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How did the conflict between Ukraine and the Russian Federation affect the energy situation and the transition to renewable energy in the European Union?

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Abstract

At the end of 2019 the EU published “The European Green deal”. This was a package of policy initiatives and measures for a green transition for the European Union (EU) with a final goal of being climate neutral by 2050 (EC, 2019). At the time of publication it was seen as the new big green shift and has been discussed as being a form of paradigm shift regarding sustainability for the EU (Schunz, 2022). In this “European Green Deal” there was also a large focus on changing the energy sector in the European green deal where natural gas was seen as the transitional energy form (Gillessen et al., 2019) giving time for renewable energy to develop. But the conflict between Ukraine and the Russian Federation exacerbated on the 24th of February 2022 (Dharmendra, 2022) - this is from now referred to as the conflict. This came as a shock for the EU and the energy sector and brought up major changes in the political field. New sanctions were introduced from the EU towards the Russian Federation that eventually ended up creating major problems with the energy supply in the European Union (EC, 2022).

In this thesis, the question asked is; How did the conflict between Ukraine and the Russian Federation affect the energy situation and the transition to renewable energy in the European Union? With the subquestion on if this accelerated the investments in the renewable energy sector. These changes are explained by the help of documentary analysis with the use of theory regarding ripple effects, where the thesis follows the consequences for every action that is done, before and after the conflict. As well as looking at herding mentality within finance.

Initially we see that the reduced import of natural gas and oil from the Russian Federation created an energy-shortage in the European Union that again led to record-high prices in the energy market (IMF., 2022). Shortly after RePower-EU was established by the European Commission (EC). In this plan the focus is divided between saving energy, producing more clean energy and diversifying energy supply (EC, 2022). The increase in energy prices and the need for energy has on one hand accelerated the green shift with record high investment into renewable energy capacity being installed, but on the other hand we also see new challenges arising, as former closed coal based power plants are being reopened under the support of “diversifying energy” (IEA, 2022).

A result of the conflict and the energy insufficiency may have impacted other policies. The taxonomy now has nuclear energy voted in as a sustainable energy source (EC, 2022) and nuclear energy is now experiencing an increasing acceptance within parts of the EU. The

conflict between Ukraine and the Russian Federation has all in all concluded into an enforced green shift and has accelerated the production of renewable energy in the European Union. But it has also made the European union more dependent on coal & oil based power plants for the time being.

Sammendrag

I slutten av 2019 publiserte Den europeiske Union “The European Green Deal". Dette var en pakke med politiske initiativer og tiltak for den grønne transisjonen som skulle gjøre EU mer miljøvennlig og mer bærekraftig med det endelige målet om at EU skulle bli klimanøytralt innen 2050. Det ble publisert som det store grønne skiftet og skulle være tilnærmet et paradigmeskifte hva angår bærekraftighet i EU (Schunz. 2022). Det var også et stort fokus på forandringer i energisektoren, hvor naturgass ble sett på som en energitype som skulle brukes i overgangen til fornybar energi (Gillessen et al. 2019). Men, konflikten mellom Ukraina og den Russiske Føderasjonen utviklet seg kraftig den 24. februar 2022 (Dharmendra, 2022). Dette kom som et sjokk både for EU og energisektoren i EU og medførte store endringer innad politikken. Nye sanksjoner ble opprettet av EU mot den Russiske Føderasjonen (EC. 2022) som endte med store problemer med energi-tilbudet i den europeiske unionen.
I problemstillingen stilles spørsmålet; Hvordan påvirket konflikten mellom Ukraina og den russiske Føderasjonen energisituasjonen og transisjonen i den Europeiske Unionen? Med et tilleggsspørsmål om dette har akselerert satsingen på fornybar energi.
Disse spørsmålene vil bli besvart med hjelp av dokumentanalyse med teori om ringvirkninger samt med flokktendenser i finansmarkedene. Først ser man en reduksjon i importen av naturgass og olje fra Russland, noe som skaper en energi-mangel innad i den Europeiske Union. Dette igjen medførte rekordhøye energipriser i energimarkedet (IMF. 2022).
Kort tid senere lanserer European Commission planen RePower-EU. I denne planen er det et tredelt fokus på energisparing, produksjon av ren energi og diversifisering av energiforsyningen (EC, 2022).
Totalt ser man at denne økningen i energiprisene og den økte etterspørselen etter energi har på den ene siden skapt en akselerasjon innad det grønne skiftet med rekordhøye investeringer i fornybar energi som blir installert, mens på den andre siden har det kommet nye utfordringer, hvor kullkraftverk blir gjenåpnet under støtte av diversifisering av energi (IEA. 2022).

Konflikten og den medfølgende energimangelen kan også ha bidratt til å endre standpunktene angående atomkraft, som nå er stemt gjennom til å være inkludert innenfor den taksonomien som en bærekraftig energikilde i EU (EC, 2022). Alt i alt har konflikten medført en akselerasjon i produksjonen av fornybar energi i den europeiske unionen, men det har også gjort EU mer avhengig av kull og oljebaserte kraftverk i en periode.

Preface

This master thesis has been somewhat challenging to write since the conflict is ongoing. It evolves and the realities of an ongoing conflict means it will be dynamic. Throughout the writing period the sanctions between the European Union and the Russian Federation have been changing throughout. The consequences to the energy sector have thus been altered.
It has been interesting studying the impact on how one action leads to another. It has also been interesting to see how the EU have reacted upon the new realities that the conflict between the Russian Federation and Ukraine has brought upon them, may it be sanctions, new challenges or the prime underlying focus for this thesis, the European energy crisis - Especially since the EU are a wide variety of different countries with different dependence on Russian energy.

A gratitude must be sent to supervisor Igor Khodachek. Without the help of Mr. Khodacheck, this master thesis would lack necessary substance and information in many sectors. He has highlighted what needs to be removed and rewritten and helped a lot with the science part of this thesis. Thank you.

I will also send my gratitudes to the workers, teachers, doctors and professors at Nord University. In my academic resume I have now attended six different universities and my experience is that nobody has been as flexible and helpful as the working staff at Nord University. I have managed to receive one bachelor grade and two master grades, at the same time living over 1000 km from the actual university and working full time. This has not been possible without the flexibility and help that I have attained from the employers of Nord University. So, to all of you, thank you so much, it has been greatly appreciated.

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1. Introduction

Electrical energy in all forms is essential in modern society. Most of the production of this energy has been dominated by power plants driven on fossil fuel, but that is not a sustainable solution. Renewable energy production is for many seen as an answer to this problem, but even though the existence of a solution has been there for many years, there has not been a fundamental shift towards renewable energy.

The green shift, sustainability and renewable energy has been discussed under different topics for decades. Over 50 years ago Arne Næsss (1973) wrote that modern society had to fundamentally change if we were to avoid an ecological collapse, while the report "Our Common Future" (1987) published by the United Nations talked about the importance of sustainability and environment, but still no major changes were done with the sustainability policies and renewable energy. In 1997 the Kyoto protocol was signed (UNFCCC. 1997). This is for many seen as the first real effort to reduce greenhouse gases, even though the results are arguable, it is still seen as a symbol for the first step towards combating global warming (N.G 2023). Even though the protocol is widely known, accepted and agreed upon, no transformational change has been done with the total CO2 emissions (IEA. 2021). There have been many agreements since the Kyoto protocol, but the first one that had a binding agreement towards the common cause of limiting the global average temperature to 2°C above pre-industrial levels and efforts to limit it to 1.5°C pre-industrial level was the Paris Agreement in 2016 (UNFCCC. 2016). This has again developed into new legislations and frameworks in the EU, as in example the European Climate Law and "The European Green Deal" that was initiated in 2019 (EC. 2019). But the sign of a paradigm shift and a complete change of the way the world lives and operates has not been evidenced, not in the EU either.

But what happens if a shock like the conflict between the Russian Federation and Ukraine hits the energy sector?

The purpose of this study is to see if a shock to the energy market can affect the energy sector and the transition towards renewable and sustainable energy in the European Union. This thesis focuses on the energy situation within the European Union with a primary focus on the renewable energy production seen in the context of the conflict between Ukraine and the Russian Federation. The main research question for this paper is thus "How did the conflict between Ukraine and the Russian Federation affect the energy situation and the transition to

renewable energy in the European Union? With the subquestion on if this accelerated the investments in the renewable energy sector.
In a more philosophical formulation, could this be a paradigm shift for the renewable energy sector?
In the second chapter a research literature review is done to find the research gap in the literature. The third chapter is the theoretical framework while the methodology is listed in chapter four. The research design and method that has been used is a document analysis with empirical review combined with semi-structured interviews. The research is completed by a document analysis reviewing relevant energy reports provided by IRENA, IEA, BloombergNEF among others as well as official publications from the European Commission treating these materials as empirical data and comparing that with before and after the conflict.
The empirics has been seen through a theoretical framework looking at ripple effects and herding tendency. With the use of the ripple effects in the framework the step by step effects of the conflict can be followed and may suggest why one thing leads to another. To find the amplitude of the ripple effects and to find out if the conflict in Ukraine also resulted in an acceleration in renewable energy investment it has been seen in relation to herding tendency within finance. In the fifth chapter the empirical findings are described, while in chapter six there is a discussion and analysis of the findings made in relation to the literature review and the theoretical framework. All this is to be concluded in chapter seven along limitations and presenting suggestions for further research.

