76932	26.09.2019	17,5	12,8
Heimdal	SN76932	27.09.2019	7,7	5,5
Heimdal	SN76932	28.09.2019	7,7	5,6
Heimdal	SN76932	29.09.2019	9,8	7,1
Heimdal	SN76932	30.09.2019	12,9	11,1
Heimdal	SN76932	01.10.2019	12	10
Heimdal	SN76932	02.10.2019	11,5	9,6
Heimdal	SN76932	03.10.2019	6	4,5
Heimdal	SN76932	04.10.2019	7	4,5
Heimdal	SN76932	05.10.2019	9,8	6,9
Heimdal	SN76932	06.10.2019	11,5	9,2
Heimdal	SN76932	07.10.2019	9,8	7,7
Heimdal	SN76932	08.10.2019	7,2	6,4
Heimdal	SN76932	09.10.2019	8,2	7,3
Heimdal	SN76932	10.10.2019	11,8	9,3
Heimdal	SN76932	11.10.2019	8,7	6,5
Heimdal	SN76932	12.10.2019	5,7	4
Heimdal	SN76932	13.10.2019	3,6	1,9
Heimdal	SN76932	14.10.2019	4,6	3,1
Heimdal	SN76932	15.10.2019	10,8	7,3
Heimdal	SN76932	16.10.2019	10,3	6,6
Heimdal	SN76932	17.10.2019	11,8	7,5
Heimdal	SN76932	18.10.2019	7,2	5,2
Heimdal	SN76932	19.10.2019	9,4	6,1
Heimdal	SN76932	20.10.2019	10,8	8
Heimdal	SN76932	21.10.2019	13,4	7,1
Heimdal	SN76932	22.10.2019	13,4	12
Heimdal	SN76932	23.10.2019	14,4	11,1
Heimdal	SN76932	24.10.2019	15,4	12,2
Heimdal	SN76932	25.10.2019	14,9	12,3
Heimdal	SN76932	26.10.2019	12,9	10,8
Heimdal	SN76932	27.10.2019	10,3	6,8
Heimdal	SN76932	28.10.2019	8,7	7,6
Heimdal	SN76932	29.10.2019	9,3	5,4
Heimdal	SN76932	30.10.2019	5,7	4,7
Heimdal	SN76932	31.10.2019	5,1	4,4
Heimdal	SN76932	01.11.2019	9,8	6,3
Heimdal	SN76932	02.11.2019	9,8	6,6
Heimdal	SN76932	03.11.2019	7,2	4,6
Heimdal	SN76932	04.11.2019	5,7	4,1
Heimdal	SN76932	05.11.2019	7,7	7
Heimdal	SN76932	06.11.2019	8,2	4,8
Heimdal	SN76932	07.11.2019	7,2	3,3
Heimdal	SN76932	08.11.2019	7,7	6,2
Heimdal	SN76932	09.11.2019	8,7	5,1
Heimdal	SN76932	10.11.2019	9,8	6,3
Heimdal	SN76932	11.11.2019	11,8	6
Heimdal	SN76932	12.11.2019	10,8	6,9
Heimdal	SN76932	13.11.2019	7,2	3,5
Heimdal	SN76932	14.11.2019	4,6	3,1
Heimdal	SN76932	15.11.2019	4,6	2,7
Heimdal	SN76932	16.11.2019	5,7	3,9
Heimdal	SN76932	17.11.2019	7,2	4,1
Heimdal	SN76932	18.11.2019	8,7	6,7
Heimdal	SN76932	19.11.2019	8,2	6,3
Heimdal	SN76932	20.11.2019	6,2	4,9
Heimdal	SN76932	21.11.2019	5,1	3,5
Heimdal	SN76932	22.11.2019	9,8	5,2
Heimdal	SN76932	23.11.2019	9,3	5,9

Source: (Norsk Klima Service Senter, n.d.)

20. The data of wind speed at Heimdal (Page 3)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Heimdal	SN76932	24.11.2019	13,4	11,2
Heimdal	SN76932	25.11.2019	13,9	10,5
Heimdal	SN76932	26.11.2019	9,3	4,3
Heimdal	SN76932	27.11.2019	6,7	4,8
Heimdal	SN76932	28.11.2019	17	14,3
Heimdal	SN76932	29.11.2019	12,9	10,4
Heimdal	SN76932	30.11.2019	9,3	6,1
Heimdal	SN76932	01.12.2019	10,3	9
Heimdal	SN76932	02.12.2019	11,3	6,4
Heimdal	SN76932	03.12.2019	11,8	9,5
Heimdal	SN76932	04.12.2019	15,9	12,3
Heimdal	SN76932	05.12.2019	18,5	15,2
Heimdal	SN76932	06.12.2019	7,7	5,4
Heimdal	SN76932	07.12.2019	9,8	7
Heimdal	SN76932	08.12.2019	16,5	13,5
Heimdal	SN76932	09.12.2019	19	14,5
Heimdal	SN76932	10.12.2019	17,5	11,7
Heimdal	SN76932	11.12.2019	20,6	17,1
Heimdal	SN76932	12.12.2019	18,5	11,6
Heimdal	SN76932	13.12.2019	17,5	12,4
Heimdal	SN76932	14.12.2019	18	10,7
Heimdal	SN76932	15.12.2019	8,7	6,2
Heimdal	SN76932	16.12.2019	9,3	4,8
Heimdal	SN76932	17.12.2019	10,3	6
Heimdal	SN76932	18.12.2019	6,7	4,8
Heimdal	SN76932	19.12.2019	10,8	7,6
Heimdal	SN76932	20.12.2019	15,9	10,4
Heimdal	SN76932	21.12.2019	11,8	9,5
Heimdal	SN76932	22.12.2019	8,7	4,9
Heimdal	SN76932	23.12.2019	5,1	3,2
Heimdal	SN76932	24.12.2019	4,1	1,9
Heimdal	SN76932	25.12.2019	7,2	6,1
Heimdal	SN76932	26.12.2019	3,6	2,1
Heimdal	SN76932	27.12.2019	17	7,9
Heimdal	SN76932	28.12.2019	15,4	11,9
Heimdal	SN76932	29.12.2019	18	13,8
Heimdal	SN76932	30.12.2019	13,4	12
Heimdal	SN76932	31.12.2019	13,9	9,5
Heimdal	SN76932	01.01.2020	12,9	10,2
Heimdal	SN76932	02.01.2020	18	16,9
Heimdal	SN76932	03.01.2020	17	14,2
Heimdal	SN76932	04.01.2020	16,5	10,3
Heimdal	SN76932	05.01.2020	13,9	12,1
Heimdal	SN76932	06.01.2020	17,5	13,2
Heimdal	SN76932	07.01.2020	20,6	15,4
Heimdal	SN76932	08.01.2020	18,5	16
Heimdal	SN76932	09.01.2020	7,7	4,3
Heimdal	SN76932	10.01.2020	19,5	8,5
Heimdal	SN76932	11.01.2020	19	14,7
Heimdal	SN76932	12.01.2020	14,4	12,9
Heimdal	SN76932	13.01.2020	15,4	12,5
Heimdal	SN76932	14.01.2020	17	15,2
Heimdal	SN76932	15.01.2020	19	16,4
Heimdal	SN76932	16.01.2020	17	11,9
Heimdal	SN76932	17.01.2020	13,9	11,8
Heimdal	SN76932	18.01.2020	15,9	12,3
Heimdal	SN76932	19.01.2020	13,4	9,9
Heimdal	SN76932	20.01.2020	12,9	11,9
Heimdal	SN76932	21.01.2020	14,4	9,3
Heimdal	SN76932	22.01.2020	8,2	6,2
Heimdal	SN76932	23.01.2020	13,4	11,3
Heimdal	SN76932	24.01.2020	11,8	10

Source: (Norsk Klima Service Senter, n.d.)

21. The data of wind speed at Heimdal (Page 4)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Heimdal	SN76932	25.01.2020	12,9	10,2
Heimdal	SN76932	26.01.2020	14,9	11,8
Heimdal	SN76932	27.01.2020	14,9	7,8
Heimdal	SN76932	28.01.2020	9,8	5,3
Heimdal	SN76932	29.01.2020	7,2	4,6
Heimdal	SN76932	30.01.2020	13,4	7,7
Heimdal	SN76932	31.01.2020	15,9	12,2
Heimdal	SN76932	01.02.2020	13,9	11,8
Heimdal	SN76932	02.02.2020	12,3	6,1
Heimdal	SN76932	03.02.2020	14,9	10,4
Heimdal	SN76932	04.02.2020	10,8	7,4
Heimdal	SN76932	05.02.2020	14,4	10,5
Heimdal	SN76932	06.02.2020	9	6,6
Heimdal	SN76932	07.02.2020	10,3	8,3
Heimdal	SN76932	08.02.2020	15,4	11,7
Heimdal	SN76932	09.02.2020	23,7	12
Heimdal	SN76932	10.02.2020	17	13,2
Heimdal	SN76932	11.02.2020	18	13,8
Heimdal	SN76932	12.02.2020	11,8	10
Heimdal	SN76932	13.02.2020	7,7	5,1
Heimdal	SN76932	14.02.2020	17,5	11,2
Heimdal	SN76932	15.02.2020	17,5	10
Heimdal	SN76932	16.02.2020	19,5	16,4
Heimdal	SN76932	17.02.2020	22,1	18,4
Heimdal	SN76932	18.02.2020	17,5	13,5
Heimdal	SN76932	19.02.2020	12,3	5,8
Heimdal	SN76932	20.02.2020	13,9	10,7
Heimdal	SN76932	21.02.2020	21,6	15,9
Heimdal	SN76932	22.02.2020	21,6	16,5
Heimdal	SN76932	23.02.2020	14,9	9,5
Heimdal	SN76932	24.02.2020	9,6	5,6
Heimdal	SN76932	25.02.2020	3,6	2,7
Heimdal	SN76932	26.02.2020	8,2	5,7
Heimdal	SN76932	27.02.2020	9,8	7,2
Heimdal	SN76932	28.02.2020	11,3	6,3
Heimdal	SN76932	29.02.2020	17,5	9,9
Heimdal	SN76932	01.03.2020	9,8	7,8
Heimdal	SN76932	02.03.2020	13,4	12
Heimdal	SN76932	03.03.2020	7,2	5
Heimdal	SN76932	04.03.2020	5,7	4,6
Heimdal	SN76932	05.03.2020	6,7	5,5
Heimdal	SN76932	06.03.2020	8,2	5,2
Heimdal	SN76932	07.03.2020	16,5	12,5
Heimdal	SN76932	08.03.2020	16,5	12,2
Heimdal	SN76932	09.03.2020	8,7	7,1
Heimdal	SN76932	10.03.2020	17	10,7
Heimdal	SN76932	11.03.2020	18,5	14,8
Heimdal	SN76932	12.03.2020	14,9	11,1
Heimdal	SN76932	13.03.2020	14,9	9,3
Heimdal	SN76932	14.03.2020	15,4	10,9
Heimdal	SN76932	15.03.2020	13,4	9,5
Heimdal	SN76932	16.03.2020	17	10,4
Heimdal	SN76932	17.03.2020	15,9	12,4
Heimdal	SN76932	18.03.2020	15,4	12
Heimdal	SN76932	19.03.2020	13,9	9,2
Heimdal	SN76932	20.03.2020	9,3	6,8
Heimdal	SN76932	21.03.2020	11,8	4,6
Heimdal	SN76932	22.03.2020	15,4	14,6
Heimdal	SN76932	23.03.2020	19,5	18,3
Heimdal	SN76932	24.03.2020	19	17
Heimdal	SN76932	25.03.2020	18	8,5
Heimdal	SN76932	26.03.2020	3,6	2,3

Source: (Norsk Klima Service Senter, n.d.)

22. The data of wind speed at Heimdal (Page 5)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Heimdal	SN76932	27.03.2020	7,2	4,2
Heimdal	SN76932	28.03.2020	14,9	11,3
Heimdal	SN76932	29.03.2020	13,4	10,2
Heimdal	SN76932	30.03.2020	13,4	8,4
Heimdal	SN76932	31.03.2020	8,2	7,8
Heimdal	SN76932	01.04.2020	14,9	11,5
Heimdal	SN76932	02.04.2020	24,7	17,7
Heimdal	SN76932	03.04.2020	14,9	9,1
Heimdal	SN76932	04.04.2020	9,3	5,2
Heimdal	SN76932	05.04.2020	10,3	7,9
Heimdal	SN76932	06.04.2020	11,8	8,9
Heimdal	SN76932	07.04.2020	13,4	9
Heimdal	SN76932	08.04.2020	11,3	8,4
Heimdal	SN76932	09.04.2020	10,3	5,3
Heimdal	SN76932	10.04.2020	5,1	3,8
Heimdal	SN76932	11.04.2020	10,3	7,1
Heimdal	SN76932	12.04.2020	16,5	13,6
Heimdal	SN76932	13.04.2020	13,4	11,1
Heimdal	SN76932	14.04.2020	12,9	10
Heimdal	SN76932	15.04.2020	13,4	11,9
Heimdal	SN76932	16.04.2020	9,8	7,1
Heimdal	SN76932	17.04.2020	6,2	4,8
Heimdal	SN76932	18.04.2020	5,1	3,5
Heimdal	SN76932	19.04.2020	3,1	1,6
Heimdal	SN76932	20.04.2020	4,1	2,7
Heimdal	SN76932	21.04.2020	3,1	2,1
Heimdal	SN76932	22.04.2020	3,6	2,3
Heimdal	SN76932	23.04.2020	6,7	4,1
Heimdal	SN76932	24.04.2020	9,8	8,7
Heimdal	SN76932	25.04.2020	7,7	6
Heimdal	SN76932	26.04.2020	5,7	2,8
Heimdal	SN76932	27.04.2020	8,7	6
Heimdal	SN76932	28.04.2020	5,7	2,2
Heimdal	SN76932	29.04.2020	7,2	5
Heimdal	SN76932	30.04.2020	15,9	9,9
Heimdal	SN76932	01.05.2020	10,8	6,1
Heimdal	SN76932	02.05.2020	7,2	4,3
Heimdal	SN76932	03.05.2020	6,7	5,9
Heimdal	SN76932	04.05.2020	7,7	5,5
Heimdal	SN76932	05.05.2020	7,7	5
Heimdal	SN76932	06.05.2020	8,7	6,4
Heimdal	SN76932	07.05.2020	5,7	4,1
Heimdal	SN76932	08.05.2020	6,7	4,6
Heimdal	SN76932	09.05.2020	5,1	3,3
Heimdal	SN76932	10.05.2020	13,4	11,9
Heimdal	SN76932	11.05.2020	12,9	9,4
Heimdal	SN76932	12.05.2020	12,3	8,7
Heimdal	SN76932	13.05.2020	9,8	7,3
Heimdal	SN76932	14.05.2020	12,3	8,3
Heimdal	SN76932	15.05.2020	7,7	5,9
Heimdal	SN76932	16.05.2020	13,9	11,4
Heimdal	SN76932	17.05.2020	12,3	8,9
Heimdal	SN76932	18.05.2020	4,1	2,6
Heimdal	SN76932	19.05.2020	5,1	2,8
Heimdal	SN76932	20.05.2020	6,2	4,6
Heimdal	SN76932	21.05.2020	7,2	5,9
Heimdal	SN76932	22.05.2020	14,9	10,2
Heimdal	SN76932	23.05.2020	14,4	12,8
Heimdal	SN76932	24.05.2020	16,5	11,3
Heimdal	SN76932	25.05.2020	8,7	5,8
Heimdal	SN76932	26.05.2020	9,8	5,8
Heimdal	SN76932	27.05.2020	8,7	6,6

Source: (Norsk Klima Service Senter, n.d.)

23. The data of wind speed at Heimdal (Page 6)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Heimdal	SN76932	28.05.2020	3,6	2,8
Heimdal	SN76932	29.05.2020	5,1	3,2
Heimdal	SN76932	30.05.2020	3,6	2,8
Heimdal	SN76932	31.05.2020	4,6	2,2
Heimdal	SN76932	01.06.2020	6,7	4,8
Heimdal	SN76932	02.06.2020	6,7	4,3
Heimdal	SN76932	03.06.2020	13,4	10,4
Heimdal	SN76932	04.06.2020	9,3	7
Heimdal	SN76932	05.06.2020	9,3	5,5
Heimdal	SN76932	06.06.2020	7,2	4,8
Heimdal	SN76932	07.06.2020	12,3	11,4
Heimdal	SN76932	08.06.2020	10,1	8,7
Heimdal	SN76932	09.06.2020	6,8	4,3
Heimdal	SN76932	10.06.2020	3,6	2,3
Heimdal	SN76932	11.06.2020	8,2	5,3
Heimdal	SN76932	12.06.2020	7,7	4,6
Heimdal	SN76932	13.06.2020	7,7	4,3
Heimdal	SN76932	14.06.2020	6,7	4,2
Heimdal	SN76932	15.06.2020	6,2	3,6
Heimdal	SN76932	16.06.2020	3,1	2,1
Heimdal	SN76932	17.06.2020	5,1	4,2
Heimdal	SN76932	18.06.2020	6,2	4,4
Heimdal	SN76932	19.06.2020	4,1	3,1
Heimdal	SN76932	20.06.2020	5,7	3,7
Heimdal	SN76932	21.06.2020	7,7	6
Heimdal	SN76932	22.06.2020	9,3	6,8
Heimdal	SN76932	23.06.2020	12,3	6,8
Heimdal	SN76932	24.06.2020	8,7	7,2
Heimdal	SN76932	25.06.2020	7,2	4,1
Heimdal	SN76932	26.06.2020	9,3	6,8
Heimdal	SN76932	27.06.2020	11,8	8,9
Heimdal	SN76932	28.06.2020	12,9	7,6
Heimdal	SN76932	29.06.2020	10,3	7,5
Heimdal	SN76932	30.06.2020	8,7	5,9
Heimdal	SN76932	01.07.2020	8,2	6,8
Heimdal	SN76932	02.07.2020	11,8	7,8
Heimdal	SN76932	03.07.2020	11,3	4,2
Heimdal	SN76932	04.07.2020	5,1	3,2
Heimdal	SN76932	05.07.2020	11,8	8,4
Heimdal	SN76932	06.07.2020	17	12,6
Heimdal	SN76932	07.07.2020	10,8	8,2
Heimdal	SN76932	08.07.2020	8,2	6,5
Heimdal	SN76932	09.07.2020	4,1	3,3
Heimdal	SN76932	10.07.2020	7,7	6,4
Heimdal	SN76932	11.07.2020	8,2	6,4
Heimdal	SN76932	12.07.2020	11,8	8,4
Heimdal	SN76932	13.07.2020	7,2	4,8
Heimdal	SN76932	14.07.2020	7,2	4,8
Heimdal	SN76932	15.07.2020	5,1	2,5
Heimdal	SN76932	16.07.2020	9,8	6,3
Heimdal	SN76932	17.07.2020	9,3	5,3
Heimdal	SN76932	18.07.2020	7,7	6,2
Heimdal	SN76932	19.07.2020	6,7	5,9
Heimdal	SN76932	20.07.2020	6,2	5,4
Heimdal	SN76932	21.07.2020	6,7	5,7
Heimdal	SN76932	22.07.2020	5,1	2,3
Heimdal	SN76932	23.07.2020	4,6	2,5
Data valid for 23.07.2020 (CC BY 4.0), The Norwegian Meteorological Institute (MET Norway)				

Source: (Norsk Klima Service Senter, n.d.)

24. The data of wind speed at Sleipner A (Page 1)

Field	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Sleipner A	SN76926	23.07.2019	9,3	7,7
Sleipner A	SN76926	24.07.2019	12,9	9,8
Sleipner A	SN76926	25.07.2019	11,8	9
Sleipner A	SN76926	26.07.2019	15,4	12,2
Sleipner A	SN76926	27.07.2019	12,3	10,1
Sleipner A	SN76926	28.07.2019	11,3	8,2
Sleipner A	SN76926	29.07.2019	7,2	5,9
Sleipner A	SN76926	30.07.2019	9,3	5,9
Sleipner A	SN76926	31.07.2019	9,3	8,3
Sleipner A	SN76926	01.08.2019	9,8	6,7
Sleipner A	SN76926	02.08.2019	7,7	5,9
Sleipner A	SN76926	03.08.2019	7,2	5,8
Sleipner A	SN76926	04.08.2019	4,1	2,7
Sleipner A	SN76926	05.08.2019	4,6	3,5
Sleipner A	SN76926	06.08.2019	5,7	4,6
Sleipner A	SN76926	07.08.2019	6,7	4,7
Sleipner A	SN76926	08.08.2019	6,7	5,4
Sleipner A	SN76926	09.08.2019	13,4	8,9
Sleipner A	SN76926	10.08.2019	10,8	5,9
Sleipner A	SN76926	11.08.2019	11,3	8,7
Sleipner A	SN76926	12.08.2019	10,8	7,7
Sleipner A	SN76926	13.08.2019	8,7	6,7
Sleipner A	SN76926	14.08.2019	8,7	5,8
Sleipner A	SN76926	15.08.2019	10,8	8,9
Sleipner A	SN76926	16.08.2019	12,9	9,4
Sleipner A	SN76926	17.08.2019	10,8	8,6
Sleipner A	SN76926	18.08.2019	11,8	10,1
Sleipner A	SN76926	19.08.2019	10,3	7,9
Sleipner A	SN76926	20.08.2019	9,3	7
Sleipner A	SN76926	21.08.2019	10,3	6,5
Sleipner A	SN76926	22.08.2019	13,9	9,9
Sleipner A	SN76926	23.08.2019	10,3	7
Sleipner A	SN76926	24.08.2019	9,8	8,5
Sleipner A	SN76926	25.08.2019	7,7	5,7
Sleipner A	SN76926	26.08.2019	11,8	8,7
Sleipner A	SN76926	27.08.2019	8,2	7,5
Sleipner A	SN76926	28.08.2019	8,2	7
Sleipner A	SN76926	29.08.2019	11,3	8
Sleipner A	SN76926	30.08.2019	13,9	12,1
Sleipner A	SN76926	31.08.2019	13,9	11,8
Sleipner A	SN76926	01.09.2019	9,8	7,2
Sleipner A	SN76926	02.09.2019	12,9	7,9
Sleipner A	SN76926	03.09.2019	9,3	5,7
Sleipner A	SN76926	04.09.2019	10,8	5,7
Sleipner A	SN76926	05.09.2019	14,9	10,6
Sleipner A	SN76926	06.09.2019	11,8	9,2
Sleipner A	SN76926	07.09.2019	13,4	10,6
Sleipner A	SN76926	08.09.2019	7,2	3,7
Sleipner A	SN76926	09.09.2019	7,7	5,8
Sleipner A	SN76926	10.09.2019	10,3	4,6
Sleipner A	SN76926	11.09.2019	14,4	10,8
Sleipner A	SN76926	12.09.2019	10,3	9,5
Sleipner A	SN76926	13.09.2019	11,8	10,6
Sleipner A	SN76926	14.09.2019	17	12,5
Sleipner A	SN76926	15.09.2019	19,1	15,8
Sleipner A	SN76926	16.09.2019	13,3	11
Sleipner A	SN76926	17.09.2019	14,4	11,9
Sleipner A	SN76926	18.09.2019	8,7	6,7
Sleipner A	SN76926	19.09.2019	6,2	3,9
Sleipner A	SN76926	20.09.2019	5,7	3,8
Sleipner A	SN76926	21.09.2019	10,3	7,2
Sleipner A	SN76926	22.09.2019	13,9	10,1

Source: (Norsk Klima Service Senter, n.d.)

25. The data of wind speed at Sleipner A (Page 2)

Field	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Sleipner A	SN76926	23.09.2019	15,4	14,4
Sleipner A	SN76926	24.09.2019	13,9	11,1
Sleipner A	SN76926	25.09.2019	14,9	14,5
Sleipner A	SN76926	26.09.2019	17,5	13,3
Sleipner A	SN76926	27.09.2019	8,7	7,5
Sleipner A	SN76926	28.09.2019	8,2	7,1
Sleipner A	SN76926	29.09.2019	8,7	6,6
Sleipner A	SN76926	30.09.2019	11,8	9,1
Sleipner A	SN76926	01.10.2019	9,8	7,9
Sleipner A	SN76926	02.10.2019	10	9,8
Sleipner A	SN76926	03.10.2019	10,1	8,1
Sleipner A	SN76926	04.10.2019	11	7,6
Sleipner A	SN76926	05.10.2019	11,1	10,4
Sleipner A	SN76926	06.10.2019	10,8	9,8
Sleipner A	SN76926	07.10.2019	15,4	11,7
Sleipner A	SN76926	08.10.2019	9,8	8,3
Sleipner A	SN76926	09.10.2019	9,8	8,4
Sleipner A	SN76926	10.10.2019	10,8	9,1
Sleipner A	SN76926	11.10.2019	11,8	10,7
Sleipner A	SN76926	12.10.2019	10,8	8,7
Sleipner A	SN76926	13.10.2019	5,1	3,8
Sleipner A	SN76926	14.10.2019	6,7	4,2
Sleipner A	SN76926	15.10.2019	14,4	10
Sleipner A	SN76926	16.10.2019	11,8	9,3
Sleipner A	SN76926	17.10.2019	11,3	6,5
Sleipner A	SN76926	18.10.2019	9,8	7,1
Sleipner A	SN76926	19.10.2019	9,8	7,3
Sleipner A	SN76926	20.10.2019	8,7	7
Sleipner A	SN76926	21.10.2019	10,8	5,5
Sleipner A	SN76926	22.10.2019	11,8	10
Sleipner A	SN76926	23.10.2019	12,9	10,7
Sleipner A	SN76926	24.10.2019	12,9	9,6
Sleipner A	SN76926	25.10.2019	11,3	9,6
Sleipner A	SN76926	26.10.2019	9,3	8,1
Sleipner A	SN76926	27.10.2019	13,4	10,3
Sleipner A	SN76926	28.10.2019	9,5	8,3
Sleipner A	SN76926	29.10.2019	7,7	5,6
Sleipner A	SN76926	30.10.2019	3,7	3,2
Sleipner A	SN76926	31.10.2019	9,3	5,6
Sleipner A	SN76926	01.11.2019	10,8	9,4
Sleipner A	SN76926	02.11.2019	15,9	14,9
Sleipner A	SN76926	03.11.2019	16,5	13,7
Sleipner A	SN76926	04.11.2019	12,9	9,9
Sleipner A	SN76926	05.11.2019	6,2	3,5
Sleipner A	SN76926	06.11.2019	7,2	4,5
Sleipner A	SN76926	07.11.2019	4,1	3,1
Sleipner A	SN76926	08.11.2019	8,7	6,6
Sleipner A	SN76926	09.11.2019	6,2	5,1
Sleipner A	SN76926	10.11.2019	5,6	5,2
Sleipner A	SN76926	11.11.2019	12,3	9,5
Sleipner A	SN76926	12.11.2019	14,4	9,8
Sleipner A	SN76926	13.11.2019	8,2	5,4
Sleipner A	SN76926	14.11.2019	3,6	2,7
Sleipner A	SN76926	15.11.2019	7,2	5,9
Sleipner A	SN76926	16.11.2019	6,2	5
Sleipner A	SN76926	17.11.2019	6,2	3,8
Sleipner A	SN76926	18.11.2019	8,7	7,1
Sleipner A	SN76926	19.11.2019	9,3	5,7
Sleipner A	SN76926	20.11.2019	9,3	7,9
Sleipner A	SN76926	21.11.2019	9,8	8
Sleipner A	SN76926	22.11.2019	11,8	8,6
Sleipner A	SN76926	23.11.2019	12,3	9,4

Source: (Norsk Klima Service Senter, n.d.)