2. Literature review

A literature review can be described as a more or less systematic way of collecting and synthesizing previous research (Snyder, 2021). It can serve as the basis for knowledge development, evidence of effect and can give new ideas. Snyder (2021) points out that it is hard to keep up with the state-of-the-art since tremendous amounts of research is being produced continuously. Traditional literature reviews are often lacking thoroughness and rigor, and are more conducted ad hoc, instead of using a well-developed methodology. This can raise questions about the quality and trustworthiness of these reviews (Snyder, 2021). For this thesis the chosen methodology for the literature review is a semi-systematic approach. A semi-systematic approach is used since the question in the thesis is considering a topic that has been conceptualized differently and studied by a whole range of different researchers under diverse disciplines. In this thesis the question asked is: How did the conflict between Ukraine and the Russian Federation affect the energy situation in the European Union, and did the conflict accelerate investments in renewable energy?
To find information for the literature review, several filters and decisions must be considered. Since renewable energy has mostly had an enlightened focus for approximately the last 20 years, ten articles from 2004 and towards today's date have been selected. Searching in researchgate with the following key words: “renewable energy”/energy” +- “ shock”/”ripple”. When applying this search the following were discovered.

Energy is quickly becoming one of the most essential parts of a modern society. As Byrne (P.1. 2005) writes: “The modern energy regime is to be credited with creating an integrating quantitative and transcendent logic which catalyzed the economic and technological forces underpinning industrial and, now, post-in-dustrial societies”. Our society has now grown dependent upon energy in the society and it is closely linked with economical and industrial development, but as Byrne (2005) writes, the energy-economy synergy was not propelled by energy scarcity nor by sudden technological breakthrough. This implies that the necessity for energy, especially electrical energy, is self-inflicted. As Byrne quotes Mumfords work of Technics and Civilization from 1934: the rise of “carboniferous capitalism” in the “paleotechnic phase” of technology-environment-society relations. During this phase, “an alliance of science, capitalism, and carbon power” reorganizes social order for the purposes

of fulfilling an underlying imperative of ceaseless growth (Byrne et al., 2002: 267). That industrialization and the energizing of our societies is common in modern industrialized countries is not debatable. That the result of this "carboniferous capitalism" has created an energy addiction in these societies is also evidenced. So, the question is what happens when this energy system receives major shocks?

Turner (2012) writes that shocks may come from several factors, one is physical constraints. Other factors are peak in the national and global production rate of oil, thus meaning reaching a level of production that will not come back, or institutional constraints as for example economical incentives to reduce carbon emissions. It could be argued that there is physical constraint by the reduced imports of oil and natural gas into the European Union due to sanctions towards the Russian Federation (EC, 2022). Peak oil is by new research from the independent RMI (2023) considered to have happened and the institutional constraints comes in the form of new policies and incentives as "The European Green Deal" creating motivation for reducing carbon emission.

Arguably, all these factors are currently being felt to some extent in the European Union, suggesting that this conflict is in summary a shock to the EUs energy system.

What these shocks may do depends on geographical location and area according to previous research. In a research done by Usman, Alola & Akadiri (2021) on the "Effects of domestic material consumption, renewable energy, and financial development on environmental sustainability in the EU-28" they found that by using Generalized Method of Moments (GMM) estimation of panel vector autoregressive (PVAR) with impulse response functions (IMFs) they found that general shocks lead to more renewable energy. They found that there was a unidirectional causality between greenhouse gas emissions and renewable energy, while the causality between economic growth and renewable energy, economic growth and financial development, and financial development and renewable energy has a feedback effect. Thus, as the author understands their conclusion, a shock can have a self-reinforcing effect on renewable energy. In a research from Demir & Gozgor (2018) they analyzed if it was a unit root in renewable energy consumption in 54 countries over a time-period. The evidence they found implied that it was only in nine of 54 countries that had permanent effects of renewable energy demand policies that were aimed to decrease carbon emissions. The EU has during the shock of the conflict published many new policies under the umbrella of "RePowerEU" regarding the green transition and renewable energy. How would the Unit root be for the EU? Lin, Omoju & Okonkwo (2016) found in a analysis by using Johansen cointegration technique and vector error correction model that in China, if there was economic and financial

development - that would promote renewable energy consumption, while foreign direct investment, trade openness and the lobby of conventional energy would undermine the renewable energy share in the total electricity consumption. They found out that shock-effects to these variables will die out over time, while the “lobby effect” is persistent and explosive. This study did not have the same type of shocks that are now experienced in the EU, they were also seeing the relations between other factors other than that are now relevant. But it still gives indications that the shocks that are experienced may have limited effect over time. In a study focusing on the United States of America done by Hossain, Sharma, Singh & Apostu (2023) they asked the question: “Overcoming the shock of energy depletion for energy policy? Tracing the missing link between energy depletion, renewable energy development and decarbonization in the USA”. To absorb the shock of energy depletion they looked at the relationship between CO2 emissions, energy depletion, renewable energy development and economic growth in the USA with the time range from 1980 to 2019. They used a novel dynamic ARDL model to find their empirical conclusions. Here they found that economic growth negatively affects the USAs ecological balance. They also observed that energy depletion reduced CO2 emissions and the transition to renewables lessens the overall pollution. They concluded that the US should “judiciously estimate and juxtapose the costs and benefits of energy depletion and transition to renewables. If the cost is too high, the country can consider a phase-to-phase transition rather than a complete 100% transition.” (Hossain, Sharma, Singh & Apostu. P.1. 2023). In a research from Alege, Oye & Adu (2019) where they researched “Renewable Energy, Shocks and the Growth Agenda” using an energy augmented small open economy with a dynamic stochastic general equilibrium model, they found that the renewable energy sector is more labor-intensive while the fossil fuel sector is more capital-intensive. Thus more labor is needed in the alternative energy sector and therefore can generate more employment. They also found that shocks in the renewable energy sector had a higher impact compared to the shocks to the fossil fuel sector. The result from their impulse analysis showed that shocks to alternative energy have a positive ripple effect on the Nigerian Economy, even though household consumption responded negatively to investment shock in the renewable sector. Thus meaning households that invest in renewable energy must give up their consumption when they invest in this sector. Even so, the results confirm that the commitment from the Nigerian Government to renewable energy holds positive potential for economic development (Alege, Oye & Adu. 2019). This type of ripple effects will also be researched in this thesis.

According to Delardas & Giannos (2022) there is concern for the future of academia and research laboratories due to the ripple effects of the energy crisis. Not only due to the extreme energy prices, but also due to the rising inflation and the need for external money, if public funding is to decrease. The private sector could also suffer, say Delardas & Giannos (2022). This could affect research and development within the industry, which again also reduces the collaboration between the industry and academia.

In summary there is evidence of shocks creating different types of effects in different parts of the world. However, there is no literature that concerns the impact of a conflict of the type that is currently ongoing between the Russian Federation and Ukraine and how that affects the European Union, so research on this type of effects is currently a missing part of the literature, some of this gap can potentially be answered by this thesis.

Nine of the selected ten articles represent research done in the last 7 years and were at the same time the most specific and relevant articles found when applying the search filter. The last one is from Byrne, written less than 20 years ago.

When applying the search filter there was more research that was discovered, but they were not deemed relevant enough.

3. Theoretical framework

The theoretical framework will be the structure that will support the theory of a research. It describes the theory behind what is to be explained in the research problem, thus it will be a guidance for the research design and the data analysis (Adom, Hussein & Adu-Agyem. 2018). There is existing research regarding shocks on energy systems, there is also research on the effects of these shocks. But it differs in what the focus has been in those studies, the different researches have also implied different backgrounds to these shocks and most of them have focused on other geographical areas than the EU. Currently there is no existing research about what happens when a shock hits the energy system of the European Union due to an external conflict where exports and imports are used as an economical weapon. This is not surprising since the conflict is ongoing and new in historic terms.
This next chapter explains the different lenses used for the research model and how this is used when gaining data for the thesis.

3.1 Ripple-effects

The main part of the theoretical framework for the master thesis will be using *Ripple-effects* that are translated from the Norwegian word “Ringvirkninger”.
Ripple-effects are used in many types of studies, from looking at economic development in the aviation business to valuation in the energy market to impacts of wider systems change efforts in public health. In the last one mentioned, a study from Nobles et al. (2021), they used the method of Ripple Effects Mapping (REM), a qualitative method to capture the wider impacts and adaptive nature of a systems approach. In their use of ripple effects they build on the field guide to ripple effects from Chazdon et al. (2017). In the book from Chazdon et al. (2017) they explain the four core elements of ripple effects as 1. Appreciative inquiry. 2. A participatory approach. 3. Interactive group interviewing and reflection and 4. Radiant thinking (mind mapping). This method will not be used in this thesis, however parallels may be found with what Chazdon et al. writes.
The thesis will look at the *Ripple-effects* that the conflict in Ukraine has resulted in, with a special focus on energy and the renewable energy sector. J. A. Schumpeter (1934) wrote about ripple-effects as a scientific term where he saw that regional development resulted in additional effects in the form of economic and social forms that could affect the economy. Factors that not always could be explained by the economy itself, but by other effects of the

initial cause. *Ripple-effects* have further been defined by J.T Henriksen (2010) as an activity or action that creates further effects on other areas, where the relationship between the factors often are causal. In this context causal means a relationship between two things in which one causes the other.

The changes due to *ripple-effects* creates changes in other areas. J. T Henriksen (2010) writes that these changes can both be expected and can be measurable. Thus, many of the actions and changes that are coming from the conflict can be known, but that all ripple-effects can be measured is rather doubtful. In a report regarding ripple effects from Kjærland, Mathisen & Solvoll (2010), the Ripple-effects will be measured based on four factors. These are direct, indirect, catalytic and induced effects. The direct effect would be what happens as a direct consequence of an action. The indirect effect would be the effects that are a consequence of the direct consequences while the induced effect can be created by one or the combination of the direct and indirect effect. They again could lead to catalytic effects, thus meaning the direct, indirect and induced effects will create a way for new actions to take place.

This is based on what Cooper & Smith (2005) wrote about in their report regarding the economic catalytic effect the Air Transport in Europe has. The aim for that study was to develop a robust methodology for measuring the economical catalytic impacts of air transport. In that research the practicality of this methodology for quantifying the catalytic impacts of transport was verified by analyzing the economic contribution of two European airports. Kjærland, Mathisen & Solvoll (2012) made a quantitative analysis where they looked at ripple effects in the form of valuation with examples from the energy market, they also did a report regarding Statkraft (2010) by using the method from Cooper & Smith (2005). Neither of these methods can be used directly for this master thesis, For this qualitative research that this thesis is using there will be adaptations to the models previously being used. By using an original quantitative model that has mainly been used in quantitative research and modifying this model so it can be used successfully for qualitative research could be a form of development in terms of approach and is thus chosen for this thesis.