26. The data of wind speed at Sleipner A (Page 3)

Field	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Sleipner A	SN76926	24.11.2019	12,3	11,4
Sleipner A	SN76926	25.11.2019	11,8	10,5
Sleipner A	SN76926	26.11.2019	11,8	9,8
Sleipner A	SN76926	27.11.2019	12,3	9,8
Sleipner A	SN76926	28.11.2019	17	14,5
Sleipner A	SN76926	29.11.2019	14,4	10,2
Sleipner A	SN76926	30.11.2019	7,2	5,3
Sleipner A	SN76926	01.12.2019	9,8	7,7
Sleipner A	SN76926	02.12.2019	8,7	6,8
Sleipner A	SN76926	03.12.2019	10,8	8,2
Sleipner A	SN76926	04.12.2019	13,9	12
Sleipner A	SN76926	05.12.2019	16,5	14,7
Sleipner A	SN76926	06.12.2019	9,8	7,9
Sleipner A	SN76926	07.12.2019	12,9	8,1
Sleipner A	SN76926	08.12.2019	17,5	15,2
Sleipner A	SN76926	09.12.2019	18	13,2
Sleipner A	SN76926	10.12.2019	21,1	14,5
Sleipner A	SN76926	11.12.2019	16,5	14,8
Sleipner A	SN76926	12.12.2019	14,9	10,5
Sleipner A	SN76926	13.12.2019	15,9	14,5
Sleipner A	SN76926	14.12.2019	15,4	8,2
Sleipner A	SN76926	15.12.2019	11,8	9,8
Sleipner A	SN76926	16.12.2019	8,7	5,8
Sleipner A	SN76926	17.12.2019	11,8	9,6
Sleipner A	SN76926	18.12.2019	11,3	7
Sleipner A	SN76926	19.12.2019	16,5	12,2
Sleipner A	SN76926	20.12.2019	15,4	13,3
Sleipner A	SN76926	21.12.2019	13,4	9,4
Sleipner A	SN76926	22.12.2019	9,3	8
Sleipner A	SN76926	23.12.2019	6,2	3,4
Sleipner A	SN76926	24.12.2019	4,1	1,9
Sleipner A	SN76926	25.12.2019	7,2	5,3
Sleipner A	SN76926	26.12.2019	6,2	4
Sleipner A	SN76926	27.12.2019	17,5	11,3
Sleipner A	SN76926	28.12.2019	14,4	12,8
Sleipner A	SN76926	29.12.2019	16,5	14,7
Sleipner A	SN76926	30.12.2019	14,4	11,6
Sleipner A	SN76926	31.12.2019	12,3	8,5
Sleipner A	SN76926	01.01.2020	14,9	12,7
Sleipner A	SN76926	02.01.2020	15,4	14,8
Sleipner A	SN76926	03.01.2020	17,5	14,8
Sleipner A	SN76926	04.01.2020	12,9	8,4
Sleipner A	SN76926	05.01.2020	11,3	10
Sleipner A	SN76926	06.01.2020	14,9	12,2
Sleipner A	SN76926	07.01.2020	17,5	13,7
Sleipner A	SN76926	08.01.2020	17	14,8
Sleipner A	SN76926	09.01.2020	9,3	4,4
Sleipner A	SN76926	10.01.2020	14,9	6,7
Sleipner A	SN76926	11.01.2020	18	14,1
Sleipner A	SN76926	12.01.2020	12,3	10,8
Sleipner A	SN76926	13.01.2020	20,6	14
Sleipner A	SN76926	14.01.2020	16,5	13,4
Sleipner A	SN76926	15.01.2020	17,5	16,8
Sleipner A	SN76926	16.01.2020	18,5	14
Sleipner A	SN76926	17.01.2020	15,4	10
Sleipner A	SN76926	18.01.2020	12,9	11,6
Sleipner A	SN76926	19.01.2020	11,3	9,1
Sleipner A	SN76926	20.01.2020	12,3	10,9
Sleipner A	SN76926	21.01.2020	14,9	11,7
Sleipner A	SN76926	22.01.2020	7,2	6,6
Sleipner A	SN76926	23.01.2020	10,3	9,4
Sleipner A	SN76926	24.01.2020	9,8	7,8

Source: (Norsk Klima Service Senter, n.d.)

27. The data of wind speed at Sleipner A (Page 4)

Field	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Sleipner A	SN76926	25.01.2020	12,9	10,5
Sleipner A	SN76926	26.01.2020	11,8	10,4
Sleipner A	SN76926	27.01.2020	10,8	7,5
Sleipner A	SN76926	28.01.2020	8,2	5,6
Sleipner A	SN76926	29.01.2020	13,4	8,4
Sleipner A	SN76926	30.01.2020	14,9	8,7
Sleipner A	SN76926	31.01.2020	17	12,5
Sleipner A	SN76926	01.02.2020	15,4	12,4
Sleipner A	SN76926	02.02.2020	9,8	5,3
Sleipner A	SN76926	03.02.2020	14,9	11,7
Sleipner A	SN76926	04.02.2020	14,9	9,8
Sleipner A	SN76926	05.02.2020	10,8	8,8
Sleipner A	SN76926	06.02.2020	8,7	5,3
Sleipner A	SN76926	07.02.2020	15,4	10,8
Sleipner A	SN76926	08.02.2020	20,6	15,6
Sleipner A	SN76926	09.02.2020	20,6	15,8
Sleipner A	SN76926	10.02.2020	15,9	13,8
Sleipner A	SN76926	11.02.2020	17	15,7
Sleipner A	SN76926	12.02.2020	13,4	8,6
Sleipner A	SN76926	13.02.2020	8,2	3,7
Sleipner A	SN76926	14.02.2020	18	10,2
Sleipner A	SN76926	15.02.2020	19,5	13,2
Sleipner A	SN76926	16.02.2020	18	16
Sleipner A	SN76926	17.02.2020	21,1	17,4
Sleipner A	SN76926	18.02.2020	16,5	12,2
Sleipner A	SN76926	19.02.2020	14,4	9,8
Sleipner A	SN76926	20.02.2020	14,4	12
Sleipner A	SN76926	21.02.2020	19,5	16,3
Sleipner A	SN76926	22.02.2020	20,6	17,2
Sleipner A	SN76926	23.02.2020	19,5	13,4
Sleipner A	SN76926	24.02.2020	12,9	7,5
Sleipner A	SN76926	25.02.2020	7,2	4,4
Sleipner A	SN76926	26.02.2020	8,7	5,3
Sleipner A	SN76926	27.02.2020	11,3	7,6
Sleipner A	SN76926	28.02.2020	13,4	9,9
Sleipner A	SN76926	29.02.2020	18	13,2
Sleipner A	SN76926	01.03.2020	12,9	11
Sleipner A	SN76926	02.03.2020	13,4	9,8
Sleipner A	SN76926	03.03.2020	8,2	6,1
Sleipner A	SN76926	04.03.2020	5,1	3,6
Sleipner A	SN76926	05.03.2020	8,7	5,1
Sleipner A	SN76926	06.03.2020	6,2	3,7
Sleipner A	SN76926	07.03.2020	15,4	11,8
Sleipner A	SN76926	08.03.2020	15,9	11,5
Sleipner A	SN76926	09.03.2020	10,3	7,1
Sleipner A	SN76926	10.03.2020	14,9	11,5
Sleipner A	SN76926	11.03.2020	15,4	12,5
Sleipner A	SN76926	12.03.2020	14,4	8
Sleipner A	SN76926	13.03.2020	15,9	8,9
Sleipner A	SN76926	14.03.2020	14,9	11,6
Sleipner A	SN76926	15.03.2020	15,4	10
Sleipner A	SN76926	16.03.2020	15,4	9,4
Sleipner A	SN76926	17.03.2020	15,9	12,3
Sleipner A	SN76926	18.03.2020	10,8	10,2
Sleipner A	SN76926	19.03.2020	11,3	8,2
Sleipner A	SN76926	20.03.2020	7,7	6,1
Sleipner A	SN76926	21.03.2020	10,3	6
Sleipner A	SN76926	22.03.2020	15,9	12,5
Sleipner A	SN76926	23.03.2020	16,5	15,4
Sleipner A	SN76926	24.03.2020	15,9	14,9
Sleipner A	SN76926	25.03.2020	13,4	10,2
Sleipner A	SN76926	26.03.2020	5,7	3,4

Source: (Norsk Klima Service Senter, n.d.)

28. The data of wind speed at Sleipner A (Page 5)

Field	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Sleipner A	SN76926	27.03.2020	6,9	4,1
Sleipner A	SN76926	28.03.2020	14,9	12,2
Sleipner A	SN76926	29.03.2020	11,3	8,9
Sleipner A	SN76926	30.03.2020	13,4	8,8
Sleipner A	SN76926	31.03.2020	9,8	7,8
Sleipner A	SN76926	01.04.2020	12,3	11,1
Sleipner A	SN76926	02.04.2020	20,1	16,3
Sleipner A	SN76926	03.04.2020	12,9	7,2
Sleipner A	SN76926	04.04.2020	9,3	5,3
Sleipner A	SN76926	05.04.2020	15,9	12,7
Sleipner A	SN76926	06.04.2020	17,5	12,4
Sleipner A	SN76926	07.04.2020	12,3	8,3
Sleipner A	SN76926	08.04.2020	10,8	8,3
Sleipner A	SN76926	09.04.2020	6,7	4,3
Sleipner A	SN76926	10.04.2020	8,2	5,5
Sleipner A	SN76926	11.04.2020	9,3	6,8
Sleipner A	SN76926	12.04.2020	14,9	10,9
Sleipner A	SN76926	13.04.2020	12,9	10,8
Sleipner A	SN76926	14.04.2020	9,3	7,5
Sleipner A	SN76926	15.04.2020	12,9	11,1
Sleipner A	SN76926	16.04.2020	8,7	5,9
Sleipner A	SN76926	17.04.2020	5,7	5,1
Sleipner A	SN76926	18.04.2020	5,7	4,1
Sleipner A	SN76926	19.04.2020	3,1	2,5
Sleipner A	SN76926	20.04.2020	5,7	4
Sleipner A	SN76926	21.04.2020	5,7	4,1
Sleipner A	SN76926	22.04.2020	7,2	3,6
Sleipner A	SN76926	23.04.2020	5,1	2,8
Sleipner A	SN76926	24.04.2020	8,7	7,4
Sleipner A	SN76926	25.04.2020	5,1	4
Sleipner A	SN76926	26.04.2020	3,6	2,6
Sleipner A	SN76926	27.04.2020	7,7	5,8
Sleipner A	SN76926	28.04.2020	5,1	3,4
Sleipner A	SN76926	29.04.2020	7,2	5,5
Sleipner A	SN76926	30.04.2020	14,9	10,6
Sleipner A	SN76926	01.05.2020	7,2	5,9
Sleipner A	SN76926	02.05.2020	6,7	4,3
Sleipner A	SN76926	03.05.2020	5,7	4,6
Sleipner A	SN76926	04.05.2020	6,2	4,5
Sleipner A	SN76926	05.05.2020	6,2	3,7
Sleipner A	SN76926	06.05.2020	7,2	5,4
Sleipner A	SN76926	07.05.2020	5,7	3,5
Sleipner A	SN76926	08.05.2020	4,1	2,3
Sleipner A	SN76926	09.05.2020	9,3	3,6
Sleipner A	SN76926	10.05.2020	13,4	11,5
Sleipner A	SN76926	11.05.2020	10,8	8,6
Sleipner A	SN76926	12.05.2020	9,3	7,5
Sleipner A	SN76926	13.05.2020	8,7	6,8
Sleipner A	SN76926	14.05.2020	11,8	9,3
Sleipner A	SN76926	15.05.2020	11,8	9,4
Sleipner A	SN76926	16.05.2020	11,3	9,8
Sleipner A	SN76926	17.05.2020	8,2	5
Sleipner A	SN76926	18.05.2020	6,7	4,2
Sleipner A	SN76926	19.05.2020	6,7	4,3
Sleipner A	SN76926	20.05.2020	6,7	5,3
Sleipner A	SN76926	21.05.2020	10,8	7,9
Sleipner A	SN76926	22.05.2020	14,9	11,9
Sleipner A	SN76926	23.05.2020	13,4	12,6
Sleipner A	SN76926	24.05.2020	17	13
Sleipner A	SN76926	25.05.2020	9,3	5,8
Sleipner A	SN76926	26.05.2020	9,3	5,4
Sleipner A	SN76926	27.05.2020	5,7	4,9

Source: (Norsk Klima Service Senter, n.d.)

29. The data of wind speed at Sleipner A (Page 6)

Field	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Sleipner A	SN76926	28.05.2020	6,7	4,2
Sleipner A	SN76926	29.05.2020	7,2	4,6
Sleipner A	SN76926	30.05.2020	5,7	3,7
Sleipner A	SN76926	31.05.2020	8,2	5,8
Sleipner A	SN76926	01.06.2020	7,2	4,3
Sleipner A	SN76926	02.06.2020	6,2	3,4
Sleipner A	SN76926	03.06.2020	10,3	8,2
Sleipner A	SN76926	04.06.2020	8,7	7
Sleipner A	SN76926	05.06.2020	11,8	10,3
Sleipner A	SN76926	06.06.2020	10,3	5,7
Sleipner A	SN76926	07.06.2020	11,3	10
Sleipner A	SN76926	08.06.2020	9,3	8
Sleipner A	SN76926	09.06.2020	6,7	3,5
Sleipner A	SN76926	10.06.2020	4,6	3,4
Sleipner A	SN76926	11.06.2020	11,3	7,3
Sleipner A	SN76926	12.06.2020	11,8	9,1
Sleipner A	SN76926	13.06.2020	10,8	8,8
Sleipner A	SN76926	14.06.2020	10,8	9
Sleipner A	SN76926	15.06.2020	8,7	4,4
Sleipner A	SN76926	16.06.2020	2,6	1,2
Sleipner A	SN76926	17.06.2020	6,2	4,4
Sleipner A	SN76926	18.06.2020	4,6	3,7
Sleipner A	SN76926	19.06.2020	3,6	3,3
Sleipner A	SN76926	20.06.2020	7,2	5,5
Sleipner A	SN76926	21.06.2020	11,3	9,1
Sleipner A	SN76926	22.06.2020	9,3	6,9
Sleipner A	SN76926	23.06.2020	12,9	8,7
Sleipner A	SN76926	24.06.2020	10,8	9,4
Sleipner A	SN76926	25.06.2020	8,2	6,2
Sleipner A	SN76926	26.06.2020	10,8	10,3
Sleipner A	SN76926	27.06.2020	13,4	11,5
Sleipner A	SN76926	28.06.2020	12,9	11,5
Sleipner A	SN76926	29.06.2020	11,3	7,3
Sleipner A	SN76926	30.06.2020	5,7	4
Sleipner A	SN76926	01.07.2020	7,7	5
Sleipner A	SN76926	02.07.2020	6,2	5,7
Sleipner A	SN76926	03.07.2020	8,2	5,4
Sleipner A	SN76926	04.07.2020	5,1	2,9
Sleipner A	SN76926	05.07.2020	12,3	9,8
Sleipner A	SN76926	06.07.2020	14,9	12,3
Sleipner A	SN76926	07.07.2020	10,8	8,4
Sleipner A	SN76926	08.07.2020	6,7	4,7
Sleipner A	SN76926	09.07.2020	3,1	2,2
Sleipner A	SN76926	10.07.2020	7,2	4,6
Sleipner A	SN76926	11.07.2020	9,3	7
Sleipner A	SN76926	12.07.2020	11,3	7,7
Sleipner A	SN76926	13.07.2020	7,2	5,6
Sleipner A	SN76926	14.07.2020	8,2	6,2
Sleipner A	SN76926	15.07.2020	5,1	3,5
Sleipner A	SN76926	16.07.2020	8,2	4,7
Sleipner A	SN76926	17.07.2020	9,8	5,9
Sleipner A	SN76926	18.07.2020	9,3	5,5
Sleipner A	SN76926	19.07.2020	6,2	4,6
Sleipner A	SN76926	20.07.2020	7,2	4,5
Sleipner A	SN76926	21.07.2020	4,1	2,5
Sleipner A	SN76926	22.07.2020	4,6	3,9
Sleipner A	SN76926	23.07.2020	7,2	5,3
Data valid for 23.07.2020 (CC BY 4.0), The Norwegian Meteorological Institute (MET Norway)				

Source: (Norsk Klima Service Senter, n.d.)

30. The data of wind speed at Troll A (Page 1)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Troll A	SN76931	23.07.2019	9,3	7,1
Troll A	SN76931	24.07.2019	11,3	8,8
Troll A	SN76931	25.07.2019	13,9	7,7
Troll A	SN76931	26.07.2019	10,3	7,6
Troll A	SN76931	27.07.2019	9,8	5,8
Troll A	SN76931	28.07.2019	10,8	9,9
Troll A	SN76931	29.07.2019	6,7	4,6
Troll A	SN76931	30.07.2019	6,2	4,1
Troll A	SN76931	31.07.2019	6,7	4,2
Troll A	SN76931	01.08.2019	6,7	4,6
Troll A	SN76931	02.08.2019	9,8	8
Troll A	SN76931	03.08.2019	11,8	10,6
Troll A	SN76931	04.08.2019	8,2	4,4
Troll A	SN76931	05.08.2019	5,1	2,7
Troll A	SN76931	06.08.2019	4,6	3,3
Troll A	SN76931	07.08.2019	5,1	3
Troll A	SN76931	08.08.2019	12,3	9,3
Troll A	SN76931	09.08.2019	11,3	7
Troll A	SN76931	10.08.2019	12,3	7,6
Troll A	SN76931	11.08.2019	10,8	4,5
Troll A	SN76931	12.08.2019	11,8	10,6
Troll A	SN76931	13.08.2019	8,7	6,6
Troll A	SN76931	14.08.2019	5,1	3
Troll A	SN76931	15.08.2019	8,2	6,8
Troll A	SN76931	16.08.2019	12,9	8,8
Troll A	SN76931	17.08.2019	15,9	11,6
Troll A	SN76931	18.08.2019	11,3	9,4
Troll A	SN76931	19.08.2019	12,3	9,9
Troll A	SN76931	20.08.2019	8,2	6,9
Troll A	SN76931	21.08.2019	10,8	5,7
Troll A	SN76931	22.08.2019	12,9	9,7
Troll A	SN76931	23.08.2019	10,8	8,3
Troll A	SN76931	24.08.2019	11,8	9,8
Troll A	SN76931	25.08.2019	9,8	7,3
Troll A	SN76931	26.08.2019	12,3	11,1
Troll A	SN76931	27.08.2019	10,8	9,5
Troll A	SN76931	28.08.2019	13,4	10,5
Troll A	SN76931	29.08.2019	11,3	7,8
Troll A	SN76931	30.08.2019	15,9	13,6
Troll A	SN76931	31.08.2019	18	11,6
Troll A	SN76931	01.09.2019	13,4	9,4
Troll A	SN76931	02.09.2019	10,8	5,9
Troll A	SN76931	03.09.2019	10,3	5,8
Troll A	SN76931	04.09.2019	11,8	6,9
Troll A	SN76931	05.09.2019	13,9	10,6
Troll A	SN76931	06.09.2019	11,3	6,6
Troll A	SN76931	07.09.2019	14,4	13,2
Troll A	SN76931	08.09.2019	9,8	5
Troll A	SN76931	09.09.2019	6,2	4,6
Troll A	SN76931	10.09.2019	10,8	3,2
Troll A	SN76931	11.09.2019	16,5	12,2
Troll A	SN76931	12.09.2019	10,8	9,1
Troll A	SN76931	13.09.2019	11,8	10,3
Troll A	SN76931	14.09.2019	17	11,9
Troll A	SN76931	15.09.2019	21,1	17,4
Troll A	SN76931	16.09.2019	11,8	8,4
Troll A	SN76931	17.09.2019	14,9	11,1
Troll A	SN76931	18.09.2019	12,9	10,1
Troll A	SN76931	19.09.2019	8,7	5,7
Troll A	SN76931	20.09.2019	7,2	5,6
Troll A	SN76931	21.09.2019	10,8	6,9
Troll A	SN76931	22.09.2019	12,3	7,3

Source: (Norsk Klima Service Senter, n.d.)

31. The data of wind speed at Troll A (Page 2)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Troll A	SN76931	23.09.2019	6,2	4,6
Troll A	SN76931	24.09.2019	6,7	4,4
Troll A	SN76931	25.09.2019	5,1	3,8
Troll A	SN76931	26.09.2019	10,8	8
Troll A	SN76931	27.09.2019	12,3	8,7
Troll A	SN76931	28.09.2019	8,2	6,4
Troll A	SN76931	29.09.2019	12,3	7,1
Troll A	SN76931	30.09.2019	16,5	13,8
Troll A	SN76931	01.10.2019	12,3	10,7
Troll A	SN76931	02.10.2019	12,2	11,7
Troll A	SN76931	03.10.2019	11,6	10,1
Troll A	SN76931	04.10.2019	8,1	4,8
Troll A	SN76931	05.10.2019	4,5	2,3
Troll A	SN76931	06.10.2019	4,6	3,2
Troll A	SN76931	07.10.2019	17	9,9
Troll A	SN76931	08.10.2019	15,9	9,9
Troll A	SN76931	09.10.2019	10,8	8,5
Troll A	SN76931	10.10.2019	10,3	8,7
Troll A	SN76931	11.10.2019	10,8	7,3
Troll A	SN76931	12.10.2019	6,7	4,4
Troll A	SN76931	13.10.2019	3,6	2,5
Troll A	SN76931	14.10.2019	4,1	2,5
Troll A	SN76931	15.10.2019	7,2	5,8
Troll A	SN76931	16.10.2019	11,8	8,5
Troll A	SN76931	17.10.2019	10,8	9
Troll A	SN76931	18.10.2019	8,7	6,4
Troll A	SN76931	19.10.2019	11,8	8,4
Troll A	SN76931	20.10.2019	10,8	7,3
Troll A	SN76931	21.10.2019	14,9	8,1
Troll A	SN76931	22.10.2019	15,9	10,4
Troll A	SN76931	23.10.2019	14,9	11,8
Troll A	SN76931	24.10.2019	17	13,1
Troll A	SN76931	25.10.2019	14,4	11
Troll A	SN76931	26.10.2019	12,3	10,2
Troll A	SN76931	27.10.2019	9,8	5
Troll A	SN76931	28.10.2019	9,8	6,9
Troll A	SN76931	29.10.2019	8,2	5,6
Troll A	SN76931	30.10.2019	7,2	5,9
Troll A	SN76931	31.10.2019	7,7	5,4
Troll A	SN76931	01.11.2019	9,8	8,1
Troll A	SN76931	02.11.2019	8,7	5,5
Troll A	SN76931	03.11.2019	5,1	4,2
Troll A	SN76931	04.11.2019	5,1	4,3
Troll A	SN76931	05.11.2019	10,3	8,7
Troll A	SN76931	06.11.2019	8,2	4,2
Troll A	SN76931	07.11.2019	9,3	6,3
Troll A	SN76931	08.11.2019	12,3	10,5
Troll A	SN76931	09.11.2019	6,2	4,2
Troll A	SN76931	10.11.2019	11,8	7,7
Troll A	SN76931	11.11.2019	6,2	3,8
Troll A	SN76931	12.11.2019	8,2	6,1
Troll A	SN76931	13.11.2019	8,7	4,1
Troll A	SN76931	14.11.2019	6,2	3,7
Troll A	SN76931	15.11.2019	5,7	2,8
Troll A	SN76931	16.11.2019	7,7	4,1
Troll A	SN76931	17.11.2019	6,7	3,4
Troll A	SN76931	18.11.2019	10,3	3,5
Troll A	SN76931	19.11.2019	11,3	6,7
Troll A	SN76931	20.11.2019	8,7	6,4
Troll A	SN76931	21.11.2019	6,2	4,4
Troll A	SN76931	22.11.2019	7,2	6,3
Troll A	SN76931	23.11.2019	7,7	5,6

Source: (Norsk Klima Service Senter, n.d.)

32. The data of wind speed at Troll A (Page 3)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Troll A	SN76931	24.11.2019	4,6	3
Troll A	SN76931	25.11.2019	6,7	4,7
Troll A	SN76931	26.11.2019	3,6	2,2
Troll A	SN76931	27.11.2019	8,7	3,4
Troll A	SN76931	28.11.2019	18,5	16,7
Troll A	SN76931	29.11.2019	13,4	11,3
Troll A	SN76931	30.11.2019	10,8	7,3
Troll A	SN76931	01.12.2019	10,3	8,7
Troll A	SN76931	02.12.2019	9,3	6,7
Troll A	SN76931	03.12.2019	11,8	9,3
Troll A	SN76931	04.12.2019	14,9	12,5
Troll A	SN76931	05.12.2019	17,5	12,3
Troll A	SN76931	06.12.2019	8,2	5,8
Troll A	SN76931	07.12.2019	11,8	7,8
Troll A	SN76931	08.12.2019	20,1	15
Troll A	SN76931	09.12.2019	22,6	16,3
Troll A	SN76931	10.12.2019	25,7	16,2
Troll A	SN76931	11.12.2019	20,6	17,3
Troll A	SN76931	12.12.2019	20,1	14,4
Troll A	SN76931	13.12.2019	15,4	12,5
Troll A	SN76931	14.12.2019	13,9	10,4
Troll A	SN76931	15.12.2019	10,3	7,4
Troll A	SN76931	16.12.2019	8,2	5,8
Troll A	SN76931	17.12.2019	9,3	7,1
Troll A	SN76931	18.12.2019	6,7	3,7
Troll A	SN76931	19.12.2019	17	13,7
Troll A	SN76931	20.12.2019	13,9	10,2
Troll A	SN76931	21.12.2019	18	13,2
Troll A	SN76931	22.12.2019	10,3	8
Troll A	SN76931	23.12.2019	4,6	3,2
Troll A	SN76931	24.12.2019	4,1	2,7
Troll A	SN76931	25.12.2019	7,2	4,9
Troll A	SN76931	26.12.2019	4,1	2,6
Troll A	SN76931	27.12.2019	19,5	11,8
Troll A	SN76931	28.12.2019	20,6	17,2
Troll A	SN76931	29.12.2019	15,9	12,8
Troll A	SN76931	30.12.2019	13,9	12,3
Troll A	SN76931	31.12.2019	15,4	9,8
Troll A	SN76931	01.01.2020	12,3	10,5
Troll A	SN76931	02.01.2020	17,5	15,9
Troll A	SN76931	03.01.2020	19,5	15,2
Troll A	SN76931	04.01.2020	15,9	11
Troll A	SN76931	05.01.2020	13,9	11,8
Troll A	SN76931	06.01.2020	18	13,1
Troll A	SN76931	07.01.2020	19,5	14,8
Troll A	SN76931	08.01.2020	17,5	16,1
Troll A	SN76931	09.01.2020	10,3	5,7
Troll A	SN76931	10.01.2020	18	7,9
Troll A	SN76931	11.01.2020	20,6	15,7
Troll A	SN76931	12.01.2020	15,4	13
Troll A	SN76931	13.01.2020	21,1	16
Troll A	SN76931	14.01.2020	25,2	15,7
Troll A	SN76931	15.01.2020	17,5	14
Troll A	SN76931	16.01.2020	18,5	14,7
Troll A	SN76931	17.01.2020	19	13
Troll A	SN76931	18.01.2020	17,5	12,7
Troll A	SN76931	19.01.2020	15,4	9,8
Troll A	SN76931	20.01.2020	13,9	12,6
Troll A	SN76931	21.01.2020	14,9	9,7
Troll A	SN76931	22.01.2020	10,3	6,7
Troll A	SN76931	23.01.2020	13,9	12
Troll A	SN76931	24.01.2020	11,8	10,2

Source: (Norsk Klima Service Senter, n.d.)

33. The data of wind speed at Troll A (Page 4)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Troll A	SN76931	25.01.2020	12,9	10,5
Troll A	SN76931	26.01.2020	14,4	12,7
Troll A	SN76931	27.01.2020	14,1	12,9
Troll A	SN76931	28.01.2020	11,4	6,8
Troll A	SN76931	29.01.2020	5,7	3
Troll A	SN76931	30.01.2020	17	10,5
Troll A	SN76931	31.01.2020	14,4	11,4
Troll A	SN76931	01.02.2020	14,4	10,6
Troll A	SN76931	02.02.2020	11,8	6,9
Troll A	SN76931	03.02.2020	13,4	8,7
Troll A	SN76931	04.02.2020	12,3	6,9
Troll A	SN76931	05.02.2020	11,8	10,5
Troll A	SN76931	06.02.2020	9,3	6
Troll A	SN76931	07.02.2020	17	10,3
Troll A	SN76931	08.02.2020	21,6	18,1
Troll A	SN76931	09.02.2020	23,1	14,1
Troll A	SN76931	10.02.2020	17	12,2
Troll A	SN76931	11.02.2020	14,4	11,7
Troll A	SN76931	12.02.2020	13,9	11,9
Troll A	SN76931	13.02.2020	8,2	6,4
Troll A	SN76931	14.02.2020	21,1	12,2
Troll A	SN76931	15.02.2020	20,6	14,9
Troll A	SN76931	16.02.2020	19,5	16,2
Troll A	SN76931	17.02.2020	22,1	16,7
Troll A	SN76931	18.02.2020	15,9	12,2
Troll A	SN76931	19.02.2020	12,9	7,5
Troll A	SN76931	20.02.2020	18,5	12,4
Troll A	SN76931	21.02.2020	20,6	16,5
Troll A	SN76931	22.02.2020	18,5	14,1
Troll A	SN76931	23.02.2020	11,3	7,2
Troll A	SN76931	24.02.2020	9,4	6,3
Troll A	SN76931	25.02.2020	10,8	5,5
Troll A	SN76931	26.02.2020	17	11,2
Troll A	SN76931	27.02.2020	14,9	9,4
Troll A	SN76931	28.02.2020	8,7	5,8
Troll A	SN76931	29.02.2020	16,5	11,8
Troll A	SN76931	01.03.2020	12,9	10
Troll A	SN76931	02.03.2020	13,9	11,1
Troll A	SN76931	03.03.2020	11,8	10,1
Troll A	SN76931	04.03.2020	7,7	5,7
Troll A	SN76931	05.03.2020	9,8	6,2
Troll A	SN76931	06.03.2020	7,2	5,5
Troll A	SN76931	07.03.2020	19	14,9
Troll A	SN76931	08.03.2020	15,4	12,6
Troll A	SN76931	09.03.2020	10,3	8,7
Troll A	SN76931	10.03.2020	16,5	13,8
Troll A	SN76931	11.03.2020	20,1	14,5
Troll A	SN76931	12.03.2020	18,5	11,4
Troll A	SN76931	13.03.2020	17,5	10,8
Troll A	SN76931	14.03.2020	20,6	13,6
Troll A	SN76931	15.03.2020	16,5	10,1
Troll A	SN76931	16.03.2020	18	9,8
Troll A	SN76931	17.03.2020	15,4	14
Troll A	SN76931	18.03.2020	15,4	12,3
Troll A	SN76931	19.03.2020	11,3	7,5
Troll A	SN76931	20.03.2020	9,8	6
Troll A	SN76931	21.03.2020	10,8	5,1
Troll A	SN76931	22.03.2020	15,9	14,6
Troll A	SN76931	23.03.2020	23,1	20,2
Troll A	SN76931	24.03.2020	21,1	18,2
Troll A	SN76931	25.03.2020	15,9	7,5
Troll A	SN76931	26.03.2020	3,6	2,9

Source: (Norsk Klima Service Senter, n.d.)

34. The data of wind speed at Troll A (Page 5)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Troll A	SN76931	27.03.2020	9,8	6
Troll A	SN76931	28.03.2020	15,9	11,6
Troll A	SN76931	29.03.2020	13,9	10,9
Troll A	SN76931	30.03.2020	13,9	6,7
Troll A	SN76931	31.03.2020	7,2	6,2
Troll A	SN76931	01.04.2020	13,4	10
Troll A	SN76931	02.04.2020	23,1	16,6
Troll A	SN76931	03.04.2020	14,9	9
Troll A	SN76931	04.04.2020	11,8	6,2
Troll A	SN76931	05.04.2020	17,5	13,7
Troll A	SN76931	06.04.2020	20,1	15,6
Troll A	SN76931	07.04.2020	12,9	9,8
Troll A	SN76931	08.04.2020	13,4	9,1
Troll A	SN76931	09.04.2020	10,8	6,5
Troll A	SN76931	10.04.2020	5,1	3,1
Troll A	SN76931	11.04.2020	14,4	10
Troll A	SN76931	12.04.2020	17	14,3
Troll A	SN76931	13.04.2020	15,9	13,1
Troll A	SN76931	14.04.2020	11,3	9,3
Troll A	SN76931	15.04.2020	13,9	11,4
Troll A	SN76931	16.04.2020	9,8	8,3
Troll A	SN76931	17.04.2020	9,8	7,7
Troll A	SN76931	18.04.2020	8,7	5,8
Troll A	SN76931	19.04.2020	4,1	1,9
Troll A	SN76931	20.04.2020	4,1	3,6
Troll A	SN76931	21.04.2020	4,1	2,4
Troll A	SN76931	22.04.2020	5,1	3,8
Troll A	SN76931	23.04.2020	9,3	6,6
Troll A	SN76931	24.04.2020	12,3	10,9
Troll A	SN76931	25.04.2020	11,8	9,7
Troll A	SN76931	26.04.2020	6,7	2,8
Troll A	SN76931	27.04.2020	7,2	3,9
Troll A	SN76931	28.04.2020	3,6	2,2
Troll A	SN76931	29.04.2020	11,3	6
Troll A	SN76931	30.04.2020	10,8	6,3
Troll A	SN76931	01.05.2020	6,7	4,1
Troll A	SN76931	02.05.2020	7,2	4,7
Troll A	SN76931	03.05.2020	7,7	6,3
Troll A	SN76931	04.05.2020	6,7	6,1
Troll A	SN76931	05.05.2020	7,7	5,5
Troll A	SN76931	06.05.2020	8,2	6,4
Troll A	SN76931	07.05.2020	6,2	4,4
Troll A	SN76931	08.05.2020	7,7	5,4
Troll A	SN76931	09.05.2020	8,2	5,5
Troll A	SN76931	10.05.2020	14,4	12,2
Troll A	SN76931	11.05.2020	11,8	9,8
Troll A	SN76931	12.05.2020	14,4	10,5
Troll A	SN76931	13.05.2020	9,3	6,2
Troll A	SN76931	14.05.2020	8,7	3,5
Troll A	SN76931	15.05.2020	11,3	7,1
Troll A	SN76931	16.05.2020	16,5	12,7
Troll A	SN76931	17.05.2020	11,8	8,8
Troll A	SN76931	18.05.2020	4,6	2,9
Troll A	SN76931	19.05.2020	5,1	3,6
Troll A	SN76931	20.05.2020	5,1	2,5
Troll A	SN76931	21.05.2020	10,8	9,3
Troll A	SN76931	22.05.2020	17,5	13,4
Troll A	SN76931	23.05.2020	14,9	13,9
Troll A	SN76931	24.05.2020	10,3	8,2
Troll A	SN76931	25.05.2020	9,3	5,5
Troll A	SN76931	26.05.2020	11,3	7,4
Troll A	SN76931	27.05.2020	8,2	6,5

Source: (Norsk Klima Service Senter, n.d.)

35. The data of wind speed at Troll A (Page 6)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Troll A	SN76931	28.05.2020	4,1	2,6
Troll A	SN76931	29.05.2020	2,1	1,4
Troll A	SN76931	30.05.2020	6,7	2,6
Troll A	SN76931	31.05.2020	8,7	5
Troll A	SN76931	01.06.2020	5,1	3,3
Troll A	SN76931	02.06.2020	8,2	3,4
Troll A	SN76931	03.06.2020	13,9	12,6
Troll A	SN76931	04.06.2020	11,8	5,5
Troll A	SN76931	05.06.2020	11,8	8
Troll A	SN76931	06.06.2020	7,2	4,9
Troll A	SN76931	07.06.2020	13,9	12,5
Troll A	SN76931	08.06.2020	13,9	12,5
Troll A	SN76931	09.06.2020	11,3	7,5
Troll A	SN76931	10.06.2020	5,7	3
Troll A	SN76931	11.06.2020	9,8	6,4
Troll A	SN76931	12.06.2020	9,3	4,6
Troll A	SN76931	13.06.2020	11,3	5,9
Troll A	SN76931	14.06.2020	9,3	4,8
Troll A	SN76931	15.06.2020	10,3	7,5
Troll A	SN76931	16.06.2020	5,7	3
Troll A	SN76931	17.06.2020	5,7	4,7
Troll A	SN76931	18.06.2020	7,2	5,8
Troll A	SN76931	19.06.2020	5,7	3,3
Troll A	SN76931	20.06.2020	3,6	2,7
Troll A	SN76931	21.06.2020	8,2	5,2
Troll A	SN76931	22.06.2020	9,3	6,6
Troll A	SN76931	23.06.2020	12,9	9,3
Troll A	SN76931	24.06.2020	11,3	9,8
Troll A	SN76931	25.06.2020	4,6	3,8
Troll A	SN76931	26.06.2020	9,3	7,1
Troll A	SN76931	27.06.2020	9,8	6,7
Troll A	SN76931	28.06.2020	11,8	9,7
Troll A	SN76931	29.06.2020	12,3	8,4
Troll A	SN76931	30.06.2020	12,9	7,5
Troll A	SN76931	01.07.2020	12,3	10,6
Troll A	SN76931	02.07.2020	7,7	6,4
Troll A	SN76931	03.07.2020	6,7	3,5
Troll A	SN76931	04.07.2020	4,6	2,5
Troll A	SN76931	05.07.2020	11,3	7,8
Troll A	SN76931	06.07.2020	18,5	13,1
Troll A	SN76931	07.07.2020	8,7	7,1
Troll A	SN76931	08.07.2020	9,8	7,2
Troll A	SN76931	09.07.2020	5,1	4,5
Troll A	SN76931	10.07.2020	6,7	4,8
Troll A	SN76931	11.07.2020	8,2	5,8
Troll A	SN76931	12.07.2020	8,7	6
Troll A	SN76931	13.07.2020	9,3	6,1
Troll A	SN76931	14.07.2020	4,1	2,3
Troll A	SN76931	15.07.2020	3,6	1,3
Troll A	SN76931	16.07.2020	10,3	7,1
Troll A	SN76931	17.07.2020	12,3	8,3
Troll A	SN76931	18.07.2020	8,7	7,1
Troll A	SN76931	19.07.2020	8,2	6,2
Troll A	SN76931	20.07.2020	7,7	5,7
Troll A	SN76931	21.07.2020	7,2	5,3
Troll A	SN76931	22.07.2020	5,1	2,5
Troll A	SN76931	23.07.2020	5,1	3,5
Data valid for 23.07.2020 (CC BY 4.0), The Norwegian Meteorological Institute (MET Norway)				

Source: (Norsk Klima Service Senter, n.d.)

36. The data of wind speed at Heidrun (Page 1)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Heidrun	SN76928	23.07.2019	9,3	5,9
Heidrun	SN76928	24.07.2019	8,7	6,2
Heidrun	SN76928	25.07.2019	8,7	6,2
Heidrun	SN76928	26.07.2019	7,7	5,2
Heidrun	SN76928	27.07.2019	13,9	6,9
Heidrun	SN76928	28.07.2019	17,5	12,5
Heidrun	SN76928	29.07.2019	12,9	11,9
Heidrun	SN76928	30.07.2019	11,8	10,5
Heidrun	SN76928	31.07.2019	11,8	10
Heidrun	SN76928	01.08.2019	7,7	5,7
Heidrun	SN76928	02.08.2019	5,7	4,8
Heidrun	SN76928	03.08.2019	4,6	3,2
Heidrun	SN76928	04.08.2019	3,6	2,8
Heidrun	SN76928	05.08.2019	4,1	3,3
Heidrun	SN76928	06.08.2019	5,1	3,6
Heidrun	SN76928	07.08.2019	6,7	3,7
Heidrun	SN76928	08.08.2019	4,1	3,3
Heidrun	SN76928	09.08.2019	3,6	2,9
Heidrun	SN76928	10.08.2019	9,8	7,7
Heidrun	SN76928	11.08.2019	7,2	4,2
Heidrun	SN76928	12.08.2019	9,3	8,5
Heidrun	SN76928	13.08.2019	9,8	7,9
Heidrun	SN76928	14.08.2019	10,3	6,2
Heidrun	SN76928	15.08.2019	6,2	3,9
Heidrun	SN76928	16.08.2019	11,8	8,7
Heidrun	SN76928	17.08.2019	9,3	7
Heidrun	SN76928	18.08.2019	9,8	7,4
Heidrun	SN76928	19.08.2019	7,7	5,2
Heidrun	SN76928	20.08.2019	11,3	9,1
Heidrun	SN76928	21.08.2019	10,3	6,2
Heidrun	SN76928	22.08.2019	8,2	6
Heidrun	SN76928	23.08.2019	5,7	3,8
Heidrun	SN76928	24.08.2019	12,3	6,6
Heidrun	SN76928	25.08.2019	14,4	11,1
Heidrun	SN76928	26.08.2019	10,8	8,5
Heidrun	SN76928	27.08.2019	9,3	6,4
Heidrun	SN76928	28.08.2019	8,2	5,7
Heidrun	SN76928	29.08.2019	8,7	7,3
Heidrun	SN76928	30.08.2019	13,4	9,4
Heidrun	SN76928	31.08.2019	9,9	8,1
Heidrun	SN76928	01.09.2019	15,4	12,8
Heidrun	SN76928	02.09.2019	11,3	10,4
Heidrun	SN76928	03.09.2019	12,9	11,4
Heidrun	SN76928	04.09.2019	12,3	5,8
Heidrun	SN76928	05.09.2019	8,7	7,1
Heidrun	SN76928	06.09.2019	5,7	3,4
Heidrun	SN76928	07.09.2019	3,6	2,8
Heidrun	SN76928	08.09.2019	7,7	5,8
Heidrun	SN76928	09.09.2019	6,2	4,3
Heidrun	SN76928	10.09.2019	8,7	5,8
Heidrun	SN76928	11.09.2019	13,4	9,4
Heidrun	SN76928	12.09.2019	12,9	9,3
Heidrun	SN76928	13.09.2019	9,3	5,7
Heidrun	SN76928	14.09.2019	12,9	6,4
Heidrun	SN76928	15.09.2019	11,8	5,5
Heidrun	SN76928	16.09.2019	7,2	6,1
Heidrun	SN76928	17.09.2019	8,7	6,8
Heidrun	SN76928	18.09.2019	7,7	6,8
Heidrun	SN76928	19.09.2019	8,2	5,2
Heidrun	SN76928	20.09.2019	11,8	9,8
Heidrun	SN76928	21.09.2019	11,8	8,9
Heidrun	SN76928	22.09.2019	9,8	7,1

Source: (Norsk Klima Service Senter, n.d.)

37. The data of wind speed at Heidrun (Page 2)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Heidrun	SN76928	23.09.2019	8,7	6,6
Heidrun	SN76928	24.09.2019	5,7	5,6
Heidrun	SN76928	25.09.2019	7,7	6,3
Heidrun	SN76928	26.09.2019	9,3	6,4
Heidrun	SN76928	27.09.2019	10,8	9,3
Heidrun	SN76928	28.09.2019	10,8	8
Heidrun	SN76928	29.09.2019	10,3	8,7
Heidrun	SN76928	30.09.2019	14,4	6,2
Heidrun	SN76928	01.10.2019	10	7,1
Heidrun	SN76928	02.10.2019	13	10,9
Heidrun	SN76928	03.10.2019	12,4	10,4
Heidrun	SN76928	04.10.2019	8,5	7,8
Heidrun	SN76928	05.10.2019	7,6	6,7
Heidrun	SN76928	06.10.2019	5,4	3,5
Heidrun	SN76928	07.10.2019	7,2	4,1
Heidrun	SN76928	08.10.2019	6,7	5,5
Heidrun	SN76928	09.10.2019	8,2	6,8
Heidrun	SN76928	10.10.2019	6,7	6
Heidrun	SN76928	11.10.2019	6,2	4,9
Heidrun	SN76928	12.10.2019	7,2	5,5
Heidrun	SN76928	13.10.2019	6,2	2,9
Heidrun	SN76928	14.10.2019	3,1	2
Heidrun	SN76928	15.10.2019	6,7	3,5
Heidrun	SN76928	16.10.2019	11,8	10,3
Heidrun	SN76928	17.10.2019	8,7	5,3
Heidrun	SN76928	18.10.2019	12,3	5,5
Heidrun	SN76928	19.10.2019	13,4	12,2
Heidrun	SN76928	20.10.2019	7,7	5,5
Heidrun	SN76928	21.10.2019	18,5	10,5
Heidrun	SN76928	22.10.2019	22,1	18,1
Heidrun	SN76928	23.10.2019	8,7	5,2
Heidrun	SN76928	24.10.2019	15,4	11,8
Heidrun	SN76928	25.10.2019	8,2	6
Heidrun	SN76928	26.10.2019	7,7	3,5
Heidrun	SN76928	27.10.2019	10,8	8,1
Heidrun	SN76928	28.10.2019	10,8	8,1
Heidrun	SN76928	29.10.2019	9,3	6,9
Heidrun	SN76928	30.10.2019	12,9	11,5
Heidrun	SN76928	31.10.2019	9,3	5,4
Heidrun	SN76928	01.11.2019	5,7	4,1
Heidrun	SN76928	02.11.2019	10,8	8,7
Heidrun	SN76928	03.11.2019	7,7	5,6
Heidrun	SN76928	04.11.2019	6,7	4,6
Heidrun	SN76928	05.11.2019	10,8	7,3
Heidrun	SN76928	06.11.2019	9,3	7,4
Heidrun	SN76928	07.11.2019	6,7	5,5
Heidrun	SN76928	08.11.2019	6,7	3,9
Heidrun	SN76928	09.11.2019	5,7	4,3
Heidrun	SN76928	10.11.2019	9,3	7,4
Heidrun	SN76928	11.11.2019	8,7	6,9
Heidrun	SN76928	12.11.2019	6,2	5
Heidrun	SN76928	13.11.2019	8,2	5,8
Heidrun	SN76928	14.11.2019	9,3	7,8
Heidrun	SN76928	15.11.2019	10,8	7,3
Heidrun	SN76928	16.11.2019	5,1	3
Heidrun	SN76928	17.11.2019	6,7	4,3
Heidrun	SN76928	18.11.2019	6,7	4
Heidrun	SN76928	19.11.2019	7,7	5,7
Heidrun	SN76928	20.11.2019	13,4	10
Heidrun	SN76928	21.11.2019	6,7	4,4
Heidrun	SN76928	22.11.2019	8,2	5,7
Heidrun	SN76928	23.11.2019	9,8	6,1

Source: (Norsk Klima Service Senter, n.d.)

38. The data of wind speed at Heidrun (Page 2)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Heidrun	SN76928	24.11.2019	5,1	2,6
Heidrun	SN76928	25.11.2019	3,6	2,6
Heidrun	SN76928	26.11.2019	9,3	7,3
Heidrun	SN76928	27.11.2019	7,2	6,1
Heidrun	SN76928	28.11.2019	14,9	8,5
Heidrun	SN76928	29.11.2019	18	12,3
Heidrun	SN76928	30.11.2019	13,9	11,2
Heidrun	SN76928	01.12.2019	14,4	10,3
Heidrun	SN76928	02.12.2019	12,3	8,5
Heidrun	SN76928	03.12.2019	13,9	12,2
Heidrun	SN76928	04.12.2019	15,9	14,7
Heidrun	SN76928	05.12.2019	15,4	11,9
Heidrun	SN76928	06.12.2019	14,4	12,2
Heidrun	SN76928	07.12.2019	10,3	9,2
Heidrun	SN76928	08.12.2019	12,9	9,5
Heidrun	SN76928	09.12.2019	15,9	12,1
Heidrun	SN76928	10.12.2019	15,9	9,1
Heidrun	SN76928	11.12.2019	18,5	14,2
Heidrun	SN76928	12.12.2019	23,1	16,5
Heidrun	SN76928	13.12.2019	11,8	8,8
Heidrun	SN76928	14.12.2019	12,9	10,6
Heidrun	SN76928	15.12.2019	11,8	9
Heidrun	SN76928	16.12.2019	4,6	3,1
Heidrun	SN76928	17.12.2019	5,1	3,2
Heidrun	SN76928	18.12.2019	6,2	5
Heidrun	SN76928	19.12.2019	6,2	4,3
Heidrun	SN76928	20.12.2019	11,8	9,9
Heidrun	SN76928	21.12.2019	12,9	8,2
Heidrun	SN76928	22.12.2019	3,1	1,6
Heidrun	SN76928	23.12.2019	5,1	3,8
Heidrun	SN76928	24.12.2019	6,7	5,4
Heidrun	SN76928	25.12.2019	6,7	5,7
Heidrun	SN76928	26.12.2019	6,2	3,4
Heidrun	SN76928	27.12.2019	13,9	7,5
Heidrun	SN76928	28.12.2019	19	16,4
Heidrun	SN76928	29.12.2019	16,5	13,3
Heidrun	SN76928	30.12.2019	17	14,9
Heidrun	SN76928	31.12.2019	16,5	13,9
Heidrun	SN76928	01.01.2020	18,5	16,5
Heidrun	SN76928	02.01.2020	22,1	16,3
Heidrun	SN76928	03.01.2020	25,2	19,1
Heidrun	SN76928	04.01.2020	18	12,5
Heidrun	SN76928	05.01.2020	17,5	12
Heidrun	SN76928	06.01.2020	18,5	13,1
Heidrun	SN76928	07.01.2020	20,6	16
Heidrun	SN76928	08.01.2020	20,1	17,9
Heidrun	SN76928	09.01.2020	18	12,5
Heidrun	SN76928	10.01.2020	13,9	9,1
Heidrun	SN76928	11.01.2020	20,1	17,4
Heidrun	SN76928	12.01.2020	17	12,2
Heidrun	SN76928	13.01.2020	14,9	10,3
Heidrun	SN76928	14.01.2020	12,3	10,8
Heidrun	SN76928	15.01.2020	17,5	8,7
Heidrun	SN76928	16.01.2020	15,4	13,6
Heidrun	SN76928	17.01.2020	10,8	7,3
Heidrun	SN76928	18.01.2020	15,9	10,3
Heidrun	SN76928	19.01.2020	17,5	13,8
Heidrun	SN76928	20.01.2020	19,5	16
Heidrun	SN76928	21.01.2020	19	17,2
Heidrun	SN76928	22.01.2020	15,9	11,1
Heidrun	SN76928	23.01.2020	17	13,8
Heidrun	SN76928	24.01.2020	14,9	13,4

Source: (Norsk Klima Service Senter, n.d.)

39. The data of wind speed at Heidrun (Page 3)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Heidrun	SN76928	25.01.2020	10,8	6,6
Heidrun	SN76928	26.01.2020	11,3	7,7
Heidrun	SN76928	27.01.2020	11,8	7,7
Heidrun	SN76928	28.01.2020	7,7	6
Heidrun	SN76928	29.01.2020	11,8	9,8
Heidrun	SN76928	30.01.2020	7,7	5,5
Heidrun	SN76928	31.01.2020	18	12,7
Heidrun	SN76928	01.02.2020	13,9	12,3
Heidrun	SN76928	02.02.2020	13,4	10,7
Heidrun	SN76928	03.02.2020	6,7	3,5
Heidrun	SN76928	04.02.2020	15,4	9,3
Heidrun	SN76928	05.02.2020	10,8	6,3
Heidrun	SN76928	06.02.2020	10,3	5,9
Heidrun	SN76928	07.02.2020	12,3	10,9
Heidrun	SN76928	08.02.2020	12,9	10
Heidrun	SN76928	09.02.2020	15,9	9,4
Heidrun	SN76928	10.02.2020	13,9	9
Heidrun	SN76928	11.02.2020	7,2	3,7
Heidrun	SN76928	12.02.2020	7,7	5,4
Heidrun	SN76928	13.02.2020	10,8	8,2
Heidrun	SN76928	14.02.2020	13,4	7,3
Heidrun	SN76928	15.02.2020	14,4	10
Heidrun	SN76928	16.02.2020	15,9	11,5
Heidrun	SN76928	17.02.2020	11,3	9,2
Heidrun	SN76928	18.02.2020	10,8	7,1
Heidrun	SN76928	19.02.2020	8,7	5,6
Heidrun	SN76928	20.02.2020	14,9	10,4
Heidrun	SN76928	21.02.2020	18	15,6
Heidrun	SN76928	22.02.2020	19	14,3
Heidrun	SN76928	23.02.2020	11,9	10,8
Heidrun	SN76928	24.02.2020	9,8	7,9
Heidrun	SN76928	25.02.2020	8,2	4,9
Heidrun	SN76928	26.02.2020	10,3	8,8
Heidrun	SN76928	27.02.2020	11,3	8,4
Heidrun	SN76928	28.02.2020	14,4	7,9
Heidrun	SN76928	29.02.2020	10,3	7,9
Heidrun	SN76928	01.03.2020	17	14,6
Heidrun	SN76928	02.03.2020	18,5	17
Heidrun	SN76928	03.03.2020	15,4	13,8
Heidrun	SN76928	04.03.2020	12,3	9,3
Heidrun	SN76928	05.03.2020	4,6	3,7
Heidrun	SN76928	06.03.2020	7,7	4,8
Heidrun	SN76928	07.03.2020	13,4	10,6
Heidrun	SN76928	08.03.2020	14,9	12,7
Heidrun	SN76928	09.03.2020	14,9	11,7
Heidrun	SN76928	10.03.2020	10,8	7,4
Heidrun	SN76928	11.03.2020	9,3	5,2
Heidrun	SN76928	12.03.2020	17,5	11,6
Heidrun	SN76928	13.03.2020	13,9	11,3
Heidrun	SN76928	14.03.2020	21,1	12,9
Heidrun	SN76928	15.03.2020	13,9	9,3
Heidrun	SN76928	16.03.2020	13,4	7,9
Heidrun	SN76928	17.03.2020	21,1	12,7
Heidrun	SN76928	18.03.2020	12,3	9,5
Heidrun	SN76928	19.03.2020	13,9	9
Heidrun	SN76928	20.03.2020	9,8	6,4
Heidrun	SN76928	21.03.2020	10,3	7,7
Heidrun	SN76928	22.03.2020	19,5	13
Heidrun	SN76928	23.03.2020	20,1	18,6
Heidrun	SN76928	24.03.2020	20,6	13,2
Heidrun	SN76928	25.03.2020	15,4	8,2
Heidrun	SN76928	26.03.2020	13,4	11,4

Source: (Norsk Klima Service Senter, n.d.)