So in this thesis the defined usage of the ripple effects are explained below.

The ripple-effect model will consist of four factors:

- *Direct effects* will come from a direct consequence of the “event”.
- *Indirect effect* either caused by the *direct effect* or caused indirectly by the “event”
- *Induced effect* will be created by either the *direct effect*, the *indirect effect* or the combination of these two. In other words, this effect will not happen because of the

"event" but will be created due to how the direct/indirect effect transpired from the event. Thus, effects that come from stimulation.

- *Catalytic effects* will be effects that in example accelerate activities, investments or actions due to the ripple effect of the event.

The direct effect will look at initial effects after the conflict exacerbated the 24th of February along with the direct effects that came due to this conflict and how that affected the targeted area, the European Union. This means actions taken due to the conflict, not only the actions immediately after, but also actions that are made due to the fact that the conflict exacerbated. The indirect effect will look at what effects came from the actions that were done. Thus defining the ripple-effects of it. Since the action that is taken has a direct effect, it will create consequences and affect other areas as an indirect effect. For this thesis that will be limited down to the energy sector.
When these direct and indirect effects are identified it may be possible to find what the induced effect of them will be. Thus meaning what the direct and indirect creates and induces in other areas within the energy sector. This will be followed to see if the direct, indirect or induced effects creates new actions or effects within the energy sector, meaning if it can catalyze the beginning of something or increase the amplitude of something existing. For this thesis it will focus on the energy sector.
To measure the amplitude and strength of the effects, they will be seen together with the financial investments along with the herding mechanism within finance.

3.2 - Financial markets: Herding and investments

Herding within finance is defined by Bikchandani & Sharma (2000) as: herding results from an obvious intent by investors to copy the behavior of other investors. This leads to the question if the great shock of the conflict can create a herding effect within finance. Since, according to IEA (2021), the financial markets are essential if the transition to renewable energy is to accelerate. A large part of the capital needed for the development of renewable energy must come from the private sector if climate goals are to be reached (IEA. 2021). The potential problem is that when greater political happenings - like this conflict, together with the fact it was followed by the pandemic before that, if the market receives it as a shock. In the research from Beck & Levine (2004) they found a high degree of correlation between growth in the stock market and the growth in the economic system. But if growth should occur it is often dependent upon a somewhat stable global economy without any great shocks

(Beck & Levine 2004). When events like this conflict occur, shortly after the covid-19 pandemic, this could have an effect on the financial market. In the research from Ali & Afzal (2012) they found that the financial market is highly sensitive to international events. In their research they studied the financial crisis in 2008 with specific focus on India and Pakistan, where they found that the effects from the financial crisis in the USA also had a great effect on India and Pakistan. This suggests that the whole global economy is affected by global events. It is not only financial events that could affect the financial markets.
In the research from Karolyi & Martell (2006) they found correlation between terrorist attacks and effects on the financial market, while Klement (2018) shows that similar effects comes from war. The research shows that if the attitude of the financial market becomes negative and the stability in the world decreases, more capital will be withdrawn from the stock market. This will create further downturn in the economy that had already started from the global events in the first place. However, Antoniuk & Leirvik (2021) has found that some events can affect the global financial markets positively. For example, did the investment into the renewable energy sector increase after both the Paris agreement that was signed in 2016 but also by negative happenings such as the Fukushima nuclear accident in Japan, where public support for nuclear power weakened (Lei & Shcherbakova, 2015), thus creating a need for an alternative energy source. In 2018 Mertzanis & Allam (2018) did an research where they found that investors made rational choices in globally stable periods with thorough research in form of analysis and gathering of information, but in more unstable periods as the world is in now, with high volatility in the financial market, there will be a higher degree of herd mentality where investors follow others decisions. Sharma and & Bikchandani (2000) also found that the financial markets can be affected by the momentum going in either direction, but this would be more prominent in emerging markets than in developed markets, due to the lack of transparency in the emerging markets and asymmetrical information distribution. However, they did not find any strong evidence that this was always the case. In new research from Aslam et al. (2021) the results showed that under the Covid-19 pandemic the European market had more of a herd tendency and was following each other more than the Asian market did (who consist more of the emerging markets). One possible explanation is the fact that the European markets are more sensitive to asset losses than the Asian Markets, so investors would thus be more likely to show herding behavior in the European market.
There are three factors that will be introduced into this subject as partial factors that also could explain the investment amplitude: The Pandemic, the conflict and the inflation. Arguments for reduced investment will be increased inflation creating less interest for growth

companies - something that renewable energy companies mostly are (Mckinsey, 2022) also, some research shows negative shocks make capital investments decrease. However, arguments for increased investment are the necessity of going from natural gas to alternative energy forms in the European Union to replace the reduction of supply of natural gas. Another argument for increased investment is that herd mentality in the European market can be affected by the fact that renewable energy is found to be an essential component of the energy transition and that the European Union is establishing new policies for this sector with the "European Green deal" and "RePowerEU". Thus, a momentum can be created and could make the European "herd" go in that direction, all released by the ripple effects of the conflict. In summary, to find the potential strength of changes in the energy sector, the herd tendency can be the denominator for the conclusion and could hopefully give an answer to the subquestion in the thesis, if this works as a paradigm shift and an acceleration of the green shift towards renewable energy.

The current state-of-the-art also suggests that if a herding tendency is found, it could indicate the strength and amplitude of the ripple effects in the energy sector and thus if this situation is conceived as a shock.

3.3 Theoretical frames of reference

In the thesis the question asked is "How did the conflict between Ukraine and the Russian Federation affect the energy situation and the transition to renewable energy in the European Union? With the subquestion on if this accelerated the investments in the renewable energy sector." In the theoretical frames of references that are described above there are different theories that would be used to scientifically explain and organize the information gathered from the research. The thesis will be using the lens of ripple effects in a qualitative method. To see the strength of some of the ripple effects caused by the conflict, the researcher has been looking at the herding effect within finance. This herding effect will hopefully be given by the information on how much investment is going into the energy sector. The larger the change in the capital investment from before and after the conflict gives indications of the strength of the herding tendencies and thus the strength of the ripple effects. In other words, the ripple effects of the conflict is what creates subsequent actions in the energy system and would be used to answer the thesis question

4. Research Methodology

A research design is methodological strategy and an approach that ideally will give the answer for the research question (Vaus, 2001). While Yin (2003) describes it as the logic that links the data gathered and what is to be concluded to the questions in the thesis. Johannessen, Christoffersen and Tufte (2011) sees it as the early phase in a study where you have to choose what and whom that is to be examined and how the research is going to be carried out.
The theoretical lens will affect both the methodological approach and within methodology it will affect how some collect the data and the procedure to analyze and interpret this data. In this chapter the qualitative research is explained as well as the background for choosing this method. The thesis will be based on documentary analysis and semi-structured interviews and is explained below.

4.1 Research design and limitations - Qualitative analysis

For this thesis a qualitative analysis is being used in a combination of document analysis and semi-structured interviews. To create the most complete answer it will be gathered information from different sources creating a form of method triangulation consisting of semi-structured interviews along with documentary analysis consisting of publications, research, books and scientific articles.
Qualitative research is according to Aspers & Corte (2019) hard to define. They analyzed 89 sources with the term qualitative and defined it as “an interactive process in which improved understanding to the scientific community is achieved by making new significant distinctions resulting from getting closer to the phenomenon studied (Aspes & Corte, P.1., 2019). Qualitative analysis is for Aspers & Corte (2019) a combination of two criteria. One is how to do things, generating and analyzing empirical material, in an iterative process in which one gets closer by making distinctions, and the second is the outcome - improved understanding novel to the scholarly community.

A *document analysis* is described by Bowen (2017) as a systematic procedure for reviewing or evaluating documents. While *semi-structured interview* is seen as a popular method for research often used in social sciences. “The semi-structured interview is more powerful than other types of interviews for qualitative research because it allows for researchers to acquire

in-depth information and evidence from interviewees while considering the focus of the study" (Ruslin, Mashuri, Sarib & Alhabsyi. P.22. 2022)
According to Wilson (2014) the semi-structured interview combines some structured questions with some unstructured exploration and is useful when knowing something about a topic, but it is desirable to give the interview candidates an opportunity to raise new issues, thus making it helpful when working with complex issues, "because you can use probes and spontaneous questions to explore, deepen understanding, and clarify answers to questions" (Wilson, P.3, 2014). Ruslin, Mashuri, Sarib & Alhabsyi (2022) also says that semi-structured interview gives the possibility for researchers to change their research questions while doing their research and at the same time, still be maintaining the track.

The reason for the combination of these two types of methodology is due to the weaknesses and strengths for them both when using only one of them. In combination they will complement each other. For this thesis, semi-structured interviews will give the specific answers from some specific people that are being interviewed, but the external validity is weak according to Johnsen (2019). Since these are subjects with answers that are influenced by the realities they live in, objectivity can also be questioned. Other weaknesses listed by Kakilla (2021) are mainly regarding interviews that are face to face, orally, web-camera etc. But the objectivity of the person who is being interviewed must be taken into consideration. Due to these weaknesses, these answers must be combined with document analysis to find a comprehensive conclusion. The document analysis weakness could be that not everything will be written down according to Bowen (2009). Either not specifically and therefore it cannot be used in the research or not written down in entirety, lacking the full picture of the situation. When using several subjects for the interview, from different backgrounds, but with knowledge regarding the subjects, answers can be seen in relation to other answers and at the same time this can be validated by the document analysis. Bowen (2009) writes that document analysis is often combined with data from interviews and observation to minimize bias and to establish credibility. Other advantages of document analysis is that it is efficient, available, cost-effective, lacks obtrusiveness and reactivity, stability, exactness and coverage (Bowen, 2009). While weaknesses are described as it could lack insufficient detail, thus making it important with qualitative semi-structured interviews that could fill potential gaps. Retrievability is mentioned as a weakness for document analysis, but should not become a problem since the information gathered is considered non-sensitive. However, there is one weakness Bowen (2009) writes about that could be a weakness that is relevant for this thesis,

and that is Biased selectivity. There are several parts in this situation, most important for this thesis is the European Union and the Russian Federation with different points of views. However, the thesis question is regarding how the conflict affected the European Union's energy transition, thus it is deemed a lesser problem.