40. The data of wind speed at Heidrun (Page 4)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Heidrun	SN76928	27.03.2020	15,4	10,8
Heidrun	SN76928	28.03.2020	16,5	12,7
Heidrun	SN76928	29.03.2020	11,8	8,1
Heidrun	SN76928	30.03.2020	17	8,4
Heidrun	SN76928	31.03.2020	18	14,3
Heidrun	SN76928	01.04.2020	15,4	7,7
Heidrun	SN76928	02.04.2020	18,5	11,5
Heidrun	SN76928	03.04.2020	13,9	10,4
Heidrun	SN76928	04.04.2020	10,8	8,6
Heidrun	SN76928	05.04.2020	10,3	7,1
Heidrun	SN76928	06.04.2020	14,4	12,9
Heidrun	SN76928	07.04.2020	15,9	12,3
Heidrun	SN76928	08.04.2020	19	14,4
Heidrun	SN76928	09.04.2020	9,8	7
Heidrun	SN76928	10.04.2020	9,3	7,3
Heidrun	SN76928	11.04.2020	9,8	6,4
Heidrun	SN76928	12.04.2020	22,1	14,3
Heidrun	SN76928	13.04.2020	18,5	12,5
Heidrun	SN76928	14.04.2020	14,4	10,5
Heidrun	SN76928	15.04.2020	15,4	9,3
Heidrun	SN76928	16.04.2020	14,4	11,8
Heidrun	SN76928	17.04.2020	10,3	7
Heidrun	SN76928	18.04.2020	5,7	4,1
Heidrun	SN76928	19.04.2020	5,1	3,9
Heidrun	SN76928	20.04.2020	4,6	2,6
Heidrun	SN76928	21.04.2020	2,1	1,3
Heidrun	SN76928	22.04.2020	3,1	1,5
Heidrun	SN76928	23.04.2020	8,2	6,9
Heidrun	SN76928	24.04.2020	6,7	5,8
Heidrun	SN76928	25.04.2020	6,7	5
Heidrun	SN76928	26.04.2020	9,8	7
Heidrun	SN76928	27.04.2020	12,3	10,7
Heidrun	SN76928	28.04.2020	8,7	6
Heidrun	SN76928	29.04.2020	4,1	2,8
Heidrun	SN76928	30.04.2020	8,2	5
Heidrun	SN76928	01.05.2020	9,8	8,9
Heidrun	SN76928	02.05.2020	9,8	7,5
Heidrun	SN76928	03.05.2020	9,3	7,7
Heidrun	SN76928	04.05.2020	7,2	5,5
Heidrun	SN76928	05.05.2020	15,9	13,1
Heidrun	SN76928	06.05.2020	12,3	10
Heidrun	SN76928	07.05.2020	5,7	2,6
Heidrun	SN76928	08.05.2020	7,2	5,4
Heidrun	SN76928	09.05.2020	8,2	5,2
Heidrun	SN76928	10.05.2020	7,2	5,8
Heidrun	SN76928	11.05.2020	10,8	8,4
Heidrun	SN76928	12.05.2020	10,3	8,5
Heidrun	SN76928	13.05.2020	9,8	6,9
Heidrun	SN76928	14.05.2020	7,2	5
Heidrun	SN76928	15.05.2020	10,8	8,7
Heidrun	SN76928	16.05.2020	12,3	6,7
Heidrun	SN76928	17.05.2020	10,3	8
Heidrun	SN76928	18.05.2020	6,2	4,7
Heidrun	SN76928	19.05.2020	6,7	4,8
Heidrun	SN76928	20.05.2020	4,1	2,6
Heidrun	SN76928	21.05.2020	7,2	5,7
Heidrun	SN76928	22.05.2020	12,9	8,1
Heidrun	SN76928	23.05.2020	10,8	7,7
Heidrun	SN76928	24.05.2020	10,3	6,7
Heidrun	SN76928	25.05.2020	11,8	7,8
Heidrun	SN76928	26.05.2020	12,9	10,7
Heidrun	SN76928	27.05.2020	11,8	8,7

Source: (Norsk Klima Service Senter, n.d.)

41. The data of wind speed at Heidrun (Page 5)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Heidrun	SN76928	28.05.2020	11,3	10,2
Heidrun	SN76928	29.05.2020	9,3	5,7
Heidrun	SN76928	30.05.2020	5,7	3,8
Heidrun	SN76928	31.05.2020	6,7	5,2
Heidrun	SN76928	01.06.2020	8,2	5,5
Heidrun	SN76928	02.06.2020	7,2	5,2
Heidrun	SN76928	03.06.2020	9,3	5,8
Heidrun	SN76928	04.06.2020	10,8	8,6
Heidrun	SN76928	05.06.2020	12,3	10,7
Heidrun	SN76928	06.06.2020	8,7	6,8
Heidrun	SN76928	07.06.2020	10,8	8,4
Heidrun	SN76928	08.06.2020	10,8	6,7
Heidrun	SN76928	09.06.2020	6,7	3,5
Heidrun	SN76928	10.06.2020	8,2	7,1
Heidrun	SN76928	11.06.2020	7,7	7
Heidrun	SN76928	12.06.2020	7,2	6,6
Heidrun	SN76928	13.06.2020	5,7	3,3
Heidrun	SN76928	14.06.2020	5,7	4,2
Heidrun	SN76928	15.06.2020	6,7	4,1
Heidrun	SN76928	16.06.2020	5,7	4,2
Heidrun	SN76928	17.06.2020	7,2	6,2
Heidrun	SN76928	18.06.2020	8,7	7,5
Heidrun	SN76928	19.06.2020	9,3	7,9
Heidrun	SN76928	20.06.2020	9,8	5,9
Heidrun	SN76928	21.06.2020	9,3	5,5
Heidrun	SN76928	22.06.2020	6,2	4,2
Heidrun	SN76928	23.06.2020	9,8	6,6
Heidrun	SN76928	24.06.2020	10,3	6,2
Heidrun	SN76928	25.06.2020	7,7	5,8
Heidrun	SN76928	26.06.2020	8,7	5,2
Heidrun	SN76928	27.06.2020	11,8	9,4
Heidrun	SN76928	28.06.2020	13,9	10,8
Heidrun	SN76928	29.06.2020	11,8	7,3
Heidrun	SN76928	30.06.2020	12,3	10,9
Heidrun	SN76928	01.07.2020	8,7	5,8
Heidrun	SN76928	02.07.2020	5,7	3
Heidrun	SN76928	03.07.2020	3,1	2,1
Heidrun	SN76928	04.07.2020	2,6	1,2
Heidrun	SN76928	05.07.2020	13,4	8,6
Heidrun	SN76928	06.07.2020	12,9	9,3
Heidrun	SN76928	07.07.2020	5,7	3,9
Heidrun	SN76928	08.07.2020	7,7	5,2
Heidrun	SN76928	09.07.2020	8,7	7,1
Heidrun	SN76928	10.07.2020	8,2	6,7
Heidrun	SN76928	11.07.2020	8,2	7,6
Heidrun	SN76928	12.07.2020	8,7	5,3
Heidrun	SN76928	13.07.2020	4,1	2,3
Heidrun	SN76928	14.07.2020	6,2	5,3
Heidrun	SN76928	15.07.2020	6,2	4
Heidrun	SN76928	16.07.2020	10,8	4,5
Heidrun	SN76928	17.07.2020	14,4	8,4
Heidrun	SN76928	18.07.2020	9,2	7,8
Heidrun	SN76928	19.07.2020	9,8	8,6
Heidrun	SN76928	20.07.2020	6,7	6,1
Heidrun	SN76928	21.07.2020	7,7	5,2
Heidrun	SN76928	22.07.2020	7,2	4,8
Heidrun	SN76928	23.07.2020	7,7	6,8
Data valid for 23.07.2020 (CC BY 4.0), The Norwegian Meteorological Institute (MET Norway)				

Source: (Norsk Klima Service Senter, n.d.)

42. The data of wind speed at Heidrun (Page 6)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Aasta Hansteen	SN77040	10.10.2019	5,7	4,9
Aasta Hansteen	SN77040	11.10.2019	6,7	5,7
Aasta Hansteen	SN77040	12.10.2019	6,7	5,7
Aasta Hansteen	SN77040	13.10.2019	5,1	4
Aasta Hansteen	SN77040	14.10.2019	5,1	3,2
Aasta Hansteen	SN77040	15.10.2019	6,2	4,7
Aasta Hansteen	SN77040	16.10.2019	9,8	6,7
Aasta Hansteen	SN77040	17.10.2019	9,3	7,5
Aasta Hansteen	SN77040	18.10.2019	10,8	9,7
Aasta Hansteen	SN77040	19.10.2019	12	8,7
Aasta Hansteen	SN77040	20.10.2019	6,7	3,5
Aasta Hansteen	SN77040	21.10.2019	15,4	8,7
Aasta Hansteen	SN77040	22.10.2019	18,5	14,2
Aasta Hansteen	SN77040	23.10.2019	9,8	6,5
Aasta Hansteen	SN77040	24.10.2019	13,4	9,4
Aasta Hansteen	SN77040	25.10.2019	13,4	11,1
Aasta Hansteen	SN77040	26.10.2019	12,3	10
Aasta Hansteen	SN77040	27.10.2019	8,2	7,4
Aasta Hansteen	SN77040	28.10.2019	11,3	9,1
Aasta Hansteen	SN77040	29.10.2019	9,8	5,9
Aasta Hansteen	SN77040	30.10.2019	14,9	12,2
Aasta Hansteen	SN77040	31.10.2019	12,9	8
Aasta Hansteen	SN77040	01.11.2019	8,7	4,8
Aasta Hansteen	SN77040	02.11.2019	9,3	8,1
Aasta Hansteen	SN77040	03.11.2019	9,3	5,4
Aasta Hansteen	SN77040	04.11.2019	7,7	5
Aasta Hansteen	SN77040	05.11.2019	8,2	6,5
Aasta Hansteen	SN77040	06.11.2019	8,7	7,1
Aasta Hansteen	SN77040	07.11.2019	7,2	6,1
Aasta Hansteen	SN77040	08.11.2019	7,7	5,3
Aasta Hansteen	SN77040	09.11.2019	9,8	6,8
Aasta Hansteen	SN77040	10.11.2019	8,2	7,2
Aasta Hansteen	SN77040	11.11.2019	8,7	7,6
Aasta Hansteen	SN77040	12.11.2019	6,7	5,3
Aasta Hansteen	SN77040	13.11.2019	9,3	7,9
Aasta Hansteen	SN77040	14.11.2019	9,8	5,6
Aasta Hansteen	SN77040	15.11.2019	6,2	3,1
Aasta Hansteen	SN77040	16.11.2019	5,1	3,1
Aasta Hansteen	SN77040	17.11.2019	6,2	4,6
Aasta Hansteen	SN77040	18.11.2019	7,4	3,8
Aasta Hansteen	SN77040	19.11.2019	12	10,7
Aasta Hansteen	SN77040	20.11.2019	13,9	10,4
Aasta Hansteen	SN77040	21.11.2019	11,3	6,7
Aasta Hansteen	SN77040	22.11.2019	7,2	6,2
Aasta Hansteen	SN77040	23.11.2019	7,2	6,1
Aasta Hansteen	SN77040	24.11.2019	4,6	3,7
Aasta Hansteen	SN77040	25.11.2019	3,1	2,3
Aasta Hansteen	SN77040	26.11.2019	7,2	6,1
Aasta Hansteen	SN77040	27.11.2019	3,6	2,3
Aasta Hansteen	SN77040	28.11.2019	11,8	9,4
Aasta Hansteen	SN77040	29.11.2019	14,9	12,1
Aasta Hansteen	SN77040	30.11.2019	14,9	12,6
Aasta Hansteen	SN77040	01.12.2019	14,4	11,5
Aasta Hansteen	SN77040	02.12.2019	11,8	9,1
Aasta Hansteen	SN77040	03.12.2019	17,5	11,8
Aasta Hansteen	SN77040	04.12.2019	16,5	14,9
Aasta Hansteen	SN77040	05.12.2019	14,9	11,9
Aasta Hansteen	SN77040	06.12.2019	15,9	14,1
Aasta Hansteen	SN77040	07.12.2019	14,9	8,7
Aasta Hansteen	SN77040	08.12.2019	8,7	7,1
Aasta Hansteen	SN77040	09.12.2019	15,4	11,4

Source: (Norsk Klima Service Senter, n.d.)

43. The data of wind speed at Aasta Hansteen (Page 1)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Aasta Hansteen	SN77040	10.12.2019	17,5	9,3
Aasta Hansteen	SN77040	11.12.2019	18	13,8
Aasta Hansteen	SN77040	12.12.2019	17,5	15,2
Aasta Hansteen	SN77040	13.12.2019	14,4	9,3
Aasta Hansteen	SN77040	14.12.2019	14,4	11,3
Aasta Hansteen	SN77040	15.12.2019	10,8	8,8
Aasta Hansteen	SN77040	16.12.2019	6,2	4,4
Aasta Hansteen	SN77040	17.12.2019	3,1	2,4
Aasta Hansteen	SN77040	18.12.2019	4,1	3
Aasta Hansteen	SN77040	19.12.2019	4,6	3
Aasta Hansteen	SN77040	20.12.2019	12,3	8,6
Aasta Hansteen	SN77040	21.12.2019	14,9	11,8
Aasta Hansteen	SN77040	22.12.2019	4,6	3,1
Aasta Hansteen	SN77040	23.12.2019	5,7	4,4
Aasta Hansteen	SN77040	24.12.2019	7,7	5,9
Aasta Hansteen	SN77040	25.12.2019	8,7	7,8
Aasta Hansteen	SN77040	26.12.2019	6,7	3,4
Aasta Hansteen	SN77040	27.12.2019	15,4	8,2
Aasta Hansteen	SN77040	28.12.2019	21,6	16,7
Aasta Hansteen	SN77040	29.12.2019	18,5	10,9
Aasta Hansteen	SN77040	30.12.2019	12,9	9,3
Aasta Hansteen	SN77040	31.12.2019	13,4	11,1
Aasta Hansteen	SN77040	01.01.2020	25,7	17,1
Aasta Hansteen	SN77040	02.01.2020	21,1	16,5
Aasta Hansteen	SN77040	03.01.2020	25,2	19,6
Aasta Hansteen	SN77040	04.01.2020	16,5	12,9
Aasta Hansteen	SN77040	05.01.2020	17,5	11,8
Aasta Hansteen	SN77040	06.01.2020	18	12,7
Aasta Hansteen	SN77040	07.01.2020	20,1	16,6
Aasta Hansteen	SN77040	08.01.2020	24,7	18,6
Aasta Hansteen	SN77040	09.01.2020	21,1	12,6
Aasta Hansteen	SN77040	10.01.2020	13,4	10
Aasta Hansteen	SN77040	11.01.2020	19,5	14,3
Aasta Hansteen	SN77040	12.01.2020	20,6	14,3
Aasta Hansteen	SN77040	13.01.2020	15,4	9
Aasta Hansteen	SN77040	14.01.2020	9,8	8,2
Aasta Hansteen	SN77040	15.01.2020	8,7	6,4
Aasta Hansteen	SN77040	16.01.2020	12,3	7,8
Aasta Hansteen	SN77040	17.01.2020	8,2	6,7
Aasta Hansteen	SN77040	18.01.2020	13,4	8,9
Aasta Hansteen	SN77040	19.01.2020	14,4	10,3
Aasta Hansteen	SN77040	20.01.2020	19	14,3
Aasta Hansteen	SN77040	21.01.2020	20,6	18,9
Aasta Hansteen	SN77040	22.01.2020	14,4	9,6
Aasta Hansteen	SN77040	23.01.2020	16,5	13,8
Aasta Hansteen	SN77040	24.01.2020	14,9	11,9
Aasta Hansteen	SN77040	25.01.2020	12,3	7,3
Aasta Hansteen	SN77040	26.01.2020	14,4	10,6
Aasta Hansteen	SN77040	27.01.2020	12,9	10,6
Aasta Hansteen	SN77040	28.01.2020	10,3	7,6
Aasta Hansteen	SN77040	29.01.2020	11,3	8,6
Aasta Hansteen	SN77040	30.01.2020	11,8	9,7
Aasta Hansteen	SN77040	31.01.2020	13,9	11
Aasta Hansteen	SN77040	01.02.2020	13,9	10,1
Aasta Hansteen	SN77040	02.02.2020	11,8	9,1
Aasta Hansteen	SN77040	03.02.2020	6,7	3,9
Aasta Hansteen	SN77040	04.02.2020	13,9	8,4
Aasta Hansteen	SN77040	05.02.2020	14,4	8,9
Aasta Hansteen	SN77040	06.02.2020	14,4	6,2
Aasta Hansteen	SN77040	07.02.2020	12,3	11,1
Aasta Hansteen	SN77040	08.02.2020	17	12,9
Aasta Hansteen	SN77040	09.02.2020	17,5	9,3
Aasta Hansteen	SN77040	10.02.2020	8,7	6,9

Source: (Norsk Klima Service Senter, n.d.)

44. The data of wind speed at Aasta Hansteen (Page 2)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Aasta Hansteen	SN77040	11.02.2020	5,7	4,3
Aasta Hansteen	SN77040	12.02.2020	12,6	9,5
Aasta Hansteen	SN77040	13.02.2020	13,7	9,8
Aasta Hansteen	SN77040	14.02.2020	13,8	8,7
Aasta Hansteen	SN77040	15.02.2020	17,9	13,5
Aasta Hansteen	SN77040	16.02.2020	22,6	15,2
Aasta Hansteen	SN77040	17.02.2020	10,8	8,2
Aasta Hansteen	SN77040	18.02.2020	16,7	13,1
Aasta Hansteen	SN77040	19.02.2020	11,7	6,7
Aasta Hansteen	SN77040	20.02.2020	21	14,7
Aasta Hansteen	SN77040	21.02.2020	22,9	17,5
Aasta Hansteen	SN77040	22.02.2020	15,9	12
Aasta Hansteen	SN77040	23.02.2020	19,7	16,5
Aasta Hansteen	SN77040	24.02.2020	16,2	11,6
Aasta Hansteen	SN77040	25.02.2020	14	9,1
Aasta Hansteen	SN77040	26.02.2020	12,4	11,2
Aasta Hansteen	SN77040	27.02.2020	16,7	13,8
Aasta Hansteen	SN77040	28.02.2020	16,6	13
Aasta Hansteen	SN77040	29.02.2020	15	12,5
Aasta Hansteen	SN77040	01.03.2020	20,5	16,4
Aasta Hansteen	SN77040	02.03.2020	19,9	19,2
Aasta Hansteen	SN77040	03.03.2020	18,5	17,7
Aasta Hansteen	SN77040	04.03.2020	16,8	15,4
Aasta Hansteen	SN77040	05.03.2020	10,8	6,7
Aasta Hansteen	SN77040	06.03.2020	10,3	6,6
Aasta Hansteen	SN77040	07.03.2020	15,5	10,9
Aasta Hansteen	SN77040	08.03.2020	17,1	15,6
Aasta Hansteen	SN77040	09.03.2020	19,5	15,7
Aasta Hansteen	SN77040	10.03.2020	15	12,2
Aasta Hansteen	SN77040	11.03.2020	19,1	13,6
Aasta Hansteen	SN77040	12.03.2020	21,2	18,1
Aasta Hansteen	SN77040	13.03.2020	18,6	15,7
Aasta Hansteen	SN77040	14.03.2020	23,1	14,4
Aasta Hansteen	SN77040	15.03.2020	17,4	11,8
Aasta Hansteen	SN77040	16.03.2020	19,1	13,6
Aasta Hansteen	SN77040	17.03.2020	19	16
Aasta Hansteen	SN77040	18.03.2020	18	8,9
Aasta Hansteen	SN77040	19.03.2020	17,4	12,2
Aasta Hansteen	SN77040	20.03.2020	18,8	11,5
Aasta Hansteen	SN77040	21.03.2020	16,3	12,8
Aasta Hansteen	SN77040	22.03.2020	21,6	18,2
Aasta Hansteen	SN77040	23.03.2020	21,8	18,6
Aasta Hansteen	SN77040	24.03.2020	19,2	16,7
Aasta Hansteen	SN77040	25.03.2020	13,9	10,5
Aasta Hansteen	SN77040	26.03.2020	18,2	16,5
Aasta Hansteen	SN77040	27.03.2020	17,8	14,8
Aasta Hansteen	SN77040	28.03.2020	20,9	17,4
Aasta Hansteen	SN77040	29.03.2020	13,3	9,7
Aasta Hansteen	SN77040	30.03.2020	21,4	11,5
Aasta Hansteen	SN77040	31.03.2020	23,4	19,1
Aasta Hansteen	SN77040	01.04.2020	14,6	10,5
Aasta Hansteen	SN77040	02.04.2020	22,1	19,4
Aasta Hansteen	SN77040	03.04.2020	16,8	13,8
Aasta Hansteen	SN77040	04.04.2020	15	11,7
Aasta Hansteen	SN77040	05.04.2020	16,8	9,2
Aasta Hansteen	SN77040	06.04.2020	16,2	13,4
Aasta Hansteen	SN77040	07.04.2020	20	15,8
Aasta Hansteen	SN77040	08.04.2020	21,6	13,2
Aasta Hansteen	SN77040	09.04.2020	12,6	10,5
Aasta Hansteen	SN77040	10.04.2020	16,2	12
Aasta Hansteen	SN77040	11.04.2020	11,7	7,4
Aasta Hansteen	SN77040	12.04.2020	26,5	18,9

Source: (Norsk Klima Service Senter, n.d.)

45. The data of wind speed at Aasta Hansteen (Page 3)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Aasta Hansteen	SN77040	13.04.2020	21,9	14,6
Aasta Hansteen	SN77040	14.04.2020	13,7	11,9
Aasta Hansteen	SN77040	15.04.2020	17	11,9
Aasta Hansteen	SN77040	16.04.2020	17,6	16,2
Aasta Hansteen	SN77040	17.04.2020	14,6	10,3
Aasta Hansteen	SN77040	18.04.2020	7,6	6,7
Aasta Hansteen	SN77040	19.04.2020	10,7	8,6
Aasta Hansteen	SN77040	20.04.2020	9,8	7,8
Aasta Hansteen	SN77040	21.04.2020	8,6	5,4
Aasta Hansteen	SN77040	22.04.2020	7,3	6,2
Aasta Hansteen	SN77040	23.04.2020	12,8	10,5
Aasta Hansteen	SN77040	24.04.2020	10,3	8,9
Aasta Hansteen	SN77040	25.04.2020	11	9
Aasta Hansteen	SN77040	26.04.2020	13,1	11,5
Aasta Hansteen	SN77040	27.04.2020	13,8	12,5
Aasta Hansteen	SN77040	28.04.2020	8,8	5,9
Aasta Hansteen	SN77040	29.04.2020	10,9	6,7
Aasta Hansteen	SN77040	30.04.2020	11,4	5,7
Aasta Hansteen	SN77040	01.05.2020	10,1	7,2
Aasta Hansteen	SN77040	02.05.2020	12,4	11,5
Aasta Hansteen	SN77040	03.05.2020	12,4	9,1
Aasta Hansteen	SN77040	04.05.2020	12	8,2
Aasta Hansteen	SN77040	05.05.2020	21,2	18,4
Aasta Hansteen	SN77040	06.05.2020	18,5	16,1
Aasta Hansteen	SN77040	07.05.2020	11	7
Aasta Hansteen	SN77040	08.05.2020	10,5	8,7
Aasta Hansteen	SN77040	09.05.2020	11,1	8,7
Aasta Hansteen	SN77040	10.05.2020	14,6	8
Aasta Hansteen	SN77040	11.05.2020	15,3	11,7
Aasta Hansteen	SN77040	12.05.2020	15	13,9
Aasta Hansteen	SN77040	13.05.2020	13,3	10,6
Aasta Hansteen	SN77040	14.05.2020	9,1	7,2
Aasta Hansteen	SN77040	15.05.2020	15,4	10,3
Aasta Hansteen	SN77040	16.05.2020	17,1	10,8
Aasta Hansteen	SN77040	17.05.2020	13,4	11,6
Aasta Hansteen	SN77040	18.05.2020	10	8,7
Aasta Hansteen	SN77040	19.05.2020	10,2	7
Aasta Hansteen	SN77040	20.05.2020	8,3	5,7
Aasta Hansteen	SN77040	21.05.2020	8,7	6,7
Aasta Hansteen	SN77040	22.05.2020	9,5	8,5
Aasta Hansteen	SN77040	23.05.2020	11,3	9,7
Aasta Hansteen	SN77040	24.05.2020	9,4	7,8
Aasta Hansteen	SN77040	25.05.2020	14,8	10,8
Aasta Hansteen	SN77040	26.05.2020	16,4	12,9
Aasta Hansteen	SN77040	27.05.2020	16,7	13,9
Aasta Hansteen	SN77040	28.05.2020	14,3	11,1
Aasta Hansteen	SN77040	29.05.2020	13,5	7,3
Aasta Hansteen	SN77040	30.05.2020	8,7	7,2
Aasta Hansteen	SN77040	31.05.2020	8	6,3
Aasta Hansteen	SN77040	01.06.2020	8,2	7,2
Aasta Hansteen	SN77040	02.06.2020	8,7	7
Aasta Hansteen	SN77040	03.06.2020	10,5	6,4
Aasta Hansteen	SN77040	04.06.2020	16	13,3
Aasta Hansteen	SN77040	05.06.2020	8,9	7,9
Aasta Hansteen	SN77040	06.06.2020	10,6	6,3
Aasta Hansteen	SN77040	07.06.2020	13,8	10,5
Aasta Hansteen	SN77040	08.06.2020	13,4	9,2
Aasta Hansteen	SN77040	09.06.2020	4,6	2,2
Aasta Hansteen	SN77040	10.06.2020	8	6
Aasta Hansteen	SN77040	11.06.2020	7,5	5,1
Aasta Hansteen	SN77040	12.06.2020	6,2	3,1
Aasta Hansteen	SN77040	13.06.2020	6,6	3,2
Aasta Hansteen	SN77040	14.06.2020	3,4	2

Source: (Norsk Klima Service Senter, n.d.)