4.2 Data gathering for the semi-structured interviews and the document analysis

For the questions used in the semi-structured interview there is a designed general interview guide where some questions were adjusted for each informant. The questions were either to be sent in text making it possible for the informants to do their answers in writing or the interview was to be conducted live and transcribed by the author. All informants were given the opportunity for quote checks after the transcriptions were completed.

For the informants doing it in writing the questions and answers were submitted by email, this gave the possibility to give personal answers and the questions were made in a way that keeps them within relevant subjects. Since there was a certain form of standardization on the questions made it is possible to compare answers in case there was disharmony between the answers from different informants while the small variation gave the flexibility to the informant to share his or her knowledge. The author first sent an email with background regarding the thesis, if they agreed to contribute, the questions were sent on the next email. If there were irregularities or uncertainties in the answers, it was followed up by a new email. Author did not however hand in notice to the “NSD - Norsk Senter for Forskningsdata” to receive approval for the interviews. Thus, all interviews are now made anonymous and are in the text removed. Their statements have been supported by other official sources and documents that were analyzed, thus reducing the impact of the anonymized informants and confirming what they have written by other sources.

Often there is some degree of interpretation by the informants on the question given, so the author's job was to make the questions as accurate and objective as possible. The qualitative interview gives freedom to the informant instead of being locked to a structured questionnaire where the informant has limited possibilities to share their specific knowledge and point of view. Informants were chosen due to their knowledge regarding energy and/or the European Union.

The documentary analysis consisted of research from many sources. Many are found on research gate or google scholar.

The reports used for information concerning the invested capital and the data material that was used to compare the difference between 2021 and 2022 in the thesis came from the

International Energy Agency (IEA), the International Renewable Energy Agency (IRENA), McKinsey, and BloombergNEF. There have also been some references to online analytics and think tanks like Ember. This has partly been used for making a case study and constructing part of the case based on the online analytics. Cost and values and similar information has been given by historic statistics from Trading economics or other official sources. Some information was also gathered from sources that have a more complex background, for example International Atomic Energy Agency (IAEA) and World Nuclear News (WNN) that is supported by the World Nuclear Association. These sources are positive to nuclear energy so this information had to be compared with other nuclear energy information and was filtered by using neutral sources and sources that were negative to nuclear energy. There are also a few articles that come from newspapers.
The biggest single information source was found in the official sources of what the European Union and the European Commission has reported.

4.3 Validity and reliability

There are discussions regarding validity and reliability in qualitative methods.
The term validity is defined by some as appropriateness of the tools, processes and data (Leung. 2015). In a research from Golafshani (2003) he finds that Stenbacka (2001) says that the concept of reliability is misleading in qualitative research, while Patton (2001) states that both validity and reliability are two factors that are important for the research.
The reason why the thesis is not solely based on document analysis with the use of official documents from official sources is that there will be some effects that could be hard to explain by only using document analysis from official sources. There will also be possible to interpret publications in different directions. There are also other advantages of receiving information from different sources. One is the safety that the information is valid, defined as validity, and that the information is reliable, defined as reliability. This combination of methods increases the trust in the conclusions and gives the thesis a broader and more comprehensive answer to the questions asked.
A weakness in the thesis is that all of the informants for the semi-structured interviews have been of Norwegian nationality. This may lead to a unilateral view, something the authors must be aware of when analyzing the information. Another weakness is that they could either be biased, subjective or do not inherit the knowledge required. If some answers had differentiated far from what the documentations or the majority of the subjects interviewed had answered, this would be noticed in the thesis. As mentioned above, since they have been

anonymised, their statements have been supported by other official sources and documents that were analyzed, thus reducing the impact of the anonymized informants and confirming what they have written.

4.4 Ethical issues

There are limited ethical issues related to this work. Informants were asked questions they had knowledge about and the information was used for a master thesis. Thus, there was no prestige regarding the answers coming from the informants. There is none known conflict of interest for the author. There are human aspects, as mentioned above, as for example that the researcher can be prejudiced. The author has an idea of what the conclusion could be, but inhibits too little information regarding relevant subjects thus making it difficult to create anything else than a neutral presentation of facts. There is no prestige for the author involved since the value of the task is only to answer a master thesis. The information gained by research and interviews was considered non-sensitive.

4.5 Reflection and limitations

The conflict in Ukraine is an on-going conflict that changes frequently, so it could prove difficult to find concrete data that will also be valid in the future. Though, all social science studies are dynamic. This conflict is a dynamic process where earlier statues change with changes in the ongoing conflict. It will regardless be necessary to limit the scope of the thesis. The timeframe that will be researched and used in comparison to see if there has been a change in the energy transition and if there was an acceleration in renewable energy has been restricted to February 2022 to April 2023. Thematic focus on the difference in the energy sector is set to be between 2021-2023. The geographical demarcation is set to the European Union while the focus area is on change in the energy sector with special focus on renewable energy.

This study could potentially be done as a quantitative study. As a social science researcher the studies that researcher meet are dynamic and here the researcher must distinguish analytically between longitudinal research - where the studies are continuous or repeated over a prolonged period of time (Caruana et al. 2015) and cross-sectional studies - where there is a observational study design where investigator measures the outcome and exposure in the study participants at the same time (Setia. 2016). But none of them is appropriate for this study. Thus a qualitative method was chosen.

5. Empirical findings

By using qualitative methods with a theoretical framework that is more consistent with a quantitative method creates a slightly more complex way to handle the empirical findings. The framework for the data analysis is based on “ripple effects” and “herding tendency”. To find the ripple effects in the energy sector it needs to be compared and follow a timeline stretching from a time period before the conflict in Ukraine exacerbated and towards a specified time after. For the actual ripple effects that have transpired in the European Union’s energy sector the timeframe investigated will be from 1th of February 2022 until 1th of May 2023.

Documentation laying the foundation of the investments in the energy sector goes back a decade. The reason to find investments before and after the conflict, in regards to the ripple effects, is to determine the magnitude of the ripple effects. In example, if there is a great change in investment from 2021 to 2022, the ripple effects are stronger than if the investments have just slightly changed, creating an argument that the shock effects have had strong or limited results.
Finding the capital investments a decade before the conflict is done to find the trends in the energy sector. If there is a linear increase from year to year, this could be a partial explanation in the increased investment from 2021 to 2022 and thus suggesting there has not been an acceleration in the renewable energy sector and thus, also no herding tendency.

Chapter 5 regarding Empirical Findings is broadly divided into two main categories:

- **before** the conflict in Ukraine, and **after** the conflict in Ukraine had transpired.

Within these two categories two thematics are followed:

- **Energy** and **investment.**

Between the **before** and **after** category, subchapter 5.4 is added that could give further explanation to the factors affecting the energy system.

5.1 EU and the energy transition - before the conflict

This subchapter takes a closer look at what the European Union had been initiating in terms of policies, initiatives and investments in the energy sector before the conflict in Ukraine escalated in February 2022. In later subchapters there will be an overview of what has been done after the conflict. Comparing these two will give an indication on what has changed within the energy sector in the European Union before and after the conflict and gives fundamental information for the thesis.

5.1.1 - The European Green Deal

When EU-president Ursula Von Leyen was chosen with small margins in 2019 she stated that environment and climate would be her main cases (Schiermeier. 2019). At that time the energy mix in the EU was made up of over 2/3 of energy sources that were creating greenhouse gases. Of the total energy mix, 35% was based on petroleum, 24% came from natural gas and 12% came from coal. Together this makes it 71% of the total energy mix. The remaining energy sources were 17% renewable energy and 13% that came from nuclear power plants (Eurostat. 2022).

2019 was also the year the EU launched the “European Green Deal” where it described a course of action that in total was set to make the EU climate-neutral within 2050. This package was approved in 2020. One of the steps towards 2050 was to reduce climate hostile emissions by 55% of what it was in 1990, a target that is set to be achieved by 2030. In total it is estimated that this will cost USD 260 billion every year (EC. 2019). The energy sector stands for 75% of all climate emissions. If substituting coal, oil and natural gas in the energy production with renewable energy, it would be a major contribution towards the climate neutrality targets that are to be achieved by 2050. The EU had originally set a target of 32% renewable energy within 2030, but this was further adjusted to 40% before the climate summit at Glasgow in 2021 (EC. 2021). The clean energy topic in “The European Green deal” is made up of three main branches. One is to secure a safe and affordable energy supply. Number two is to develop a fully integrated, interconnected and digitalised energy market in the EU and the third is to focus on increased efficiency within energy, better use of energy in existing buildings and to develop an energy sector that mainly consist of renewable energy (EC. 2019). In this thesis the analysis is limited down to the energy sector. In the publications on “The European Green Deal” from the European Commission there is limited clarifications

regarding details on how much and which areas they are focusing on within the renewable energy sector. What is clearly defined is regarding offshore wind energy. It is set to increase from the 2019 numbers that was 13 MegaWatt of energy production and go up to 1000 MegaWatt within 2030. That is an increase of almost 100 times of 2019 numbers, however it should be noted that 13MW is a rather small initial number. These offshore measures are estimated to have a total cost of €800 billion towards 2050, or around €25 billion every year (EC. 2019).