46. The data of wind speed at Aasta Hansteen (Page 4)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Aasta Hansteen	SN77040	15.06.2020	8	6,2
Aasta Hansteen	SN77040	16.06.2020	7,1	5,3
Aasta Hansteen	SN77040	17.06.2020	7,1	4,9
Aasta Hansteen	SN77040	18.06.2020	9,8	8,7
Aasta Hansteen	SN77040	19.06.2020	11,5	10,3
Aasta Hansteen	SN77040	20.06.2020	10,9	9,7
Aasta Hansteen	SN77040	21.06.2020	6,7	5,6
Aasta Hansteen	SN77040	22.06.2020	7,1	4,9
Aasta Hansteen	SN77040	23.06.2020	14	9,2
Aasta Hansteen	SN77040	24.06.2020	13,3	8,8
Aasta Hansteen	SN77040	25.06.2020	13,6	12,1
Aasta Hansteen	SN77040	26.06.2020	10,1	6,3
Aasta Hansteen	SN77040	27.06.2020	13,7	12
Aasta Hansteen	SN77040	28.06.2020	14,6	13
Aasta Hansteen	SN77040	29.06.2020	18,7	16,7
Aasta Hansteen	SN77040	30.06.2020	18,6	15,4
Aasta Hansteen	SN77040	01.07.2020	11,5	7,6
Aasta Hansteen	SN77040	02.07.2020	4,8	3,4
Aasta Hansteen	SN77040	03.07.2020	4,7	2,7
Aasta Hansteen	SN77040	04.07.2020	5,4	3,5
Aasta Hansteen	SN77040	05.07.2020	9,5	4,9
Aasta Hansteen	SN77040	06.07.2020	10,6	9,3
Aasta Hansteen	SN77040	07.07.2020	8,3	5,4
Aasta Hansteen	SN77040	08.07.2020	12,7	10,3
Aasta Hansteen	SN77040	09.07.2020	14,8	12,9
Aasta Hansteen	SN77040	10.07.2020	12,1	10,4
Aasta Hansteen	SN77040	11.07.2020	10,4	9,4
Aasta Hansteen	SN77040	12.07.2020	7,3	3,3
Aasta Hansteen	SN77040	13.07.2020	4,7	3,2
Aasta Hansteen	SN77040	14.07.2020	9,7	8
Aasta Hansteen	SN77040	15.07.2020	6,4	4,8
Aasta Hansteen	SN77040	16.07.2020	11,4	6,2
Aasta Hansteen	SN77040	17.07.2020	13,9	8,3
Aasta Hansteen	SN77040	18.07.2020	11,7	10,4
Aasta Hansteen	SN77040	19.07.2020	13,1	11,2
Aasta Hansteen	SN77040	20.07.2020	11,2	8,9
Aasta Hansteen	SN77040	21.07.2020	6,6	5
Aasta Hansteen	SN77040	22.07.2020	7,3	6,3
Aasta Hansteen	SN77040	23.07.2020	8,4	6,4
Data valid for 23.07.2020 (CC BY 4.0), The Norwegian Meteorological Institute (MET Norway)				

Source: (Norsk Klima Service Senter, n.d.)

47. The data of wind speed at Draugen (Page 1)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Draugen	SN76925	23.07.2019	9,3	5,6
Draugen	SN76925	24.07.2019	10,3	6,4
Draugen	SN76925	25.07.2019	8,2	4,3
Draugen	SN76925	26.07.2019	9,8	6,6
Draugen	SN76925	27.07.2019	15,4	5,9
Draugen	SN76925	28.07.2019	20,1	13,2
Draugen	SN76925	29.07.2019	10,8	5
Draugen	SN76925	30.07.2019	14,9	12,9
Draugen	SN76925	31.07.2019	14,9	11,5
Draugen	SN76925	01.08.2019	7,7	5,5
Draugen	SN76925	02.08.2019	5,1	4,4
Draugen	SN76925	03.08.2019	5,1	3,2
Draugen	SN76925	04.08.2019	5,7	3,7
Draugen	SN76925	05.08.2019	5,7	4,5
Draugen	SN76925	06.08.2019	8,2	6,2
Draugen	SN76925	07.08.2019	6,2	5,2
Draugen	SN76925	08.08.2019	5,1	3,5
Draugen	SN76925	09.08.2019	7,7	4,2
Draugen	SN76925	10.08.2019	10,3	6,7
Draugen	SN76925	11.08.2019	6,2	3,2
Draugen	SN76925	12.08.2019	9,3	7
Draugen	SN76925	13.08.2019	10,3	7,4
Draugen	SN76925	14.08.2019	9,8	6,3
Draugen	SN76925	15.08.2019	9,3	4,7
Draugen	SN76925	16.08.2019	13,9	8,6
Draugen	SN76925	17.08.2019	7,7	6,4
Draugen	SN76925	18.08.2019	8,7	6,4
Draugen	SN76925	19.08.2019	6,2	4
Draugen	SN76925	20.08.2019	11,8	9,7
Draugen	SN76925	21.08.2019	11,3	9,3
Draugen	SN76925	22.08.2019	8,7	5,2
Draugen	SN76925	23.08.2019	5,7	2,4
Draugen	SN76925	24.08.2019	8,6	5,4
Draugen	SN76925	25.08.2019	14,4	10,8
Draugen	SN76925	26.08.2019	10,3	7,8
Draugen	SN76925	27.08.2019	7,7	4,8
Draugen	SN76925	28.08.2019	6,7	5
Draugen	SN76925	29.08.2019	8,7	6,2
Draugen	SN76925	30.08.2019	9,3	7,3
Draugen	SN76925	31.08.2019	9,8	6,6
Draugen	SN76925	01.09.2019	17	12,5
Draugen	SN76925	02.09.2019	11,3	10,3
Draugen	SN76925	03.09.2019	13,9	11,4
Draugen	SN76925	04.09.2019	11,8	6,2
Draugen	SN76925	05.09.2019	9,8	8,4
Draugen	SN76925	06.09.2019	9,3	4,4
Draugen	SN76925	07.09.2019	5,1	3,1
Draugen	SN76925	08.09.2019	6,2	3,7
Draugen	SN76925	09.09.2019	5,1	3
Draugen	SN76925	10.09.2019	3,6	2,8
Draugen	SN76925	11.09.2019	9,8	6,3
Draugen	SN76925	12.09.2019	14,9	12,1
Draugen	SN76925	13.09.2019	14,9	11
Draugen	SN76925	14.09.2019	14,9	12
Draugen	SN76925	15.09.2019	17	12,6
Draugen	SN76925	16.09.2019	14,9	11,1
Draugen	SN76925	17.09.2019	7,2	5,5
Draugen	SN76925	18.09.2019	11,3	8,2
Draugen	SN76925	19.09.2019	6,7	4,6
Draugen	SN76925	20.09.2019	16,5	13,7
Draugen	SN76925	21.09.2019	15,9	10,3
Draugen	SN76925	22.09.2019	9,8	7,4

Source: (Norsk Klima Service Senter, n.d.)

48. The data of wind speed at Draugen (Page 2)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Draugen	SN76925	23.09.2019	8,7	6,2
Draugen	SN76925	24.09.2019	6,2	4,6
Draugen	SN76925	25.09.2019	8,2	6,6
Draugen	SN76925	26.09.2019	8,2	6,6
Draugen	SN76925	27.09.2019	10,3	9,1
Draugen	SN76925	28.09.2019	8,7	4,6
Draugen	SN76925	29.09.2019	10,3	6,8
Draugen	SN76925	30.09.2019	5,1	3,2
Draugen	SN76925	01.10.2019	9,3	7,2
Draugen	SN76925	02.10.2019	8,4	8,3
Draugen	SN76925	03.10.2019	10,2	9,1
Draugen	SN76925	04.10.2019	10,1	9,6
Draugen	SN76925	05.10.2019	8,4	7,1
Draugen	SN76925	06.10.2019	5,5	4,2
Draugen	SN76925	07.10.2019	7,2	5
Draugen	SN76925	08.10.2019	6,2	3,6
Draugen	SN76925	09.10.2019	8,2	6,1
Draugen	SN76925	10.10.2019	7,7	5,5
Draugen	SN76925	11.10.2019	7,2	4,8
Draugen	SN76925	12.10.2019	8,2	5,7
Draugen	SN76925	13.10.2019	7,2	3,2
Draugen	SN76925	14.10.2019	3,1	2,6
Draugen	SN76925	15.10.2019	10,3	4,9
Draugen	SN76925	16.10.2019	11,8	10,6
Draugen	SN76925	17.10.2019	6,7	4,8
Draugen	SN76925	18.10.2019	10,8	3,7
Draugen	SN76925	19.10.2019	15,4	13,3
Draugen	SN76925	20.10.2019	7,2	5,1
Draugen	SN76925	21.10.2019	20,1	9,3
Draugen	SN76925	22.10.2019	24,7	20,3
Draugen	SN76925	23.10.2019	9,8	6,9
Draugen	SN76925	24.10.2019	9,8	8
Draugen	SN76925	25.10.2019	11,3	8,6
Draugen	SN76925	26.10.2019	11,3	5,8
Draugen	SN76925	27.10.2019	8,7	6,5
Draugen	SN76925	28.10.2019	9,8	7,7
Draugen	SN76925	29.10.2019	7,7	6,2
Draugen	SN76925	30.10.2019	12,9	11,1
Draugen	SN76925	31.10.2019	9,3	5
Draugen	SN76925	01.11.2019	8,2	4,8
Draugen	SN76925	02.11.2019	11,3	8,6
Draugen	SN76925	03.11.2019	8,2	7
Draugen	SN76925	04.11.2019	8,7	7,6
Draugen	SN76925	05.11.2019	8,7	5,7
Draugen	SN76925	06.11.2019	8,2	7,1
Draugen	SN76925	07.11.2019	8,2	6,5
Draugen	SN76925	08.11.2019	5,7	2,8
Draugen	SN76925	09.11.2019	7,2	5,6
Draugen	SN76925	10.11.2019	9,3	8,2
Draugen	SN76925	11.11.2019	8,7	6,9
Draugen	SN76925	12.11.2019	5,7	4,2
Draugen	SN76925	13.11.2019	5,7	4,3
Draugen	SN76925	14.11.2019	10,3	6,1
Draugen	SN76925	15.11.2019	9,3	7,8
Draugen	SN76925	16.11.2019	5,1	3,8
Draugen	SN76925	17.11.2019	6,7	4,5
Draugen	SN76925	18.11.2019	6,7	4,4
Draugen	SN76925	19.11.2019	7,7	5,1
Draugen	SN76925	20.11.2019	12,3	9,2
Draugen	SN76925	21.11.2019	5,7	4,2
Draugen	SN76925	22.11.2019	8,2	4,4
Draugen	SN76925	23.11.2019	6,7	5

Source: (Norsk Klima Service Senter, n.d.)

49. The data of wind speed at Draugen (Page 3)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Draugen	SN76925	24.11.2019	4,6	3,8
Draugen	SN76925	25.11.2019	6,7	5,4
Draugen	SN76925	26.11.2019	10,8	7,4
Draugen	SN76925	27.11.2019	11,3	10,2
Draugen	SN76925	28.11.2019	11,3	7,5
Draugen	SN76925	29.11.2019	13,4	10,7
Draugen	SN76925	30.11.2019	14,4	11,4
Draugen	SN76925	01.12.2019	15,9	10,6
Draugen	SN76925	02.12.2019	11,8	9,9
Draugen	SN76925	03.12.2019	15,9	14,5
Draugen	SN76925	04.12.2019	19	16,4
Draugen	SN76925	05.12.2019	18,5	14,9
Draugen	SN76925	06.12.2019	14,9	12,6
Draugen	SN76925	07.12.2019	10,8	9,1
Draugen	SN76925	08.12.2019	15,9	9,7
Draugen	SN76925	09.12.2019	11,3	9,9
Draugen	SN76925	10.12.2019	15,4	9,5
Draugen	SN76925	11.12.2019	19	14,6
Draugen	SN76925	12.12.2019	17	15,1
Draugen	SN76925	13.12.2019	12,3	7,8
Draugen	SN76925	14.12.2019	13,4	10,7
Draugen	SN76925	15.12.2019	9,3	6,8
Draugen	SN76925	16.12.2019	7,2	4,9
Draugen	SN76925	17.12.2019	7,2	4,6
Draugen	SN76925	18.12.2019	4,6	3,1
Draugen	SN76925	19.12.2019	5,7	4,8
Draugen	SN76925	20.12.2019	9,8	8,1
Draugen	SN76925	21.12.2019	8,7	6
Draugen	SN76925	22.12.2019	3,1	1,7
Draugen	SN76925	23.12.2019	2,1	1,7
Draugen	SN76925	24.12.2019	7,2	5,3
Draugen	SN76925	25.12.2019	6,7	5,1
Draugen	SN76925	26.12.2019	4,6	3,1
Draugen	SN76925	27.12.2019	9,8	5,3
Draugen	SN76925	28.12.2019	20,1	15,8
Draugen	SN76925	29.12.2019	19	16,5
Draugen	SN76925	30.12.2019	17,5	14,8
Draugen	SN76925	31.12.2019	16,5	14,9
Draugen	SN76925	01.01.2020	21,6	18,4
Draugen	SN76925	02.01.2020	23,1	20,1
Draugen	SN76925	03.01.2020	25,2	19
Draugen	SN76925	04.01.2020	17	12
Draugen	SN76925	05.01.2020	12,9	10,8
Draugen	SN76925	06.01.2020	15,4	12
Draugen	SN76925	07.01.2020	17	13,7
Draugen	SN76925	08.01.2020	22,1	17,7
Draugen	SN76925	09.01.2020	18,5	13,6
Draugen	SN76925	10.01.2020	14,4	9,8
Draugen	SN76925	11.01.2020	18,5	16
Draugen	SN76925	12.01.2020	16,5	13,1
Draugen	SN76925	13.01.2020	17,5	12,5
Draugen	SN76925	14.01.2020	13,9	10,3
Draugen	SN76925	15.01.2020	12,9	9,6
Draugen	SN76925	16.01.2020	17	15
Draugen	SN76925	17.01.2020	9,8	6,6
Draugen	SN76925	18.01.2020	15,4	10,2
Draugen	SN76925	19.01.2020	20,1	15,8
Draugen	SN76925	20.01.2020	20,6	18
Draugen	SN76925	21.01.2020	20,6	18,4
Draugen	SN76925	22.01.2020	17	12,3
Draugen	SN76925	23.01.2020	18	15,6
Draugen	SN76925	24.01.2020	18,5	15,2

Source: (Norsk Klima Service Senter, n.d.)

50. The data of wind speed at Draugen (Page 4)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Draugen	SN76925	25.01.2020	19	11
Draugen	SN76925	26.01.2020	15,4	11,3
Draugen	SN76925	27.01.2020	9,3	5,8
Draugen	SN76925	28.01.2020	7,7	6,1
Draugen	SN76925	29.01.2020	14,9	11,2
Draugen	SN76925	30.01.2020	8,2	5,8
Draugen	SN76925	31.01.2020	17,5	12,1
Draugen	SN76925	01.02.2020	13,9	10,8
Draugen	SN76925	02.02.2020	14,9	10,6
Draugen	SN76925	03.02.2020	8,2	5,2
Draugen	SN76925	04.02.2020	14,4	9,7
Draugen	SN76925	05.02.2020	17	9,6
Draugen	SN76925	06.02.2020	12,3	6,7
Draugen	SN76925	07.02.2020	13,9	11
Draugen	SN76925	08.02.2020	13,4	8,5
Draugen	SN76925	09.02.2020	12,3	7
Draugen	SN76925	10.02.2020	14,4	9,6
Draugen	SN76925	11.02.2020	7,7	4,1
Draugen	SN76925	12.02.2020	10,8	7,7
Draugen	SN76925	13.02.2020	10,3	7
Draugen	SN76925	14.02.2020	9,8	6
Draugen	SN76925	15.02.2020	14,9	12,3
Draugen	SN76925	16.02.2020	17	12,7
Draugen	SN76925	17.02.2020	15,4	12,5
Draugen	SN76925	18.02.2020	14,4	10,6
Draugen	SN76925	19.02.2020	9,3	6,8
Draugen	SN76925	20.02.2020	12,3	9,3
Draugen	SN76925	21.02.2020	23,1	17
Draugen	SN76925	22.02.2020	19,5	12,9
Draugen	SN76925	23.02.2020	14,4	11,2
Draugen	SN76925	24.02.2020	12,3	6,6
Draugen	SN76925	25.02.2020	8,7	5,8
Draugen	SN76925	26.02.2020	9,8	8,2
Draugen	SN76925	27.02.2020	10,8	8,2
Draugen	SN76925	28.02.2020	15,9	9,6
Draugen	SN76925	29.02.2020	12,3	8,2
Draugen	SN76925	01.03.2020	17	15
Draugen	SN76925	02.03.2020	16,5	15,4
Draugen	SN76925	03.03.2020	14,9	13,4
Draugen	SN76925	04.03.2020	12,9	8,4
Draugen	SN76925	05.03.2020	6,7	4,9
Draugen	SN76925	06.03.2020	11,3	7,7
Draugen	SN76925	07.03.2020	10,8	8,4
Draugen	SN76925	08.03.2020	11,8	10,5
Draugen	SN76925	09.03.2020	14,9	11,6
Draugen	SN76925	10.03.2020	10,8	6,1
Draugen	SN76925	11.03.2020	12,9	8,6
Draugen	SN76925	12.03.2020	19	11,5
Draugen	SN76925	13.03.2020	9,8	7,3
Draugen	SN76925	14.03.2020	18	13
Draugen	SN76925	15.03.2020	17,5	11,6
Draugen	SN76925	16.03.2020	12,9	6,5
Draugen	SN76925	17.03.2020	17	14,7
Draugen	SN76925	18.03.2020	14,9	13,1
Draugen	SN76925	19.03.2020	14,4	8,1
Draugen	SN76925	20.03.2020	7,7	4,4
Draugen	SN76925	21.03.2020	9,3	5,4
Draugen	SN76925	22.03.2020	18,5	16,3
Draugen	SN76925	23.03.2020	24,7	17
Draugen	SN76925	24.03.2020	23,1	20,3
Draugen	SN76925	25.03.2020	22,1	11,9
Draugen	SN76925	26.03.2020	11,8	9,8

Source: (Norsk Klima Service Senter, n.d.)

51. The data of wind speed at Draugen (Page 5)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Draugen	SN76925	27.03.2020	18	12,8
Draugen	SN76925	28.03.2020	14,9	10,8
Draugen	SN76925	29.03.2020	13,4	9,8
Draugen	SN76925	30.03.2020	14,9	7,7
Draugen	SN76925	31.03.2020	18,5	14,1
Draugen	SN76925	01.04.2020	16,5	10,7
Draugen	SN76925	02.04.2020	15,4	7,5
Draugen	SN76925	03.04.2020	14,4	10,9
Draugen	SN76925	04.04.2020	12,9	8,3
Draugen	SN76925	05.04.2020	9,8	7,2
Draugen	SN76925	06.04.2020	13,9	11,1
Draugen	SN76925	07.04.2020	18	13,4
Draugen	SN76925	08.04.2020	21,1	16,3
Draugen	SN76925	09.04.2020	13,4	9
Draugen	SN76925	10.04.2020	9,8	6,9
Draugen	SN76925	11.04.2020	8,7	5,2
Draugen	SN76925	12.04.2020	18,5	11,9
Draugen	SN76925	13.04.2020	16,5	10,6
Draugen	SN76925	14.04.2020	14,4	12,8
Draugen	SN76925	15.04.2020	11,3	9,2
Draugen	SN76925	16.04.2020	13,9	11,4
Draugen	SN76925	17.04.2020	11,3	7,9
Draugen	SN76925	18.04.2020	6,2	4,9
Draugen	SN76925	19.04.2020	2,6	1,5
Draugen	SN76925	20.04.2020	5,1	2,6
Draugen	SN76925	21.04.2020	6,2	4,8
Draugen	SN76925	22.04.2020	4,6	3
Draugen	SN76925	23.04.2020	7,7	5,7
Draugen	SN76925	24.04.2020	6,7	5,5
Draugen	SN76925	25.04.2020	6,7	4,6
Draugen	SN76925	26.04.2020	9,8	6,9
Draugen	SN76925	27.04.2020	11,8	10,5
Draugen	SN76925	28.04.2020	11,8	8,7
Draugen	SN76925	29.04.2020	3,6	2,2
Draugen	SN76925	30.04.2020	10,3	7,1
Draugen	SN76925	01.05.2020	10,3	7,9
Draugen	SN76925	02.05.2020	6,7	4,7
Draugen	SN76925	03.05.2020	8,7	7,2
Draugen	SN76925	04.05.2020	9,3	6,8
Draugen	SN76925	05.05.2020	16,5	13,2
Draugen	SN76925	06.05.2020	11,8	10
Draugen	SN76925	07.05.2020	8,7	5,5
Draugen	SN76925	08.05.2020	9,3	5,3
Draugen	SN76925	09.05.2020	8,7	6,1
Draugen	SN76925	10.05.2020	6,7	4,4
Draugen	SN76925	11.05.2020	10,3	7,9
Draugen	SN76925	12.05.2020	8,7	6,7
Draugen	SN76925	13.05.2020	11,3	9,1
Draugen	SN76925	14.05.2020	6,7	5,1
Draugen	SN76925	15.05.2020	12,3	9,7
Draugen	SN76925	16.05.2020	11,3	9,7
Draugen	SN76925	17.05.2020	7,7	5,1
Draugen	SN76925	18.05.2020	8,7	5,5
Draugen	SN76925	19.05.2020	5,1	3
Draugen	SN76925	20.05.2020	6,7	3,6
Draugen	SN76925	21.05.2020	5,7	3,9
Draugen	SN76925	22.05.2020	11,8	7,6
Draugen	SN76925	23.05.2020	11,8	7,6
Draugen	SN76925	24.05.2020	7,7	5,2
Draugen	SN76925	25.05.2020	7,7	6,6
Draugen	SN76925	26.05.2020	12,3	9,1
Draugen	SN76925	27.05.2020	11,3	8,9

Source: (Norsk Klima Service Senter, n.d.)

52. The data of wind speed at Draugen (Page 6)

Name	Station	Time(norwegian mean time)	Maximum mean wind speed from main obs. (24 h)	Average of mean wind speed from main obs. (24 h)
Draugen	SN76925	28.05.2020	10,8	9,9
Draugen	SN76925	29.05.2020	8,2	6,1
Draugen	SN76925	30.05.2020	8,2	5,1
Draugen	SN76925	31.05.2020	7,7	5,9
Draugen	SN76925	01.06.2020	6,2	3,9
Draugen	SN76925	02.06.2020	9,3	6,2
Draugen	SN76925	03.06.2020	11,3	9,5
Draugen	SN76925	04.06.2020	11,8	7,1
Draugen	SN76925	05.06.2020	12,3	11,4
Draugen	SN76925	06.06.2020	10,3	8,5
Draugen	SN76925	07.06.2020	12,3	9,3
Draugen	SN76925	08.06.2020	10,3	6
Draugen	SN76925	09.06.2020	8,7	4,6
Draugen	SN76925	10.06.2020	10,8	9,5
Draugen	SN76925	11.06.2020	9,3	8,9
Draugen	SN76925	12.06.2020	9,8	8,4
Draugen	SN76925	13.06.2020	6,2	4,4
Draugen	SN76925	14.06.2020	5,1	2,4
Draugen	SN76925	15.06.2020	6,7	4,4
Draugen	SN76925	16.06.2020	7,2	5,8
Draugen	SN76925	17.06.2020	7,7	6,6
Draugen	SN76925	18.06.2020	9,3	7,6
Draugen	SN76925	19.06.2020	10,3	9,2
Draugen	SN76925	20.06.2020	10,3	6,2
Draugen	SN76925	21.06.2020	9,8	4,3
Draugen	SN76925	22.06.2020	6,2	3,6
Draugen	SN76925	23.06.2020	8,7	4,8
Draugen	SN76925	24.06.2020	7,2	5,3
Draugen	SN76925	25.06.2020	7,7	3,3
Draugen	SN76925	26.06.2020	8,2	6,8
Draugen	SN76925	27.06.2020	9,3	9
Draugen	SN76925	28.06.2020	13,9	10,2
Draugen	SN76925	29.06.2020	8,2	5,1
Draugen	SN76925	30.06.2020	10,8	9
Draugen	SN76925	01.07.2020	8,7	5,5
Draugen	SN76925	02.07.2020	5,7	2,7
Draugen	SN76925	03.07.2020	4,1	2,6
Draugen	SN76925	04.07.2020	4,6	3,2
Draugen	SN76925	05.07.2020	14,9	12,2
Draugen	SN76925	06.07.2020	12,3	9,6
Draugen	SN76925	07.07.2020	6,2	5,2
Draugen	SN76925	08.07.2020	7,7	5,9
Draugen	SN76925	09.07.2020	8,2	6,2
Draugen	SN76925	10.07.2020	8,7	6,6
Draugen	SN76925	11.07.2020	11,3	9,2
Draugen	SN76925	12.07.2020	10,3	8
Draugen	SN76925	13.07.2020	5,1	2,9
Draugen	SN76925	14.07.2020	7,7	6,5
Draugen	SN76925	15.07.2020	4,6	3,4
Draugen	SN76925	16.07.2020	8,2	3,6
Draugen	SN76925	17.07.2020	9,3	8,2
Draugen	SN76925	18.07.2020	9,8	7
Draugen	SN76925	19.07.2020	7,7	6,8
Draugen	SN76925	20.07.2020	7,2	5,5
Draugen	SN76925	21.07.2020	7,7	6,2
Draugen	SN76925	22.07.2020	7,2	5,4
Draugen	SN76925	23.07.2020	7,2	5,5
Data valid for 23.07.2020 (CC BY 4.0), The Norwegian Meteorological Institute (MET Norway)				

Source: (Norsk Klima Service Senter, n.d.)

53. Survey questions to the political parties (in Norwegian) (Page 1)

Olje- og gassutvinning

a) Er partiet for eller imot eksisterende olje- og gassutvinning i Norge?

1) Veldig støttende
2) Støttende
3) Nøytral
4) Mot
5) Veldig imot

b) Er partiet for eller imot å utforske og utvikle nye olje- og gassfelt i Norge?

1) Veldig støttende
2) Støttende
3) Nøytral
4) Mot
5) Veldig imot

c) Når snart skal Norge avslutte olje- og gassutvinningen?

1) Umiddelbart
2) innen 2030
3) innen 2040
4) innen 2050
5) Aldri

54. Survey questions to the political parties (in Norwegian) (Page 2)

Fornybar energi

a) Er partiet for eller imot å utvikle fornybar energi i Norge foruten eksisterende vannkraft?

1) Veldig støttende
2) Støttende
3) Nøytral
4) Mot
5) Veldig imot

b) Er partiet for eller imot offshore vindkraft på norsk sokkel?

1) Veldig støttende
2) Støttende
3) Nøytral
4) Mot
5) Veldig imot

c) Er det partiet for eller imot satsning på hydrogen i Norge?

1) Veldig støttende
2) Støttende
3) Nøytral
4) Mot
5) Veldig imot

55. Survey questions to the political parties (in Norwegian) (Page 3)

Grønne offshore felt

a) Er partiet for eller imot elektrifisering av offshore-felt ved å koble til landstrøm (fornybare kilder)?

1) Veldig støttende
2) Støttende
3) Nøytral
4) Mot
5) Veldig imot

b) Er partiet for eller imot elektrifisering av offshore felt med offshore vindkraft?

1) Veldig støttende
2) Støttende
3) Nøytral
4) Mot
5) Veldig imot

c) Mener partiet at energilagringsløsning er essensiell for å oppnå grønne offshore-felt?

1) Ja, med batteri
2) Ja, med hydrogen
3) Nei, naturgass (gassturbiner) er bra
4) Nei, strøm fra land er fleksibel nok

d) Teknologisk er det mulig at *electrolyzer kan bygges inn i havvindmøllene. Alt overskudd av hydrogen kan blandes i naturgass, noe som gjør naturgass grønnere.*Electrolyzer splitter hydrogen og oksygen fra vann med elektrisitet.

Støtter partiet eller mot å konvertere havvindmøller til hydrogenvindturbiner?

1) Nei, bare strøm er bra:
2) Ja, noen vindmøller kan generere hydrogen som energilagring
3) Ja: alle vindmøller kan konvertere til hydrogen vindkraft

e) Hvor raskt skal alle offshore-felt elektrifiseres med fornybar energi?

1) Så snart det kan
2) innen 2030
3) innen 2040
4) innen 2050
5) Ikke nødvendig

56. Survey questions to the political parties (in Norwegian) (Page 4)

Finans

a) Anser partiet at offshore vindkraft er en fremtidige eksportartikkel?

1) Ja
2) Nei

b) Er partiet villig til å støtte økonomisk (inkludert skatteinsentiver) utbygging av fornybar energi i Norge? Hvis ja, i hvilken grad?