5.1.2 Fit for 55

In July 2021 “The European Green Deal" was further expanded with the suggestions in what was named “Fit for 55”, this was an enhanced framework from the EU on the “The European Green Deal”. This enhanced framework was meant to ensure that emissions will be reduced by 55% towards 2030 and was a path for the way towards climate neutrality in 2050. The “Fit for 55” framework main component consisted of enhancing the EU ETS. EU ETS is short for the European Union - Emission Trading System and can be rephrased to carbon credits. The “Fit for 55” included a framework making it more ambitious with extensions to new areas that were covered by ETS, acceleration of phasing out free allowances for some sectors and increased funding for the modernisation fund and the innovation fund. It also included guidelines on what emissions that are excluded from the ETS and a framework for forest and land use and a carbon offsetting and reduction scheme for international aviation. (EC, 2023). There are also changes in many of the EUs laws and regulations regarding climate and energy (Øvrebrø. 2022). Simon (2021) writes that in a leaked draft from the EU they are trying to achieve 38-40% renewable energy within 2030 in connection with “Fit for 55”. But, according to Wettestad (2022) the most important element in “Fit for 55” is the further development of the EU-ETS. Wettestad (2022) writes that the EU will further reduce available CO2 credits as well as further restrictions on what the credits will cover and what has to be covered by CO2 credits. Even though the conflict in Ukraine has created an energy crisis, Wettestad (2022) says the fit for 55 package still has a high degree of support and is expected to be finalized within 2022.

5.1.3 The green taxonomy

As a part of “the European green deal” and “fit for 55” there also came a green taxonomy from the European Union. This taxonomy can be explained as a system that classifies what sustainable activity is with the purpose of investing into projects and activities that help towards the climate target that are set towards 2030 and 2050 (EC. 2022). For many years greenwashing has been a problem within the sustainability sector. Greenwashing is a term that according to Kerner (2022) was first coined in 1986. Greenwashing is when businesses and organizations say they are taking measures to be environmentally friendly to create a greener profile, but in reality many of these measures have little to no effect. So to create an overview of what in fact is sustainable and environmentally friendly a taxonomy system had to be created. This creates safety for investors, counteracts greenwashing and aid businesses and organizations, both to become more sustainable but also making them re-direct investments to where it is most effective if to attain climate targets (EC. 2022). Taxonomy reporting is required for all listed companies above 500 employees, turnover above 20 million Euro or have a balance higher than 40 million Euro. They will have to report what part of their turnover comes from sustainable activities. These sustainable activities should fulfill three demands: They must contribute to at least one of the six environmental goals, it should not harm any other of the environmental goals and must fulfill the minimum terms for social rights (NHO. 2022).
This system is not meant to define what companies and organizations are right or wrong, good or bad, it does not give any restrictions and is not complete, so certain activities can be altered in their definition of sustainability. What this system is meant for is guidance and an aid, making investments flow easier towards sustainable investments (EC, 2022)

The subchapter 5.1.x lists the official publications on what the European Union was doing in terms of the energy sector in the EU before the conflict in Ukraine escalated. In summary “The European Green Deal” had a target of 32% renewable energy within 2030. This target was adjusted to 40% renewable energy within 2030 before the climate summit in Glasgow. The “fit for 55” included laws and regulations and explained the road to the 55% reduction in greenhouse gases before 2030, but the most important part was regulations and adjustments to the EU ETS - carbon credit system. This is important due to the fact that if carbon credits rise in price, energy production made by carbon-intensive fossil fuel sources increases in price, this again increases the incentives creating less carbon intensive energy-production. Incentives are also a part of the green taxonomy, showing what is deemed sustainable activities. This shows the directions in the energy sector and can be used to answer the main

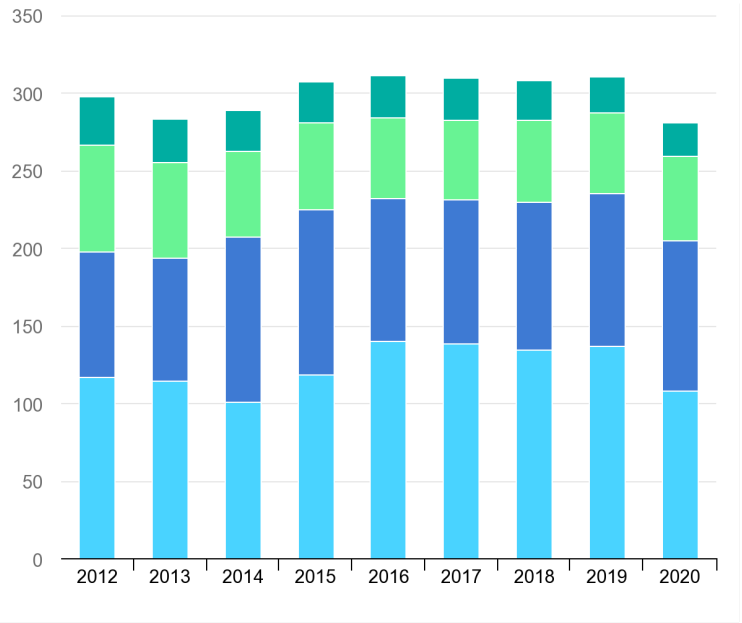
thesis questions and what the base was for the energy transition before the conflict in Ukraine escalated, and gives an impression on what the base for some of the ripple effects are.
To find evidence regarding a possible herding effect, the historical investments must be investigated. This must be seen in relation to the required investments, as the required investments could explain the amount of investment that was at that time being invested into the different energy sectors, thus, this is explained in the next chapter.

5.2 - The sustainable and renewable energy sector - before the conflict

To find out how the conflict between Ukraine and the Russian Federation has impacted the energy system in the EU and the focus on renewable and sustainable energy this subchapter will focus on the sustainable and renewable energy sector along with investments into the sector before the escalation of the conflict. There will also be research on required investments, both for actualization of the topic and to get an overview that can be used to compare the effects before and after the conflict.

5.2.1 Historical investments in renewable energy before the conflict

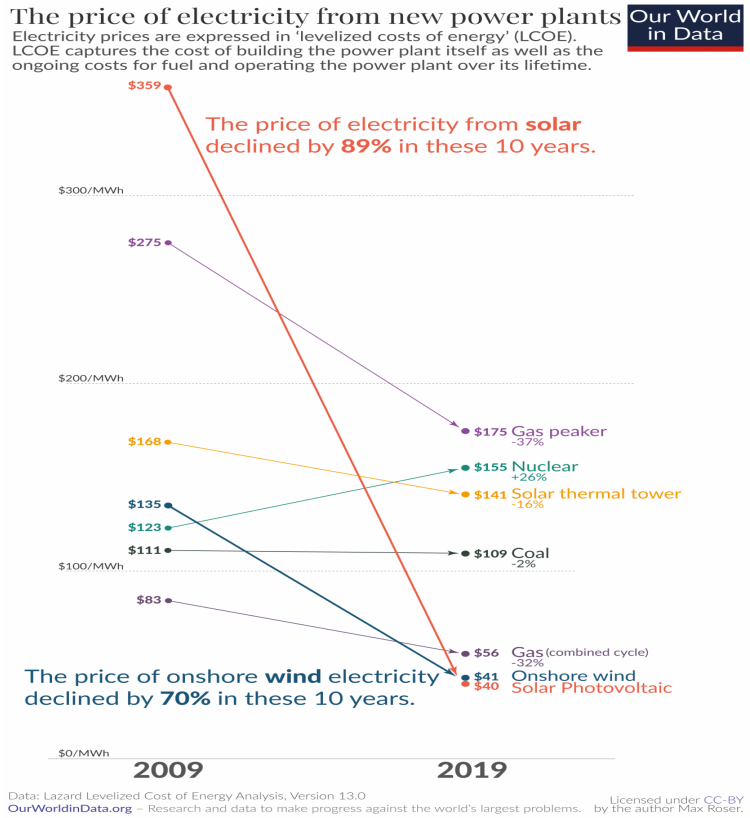
In the IEAs (2022) report there is a calculation over how much has been invested into renewable technology since 2012. The numbers that are shown below on picture 5.2.1.1 display the value in billion USD. The light blue shows investments in solar energy, dark blue is wind energy, light green is hydro energy while dark green is other renewable energy sources.



Picture 5.2.1.1 - Investments in renewable energy. 2012-2020 (IEA. 2022)

As seen in picture 5.2.1.1 above, the investments have been almost the same over the 8 years the graph covers. On average there has been investments of around USD 300 billion each year. The numbers for 2020 is the lowest in the 8-year period, but this is explained by problems in the supply chain due to the covid-19 pandemic (IEA. 2022). The numbers depicted above are an overview for the whole world and cannot be used directly when comparing investments in Europe before and after 2022, but it will give a good indication on how the investments in the renewable energy sectors have varied for the years between 2012 and 2020.
According to IEA (2022) in their World Energy Investment report, the invested amount in clean energy in the European union was in 2021 estimated to be USD 260 billion. This sum is for the clean energy sector that also includes infrastructure, storage capacity and grids.
For nuclear energy it has been kept at approximately the same level of investment for the years 2011 to 2021 (IEA. 2021)..

When looking at the renewable energy capacity in Europe it has gone from 9.6% of total energy production in 2004 to 18.9% in 2021 (EC, 2022). There could be several reasons behind this increase in renewable energy production, one of the most significant factors is explained from the graph from Lazard (2021) as seen on picture 5.2.1.2. As seen on the graph, the price for both wind energy and solar energy has decreased substantially from 2009 to 2019, where solar photovoltaic has decreased from a cost of USD 359 per MWh in 2009, to USD 40 per MWh in 2019, and for land based wind energy the price has decreased from USD 135 per MWh in 2009 to USD 41 per MWh in 2019 (Lazard, 2021). Thus, even though the total capital investments into renewable energy has not increased by a substantial amount in the years from 2012 to 2020, the investments have given more energy per USD due to the decreasing cost-prices. The cost for solar energy has decreased over 90% in the period between 2009 and 2019 while wind power on land has decreased by almost 70% in the same period (Lazard, 2021). These costs are expected to be reduced further as it follows a “learning curve” or “cost curve” - a mathematical concept that is used to explain why something becomes cheaper and more effective over time (Kagan. 2022). This could create incentives to continue investments into renewable energy for investors.