1) Ja - Omfattende eller mer enn nå
2) Ja - Samme som nå
3) Ja - Mindre enn nå
4) Ja - Ikke sikker
5) Nei

c) Er partiet villig til å støtte økonomisk (inkludert skatteinsentiver) full elektrifisering av offshore-feltet? Hvis ja, i hvilken grad?

1) Ja - Omfattende eller mer enn nå
2) Ja - Samme som nå
3) Ja - Mindre enn nå
4) Ja - Ikke sikker
5) Nei

d) Er partiet villig til å støtte økonomisk (inkludert skatteinsentiver) havvinden? Hvis ja, i hvilken grad?

1) Ja - Omfattende eller mer enn nå
2) Ja - Samme som nå
3) Ja - Mindre enn nå
4) Ja - Ikke sikker
5) Nei

e) Er partiet villig til å støtte økonomisk (inkludert skatteinsentiver) hydrogen som energilagringsløsning for å oppnå grønne offshore-felt? Hvis ja, i hvilken grad?

1) Ja - Omfattende eller mer enn nå
2) Ja - Samme som nå
3) Ja - Mindre enn nå
4) Ja - Ikke sikker
5) Nei

57. Survey questions for online random survey (in Norwegian) (Page 1)

Q1. Er du for eller imot utvinning av olje og gass i Norge?

Veldig støttende
Støttende
Nøytral
Mot
Veldig imot
Vet ikke

Q2. Er du for eller imot mer leting og utvikling av olje- og gassutvinning i Norge?

Veldig støttende
Støttende
Nøytral
Mot
Veldig imot
Vet ikke

Q3. Er du for eller imot utbygging av olje- og gassfelt i områder som Lofoten?

Veldig støttende
Støttende
Nøytral
Mot
Veldig imot
Vet ikke

Q4. Synes du Norge bør legge igjen olje og gass? Hvis ja, på hvilken tidslinje?

Ja - umiddelbart
Ja - innen 2030
Ja - innen 2040
Ja: innen 2050
Nei

Q5. Synes du Norge bør gå over fra olje og gass til fornybar energi?

Ja - men gradvis og sakte
Ja - gradvis men raskere
Ja – ASAP
Nei

58. Survey questions for online random survey (in Norwegian) (Page 2)

Q6. Det var klimaprotester over hele verden i oktober 2019.
Har du deltatt eller tenker du å delta neste gang?

Ja, det har jeg og det vil jeg neste gang
Ja det har jeg, men er ikke sikker på for neste gang
Ja det har jeg, men ikke neste gang
Nei det har jeg ikke, men det vil jeg neste gang
Nei det har jeg ikke og er ikke sikkert for neste gang
Nei det har jeg ikke, og jeg vil ikke

Q7. Har du en bil?

Bensin bil
Diesel bil
Hybrid bil
Elektrisk bil
Hydrogen bil
Nei

Q8. Vil du vurdere å kjøpe elektriske kjøretøy selv om alle skatteinsentiver og fordeler fjernes?

Ja
Nei

Q9. Vil du gi opp bilen og bruke offentlig transport som din klimahandling?

Ja
Nei

Q10. Vil du unngå å bruke flyvning som din klimahandling?

Ja
Nei

59. Survey questions for online random survey (in Norwegian) (Page 3)

Q11. Noen politiske partier ønsker å øke karbonavgiften, noe som kan føre til høyere pris på bensin, flybilletter osv.Vil du støtte det?

Veldig støttende
Støttende
Nøytral
Mot
Veldig imot
Vet ikke

Q12. Norge produserer allerede 96% av strømmen med vannkraft.
Tror du Norge bør investere for å utvikle annen fornybar energi fremfor vannkraft?

Ja hvorfor ikke?
Nei - bruk pengene til noe annet

Q13. Det pågår prosjekter som gjør eksisterende offshore-felt elektrifisert ved å koble til land med kraftkabel og offshore vindkraft. Equinor fikk 2,5 milliarder kroner fra statlig investeringsselskap for et slik prosjekten. Hva tenker du når du hører det?

Det er for mye. Får de ikke nok?
Det er et flott grep
Regjeringen bør støtte mer

Q14. Kraftselskap må belaste 1 øre per kWh fra kunde, som brukes til å finansiere det statseid investeringsselskapet Enova. Det kalles Enova-skatt. De investerer spesielt fornybar kraft- og miljøprosjekter. Visste du om den skatten?

Ja
Nei

Q15. Hva er tanken din når du hører om Enova skatt?

Det er flott, jeg støtter det
Det er bra, men bør være mindre
Jeg liker ikke det

60. Survey questions for online random survey (in Norwegian) (Page 4)

Q16. Om deg: Alder

Under 18
18-19
20-24
25-44
45-66
67-79
Over 80

Q17. Om deg: Stemmer du ved stortingsvalget i norge?

Ja, alltid
Ja, noen ganger
Ja, sjelden
Nei
Ikke stemmerett

Q18. Om deg: Stemmer du ved kommunevalget i norge?

Ja alltid
Ja noen ganger
Ja sjelden
Nei
Ikke stemmerett

Q19. Om deg: Hvilket parti støtter du?

Arbeiderpartiet
Høyre
FrP
Senterpartiet
SV
Venstre
KrF
MDG
Rød
Annet
Jeg har ikke støtteparti
Jeg vil ikke svare

Q20. Om deg: Hvor viktig energi og miljø er for deg når du stemmer?

1. prioritet
2. - 3. Prioritet
4. - 5. Prioritet
Vil vurdere, men ikke så viktig
Stemmer samme parti uansett

61. Online Survey Detailed Result (Page 1: Participant 2 – 53, Q1 – Q10)

Participant	Date Taken (Europe/Oslo)	Time (sec)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
2	June 23, 2020 5:57 PM	263	Støttende	Støttende	Mot	Nei	Ja - gradvis men raskere	Nei, det har jeg ikke, og jeg vil ikke	Elektrisk bil	Ja	Nei	Nei
3	June 23, 2020 6:00 PM	172	Nøytral	Veldig støttende	Mot	Ja - innen 2040	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Diesel bil	Nei	Nei	Nei
4	June 23, 2020 6:43 PM	468	Nøytral	Mot	Mot	Ja - innen 2040	Ja - gradvis men raskere	Nei, det har jeg ikke, men det vil jeg neste gang	Bensin bil	Ja	Nei	Nei
5	June 23, 2020 6:52 PM	223	Støttende	Støttende	Nøytral	Nei	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Diesel bil	Ja	Nei	Nei
6	June 23, 2020 7:29 PM	252	Veldig støttende	Veldig støttende	Støttende	Nei	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Nei	Ja	Ja	Nei
7	June 23, 2020 8:13 PM	258	Støttende	Støttende	Nøytral	Nei	Ja - men gradvis og sakte	Nei, det har jeg ikke og er ikke sikkert for neste gang	Hybrid bil	Ja	Ja	Nei
8	June 23, 2020 8:19 PM	167	Veldig imot	Veldig imot	Veldig imot	Ja - umiddelbart	Ja - ASAP	Ja, det har jeg og det vil jeg neste gang	Elektrisk bil	Ja	Ja	Ja
9	June 23, 2020 8:20 PM	286	Støttende	Støttende	Mot	Nei	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Hybrid bil	Nei	Ja	Nei
10	June 23, 2020 8:21 PM	222	Veldig støttende	Veldig støttende	Støttende	Ja - innen 2030	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Diesel bil	Nei	Nei	Nei
11	June 23, 2020 8:23 PM	176	Støttende	Støttende	Støttende	Nei	Ja - gradvis men raskere	Nei, det har jeg ikke, og jeg vil ikke	Elektrisk bil	Ja	Nei	Nei
12	June 23, 2020 8:25 PM	328	Støttende	Støttende	Støttende	Nei	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Bensin bil	Ja	Nei	Nei
13	June 23, 2020 8:28 PM	147	Veldig støttende	Veldig støttende	Veldig støttende	Nei	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Nei	Nei	Ja	Nei
14	June 23, 2020 9:49 PM	187	Veldig støttende	Veldig støttende	Støttende	Nei	Ja - gradvis men raskere	Nei, det har jeg ikke, og jeg vil ikke	Bensin bil	Nei	Nei	Nei
15	June 23, 2020 9:53 PM	361	Veldig støttende	Støttende	Vet ikke	Nei	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Diesel bil	Ja	Nei	Nei
16	June 23, 2020 10:00 PM	232	Veldig støttende	Mot	Støttende	Ja - innen 2050	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Bensin bil	Nei	Nei	Nei
17	June 23, 2020 10:25 PM	216	Støttende	Mot	Mot	Ja - innen 2040	Ja - gradvis men raskere	Nei, det har jeg ikke, og jeg vil ikke	Elektrisk bil	Ja	Nei	Nei
18	June 23, 2020 11:01 PM	272	Nøytral	Nøytral	Mot	Ja - innen 2030	Ja - gradvis men raskere	Nei, det har jeg ikke, men det vil jeg neste gang	Nei	Nei	Ja	Nei
19	June 23, 2020 11:14 PM	364	Støttende	Nøytral	Mot	Ja - innen 2040	Ja - men gradvis og sakte	Nei, det har jeg ikke og er ikke sikkert for neste gang	Nei	Ja	Ja	Nei
20	June 23, 2020 11:29 PM	234	Støttende	Veldig støttende	Støttende	Nei	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Elektrisk bil	Ja	Nei	Nei
21	June 23, 2020 11:43 PM	185	Støttende	Støttende	Nøytral	Ja - innen 2050	Ja - men gradvis og sakte	Nei, det har jeg ikke, men det vil jeg neste gang	Nei	Ja	Nei	Nei
22	June 24, 2020 12:33 AM	239	Støttende	Nøytral	Vet ikke	Ja - innen 2040	Ja - men gradvis og sakte	Ja, det har jeg og det vil jeg neste gang	Hybrid bil	Ja	Nei	Ja
23	June 24, 2020 1:10 AM	351	Veldig støttende	Støttende	Mot	Ja - innen 2050	Ja - men gradvis og sakte	Nei, det har jeg ikke og er ikke sikkert for neste gang	Diesel bil	Ja	Nei	Nei
24	June 24, 2020 7:41 AM	1107	Støttende	Støttende	Veldig imot	Nei	Ja - men gradvis og sakte	Nei, det har jeg ikke og er ikke sikkert for neste gang	Bensin bil	Nei	Nei	Ja
25	June 24, 2020 8:20 AM	226	Veldig støttende	Støttende	Støttende	Ja - umiddelbart	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Bensin bil	Ja	Nei	Ja
26	June 24, 2020 10:00 AM	190	Veldig støttende	Veldig støttende	Støttende	Nei	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Bensin bil	Nei	Nei	Nei
27	June 24, 2020 11:11 AM	159	Veldig støttende	Veldig støttende	Støttende	Nei	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Elektrisk bil	Ja	Nei	Nei
28	June 24, 2020 11:34 AM	233	Nøytral	Nøytral	Nøytral	Ja - innen 2050	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Nei	Ja	Nei	Nei
29	June 24, 2020 11:34 AM	274	Nøytral	Støttende	Veldig imot	Ja - innen 2050	Ja - gradvis men raskere	Nei, det har jeg ikke, men det vil jeg neste gang	Nei	Ja	Ja	Nei
30	June 24, 2020 11:37 AM	256	Nøytral	Nøytral	Nøytral	Nei	Ja - men gradvis og sakte	Nei, det har jeg ikke og er ikke sikkert for neste gang	Elektrisk bil	Ja	Nei	Nei
31	June 24, 2020 11:39 AM	207	Støttende	Nøytral	Vet ikke	Ja - innen 2030	Ja - gradvis men raskere	Nei, det har jeg ikke, men det vil jeg neste gang	Elektrisk bil	Ja	Nei	Nei
32	June 24, 2020 11:39 AM	196	Mot	Mot	Veldig imot	Ja - innen 2030	Ja - gradvis men raskere	Nei, det har jeg ikke, men det vil jeg neste gang	Diesel bil	Ja	Ja	Nei
33	June 24, 2020 11:39 AM	247	Nøytral	Nøytral	Veldig imot	Ja - innen 2030	Ja - gradvis men raskere	Nei, det har jeg ikke og er ikke sikkert for neste gang	Nei	Ja	Nei	Nei
34	June 24, 2020 11:40 AM	149	Veldig støttende	Veldig støttende	Nøytral	Ja - innen 2030	Nei	Nei, det har jeg ikke, og jeg vil ikke	Diesel bil	Ja	Nei	Nei
35	June 24, 2020 11:40 AM	255	Støttende	Nøytral	Mot	Ja - innen 2050	Ja - gradvis men raskere	Nei, det har jeg ikke og er ikke sikkert for neste gang	Nei	Ja	Ja	Nei
36	June 24, 2020 11:41 AM	230	Nøytral	Nøytral	Mot	Ja - innen 2030	Ja - gradvis men raskere	Nei, det har jeg ikke, men det vil jeg neste gang	Nei	Ja	Ja	Nei
37	June 24, 2020 11:57 AM	149	Veldig støttende	Veldig støttende	Veldig støttende	Ja - innen 2050	Ja - men gradvis og sakte	Nei, det har jeg ikke og er ikke sikkert for neste gang	Nei	Ja	Nei	Nei
38	June 24, 2020 12:07 PM	192	Veldig støttende	Veldig støttende	Veldig støttende	Nei	Ja - men gradvis og sakte	Nei, det har jeg ikke, men det vil jeg neste gang	Nei	Ja	Nei	Nei
39	June 24, 2020 12:09 PM	479	Støttende	Mot	Mot	Ja - innen 2040	Ja - men gradvis og sakte	Nei, det har jeg ikke, men det vil jeg neste gang	Elektrisk bil	Ja	Nei	Nei
40	June 24, 2020 12:11 PM	307	Nøytral	Vet ikke	Veldig imot	Ja - innen 2050	Ja - ASAP	Nei, det har jeg ikke, men det vil jeg neste gang	Elektrisk bil	Ja	Nei	Nei
41	June 24, 2020 12:30 PM	447	Nøytral	Nøytral	Mot	Nei	Ja - men gradvis og sakte	Nei, det har jeg ikke, men det vil jeg neste gang	Diesel bil	Ja	Nei	Nei
42	June 24, 2020 12:33 PM	231	Støttende	Nøytral	Støttende	Nei	Ja - men gradvis og sakte	Nei, det har jeg ikke og er ikke sikkert for neste gang	Bensin bil	Nei	Nei	Nei
43	June 24, 2020 12:41 PM	180	Nøytral	Nøytral	Mot	-	Ja - men gradvis og sakte	Nei, det har jeg ikke og er ikke sikkert for neste gang	Bensin bil	Ja	Nei	Ja
44	June 24, 2020 12:46 PM	197	Vet ikke	Mot	Mot	Ja - innen 2030	Ja - gradvis men raskere	Nei, det har jeg ikke og er ikke sikkert for neste gang	Elektrisk bil	Ja	Nei	Nei
45	June 24, 2020 1:17 PM	191	Støttende	Mot	Mot	Ja - innen 2050	Ja - gradvis men raskere	Ja, det har jeg og det vil jeg neste gang	Hybrid bil	Ja	Nei	Nei
46	June 24, 2020 1:37 PM	282	Veldig støttende	Støttende	Nøytral	Nei	Ja - men gradvis og sakte	Nei, det har jeg ikke og er ikke sikkert for neste gang	Diesel bil	Ja	Nei	Ja
47	June 24, 2020 1:39 PM	190	Nøytral	Mot	Veldig imot	Ja - innen 2040	Ja - ASAP	Nei, det har jeg ikke, men det vil jeg neste gang	Diesel bil	Ja	Nei	Ja
48	June 24, 2020 1:56 PM	493	Veldig imot	Mot	Veldig imot	Ja - innen 2030	Ja - gradvis men raskere	Nei, det har jeg ikke, men det vil jeg neste gang	Diesel bil	Ja	Nei	Nei
49	June 24, 2020 3:31 PM	342	Støttende	Støttende	Mot	Nei	Ja - men gradvis og sakte	Nei, det har jeg ikke og er ikke sikkert for neste gang	Nei	Ja	Nei	Nei
50	June 24, 2020 3:32 PM	121	Nøytral	Nøytral	Nøytral	Ja - innen 2050	Ja - men gradvis og sakte	Ja, det har jeg, men ikke neste gang	Nei	Ja	Nei	Nei
51	June 24, 2020 3:54 PM	303	Veldig støttende	Veldig støttende	Veldig støttende	Nei	Nei	Nei, det har jeg ikke, og jeg vil ikke	Elektrisk bil	Ja	Nei	Nei
52	June 24, 2020 4:08 PM	498	Veldig støttende	Veldig støttende	Mot	Nei	Ja - men gradvis og sakte	Nei, det har jeg ikke og er ikke sikkert for neste gang	Elektrisk bil	Nei	Nei	Nei
53	June 24, 2020 4:36 PM	189	Mot	Veldig imot	Veldig imot	Ja - innen 2030	Ja - gradvis men raskere	Ja, det har jeg og det vil jeg neste gang	Elektrisk bil	Ja	Nei	Ja

62. Online Survey Detailed Result (Page 2: Participant 2 – 53, Q11 – Q20)

Participant	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
2	Mot	Ja - hvorfor ikke?	Det er for mye. Får de ikke nok?	Nei	Jeg liker ikke det	25 - 44	Ja, alltid	Ja, noen ganger	Fremskrittspartiet	2. - 3. prioritet
3	Nøytral	Nei - bruk pengene til noe annet	Det er et flott grep	Nei	Det er bra, men bør være mindre	20 - 24	Ja, alltid	Nei	Arbeiderpartiet	Jeg vil vurdere, men ikke så viktig
4	Støttende	Ja - hvorfor ikke?	Det er for mye. Får de ikke nok?	Ja	Det er bra, men bør være mindre	45 - 66	Ikke stemmerett	Ja, alltid	Venstre	2. - 3. prioritet
5	Nøytral	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er flott, jeg støtter det	25 - 44	Ja, alltid	Ja, alltid	Jeg vil ikke svare	2. - 3. prioritet
6	Støttende	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er flott, jeg støtter det	25 - 44	Ikke stemmerett	Ja, alltid	Jeg har ikke støtteparti	1. prioritet
7	Veldig imot	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er flott, jeg støtter det	45 - 66	Ja, alltid	Ja, alltid	Høyre	4. - 5. prioritet
8	Veldig støttende	Ja - hvorfor ikke?	Det er for mye. Får de ikke nok?	Ja	Jeg liker ikke det	45 - 66	Ja, alltid	Ja, alltid	Rødt	2. - 3. prioritet
9	Veldig imot	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er bra, men bør være mindre	25 - 44	Ikke stemmerett	Ja, alltid	Jeg har ikke støtteparti	Jeg vil vurdere, men ikke så viktig
10	Mot	Ja - hvorfor ikke?	Det er et flott grep	Nei	Jeg liker ikke det	25 - 44	Ja, alltid	Ja, alltid	Fremskrittspartiet	Jeg vil vurdere, men ikke så viktig
11	Veldig imot	Ja - hvorfor ikke?	Regjeringen bør støtte mer	Nei	Jeg liker ikke det	45 - 66	Ja, alltid	Ja, alltid	Høyre	2. - 3. prioritet
12	Nøytral	Ja - hvorfor ikke?	Det er for mye. Får de ikke nok?	Nei	Det er flott, jeg støtter det	45 - 66	Ja, alltid	Ja, alltid	Høyre	1. prioritet
13	Mot	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er flott, jeg støtter det	25 - 44	Ikke stemmerett	Ja, alltid	Annet:blank	Jeg vil vurdere, men ikke så viktig
14	Nøytral	Ja - hvorfor ikke?	Det er et flott grep	Nei	Jeg liker ikke det	45 - 66	Ja, alltid	Ja, alltid	Fremskrittspartiet	4. - 5. prioritet
15	Nøytral	Ja - hvorfor ikke?	Det er for mye. Får de ikke nok?	Nei	Det er bra, men bør være mindre	45 - 66	Ja, alltid	Ja, alltid	Jeg vil ikke svare	4. - 5. prioritet
16	Mot	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er flott, jeg støtter det	25 - 44	Ja, alltid	Ja, alltid	Høyre	2. - 3. prioritet
17	Støttende	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er bra, men bør være mindre	25 - 44	Ja, alltid	Ja, alltid	Jeg har ikke støtteparti	4. - 5. prioritet
18	Støttende	Nei - bruk pengene til noe annet	Det er et flott grep	Nei	Det er flott, jeg støtter det	18 - 19	Nei	Nei	Arbeiderpartiet	2. - 3. prioritet
19	Veldig støttende	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er flott, jeg støtter det	18 - 19	Ja, alltid	Ja, alltid	Arbeiderpartiet	2. - 3. prioritet
20	Mot	Ja - hvorfor ikke?	Det er for mye. Får de ikke nok?	Ja	Det er flott, jeg støtter det	25 - 44	Ja, alltid	Ja, alltid	Jeg vil ikke svare	4. - 5. prioritet
21	Støttende	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er bra, men bør være mindre	20 - 24	Ja, alltid	Ja, noen ganger	Jeg vil ikke svare	2. - 3. prioritet
22	Støttende	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er flott, jeg støtter det	18 - 19	Ja, alltid	Nei	Høyre	2. - 3. prioritet
23	Nøytral	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er bra, men bør være mindre	25 - 44	Ja, alltid	Ja, noen ganger	Arbeiderpartiet	2. - 3. prioritet
24	Veldig imot	Nei - bruk pengene til noe annet	Det er et flott grep	Nei	Jeg liker ikke det	45 - 66	Ja, noen ganger	Ja, noen ganger	Jeg vil ikke svare	2. - 3. prioritet
25	Vet ikke	Nei - bruk pengene til noe annet	Det er et flott grep	Nei	Jeg liker ikke det	25 - 44	Nei	Nei	Jeg har ikke støtteparti	Jeg vil vurdere, men ikke så viktig
26	Veldig imot	Nei - bruk pengene til noe annet	Regjeringen bør støtte mer	Nei	Det er bra, men bør være mindre	25 - 44	Ja, noen ganger	Ja, noen ganger	Fremskrittspartiet	2. - 3. prioritet
27	Mot	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er bra, men bør være mindre	Under 18	Ikke stemmerett	Ikke stemmerett	Høyre	Jeg vil vurdere, men ikke så viktig
28	Nøytral	Nei - bruk pengene til noe annet	Det er et flott grep	Nei	Det er bra, men bør være mindre	18 - 19	Ikke stemmerett	Ikke stemmerett	Jeg har ikke støtteparti	Jeg vil vurdere, men ikke så viktig
29	Støttende	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er flott, jeg støtter det	25 - 44	Ikke stemmerett	Ikke stemmerett	Jeg har ikke støtteparti	2. - 3. prioritet
30	Nøytral	Ja - hvorfor ikke?	Det er for mye. Får de ikke nok?	Nei	Det er bra, men bør være mindre	18 - 19	Ja, alltid	Nei	Jeg har ikke støtteparti	2. - 3. prioritet
31	Nøytral	Ja - hvorfor ikke?	Regjeringen bør støtte mer	Ja	-	Under 18	Ikke stemmerett	Ikke stemmerett	Annet:Synes ingen av partiene er kor sæ	2. - 3. prioritet
32	Støttende	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er bra, men bør være mindre	18 - 19	Ikke stemmerett	Ikke stemmerett	Miljøpartiet De Grønne	2. - 3. prioritet
33	Nøytral	Nei - bruk pengene til noe annet	Det er et flott grep	Nei	Det er flott, jeg støtter det	18 - 19	Ja, sjelden	Nei	Høyre	Jeg vil vurdere, men ikke så viktig
34	Vet ikke	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er bra, men bør være mindre	18 - 19	Ja, noen ganger	Ja, alltid	Høyre	Jeg vil vurdere, men ikke så viktig
35	Mot	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er flott, jeg støtter det	Under 18	Ikke stemmerett	Ikke stemmerett	Sosialistisk Venstreparti	2. - 3. prioritet
36	Nøytral	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er bra, men bør være mindre	18 - 19	Nei	Nei	Høyre	2. - 3. prioritet
37	Veldig støttende	Nei - bruk pengene til noe annet	Det er et flott grep	Nei	Det er flott, jeg støtter det	18 - 19	Ikke stemmerett	Ikke stemmerett	Høyre	4. - 5. prioritet
38	Mot	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er bra, men bør være mindre	18 - 19	Ja, alltid	Ja, alltid	Høyre	2. - 3. prioritet
39	Veldig støttende	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er bra, men bør være mindre	18 - 19	Ja, alltid	Ja, alltid	Arbeiderpartiet	2. - 3. prioritet
40	Vet ikke	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er flott, jeg støtter det	Under 18	Ikke stemmerett	Ikke stemmerett	Jeg har ikke støtteparti	2. - 3. prioritet
41	Veldig imot	Ja - hvorfor ikke?	Det er et flott grep	Nei	-	18 - 19	Ikke stemmerett	Ikke stemmerett	Arbeiderpartiet	2. - 3. prioritet
42	Mot	Nei - bruk pengene til noe annet	Det er et flott grep	Nei	Det er flott, jeg støtter det	18 - 19	Ja, alltid	Ja, alltid	Høyre	Jeg vil vurdere, men ikke så viktig
43	Nøytral	Nei - bruk pengene til noe annet	-	-	-	Under 18	Ikke stemmerett	Ikke stemmerett	Jeg har ikke støtteparti	2. - 3. prioritet
44	Vet ikke	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er flott, jeg støtter det	18 - 19	Ikke stemmerett	Ikke stemmerett	Arbeiderpartiet	2. - 3. prioritet
45	Støttende	Nei - bruk pengene til noe annet	Det er et flott grep	Nei	Det er flott, jeg støtter det	Under 18	Ikke stemmerett	Ikke stemmerett	Arbeiderpartiet	2. - 3. prioritet
46	Nøytral	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er flott, jeg støtter det	25 - 44	Ja, alltid	Ja, noen ganger	Høyre	4. - 5. prioritet
47	Veldig støttende	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er flott, jeg støtter det	25 - 44	Ja, alltid	Ja, alltid	Arbeiderpartiet	1. prioritet
48	Nøytral	Nei - bruk pengene til noe annet	Det er for mye. Får de ikke nok?	Nei	Det er flott, jeg støtter det	18 - 19	Ja, alltid	Ja, alltid	Jeg har ikke støtteparti	1. prioritet
49	Mot	Nei - bruk pengene til noe annet	Det er et flott grep	Nei	Det er bra, men bør være mindre	18 - 19	Ja, alltid	Ja, alltid	Høyre	Jeg vil vurdere, men ikke så viktig
50	Veldig støttende	Ja - hvorfor ikke?	Det er et flott grep	Ja	Jeg liker ikke det	Under 18	Ikke stemmerett	Ikke stemmerett	Jeg har ikke støtteparti	Jeg vil vurdere, men ikke så viktig
51	Veldig imot	Nei - bruk pengene til noe annet	Det er for mye. Får de ikke nok?	Nei	Jeg liker ikke det	45 - 66	Ja, noen ganger	Ja, noen ganger	Fremskrittspartiet	Jeg vil vurdere, men ikke så viktig
52	Veldig imot	Ja - hvorfor ikke?	Det er et flott grep	Ja	Jeg liker ikke det	45 - 66	Ja, alltid	Ja, alltid	Fremskrittspartiet	Jeg vil vurdere, men ikke så viktig
53	Nøytral	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er flott, jeg støtter det	20 - 24	Ja, alltid	Ja, alltid	Sosialistisk Venstreparti	2. - 3. prioritet