Picture 5.2.1.2 - Price for renewable energy (Lazard / OurWorldIndata. 2020).

5.2.2 Investments required in the renewable energy market

According to Nicoson et al. (2019), it is the developed nations that have created the most carbon emissions equivalents into the atmosphere in the last 100 years. But it is the developing countries that will suffer the most from climate change. Thus, it was decided under the climate summit in Copenhagen in 2009 that wealthy nations were to grant USD 100 billion dollars every year towards 2020 to nations that needed aid to acclimate to global warming and to reduce emissions (Timperley. 2021). But, this was not achieved. Estimates from "The organization for Economic Co-operation and Development" (OECD) said it was granted a total of USD 80 billion in 2019 and USD 83 billion in 2020 to lesser rich nations (OECD. 2020) While the international charity organization, "Oxfam", estimated the contribution to only be around USD 21-25 billion in 2019 and between USD 26-31 billion in 2020 (Oxfam. 2022). Ehlers et al. (2022) in the United Nations World Bank writes there are different estimates, but they calculated the need for investments in developing nations to be USD 1000 billion, solely for energy infrastructure investments within 2030. Then USD 3000-6000 billion is needed for all sectors, every year towards 2050.

The point for this subchapter is to highlight that the investments that are required in the renewable energy sector for developing countries are substantial and the EU will be competing with these countries for capital allocated to investments into the Renewable energy-sector. Another point is that many of the "rich countries" that were defined in the Copenhagen summit of 2009 are countries within the European Union. So there is both a competition for capital but also the point that "rich countries" have to allocate money to developing countries. This could affect the amount of capital invested in sustainable and renewable energy in the European Union.

When looking at required investment in the renewable energy sector for the European Union, Mckinsey (2020) calculated that the cost for the EU to reach carbon neutrality within 2050 demands € 28 000 billion into clean energy investments until 2050. Of this amount €23 000 billion, or €800 billion each year, must be repositioned from initially being invested into carbon-intensive technologies and over to low-carbon technology. This sum equals to 25% of the yearly capital investments in the EU, or in other terms 4% of the EU gross national product (GNP). In addition to this repositioning, stakeholders must increase investments in the total sum of € 5 400 billion towards 2050. This is a yearly average of € 180 billion that must go to investment in clean energy technology. This number includes buildings, energy production, industry, farming and transport. The sum for renewable energy investments isolated will be € 1 800 billion towards 2050 along with € 1 500 billion in further development on the energy infrastructure to increase power transmission and distribution (Mckinsey. 2020)
As the European Union is not the only continent in the world that needs the energy transition, it could be a point to see this in relation to the world.

In the International Energy Agency (IEA) report "World Energy Outlook" (2021) it is described how the world can end up with zero emissions within 2050. Towards 2030 the following numbers have been found: This will require investments into clean energy in the amount of USD 4000 billion, every year, towards 2030 (IEA, 2021. The International Renewable Energy Agency (IRENA) estimates the cost to be USD 5 700 billion each year towards 2030 (IRENA. 2021). IRENA reports that this will reduce some after 2030. This amount exceeds IEAs estimates by USD 1 700 billion. In Bloomberg New Energy Finance (2022) they estimate the cost to be between USD 3 100 billion to USD 5 800 billion each year

towards 2050. There are discrepancies between the different estimates due to different calculations but the amount of capital needed is high in all estimates.
To put these numbers in perspective, the highest amount calculated by BloombergNEF will be USD 162 400 billion towards 2050. That is approximately the same as 135 times the Norwegians pension fund "Oljefondet (NBIM. 2022) or seven times the GNP of the United States of America (Trading Economics. 2022).
In another net zero emission estimate coming from "Climate champions" (2021), a UN contribution, the sum totals USD 125 000 billion in climate investments within 2050 for the world. Over this decade, 2020 to 2030, a total investment of USD 32 000 billion is required, splitted into different regions:

- USD 5 900 billion - North-America USD
- USD 1 500 billion - Central and Southern America
- **USD 6 600 billion - Europe**
- USD 13 600 billion - Asia and Pacific regions
- USD 1 200 billion - Middle-East
- USD 1 700 billion - Africa

(UNFCCC. 2021).
Of this, around USD 16 000 billion must be invested in the electricity sector.
The report points out that 70% has to come from the private sector meaning commercial institutions, infrastructure funds, institutional investors, private equity, venture equity etc (UN. 2021).
When comparing the estimates from IEA, IRENA, Climate Champions and Mckinsey there are great variations in the sum needed. Investments required vary from USD 2 200 billion and up towards USD 5 500 billion yearly. This means that capital equivalent to two to four times the Norwegians Government Global Pension fund must be invested yearly, if to acquire climate neutrality by 2050 (NBIM. 2022).
Even though estimates vary between the different organizations, they give a clear indication of the scale of investments that is required for climate neutrality within 2050. Public initiatives and measures have long been the primary driver for the sustainability sector, but it is the private capital that is needed if the targets are to be met. In an article published on the United Nations Climate Change (2017) website, the former CEO of the International Finance Corporation (IFC), which is a part of the World Bank, is quoted with: "The private sector holds the key to fight climate change," he said IFC CEO Philippe Le Houérou. He continued with "The private sector has the innovation, the financing, and the tools. We can help unlock

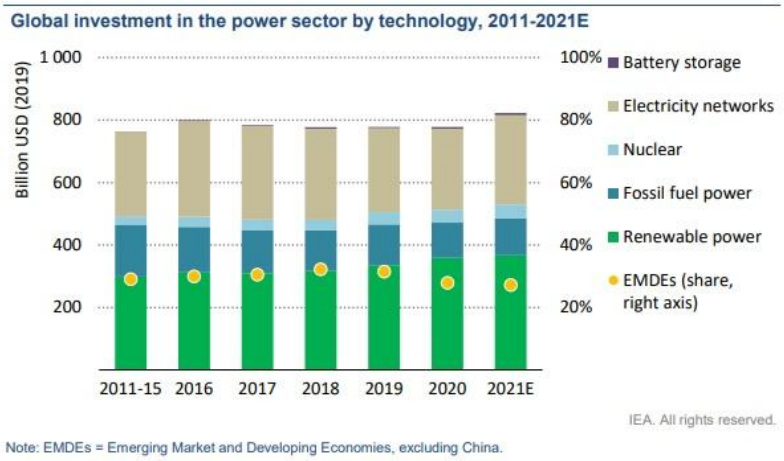
more private sector investment, but this also requires government reforms as well as innovative business models – which together will create new markets and attract the necessary investment. This can fulfill the promise of Paris." (UNFCCC. P.1, 2017).
Even though the private sector has been identified as holding the key for this energy transition, the investments that are required have not happened. The question would be if the conflict in Ukraine has changed this reality. Could the conflict in Ukraine and the following energy crisis make the European Union's capital market herd towards renewable energy and/or will it affect the energy market in other areas?

In this subchapter, required and historical investments are researched to find a base that can be used when comparing with invested capital in renewable energy after the conflict in Ukraine exacerbated. What can be seen is that the renewable energy investment has just slightly increased year after year for the last decade. On average it has been invested around USD 300 billion each year in renewable energy world wide. Reported numbers specific for renewable for the EU were not to be found, however clean energy investment, that includes more sectors like energy efficiency, grids and storages and not just renewable energy investment was in 2021 estimated to be 260 USD billion (IEA. 2022).
Even though the invested capital in renewable energy has just had a slight increase from 2012 to 2020, the levelized cost of renewable energy, especially solar and wind, has decreased substantially, meaning that the invested capital has given more renewable energy per USD.
When looking at the investment required to reach zero emissions in 2050 it varies between USD 125 000 billion and USD 162 000 billion for the whole world. Of this amount, renewable energy is estimated to need investment in the amount of USD 4000 billion to USD 5800 billion, every year towards 2050.
For the European Union it is calculated the cost for reaching carbon neutrality within 2050 demands €28 000 billion in clean energy investment.

5.3 The fossil energy sector - before the conflict

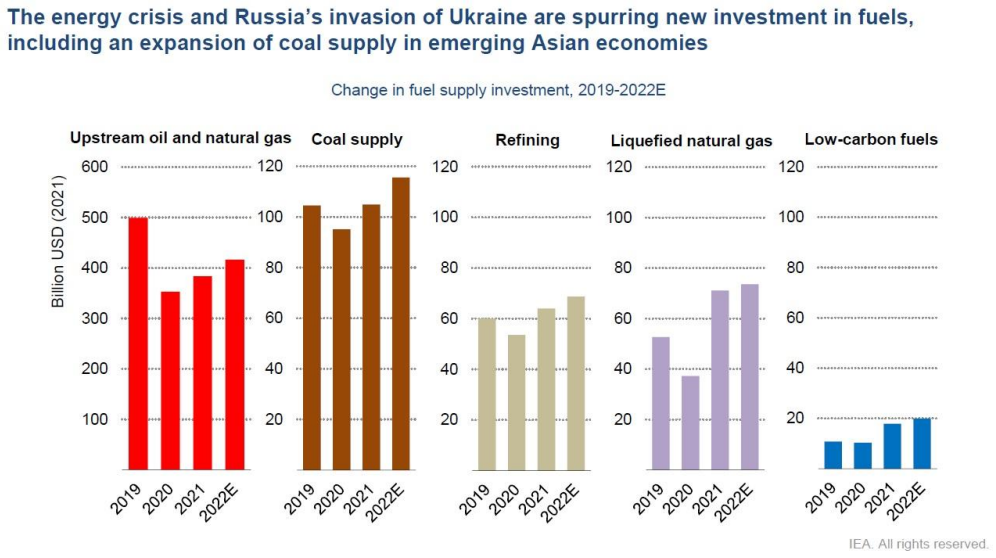
5.3.1 Historical investments in the fossil energy sector

From "the World Energy Investment" report from IEA (2021), and as shown on picture 5.3.1.1, the investment in fossil fuel power has kept almost constant the last decade. New numbers from the IEA (2022) shows that annual investment in fossil fuel has averaged around USD 800 billion.