63. Online Survey Detailed Result (Page 3: Participant 54 – 105, Q1 – Q10)

Participant	Date Taken (Europe/Oslo)	Time (sec)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
54	June 24, 2020 4:41 PM	378	Veldig støttende	Støttende	Nøytral	Ja - innen 2030	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Nei	Nei	Ja	Nei
55	June 24, 2020 4:49 PM	161	Veldig støttende	Veldig støttende	Nøytral	Ja - innen 2030	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Nei	Nei	Nei	Nei
56	June 24, 2020 4:52 PM	177	Støttende	Nøytral	Mot	Ja - innen 2030	Ja - men gradvis og sakte	Nei, det har jeg ikke, men det vil jeg neste gang	Bensin bil	Nei	Ja	Nei
57	June 24, 2020 4:55 PM	272	Støttende	Nøytral	Nøytral	Ja - innen 2040	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Bensin bil	Ja	Nei	Nei
58	June 24, 2020 4:58 PM	520	Veldig støttende	Veldig støttende	Veldig støttende	Nei	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Bensin bil	Nei	Nei	Nei
59	June 24, 2020 5:26 PM	411	Veldig støttende	Veldig støttende	Veldig støttende	Nei	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Elektrisk bil	Nei	Nei	Nei
60	June 24, 2020 5:28 PM	282	Veldig støttende	Støttende	Veldig imot	Ja - innen 2050	Ja - gradvis men raskere	Nei, det har jeg ikke og er ikke sikkert for neste gang	Elektrisk bil	Ja	Nei	Nei
61	June 24, 2020 5:48 PM	258	Støttende	Nøytral	Vet ikke	Ja - innen 2030	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Diesel bil	Ja	Nei	Nei
62	June 24, 2020 6:53 PM	182	Nøytral	Nøytral	Nøytral	Ja - innen 2030	Ja - men gradvis og sakte	Nei, det har jeg ikke og er ikke sikkert for neste gang	Nei	Ja	Nei	Ja
63	June 24, 2020 6:58 PM	317	Veldig støttende	Veldig støttende	Støttende	Nei	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Diesel bil	Ja	Nei	Nei
64	June 24, 2020 7:02 PM	259	Støttende	Støttende	Mot	Ja - innen 2050	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Nei	Nei	Ja	Nei
65	June 24, 2020 7:07 PM	222	Veldig støttende	Veldig støttende	Støttende	Nei	Ja - gradvis men raskere	Nei, det har jeg ikke og er ikke sikkert for neste gang	Hybrid bil	Nei	Nei	Nei
66	June 24, 2020 7:09 PM	251	Mot	Mot	Veldig imot	Ja - innen 2030	Ja - ASAP	Nei, det har jeg ikke, men det vil jeg neste gang	Elektrisk bil	Ja	Nei	Nei
67	June 24, 2020 7:47 PM	188	Nøytral	Nøytral	Veldig imot	Nei	Ja - gradvis men raskere	Nei, det har jeg ikke, og jeg vil ikke	Nei	Nei	Ja	Nei
68	June 24, 2020 7:56 PM	454	Støttende	Støttende	Støttende	Nei	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Diesel bil	Ja	Nei	Nei
69	June 24, 2020 7:56 PM	648	Nøytral	Nøytral	Veldig imot	Ja - innen 2040	Ja - gradvis men raskere	Ja, det har jeg og det vil jeg neste gang	Elektrisk bil	Ja	Ja	Ja
70	June 24, 2020 7:58 PM	209	Støttende	Støttende	Nøytral	Nei	Ja - men gradvis og sakte	Nei, det har jeg ikke og er ikke sikkert for neste gang	Elektrisk bil	Ja	Nei	Nei
71	June 24, 2020 8:15 PM	198	Vet ikke	Nøytral	Nøytral	Nei	Ja - ASAP	Nei, det har jeg ikke og er ikke sikkert for neste gang	Nei	Ja	Nei	Nei
72	June 24, 2020 8:32 PM	230	Veldig støttende	Veldig støttende	Veldig støttende	Nei	Nei	Nei, det har jeg ikke, og jeg vil ikke	Diesel bil	Nei	Nei	Nei
73	June 24, 2020 9:07 PM	1965	Mot	Mot	Veldig imot	Ja - innen 2050	Ja - gradvis men raskere	Nei, det har jeg ikke og er ikke sikkert for neste gang	Diesel bil	Ja	Nei	Ja
74	June 24, 2020 9:10 PM	140	Nøytral	Nøytral	Nøytral	Ja - innen 2040	Ja - gradvis men raskere	Nei, det har jeg ikke, men det vil jeg neste gang	Elektrisk bil	Ja	Ja	Nei
75	June 24, 2020 9:13 PM	285	Veldig imot	Støttende	Nøytral	Ja - innen 2050	Nei	Nei, det har jeg ikke, og jeg vil ikke	Diesel bil	Nei	Nei	Nei
76	June 24, 2020 9:36 PM	236	Støttende	Støttende	Nøytral	Nei	Nei	Nei, det har jeg ikke, og jeg vil ikke	Diesel bil	Ja	Nei	Nei
77	June 24, 2020 9:46 PM	415	Støttende	Støttende	Mot	Ja - innen 2040	Ja - gradvis men raskere	Nei, det har jeg ikke og er ikke sikkert for neste gang	Bensin bil	Ja	Nei	Nei
78	June 24, 2020 9:56 PM	714	Vet ikke	Nøytral	Nøytral	Ja - innen 2050	Ja - gradvis men raskere	Nei, det har jeg ikke, og jeg vil ikke	Bensin bil	Ja	Nei	Nei
79	June 24, 2020 10:38 PM	191	Støttende	Nøytral	Mot	Ja - innen 2040	Ja - men gradvis og sakte	Ja, det har jeg, men er ikke sikker på for neste gang	Nei	Ja	Ja	Nei
80	June 24, 2020 10:51 PM	156	Veldig støttende	Veldig støttende	Støttende	Nei	-	Nei, det har jeg ikke, og jeg vil ikke	Elektrisk bil	Ja	Nei	Nei
81	June 24, 2020 11:26 PM	318	Nøytral	Nøytral	Mot	Nei	Nei	Nei, det har jeg ikke, og jeg vil ikke	Diesel bil	Nei	Nei	Nei
82	June 25, 2020 7:36 AM	223	Støttende	Støttende	Støttende	Nei	Ja - gradvis men raskere	Ja, det har jeg og det vil jeg neste gang	Elektrisk bil	Nei	Ja	Nei
83	June 25, 2020 8:12 AM	227	Veldig støttende	Støttende	Mot	Nei	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Bensin bil	Ja	Ja	Nei
84	June 25, 2020 8:29 AM	217	Veldig støttende	Støttende	Mot	Ja - innen 2050	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Diesel bil	Ja	Ja	Nei
85	June 25, 2020 8:31 AM	267	Støttende	Nøytral	Nøytral	Ja - innen 2040	Ja - gradvis men raskere	Nei, det har jeg ikke og er ikke sikkert for neste gang	Diesel bil	Ja	Nei	Ja
86	June 25, 2020 8:49 AM	292	Støttende	Nøytral	Mot	Ja - innen 2030	Ja - ASAP	Nei, det har jeg ikke og er ikke sikkert for neste gang	Hybrid bil	Ja	Nei	Nei
87	June 25, 2020 9:03 AM	1003	Støttende	Støttende	Nøytral	Nei	Ja - men gradvis og sakte	Nei, det har jeg ikke og er ikke sikkert for neste gang	Elektrisk bil	Ja	Nei	Nei
88	June 25, 2020 10:37 AM	426	Støttende	Støttende	Nøytral	Ja - innen 2030	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Bensin bil	Ja	Ja	Nei
89	June 25, 2020 1:47 PM	212	Veldig støttende	Støttende	Nøytral	Ja - innen 2050	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Nei	Ja	Ja	Nei
90	June 25, 2020 3:01 PM	275	Støttende	Støttende	Nøytral	Nei	Ja - men gradvis og sakte	Nei, det har jeg ikke og er ikke sikkert for neste gang	Nei	Ja	Nei	Nei
91	June 25, 2020 3:55 PM	181	Støttende	Veldig støttende	Nøytral	Nei	Ja - ASAP	Nei, det har jeg ikke, og jeg vil ikke	Diesel bil	Ja	Nei	Nei
92	June 25, 2020 3:48 PM	188	Nøytral	Støttende	Nøytral	Nei	Ja - gradvis men raskere	Nei, det har jeg ikke og er ikke sikkert for neste gang	Diesel bil	Ja	Nei	Nei
93	June 25, 2020 8:15 PM	249	Veldig støttende	Støttende	Mot	Ja - innen 2040	Ja - men gradvis og sakte	Nei, det har jeg ikke og er ikke sikkert for neste gang	Bensin bil	Nei	Nei	Nei
94	June 25, 2020 10:04 PM	325	Støttende	Nøytral	Mot	Ja - innen 2050	Ja - gradvis men raskere	Nei, det har jeg ikke og er ikke sikkert for neste gang	Bensin bil	Ja	Nei	Ja
95	June 25, 2020 10:58 PM	244	Nøytral	Mot	Mot	Ja - innen 2030	Ja - gradvis men raskere	Nei, det har jeg ikke, og jeg vil ikke	Hybrid bil	Ja	Nei	Ja
96	June 26, 2020 8:48 AM	175	Nøytral	Mot	Veldig imot	Ja - innen 2040	Ja - men gradvis og sakte	Nei, det har jeg ikke og er ikke sikkert for neste gang	Hybrid bil	Ja	Nei	Ja
97	June 26, 2020 10:02 AM	192	Nøytral	Støttende	Mot	Ja - innen 2050	Nei	Nei, det har jeg ikke, og jeg vil ikke	Bensin bil	Ja	Ja	Nei
98	June 26, 2020 4:43 PM	154	Nøytral	Støttende	Mot	Ja - innen 2050	Ja - men gradvis og sakte	Nei, det har jeg ikke og er ikke sikkert for neste gang	Bensin bil	Nei	Nei	Nei
99	June 26, 2020 7:03 PM	254	Støttende	Støttende	Nøytral	Ja - innen 2040	Ja - gradvis men raskere	Nei, det har jeg ikke, og jeg vil ikke	Bensin bil	Ja	Ja	Nei
100	June 26, 2020 9:18 PM	262329	Nøytral	Mot	Vet ikke	Ja - innen 2050	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Nei	Ja	Ja	Nei
101	June 26, 2020 11:33 PM	140	Støttende	Støttende	Veldig imot	Nei	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Nei	Ja	Nei	Nei
102	June 27, 2020 6:25 PM	814	Veldig støttende	Veldig støttende	Veldig støttende	Ja - umiddelbart	Ja - ASAP	Ja, det har jeg og det vil jeg neste gang	Diesel bil	Nei	Nei	Nei
103	June 28, 2020 2:32 AM	224	Veldig støttende	Veldig støttende	Veldig støttende	Nei	Ja - gradvis men raskere	Nei, det har jeg ikke, og jeg vil ikke	Diesel bil	Nei	Nei	Nei
104	June 30, 2020 11:28 AM	173	Støttende	Støttende	Mot	Nei	Ja - gradvis men raskere	Nei, det har jeg ikke, og jeg vil ikke	Bensin bil	Nei	Nei	Nei
105	July 6, 2020 11:27 PM	260	Veldig støttende	Veldig støttende	Støttende	Nei	Ja - men gradvis og sakte	Nei, det har jeg ikke, og jeg vil ikke	Bensin bil	Nei	Nei	Nei

64. Online Survey Detailed Result (Page 4: Participant 54 – 105, Q11 – Q20)

Participant	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
54	Mot	Ja - hvorfor ikke?	Det er et flott grep	Nei	Jeg liker ikke det	20 - 24	Ja, noen ganger	Ja, noen ganger	Kristelig Folkeparti	2. - 3. prioritet
55	Veldig imot	Nei - bruk pengene til noe annet	Det er et flott grep	Nei	Det er bra, men bør være mindre	20 - 24	Nei	Nei	Jeg vil ikke svare	Stemmer samme parti uansett
56	Veldig imot	Nei - bruk pengene til noe annet	Regjeringen bør støtte mer	Ja	Det er bra, men bør være mindre	20 - 24	Ja, sjelden	Ja, sjelden	Arbeiderpartiet	2. - 3. prioritet
57	Mot	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er flott, jeg støtter det	25 - 44	Nei	Nei	Jeg har ikke støtteparti	Jeg vil vurdere, men ikke så viktig
58	Veldig imot	Ja - hvorfor ikke?	Det er for mye. Får de ikke nok?	Nei	Det er flott, jeg støtter det	20 - 24	Ja, alltid	Ja, alltid	Annet:Det varierer. Jeg er ofte usikker.	Jeg vil vurdere, men ikke så viktig
59	Veldig imot	Nei - bruk pengene til noe annet	Det er for mye. Får de ikke nok?	Nei	Jeg liker ikke det	25 - 44	Ja, alltid	Ja, alltid	Fremskrittspartiet	Stemmer samme parti uansett
60	Støttende	Ja - hvorfor ikke?	Det er et flott grep	Ja	Det er flott, jeg støtter det	45 - 66	Ja, noen ganger	Ja, noen ganger	Jeg har ikke støtteparti	4. - 5. prioritet
61	Støttende	Nei - bruk pengene til noe annet	Det er et flott grep	Nei	Det er bra, men bør være mindre	25 - 44	Nei	Nei	Arbeiderpartiet	2. - 3. prioritet
62	Veldig imot	Ja - hvorfor ikke?	-	Nei	-	18 - 19	Nei	Nei	Jeg har ikke støtteparti	2. - 3. prioritet
63	Nøytral	Nei - bruk pengene til noe annet	Det er et flott grep	Nei	Det er flott, jeg støtter det	67 - 79	Ja, alltid	Ja, alltid	Fremskrittspartiet	Stemmer samme parti uansett
64	Støttende	Nei - bruk pengene til noe annet	Det er et flott grep	Nei	Det er bra, men bør være mindre	45 - 66	Ja, alltid	Ja, alltid	Fremskrittspartiet	4. - 5. prioritet
65	Støttende	Ja - hvorfor ikke?	Regjeringen bør støtte mer	Nei	Det er flott, jeg støtter det	25 - 44	Ja, alltid	Ja, alltid	Høyre	2. - 3. prioritet
66	Veldig støttende	Ja - hvorfor ikke?	Regjeringen bør støtte mer	Ja	Det er flott, jeg støtter det	25 - 44	Ikke stemmerett	Ja, alltid	Miljøpartiet De Grønne	1. prioritet
67	Støttende	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er bra, men bør være mindre	25 - 44	Ja, alltid	Ja, alltid	Jeg vil ikke svare	Jeg vil vurdere, men ikke så viktig
68	Nøytral	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er flott, jeg støtter det	25 - 44	Ja, alltid	Ja, alltid	Arbeiderpartiet	2. - 3. prioritet
69	Støttende	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er flott, jeg støtter det	25 - 44	Ja, alltid	Ja, alltid	Sosialistisk Venstreparti	2. - 3. prioritet
70	Mot	Nei - bruk pengene til noe annet	Regjeringen bør støtte mer	Nei	Det er bra, men bør være mindre	45 - 66	Nei	Nei	Jeg har ikke støtteparti	1. prioritet
71	Mot	Nei - bruk pengene til noe annet	Det er et flott grep	Nei	Det er flott, jeg støtter det	18 - 19	Ja, alltid	Ja, alltid	Arbeiderpartiet	2. - 3. prioritet
72	Veldig imot	Nei - bruk pengene til noe annet	Det er et flott grep	Nei	Det er bra, men bør være mindre	25 - 44	Ikke stemmerett	Nei	Annet:Ingen	Jeg vil vurdere, men ikke så viktig
73	Støttende	Ja - hvorfor ikke?	Det er for mye. Får de ikke nok?	Nei	Det er flott, jeg støtter det	25 - 44	Ja, alltid	Ja, sjelden	Jeg vil ikke svare	2. - 3. prioritet
74	Veldig imot	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er bra, men bør være mindre	20 - 24	Ja, alltid	Ja, alltid	Fremskrittspartiet	4. - 5. prioritet
75	Veldig imot	Nei - bruk pengene til noe annet	Det er for mye. Får de ikke nok?	Nei	Det er flott, jeg støtter det	25 - 44	Ja, alltid	Nei	Annet	Stemmer samme parti uansett
76	Veldig imot	Nei - bruk pengene til noe annet	Det er for mye. Får de ikke nok?	Nei	Det er bra, men bør være mindre	25 - 44	Ja, noen ganger	Ja, noen ganger	Fremskrittspartiet	2. - 3. prioritet
77	Mot	Nei - bruk pengene til noe annet	Det er et flott grep	Nei	Det er bra, men bør være mindre	25 - 44	Ja, alltid	Ja, alltid	Kristelig Folkeparti	4. - 5. prioritet
78	Mot	Ja - hvorfor ikke?	Det er et flott grep	Ja	Det er flott, jeg støtter det	25 - 44	Ikke stemmerett	Nei	Jeg vil ikke svare	4. - 5. prioritet
79	Støttende	Nei - bruk pengene til noe annet	Det er et flott grep	Ja	Det er flott, jeg støtter det	20 - 24	Ja, alltid	Ja, noen ganger	Miljøpartiet De Grønne	2. - 3. prioritet
80	Nøytral	Ja - hvorfor ikke?	Det er et flott grep	Ja	Det er flott, jeg støtter det	45 - 66	Ja, alltid	Ja, alltid	Jeg vil ikke svare	2. - 3. prioritet
81	Veldig imot	Nei - bruk pengene til noe annet	Det er for mye. Får de ikke nok?	Nei	Jeg liker ikke det	45 - 66	Ikke stemmerett	Ja, alltid	Rødt	1. prioritet
82	Støttende	Ja - hvorfor ikke?	Det er for mye. Får de ikke nok?	Ja	Det er flott, jeg støtter det	25 - 44	Ikke stemmerett	Ja, alltid	Høyre	2. - 3. prioritet
83	Nøytral	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er flott, jeg støtter det	45 - 66	Ja, alltid	Ja, alltid	Arbeiderpartiet	2. - 3. prioritet
84	Støttende	Nei - bruk pengene til noe annet	Det er et flott grep	Ja	Det er flott, jeg støtter det	45 - 66	Ja, alltid	Ja, alltid	Høyre	1. prioritet
85	Veldig støttende	Ja - hvorfor ikke?	Det er for mye. Får de ikke nok?	Nei	Det er flott, jeg støtter det	25 - 44	Ja, alltid	Ja, alltid	Jeg har ikke støtteparti	2. - 3. prioritet
86	Veldig støttende	Ja - hvorfor ikke?	Det er for mye. Får de ikke nok?	Nei	Det er flott, jeg støtter det	25 - 44	Ja, alltid	Ja, alltid	Miljøpartiet De Grønne	1. prioritet
87	Nøytral	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er flott, jeg støtter det	25 - 44	Ja, noen ganger	Ja, noen ganger	Jeg har ikke støtteparti	Jeg vil vurdere, men ikke så viktig
88	Nøytral	Ja - hvorfor ikke?	Det er for mye. Får de ikke nok?	Nei	Det er flott, jeg støtter det	25 - 44	Nei	Nei	Jeg har ikke støtteparti	2. - 3. prioritet
89	Veldig imot	Ja - hvorfor ikke?	Det er for mye. Får de ikke nok?	Nei	Det er bra, men bør være mindre	25 - 44	Ja, alltid	Ja, alltid	Høyre	2. - 3. prioritet
90	Mot	Nei - bruk pengene til noe annet	Det er et flott grep	Nei	Det er flott, jeg støtter det	20 - 24	Ja, alltid	Ja, alltid	Høyre	Jeg vil vurdere, men ikke så viktig
91	Støttende	Ja - hvorfor ikke?	Det er et flott grep	Ja	Det er flott, jeg støtter det	25 - 44	Ikke stemmerett	Ja, alltid	Arbeiderpartiet	2. - 3. prioritet
92	Mot	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er bra, men bør være mindre	25 - 44	Ja, noen ganger	Ja, sjelden	Jeg har ikke støtteparti	Jeg vil vurdere, men ikke så viktig
93	Nøytral	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er flott, jeg støtter det	67 - 79	Ja, alltid	Ja, alltid	Høyre	Stemmer samme parti uansett
94	Nøytral	Ja - hvorfor ikke?	Det er for mye. Får de ikke nok?	Nei	Det er bra, men bør være mindre	20 - 24	Ja, alltid	Ja, noen ganger	Sosialistisk Venstreparti	4. - 5. prioritet
95	Nøytral	Ja - hvorfor ikke?	Det er for mye. Får de ikke nok?	Nei	Jeg liker ikke det	45 - 66	Ja, alltid	Ja, alltid	Jeg har ikke støtteparti	4. - 5. prioritet
96	Støttende	Ja - hvorfor ikke?	Det er for mye. Får de ikke nok?	Nei	Det er flott, jeg støtter det	45 - 66	Ja, alltid	Ja, alltid	Miljøpartiet De Grønne	1. prioritet
97	Veldig imot	Ja - hvorfor ikke?	Regjeringen bør støtte mer	Nei	Jeg liker ikke det	25 - 44	Ikke stemmerett	Ja, noen ganger	Arbeiderpartiet	1. prioritet
98	Støttende	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er bra, men bør være mindre	20 - 24	Ja, alltid	Nei	Arbeiderpartiet	2. - 3. prioritet
99	Nøytral	Ja - hvorfor ikke?	Det er for mye. Får de ikke nok?	Ja	Det er bra, men bør være mindre	25 - 44	Ikke stemmerett	Ikke stemmerett	Jeg vil ikke svare	4. - 5. prioritet
100	Mot	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er flott, jeg støtter det	25 - 44	Ja, noen ganger	Ja, noen ganger	Rødt	2. - 3. prioritet
101	Veldig imot	Ja - hvorfor ikke?	Det er et flott grep	Nei	Det er flott, jeg støtter det	18 - 19	Ja, alltid	Ja, alltid	Jeg vil ikke svare	Jeg vil vurdere, men ikke så viktig
102	Vet ikke	Nei - bruk pengene til noe annet	Det er et flott grep	Nei	Det er bra, men bør være mindre	45 - 66	Nei	Nei	Arbeiderpartiet	Jeg vil vurdere, men ikke så viktig
103	Veldig imot	Ja - hvorfor ikke?	Det er et flott grep	Ja	Det er flott, jeg støtter det	20 - 24	Ja, alltid	Ja, alltid	Rødt	4. - 5. prioritet
104	Mot	Nei - bruk pengene til noe annet	Det er et flott grep	Ja	Det er flott, jeg støtter det	67 - 79	Ja, alltid	Ja, alltid	Jeg vil ikke svare	2. - 3. prioritet
105	Veldig imot	Ja - hvorfor ikke?	Det er et flott grep	Nei	Jeg liker ikke det	45 - 66	Ikke stemmerett	Ja, sjelden	Jeg vil ikke svare	4. - 5. prioritet

65. Original Survey Answer from Arbeiderpartiet (Labor Party) (Page 1)

Respondent: Maria Varteressian – Political advisor (Energy and Environment) of Labor Party's Parliament team

Som industriparti jobber Arbeiderpartiet for å legge til rette for en utvikling av eksisterende og opprettelse av ny industri. Kompetansen fra olje- og gassindustrien er sentral for utvikling av tilstøtende næringer som hydrogen, ccs og havvind.

Under følger svar på dine spørsmål (merket med gult).

Spørsmål:

Olje- og gassutvinning

a) Er partiet for eller imot eksisterende olje- og gassutvinning i Norge?

1) Veldig støttende
2) Støttende
3) Nøytral
4) Mot
5) Veldig imot

b) Er partiet for eller imot å utforske og utvikle nye olje- og gassfelt i Norge?

1) Veldig støttende
2) Støttende
3) Nøytral
4) Mot
5) Veldig imot

c) Når snart skal Norge avslutte olje- og gassutvinningen?

1) Umiddelbart
2) innen 2030
3) innen 2040
4) innen 2050
5) Aldri

Svar: Ingen av alternativene over. Sluttdato for olje- og gassindustrien er ikke relevant, vi må heller sette en startdato for nye næringer som skal springe ut fra olje- og gassindustriens kompetanse

66. Original Survey Answer from Arbeiderpartiet (Labor Party) (Page 2)

Fornybar energi

a) Er partiet for eller imot å utvikle fornybar energi i Norge foruten eksisterende vannkraft?

1) Veldig støttende
2) Støttende
3) Nøytral
4) Mot
5) Veldig imot

b) Er partiet for eller imot offshore vindkraft på norsk sokkel?

1) Veldig støttende
2) Støttende
3) Nøytral
4) Mot
5) Veldig imot

c) Er det partiet for eller imot satsning på hydrogen i Norge?

1) Veldig støttende
2) Støttende
3) Nøytral
4) Mot
5) Veldig imot

67. Original Survey Answer from Arbeiderpartiet (Labor Party) (Page 3)

Grønne offshore felt

a) Er partiet for eller imot elektrifisering av offshore-felt ved å koble til landstrøm (fornybare kilder)?

1) Veldig støttende 2) Støttende
3) Nøytral 4) Mot 5) Veldig imot

b) Er partiet for eller imot elektrifisering av offshore felt med offshore vindkraft?

1) Veldig støttende 2) Støttende
3) Nøytral 4) Mot 5) Veldig imot

c) Mener partiet at energilagringsløsning er essensiell for å oppnå grønne offshore-felt?

1) Ja, med batteri
2) Ja, med hydrogen
3) Nei, naturgass (gassturbiner) er bra
4) Nei, strøm fra land er fleksibel nok

Svar: litt usikker på hva du spør om her.

d) Teknologisk er det mulig at *electrolyzer kan bygges inn i havvindmøllene. Alt overskudd av hydrogen kan blandes i naturgass, noe som gjør naturgass grønnere.*Electrolyzer splitter hydrogen og oksygen fra vann med elektrisitet.

Støtter partiet eller mot å konvertere havvindmøller til hydrogenvindturbiner?

1) Nei, bare strøm er bra 2) Ja, noen vindmøller kan generere hydrogen som energilagring
3) Ja: alle vindmøller kan konvertere til hydrogen vindkraft

Svar: Det er forskjell på grønt hydrogen (fra elektrolyse) og blått hydrogen (fra naturgass) Sistnevnte lages ved hjelp av CCS. Å blande elektrolysebasert hydrogen i naturgass har jeg aldri hørt om. Produktet du da vil sitte igjen med er verken hydrogen eller gass. Men mulig jeg misforstår spørsmålet? Her er en link til Sintef sin side med info om hydrogen: https://www.sintef.no/siste-nytt/hva-er-egentlig-gra-gronn-bla-og-turkis-hydrogen/

e) Hvor raskt skal alle offshore-felt elektrifiseres med fornybar energi?

1) Så snart det kan 2) innen 2030 3) innen 2040 4) innen 2050 5) Ikke nødvendig

Svar: Mener du absolutt alle petroleumsinstallasjoner som finnes, eller kun de som kan elektrifiseres? I tilfelle sistnevnte, er det jo «så snart som mulig» rett alternativ, men det er mange forutsetninger for hva som vil være «mulig og snart»

68. Original Survey Answer from Arbeiderpartiet (Labor Party) (Page 4)

Finans

a) Anser partiet at offshore vindkraft er en fremtidige eksportartikkel?

1) Ja 2) Nei

Svar: Det er nok ikke vindkraften i seg selv som blir en eksportartikkel, men teknologien og kompetansen. Men på lang sikt vil det være mulig å selge vindkraft produsert på norsk sokkel til det europeiske markedet.

b) Er partiet villig til å støtte økonomisk (inkludert skatteinsentiver) utbygging av fornybar energi i Norge? Hvis ja, i hvilken grad?