Picture 5.3.1.1 - Global investment in the power sector by technology 2011-2021 (IEA, 2021)

In a report from "Banking on climate chaos"(BBC) (2022), a gathering of climate organizations where they have followed the capital flow from major international banks, they found that from the years 2016-2021, 60 of the largest banks have financed around USD 3 800 billion in fossil energy sources (BBC, 2021). This compares roughly to the same values given in the IEA (2022) report. Even though the numbers for 2022 are not complete in the annual report from IEA (2022), it is estimated that the investments in coal, refining and LNG will reach record levels in 2022. This is partly related to changes in the energy situation after the conflict in Ukraine and can be seen on picture 5.3.1.2 where the estimated investments in 2022 continue to increase compared to earlier years.



Picture 5.3.1.2 - Change in fuel supply 2019-2022E (IEA. 2022)

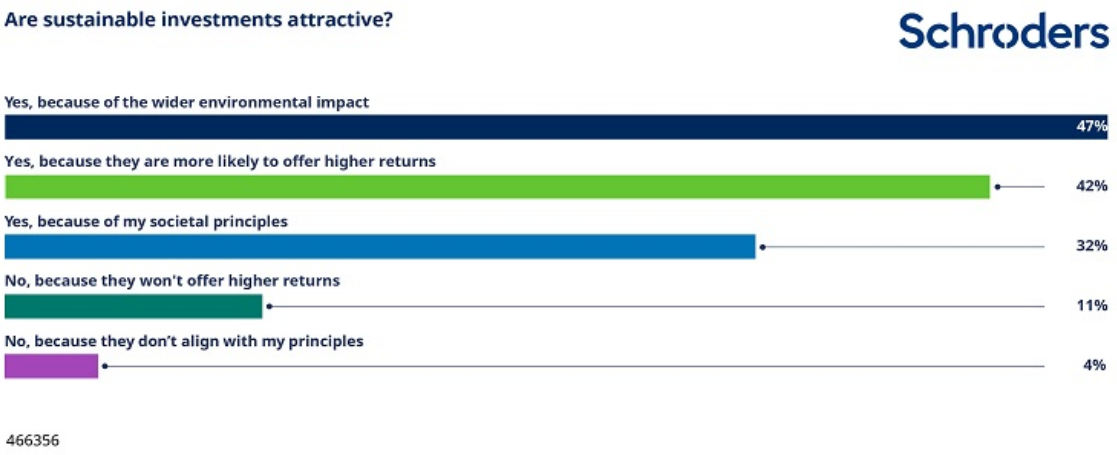
In summary the investments in fossil energy sources has been kept approximately at the same level for the last decade averaging at around USD 800 billion. 2022 may see an increase in investment. This could partly be explained by increased prices.
In the next subchapter other factors are investigated that could affect the energy sector and the investments that go towards the energy sector.

5.4 Possibly factors affecting the investment and the energy system

In this subchapter the focus is guided towards influences, variables and motivators towards the energy market. This is done for two reasons. One reason is to identify any potential ripple effects stemming from the conflict in Ukraine, number two is that it can explain herding and investments going into the sector, reasons that perhaps are not related to the conflict.

5.4.1 Investors, inflation and savings

Many investors in today's society have a higher focus on other values than just capital and capital increasement. In a study done by Schroders (2020) who did a research on 23 000 investors they found that 47% of investors looked at sustainable investments as most attractive due to the positive effect on the environment, while 32% deemed sustainable investments as attractive due to their own personal social principle. In total 79% looked at sustainable investments as attractive either due to the positive environmental impact or/and due to own principles according to Schroders (2020) These can be seen in picture 5.4.1.1.



Picture 5.4.1.1 - Are sustainable investments attractive (Schroders. 2020)

Schroders (2020) also shows a trend where sustainable investments are becoming more attractive due to higher returns, something that has been an obstacle for investments in

sustainable solutions, where in many years and in many sectors it had to be subsidized to become profitable. Schroder (2017) did an research in 2017 with similar formulations. In that research they found that the importance of an investment being sustainable had increased 78% from 2012 to 2017. It can seem that the more attention that is given to sustainability, the more focus it receives.

Another factor affecting both investment and the energy sector could be the potential savings by reducing fossil energy imports as natural gas. New calculations are being done in terms of both cost and investment, but also savings. Think tank Ember (2022) has calculated that the transition to wind and solar from fossil fuel could **save** Europe up to Euro **1 000 billion** by 2035. In this model coal is phased out completely within 2030 while natural gas would be around 5% of the energy mix. For this to happen the models estimate a solar capacity nine times of today's value and four times the wind capacity. For nights and calm days emerging technologies would help manage supply and demand issues (Ember. 2022). This could be an argument that there are savings in cutting fossil fuel imports and instead investing it into renewable energy.

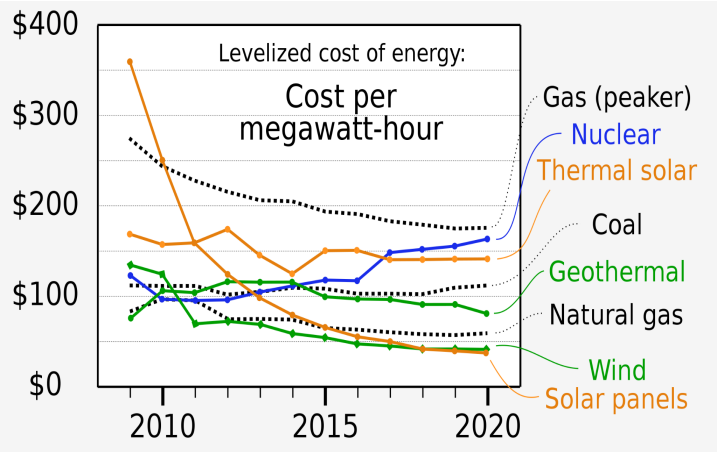
However, most renewable energy companies are growth companies that are negatively affected by the current inflation. Inflation is when the prices increase across the economy, something that has been witnessed in large parts of the world after the covid-19 pandemic (Frick. 2022). In Eurostat (2023) the calculated annual inflation in December 2022 was 9.2% in the Euro area and 10.4% in the EU. This is approximately 5 times higher than the target set out by the European Central Bank (2022) where the target inflation is set to be 2%. A part of this high inflation has been due to the increased energy prices, first due to recovery after the pandemic, then due to the conflict in Ukraine with the following energy crisis. (ECB. 2022). This inflation is mainly corrected by increasing the interest rates. But, increasing the interest rates is negative for growth companies as renewable energy companies usually are, since this will decrease future earnings and thus make the stock fall in value (Forbes. 2022). This can result in lower interest in renewable energy investments and could be a potential problem receiving capital into the renewable energy sector.

5.4.2 The Energy and carbon credit market

The European energy market is explained as, that buyers of energy report their demand, while the sellers of energy submit their supply available and the price for it. Producers of energy that are producing the cheapest energy, typically solar or wind energy, will produce and sell

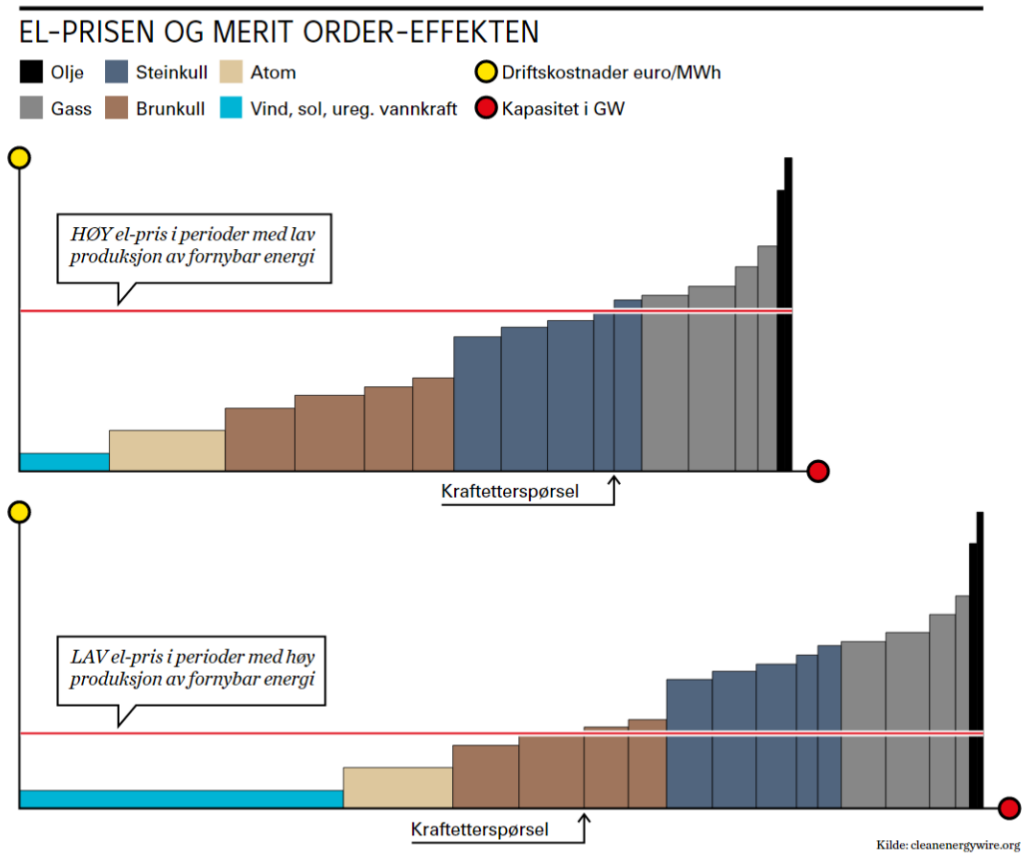
energy first according to the document from the European Commission called “EU Energy Markets and Energy Prices (2021).