1) Ja - Omfattende eller mer enn nå 2) Ja – Samme som nå
3) Ja - Mindre enn nå 4) Ja - Ikke sikker
5) Nei

c) Er partiet villig til å støtte økonomisk (inkludert skatteinsentiver) full elektrifisering av offshore-feltet? Hvis ja, i hvilken grad?

1) Ja - Omfattende eller mer enn nå 2) Ja – Samme som nå
3) Ja - Mindre enn nå 4) Ja - Ikke sikker
5) Nei

Svar: Igjen, usikker på hva du mener med full elekrifisering.

d) Er partiet villig til å støtte økonomisk (inkludert skatteinsentiver) havvinden? Hvis ja, i hvilken grad?

1) Ja - Omfattende eller mer enn nå 2) Ja - Samme som nå
3) Ja - Mindre enn nå 4) Ja - Ikke sikker
5) Nei

e) Er partiet villig til å støtte økonomisk (inkludert skatteinsentiver) hydrogen som energilagringsløsning for å oppnå grønne offshore-felt? Hvis ja, i hvilken grad?

1) Ja - Omfattende eller mer enn nå 2) Ja - Samme som nå
3) Ja - Mindre enn nå 4) Ja - Ikke sikker
5) Nei

Svar: hydrogenproduksjonen vil/bør brukes til f.eks grønn skipsfart, prosessindustri eller salg til det europeiske kraftmarkedet. Ikke til å gjøre offshorefelt grønne.

69. Original Survey Answer from Høyre (Conservative Party) (Page 1)

Respondent: Liv Kari Eskeland – Member of parliament for Conservative Party and Member of The Standing Committee on Energy and the Environment

Spørsmål:

Olje- og gassutvinning

a) Er partiet for eller imot eksisterende olje- og gassutvinning i Norge?

1) Veldig støttende 2) Støttende 3) Nøytral 4) Mot 5) Veldig imot

b) Er partiet for eller imot å utforske og utvikle nye olje- og gassfelt i Norge?

1) Veldig støttende 2) Støttende 3) Nøytral 4) Mot 5) Veldig imot

Svar: Like viktig er å utnytte infrastrukturen som er etablert med å utvinne maksimalt fra de feltene som er etablert

c) Når snart skal Norge avslutte olje- og gassutvinningen

1) Umiddelbart 2) innen 2030 3) innen 2040 4) innen 2050 5) Aldri

Svar: Vi setter ingen sluttdato

Fornybar energi

a) Er partiet for eller imot å utvikle fornybar energi i Norge foruten eksisterende vannkraft?

1) Veldig støttende 2) Støttende 3) Nøytral 4) Mot 5) Veldig imot

b) Er partiet for eller imot offshore vindkraft på norsk sokkel?

1) Veldig støttende 2) Støttende 3) Nøytral 4) Mot 5) Veldig imot

Svar: Vi ser dette i hovudsak som ei industriutvikling og teknologiutvikling der vi kan ta med vår kompetanse og teknologi til andre delar av verda

c) Er det partiet for eller imot satsning på hydrogen i Norge?

1) Veldig støttende 2) Støttende 3) Nøytral 4) Mot 5) Veldig imot

70. Original Survey Answer from Høyre (Conservative Party) (Page 2)

Grønne offshore felt

a) Er partiet for eller imot elektrifisering av offshore-felt ved å koble til landstrøm (fornybare kilder)?

1) Veldig støttende 2) Støttende 3) Nøytral 4) Mot 5) Veldig imot

b) Er partiet for eller imot elektrifisering av offshore felt med offshore vindkraft?

1) Veldig støttende 2) Støttende 3) Nøytral 4) Mot 5) Veldig imot

c) Mener partiet at energilagringsløsning er essensiell for å oppnå grønne offshore-felt?

1) Ja, med batteri 2) Ja, med hydrogen 3) Nei, naturgass (gassturbiner) er bra
4) Nei, strøm fra land er fleksibel nok

Svar: Hydrogen eller ammoniakk. Der det ligger til rette er strøm fra land bra. Dette re ikkje eit enten eller spørsmål men både og. Der hydrogen/ammoniakk ikkje er mogleg kan også gassturbiner vera eit alternativ.

d) Teknologisk er det mulig at *electrolyzer kan bygges inn i havvindmøllene. Alt overskudd av hydrogen kan blandes i naturgass, noe som gjør naturgass grønnere.*Electrolyzer splitter hydrogen og oksygen fra vann med elektrisitet. Støtter partiet eller mot å konvertere havvindmøller til hydrogenvindturbiner?

1) Nei, bare strøm er bra
2) Ja, noen vindmøller kan generere hydrogen som energilagring
3) Ja: alle vindmøller kan konvertere til hydrogen vindkraft

Svar: Mest optimalt er sjølvsagt å bruke krafta direkte, dernest er det å lagre den i hydrogen/ammoniakkbindinger

e) Hvor raskt skal alle offshore-felt elektrifiseres med fornybar energi?

1) Så snart det kan 2) innen 2030 3) innen 2040 4) innen 2050 5) Ikke nødvendig

Svar: Så snart det er samfunnsøkonomisk lønsomt. Dette vil på sikt bli del av ein offshore strømgrid som kan benyttes etter at enkelte av O&G innstallasjonene er utdatert.

71. Original Survey Answer from Høyre (Conservative Party) (Page 3)

Finans

a) Anser partiet at offshore vindkraft er en fremtidige eksportartikkel?

1) Ja 2) Nei

b) Er partiet villig til å støtte økonomisk (inkludert skatteinsentiver) utbygging av fornybar energi i Norge? Hvis ja, i hvilken grad?

1) Ja - Omfattende eller mer enn nå 2) Ja – Samme som nå 3) Ja - Mindre enn nå 4) Ja - Ikke sikker 5) Nei

c) Er partiet villig til å støtte økonomisk (inkludert skatteinsentiver) full elektrifisering av offshore-feltet? Hvis ja, i hvilken grad?

1) Ja - Omfattende eller mer enn nå 2) Ja – Samme som nå
3) Ja - Mindre enn nå 4) Ja - Ikke sikker 5) Nei

d) Er partiet villig til å støtte økonomisk (inkludert skatteinsentiver) havvinden? Hvis ja, i hvilken grad?

1) Ja - Omfattende eller mer enn nå 2) Ja - Samme som nå 3) Ja - Mindre enn nå
4) Ja - Ikke sikker 5) Nei

e) Er partiet villig til å støtte økonomisk (inkludert skatteinsentiver) hydrogen som energilagringsløsning for å oppnå grønne offshore-felt? Hvis ja, i hvilken grad?

1) Ja - Omfattende eller mer enn nå 2) Ja - Samme som nå 3) Ja - Mindre enn nå
4) Ja - Ikke sikker 5) Nei

Svar: Ettersom det ikkje er energilagring i hydrogen offshore no, må det nødvendigvis bli nr 1 dersom vi støtter dette J

72. Original Survey Answer from Fremskrittspartiet (Progress Party) (Page 1)

Respondent: Liv Lønnum – Political advisor (Energy and Environment) of Progress Party's Parliament team

FrP er positive til å jobbe for endringer over til fornybarsamfunnet. Det krever en del teknologiutvikling som spørsmålene dine reflekterer. Vi ønsker i størst mulig grad at det skal utvikles på markedsmessige vilkår og med det virkemiddelapparatet som vi har i Norge.
Det er flere av spørsmålene dine som ikke er ferdig diskutert i partiet (eks. økonomiske/ skattemessige ordninger for havvind, CCS, hydrogen mm.) og som vil være en del av programarbeidet som nå pågår. Våre forslag til løsninger og standpunkt på flere av spørsmålene dine forventer jeg derfor vil komme etter hvert.

Spørsmål:

Olje- og gassutvinning

a) Er partiet for eller imot eksisterende olje- og gassutvinning i Norge?

1) Veldig støttende
2) Støttende
3) Nøytral
4) Mot
5) Veldig imot

Svar: 1

b) Er partiet for eller imot å utforske og utvikle nye olje- og gassfelt i Norge?

1) Veldig støttende
2) Støttende
3) Nøytral
4) Mot
5) Veldig imot

Svar 1:

c) Når snart skal Norge avslutte olje- og gassutvinningen?

1) Umiddelbart
2) innen 2030
3) innen 2040
4) innen 2050
5) Aldri

Svar: 5

73. Original Survey Answer from Fremskrittspartiet (Progress Party) (Page 2)

Fornybar energi

a) Er partiet for eller imot å utvikle fornybar energi i Norge foruten eksisterende vannkraft?

1) Veldig støttende
2) Støttende
3) Nøytral
4) Mot
5) Veldig imot

Svar: 2

b) Er partiet for eller imot offshore vindkraft på norsk sokkel?

1) Veldig støttende
2) Støttende
3) Nøytral
4) Mot
5) Veldig imot

Svar: 2

c) Er det partiet for eller imot satsning på hydrogen i Norge?

1) Veldig støttende
2) Støttende
3) Nøytral
4) Mot
5) Veldig imot

Svar: 2

74. Original Survey Answer from Fremskrittspartiet (Progress Party) (Page 3)

Grønne offshore felt

a) Er partiet for eller imot elektrifisering av offshore-felt ved å koble til landstrøm (fornybare kilder)?

1) Veldig støttende 2) Støttende
3) Nøytral 4) Mot 5) Veldig imot

Svar: 2

b) Er partiet for eller imot elektrifisering av offshore felt med offshore vindkraft?

1) Veldig støttende 2) Støttende
3) Nøytral 4) Mot 5) Veldig imot

Svar: 2

c) Mener partiet at energilagringsløsning er essensiell for å oppnå grønne offshore-felt?

1) Ja, med batteri 2) Ja, med hydrogen
3) Nei, naturgass (gassturbiner) er bra 4) Nei, strøm fra land er fleksibel nok

Svar:

d) Teknologisk er det mulig at *electrolyzer kan bygges inn i havvindmøllene. Alt overskudd av hydrogen kan blandes i naturgass, noe som gjør naturgass grønnere.*Electrolyzer splitter hydrogen og oksygen fra vann med elektrisitet.

Støtter partiet eller mot å konvertere havvindmøller til hydrogenvindturbiner?

1) Nei, bare strøm er bra. 2) Ja, noen vindmøller kan generere hydrogen som energilagring
3) Ja: alle vindmøller kan konvertere til hydrogen vindkraft

Svar: 2

e) Hvor raskt skal alle offshore-felt elektrifiseres med fornybar energi?

1) Så snart det kan 2) innen 2030
3) innen 2040 4) innen 2050 5) Ikke nødvendig

Svar: 5

75. Original Survey Answer from Fremskrittspartiet (Progress Party) (Page 4)

Finans

a) Anser partiet at offshore vindkraft er en fremtidige eksportartikkel?

1) Ja 2) Nei

Svar: 1

b) Er partiet villig til å støtte økonomisk (inkludert skatteinsentiver) utbygging av fornybar energi i Norge? Hvis ja, i hvilken grad?

1) Ja - Omfattende eller mer enn nå 2) Ja – Samme som nå
3) Ja - Mindre enn nå 4) Ja - Ikke sikker 5) Nei

Svar: 4

c) Er partiet villig til å støtte økonomisk (inkludert skatteinsentiver) full elektrifisering av offshore-feltet? Hvis ja, i hvilken grad?

1) Ja - Omfattende eller mer enn nå 2) Ja – Samme som nå
3) Ja - Mindre enn nå 4) Ja - Ikke sikker 5) Nei

Svar: 5

d) Er partiet villig til å støtte økonomisk (inkludert skatteinsentiver) havvinden? Hvis ja, i hvilken grad?

1) Ja - Omfattende eller mer enn nå 2) Ja - Samme som nå
3) Ja - Mindre enn nå 4) Ja - Ikke sikker 5) Nei

Svar: 4

e) Er partiet villig til å støtte økonomisk (inkludert skatteinsentiver) hydrogen som energilagringsløsning for å oppnå grønne offshore-felt? Hvis ja, i hvilken grad?

1) Ja - Omfattende eller mer enn nå 2) Ja - Samme som nå
3) Ja - Mindre enn nå 4) Ja - Ikke sikker 5) Nei

Svar: 4

76. Original Survey Answer from Sosialistisk Venstreparti (Socialist Left Party) (Page 1)

Respondent: Ingrid Tungen– Political advisor (Climate and Environment) of Socialist Left Party's Parliament team

Her er våre svar på spørsmålene som du har stilt. Som du vil se er det mange spørsmål vi ikke kan svare på et av alternativene du setter opp fordi det enten ikke passer, eller forutsetningen i spørsmålet ikke gjør det mulig for oss å svare ja eller nei. Dette gjelder blant annet å svare på rene tekniske valg og når spørsmålene er for generelle. Jeg har forsøkt å redegjort for hvor dette er, så kan du eventuelle stille flere spørsmål om det er nødvendig.

Spørsmål

Olje- og gassutvinning

a) Er partiet for eller imot eksisterende olje- og gassutvinning i Norge?

1) Veldig støttende 2) Støttende 3) Nøytral
4) Mot 5) Veldig imot

Svar: 4)
SV er i utgangspunktet for å erstatte fossil energiproduksjon med fornybar og dermed på sikt avvikle olje- og gassutvinning i Norge, også eksisterende.

b) Er partiet for eller imot å utforske og utvikle nye olje- og gassfelt i Norge?

1) Veldig støttende 2) Støttende 3) Nøytral
4) Mot 5) Veldig imot

Svar:
SV vil ikke ha flere konsesjonsrunder på norsk sokkel og vil avvikle leterefusjonsordningen, og dersom det er det som ligger i «nye» olje- og gassfelt så vil alternativ 5 passe. Det betyr likevel ikke at SV vil være imot alle endringer og nye boringer på tilliggende felt i åpnede områder.

c) Når snart skal Norge avslutte olje- og gassutvinningen?

1) Umiddelbart 2) innen 2030
3) innen 2040 4) innen 2050 5) Aldri

Svar:
SV har ikke vedtatt en dato for avvikling av produksjon på norsk sokkel, eller om det er nødvendig med en absolutt full avvikling og ikke noe produksjon. Det viktigste for SV er at en eventuell produksjon er i samsvar med målet om en nullutslippssamfunn innen 2040. Det kan også finnes løsninger med karbon fangst og lagring for å få det til så det er ikke mulig å ta stilling til om det betyr at absolutt all produksjon på norsk sokkel skal avvikles.

77. Original Survey Answer from Sosialistisk Venstreparti (Socialist Left Party) (Page 2)

Fornybar energi

a) Er partiet for eller imot å utvikle fornybar energi i Norge foruten eksisterende vannkraft?

1) Veldig støttende
2) Støttende 3) Nøytral 4) Mot
5) Veldig imot

Svar:
SV er for å utvikle fornybar energi i Norge der det kan gjøres uten store tap av natur og biologisk mangfold. Det vil også bety at utvidelser og oppgraderinger av «eksisterende vannkraft» også kan være problematisk og det kan være ønskelige å for eksempel øke vannmengden i forbindelse med revisjoner av vannkraftkonsesjonene.

b) Er partiet for eller imot offshore vindkraft på norsk sokkel?

1) Veldig støttende
2) Støttende 3) Nøytral 4) Mot
5) Veldig imot

Svar:
SV er for å utvikle offshore vindkraft på norsk sokkel, men det må skje på premissene til fiskeriene, naturmangfold og eventuelle konsekvenser. Det er altså vanskelig å si at partiet vil være støttende til alle prosjekter.

c) Er det partiet for eller imot satsning på hydrogen i Norge?

1) Veldig støttende
2) Støttende 3) Nøytral 4) Mot
5) Veldig imot

Svar: 1)
SV har foreslått et fond på 1 mrd. for å satse på grønn hydrogen i Norge.

78. Original Survey Answer from Sosialistisk Venstreparti (Socialist Left Party) (Page 3)

Grønne offshore felt

a) Er partiet for eller imot elektrifisering av offshore-felt ved å koble til landstrøm (fornybare kilder)?

1) Veldig støttende 2) Støttende 3) Nøytral 4) Mot 5) Veldig imot

Svar: 1)
SV har lenge foreslått å elektrifisere offshore-felt der det er mulig og ta det med som et vilkår i konsesjonsprosessen.

b) Er partiet for eller imot elektrifisering av offshore felt med offshore vindkraft?

1) Veldig støttende 2) Støttende 3) Nøytral 4) Mot 5) Veldig imot

Svar: 1)
Der det er mulig så bør det stilles krav om elektrifisering, og da kan vindkraft være et alternativ.

c) Mener partiet at energilagringsløsning er essensiell for å oppnå grønne offshore-felt?

1) Ja, med batteri 2) Ja, med hydrogen 3) Nei, naturgass (gassturbiner) er bra
4) Nei, strøm fra land er fleksibel nok

Svar: Dette punktet har ikke SV en politikk på og er et rent teknisk spørsmål. Vårt mål er at også produksjon av olje- og gass må skje uten klimagassutslipp. Derfor vil ikke rene gassturbiner slik de fungerer i dag være bra nok, men hvorvidt batteri eller landstrøm er fleksibelt nok vil avhenge av de ulike feltene.

d) Teknologisk er det mulig at *electrolyzer kan bygges inn i havvindmøllene. Alt overskudd av hydrogen kan blandes i naturgass, noe som gjør naturgass grønnere.*Electrolyzer splitter hydrogen og oksygen fra vann med elektrisitet.
Støtter partiet eller mot å konvertere havvindmøller til hydrogenvindturbiner?

1) Nei, bare strøm er bra 2) Ja, noen vindmøller kan generere hydrogen som energilagring
3) Ja: alle vindmøller kan konvertere til hydrogen vindkraft

Svar: Dette er ikke noe SV har en politikk på. Dersom det er mulig å lage hydrogen ved bruk av vindkraft som deretter kan brukes til et formål eller som overskytende til drift av båter og lignende så kan det være bra. Vi ser at det er ulike prosjekter på dette og blant annet prosjekter knyttet til produksjon av hydrogen som deretter lagres eller eksporteres gjennom naturgassnettet. Det er noe vi støtter, men formålet vårt er at vi på sikt erstatter fossil produksjon med fornybar og der kan havvindmøller som både produserer ren strøm for innførsel til land og hvor energien kan brukes til andre ting som hydrogenproduksjon til havs eller amoniakkproduksjon være gode løsninger.

e) Hvor raskt skal alle offshore-felt elektrifiseres med fornybar energi?

1) Så snart det kan 2) innen 2030 3) innen 2040
4) innen 2050 5) Ikke nødvendig

Svar: 1)
SV er for at utslippene fra sokkelen, som på land, må ned så fort som mulig. Det inkluderer elektrifisering av sokkelen.

Finans

a) Anser partiet at offshore vindkraft er en fremtidige eksportartikkel?

1) Ja 2) Nei

Svar: 1)
Det kan være det om vi kommer raskt nok i gang med å stimulere teknologiutviklingen, men den er ikke det per i dag.

b) Er partiet villig til å støtte økonomisk (inkludert skatteinsentiver) utbygging av fornybar energi i Norge? Hvis ja, i hvilken grad?

1) Ja - Omfattende eller mer enn nå 2) Ja – Samme som nå
3) Ja - Mindre enn nå 4) Ja - Ikke sikker 5) Nei

Svar: 1)
ja, men det avhenger av hvilken fornybar energi det er snakk om.

c) Er partiet villig til å støtte økonomisk (inkludert skatteinsentiver) full elektrifisering av offshore-feltet? Hvis ja, i hvilken grad?

1) Ja - Omfattende eller mer enn nå
2) Ja – Samme som nå
3) Ja - Mindre enn nå 4) Ja - Ikke sikker 5) Nei

Svar:
SV ønsker å støtte opp om elektrifisering, men det kan være gjennom å endre skatteinsentiver som finnes i dag slik at det ikke vil være en økonomisk støtte som sådan, men en provenynøytral omlegging. SV vil først og fremst stille krav i konsesjoner, og åpne for muligheten til å endre eldre konsesjoner, men

80. Original Survey Answer from Sosialistisk Venstreparti (Socialist Left Party) (Page 5)

d) Er partiet villig til å støtte økonomisk (inkludert skatteinsentiver) havvinden? Hvis ja, i hvilken grad?

1) Ja - Omfattende eller mer enn nå
2) Ja - Samme som nå
3) Ja - Mindre enn nå 4) Ja - Ikke sikker 5) Nei
Svar: 1)
I dag er det ikke noe støttesystem for ny fornybar energi utover grønne sertifikater og støtte fra Enova til blant annet solinstallasjoner, så SV mener at det må på plass et støttesystem eller annen måte å få fortgang i utvikling av havvind uten at partiet har avklart hvordan.

e) Er partiet villig til å støtte økonomisk (inkludert skatteinsentiver) hydrogen som energilagringsløsning for å oppnå grønne offshore-felt?
Hvis ja, i hvilken grad?

1) Ja - Omfattende eller mer enn nå
2) Ja - Samme som nå
3) Ja - Mindre enn nå 4) Ja - Ikke sikker 5) Nei

Svar:
SV er for å støtte utviklingen av hydrogen som energilagring og energibærer, og mener vi bør satse på dette med et hydrogenfond. Dette vil være for å utvikle hydrogenløsninger i alle bransjer. Men som nevnt under spørsmål om skatteinsentiver så mener vi at det er olje- og gassbransjen selv som må stå for selve investeringene for å få ned klimagassutslippene på sokkelen og at det bør stilles strengere regulatoriske krav til bransjen. Det betyr ikke at Enova eller tilsvarende ikke skal gå inn med støtte for å få innovasjon i konkrete løsninger slik som Hywind Tampen, men i utgangspunktet er ikke partiet for en selvstendig støtteordning til olje og gassektoren.

81. Original Survey Answer from Rødt (Red Party) (Page 1)

Respondent: Mailiss Solheim-Åkerblom – Regional secretary for Red Party (West Norway)

Gjør imidlertid oppmerksom på at dette er basert på dagens arbeidsprogram. Til våren skal vi vedta et nytt program, så da vil det kunne være svar som endres. Bare si ifra om noe er uklart.

Spørsmål:

Olje- og gassutvinning

a) Er partiet for eller imot eksisterende olje- og gassutvinning i Norge?

1) Veldig støttende 2) Støttende 3) Nøytral 4) Mot 5) Veldig imot

Svar: 2) Støttende
Kommentar: Det er viktig for Rødt at den grønne omstillingen ikke skjer på bekostning av arbeidsplasser, og er derfor positive til sysselsettingen næringen bidrar til i dag – men innenfor en kort tidsperiode må kompetansen og arbeidsplassene gå fra fossil til fornybar sektor.

b) Er partiet for eller imot å utforske og utvikle nye olje- og gassfelt i Norge?

1) Veldig støttende 2) Støttende 3) Nøytral 4) Mot 5) Veldig imot

Svar: 5) veldig i mot

c) Når snart skal Norge avslutte olje- og gassutvinningen?

1) Umiddelbart 2) innen 2030 3) innen 2040 4) innen 2050 5) Aldri

Svar: 2) innen 2030
Kommentar: 90% av utvinningen skal stoppes innen 2030.

82. Original Survey Answer from Rødt (Red Party) (Page 2)

Fornybar energi

a) Er partiet for eller imot å utvikle fornybar energi i Norge foruten eksisterende vannkraft?

1) Veldig støttende 2) Støttende 3) Nøytral 4) Mot 5) Veldig imot

Svar: 1) Veldig støttende

b) Er partiet for eller imot offshore vindkraft på norsk sokkel?

1) Veldig støttende 2) Støttende 3) Nøytral 4) Mot 5) Veldig imot

Svar: 2) Støttende

c) Er det partiet for eller imot satsning på hydrogen i Norge?

1) Veldig støttende 2) Støttende 3) Nøytral 4) Mot 5) Veldig imot

Svar: 2) Støttende

83. O riginal Survey Answer from Rødt (Red Party) (Page 3)

Grønne offshore felt

a) Er partiet for eller imot elektrifisering av offshore-felt ved å koble til landstrøm (fornybare kilder)?

1) Veldig støttende 2) Støttende 3) Nøytral 4) Mot 5) Veldig imot

Svar: 4) Mot
Kommentar: Vannkraft skal ikke brukes til å elektrifisere sokkelen

b) Er partiet for eller imot elektrifisering av offshore felt med offshore vindkraft?

1) Veldig støttende 2) Støttende 3) Nøytral 4) Mot 5) Veldig imot

Svar: Nøytral
Dagens program sier ikke noe om elektrifisering ved hjelp av offshore vindkraft.

c) Mener partiet at energilagringsløsning er essensiell for å oppnå grønne offshore-felt?

1) Ja, med batteri 2) Ja, med hydrogen 3) Nei, naturgass (gassturbiner) er bra

4) Nei, strøm fra land er fleksibel nok

Svar: Har ikke programfestet noe på dette punktet.

d) Teknologisk er det mulig at *electrolyzer kan bygges inn i havvindmøllene. Alt overskudd av hydrogen kan blandes i naturgass, noe som gjør naturgass grønnere.*Electrolyzer splitter hydrogen og oksygen fra vann med elektrisitet.

Støtter partiet eller mot å konvertere havvindmøller til hydrogenvindturbiner?

1) Nei, bare strøm er bra

2) Ja, noen vindmøller kan generere hydrogen som energilagring

3) Ja: alle vindmøller kan konvertere til hydrogen vindkraft

Svar: Har ikke programfestet noe på dette punktet.

e) Hvor raskt skal alle offshore-felt elektrifiseres med fornybar energi?

1) Så snart det kan 2) innen 2030 3) innen 2040 4) innen 2050 5) Ikke nødvendig

Svar: Har ikke programfestet noe på dette punktet.

84. Original Survey Answer from Rødt (Red Party) (Page 4)

Finans

a) Anser partiet at offshore vindkraft er en fremtidige eksportartikkel?

1) Ja 2) Nei

Svar: 1) ja
Kommentar: spesielt teknologien, ikke strømmen

b) Er partiet villig til å støtte økonomisk (inkludert skatteinsentiver) utbygging av fornybar energi i Norge? Hvis ja, i hvilken grad?

1) Ja - Omfattende eller mer enn nå 2) Ja – Samme som nå

3) Ja - Mindre enn nå 4) Ja - Ikke sikker 5) Nei

Svar: 1) Ja – omfattende eller meir enn nå

c) Er partiet villig til å støtte økonomisk (inkludert skatteinsentiver) full elektrifisering av offshore-feltet? Hvis ja, i hvilken grad?

1) Ja - Omfattende eller mer enn nå 2) Ja – Samme som nå

3) Ja - Mindre enn nå 4) Ja - Ikke sikker 5) Nei

Svar: Har ikke programfestet noe på dette punktet.

d) Er partiet villig til å støtte økonomisk (inkludert skatteinsentiver) havvinden? Hvis ja, i hvilken grad?

1) Ja - Omfattende eller mer enn nå 2) Ja - Samme som nå

3) Ja - Mindre enn nå 4) Ja - Ikke sikker 5) Nei

Svar: 1) Ja – omfattende eller meir enn nå

e) Er partiet villig til å støtte økonomisk (inkludert skatteinsentiver) hydrogen som energilagringsløsning for å oppnå grønne offshore-felt? Hvis ja, i hvilken grad?

1) Ja - Omfattende eller mer enn nå 2) Ja - Samme som nå

3) Ja - Mindre enn nå 4) Ja - Ikke sikker 5) Nei

Svar: Har ikke programfestet noe på dette punktet.