If the market demands more energy, the next energy producer that produces energy at a little higher cost will sell and produce electricity. This continues until the demand for energy is covered. When the supply for energy in Europe has met the demands, the price for the most expensive energy will be set as the market price for all of the energy in the market. Thus, the energy production that is the most expensive will define the price in the market (EC. 2021). This type of system can be called Merit/order type according to an expert interview done with professor Lars Sørgård in the independent news paper “Energi & Klima” that is owned by the independent foundation “Klimastiftelsen”.



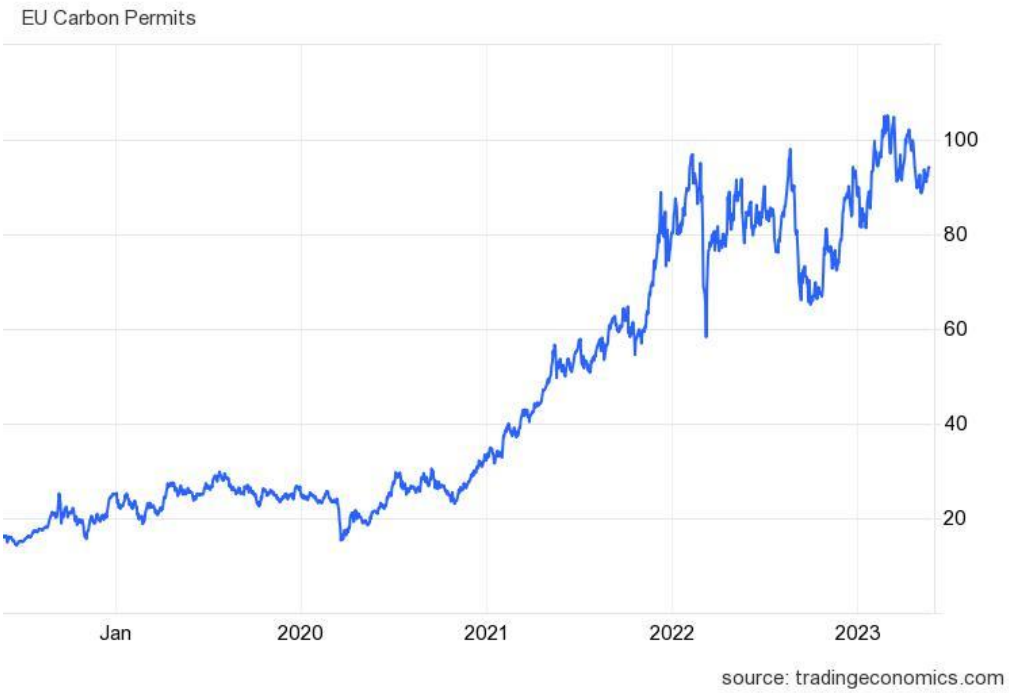
Picture 5.4.2.1 - Levelized cost of energy (Lazard. 2021)

In the picture 5.4.2.1 the natural gas price is shown as slightly higher than solar and wind energy. The energy produced by natural gas has worked as a stabilizer when there is little wind and sun on the European continent, since the price of gas energy is just slightly higher than renewable energy sources. Thus, this is one of the most essential single factors that affects energy prices, since when the demand exceeds the supply of renewable energy, the next energy generation has been from the relatively low cost production creating energy by the use of natural gas But, if the graph in 5.4.2.1 had continued until 2022 it would show that the gas-price had exceeded the price of producing energy from coal based power plants and thus the price for energy would increase dramatically as seen on the picture 5.4.2.2 below.



Picture 5.4.2.2 - Price for electricity and the merit order effect (Sørgård / CleanEnergyWire. 2022)

In the European Union there has been implemented a CO2 credit system called Emission Trading System (ETS) that was mentioned in chapter 5.1. Energy production is a sector that is part of this credit system, thus, for each tonne of CO2 that is produced, the energy producer must pay a certain variable amount. This is shown on the graph in picture 5.3.2.3 with the vertical graph showing the price in Euro for each tonne of CO2 emission, while the horizontal line is the time period set. Øvrebø (2022) explains that this market price for carbon credits correlates to the demand. When demand increases, the price for each CO2 tonne also increases, at the same time the credit system has in recent years been re-regulated and the initial price for each CO2 credit is higher than before (Øvrebø, 2022).
The credit market thus gives incentives to restrict emission, but when this is not possible, these need to be paid for.



Picture 5.4.2.3 - Carbon Permit price - Euro Per Tonne

The income gained from these carbon credits are divided among the member states, the Union's budget, compensations, free allocation, innovation fund and modernisation fund. Before “fit-for-55” - 50% of the income into the EU’s innovation and modernisation fund were directed towards sustainable investments, but this has now altered to that 100% of the income shall go to climate measures, further accelerating the green shift (EC. 2022).

The motivation of doing sustainable investment has increased rapidly in the last decade according to Schroder (2020). This could be an argument for increased herding tendencies towards renewable energy. Also, there could be more capital available when looking at the savings gained when not importing the same amount of fossil fuel, since the energy must be replaced and the most cost-effective energy available is currently renewable energy.
The argument of renewable energy is further enhanced when looking at the carbon credit system of the European Union called EU ETS. The price for each tonne of CO2 has increased from approximately averaging at a price of €10 - €20 euro in the period of 2005 to 2020, but this has now increased to almost 10 times that price in 2021-2023, making carbon-intensive energy more costly than before. However, the argument for a reduction in investment in renewable energy is related to inflation, as most renewable energy companies are growth companies that suffer decreased future earnings when the interest rates increase.

5.5 EU and the energy transition - after the conflict

5.5.1 The Green taxonomy - After the conflict

The green taxonomy has been a source for discussion and debate within the European Union, also in the energy sector. Especially has the discussion regarding nuclear energy and natural gas being a part of the taxonomy, been a much discussed topic.

Of the 27 member states in the EU, 13 member states received electrical energy produced by nuclear power plants in 2021, and nuclear energy constituted 25% of the total electrical energy production (Eurostat, 2022).

Of this, France received 52% of their electricity from nuclear power, while Germany received 9.4%, Spain 7.7%, Sweden 7.2% and Belgium 6.9%, together they made up 83.1% of the EUs total amount of electricity generation from nuclear facilities. There is also nuclear based energy production in the Czech Republic, Hungary, Poland, Slovakia, Romania, Bulgaria, Finland and Slovenia (Eurostat, 2022).

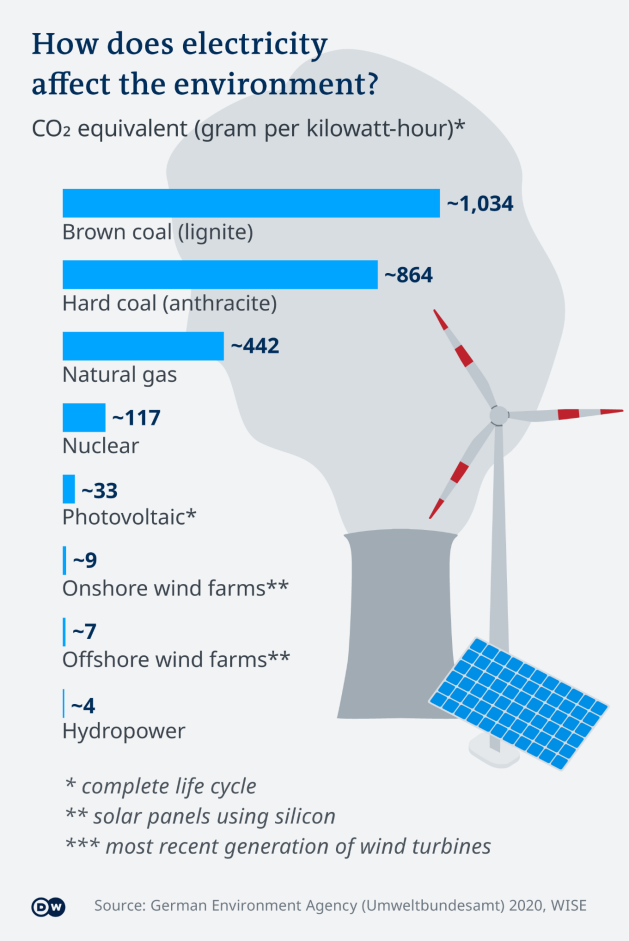
In 2019, Britain, France, the Czech Republic, Hungary, Poland, Slovakia, Romania, Bulgaria and Slovenia threatened to veto the taxonomy regulation if nuclear power was **not** included as green, after they lost the vote for including it in the taxonomy in 2019 (Simon & Taylor, 2021). Germany, a nuclear country itself, is one of the states that has been opposed to include nuclear energy in the green taxonomy and had earlier stated they were to shut down their nuclear power plants, but they have now partly changed their point of view and are now prolonging the lifetime of some nuclear power plants that earlier had been decided to shut down (Rinke, Alkousaa. Käckenhoff, 2022). At the same time Luxembourg is reacting heavily on the fact that Belgium is prolonging the lifetime of their nuclear power plants (Monaghan. 2022), while Sweden is trying to increase their nuclear power production (Moderaterna. 2022), something also France is doing (EIA, 2023). All this is happening at the same time that Austria is going to court in a fight to remove both nuclear power plants and power plants driven by natural gas from the taxonomy (Euronews, 2022).

Thus, different countries in the European Union are still very divided regarding this subject, but after many years of discussions, both natural gas and nuclear energy were voted into the green taxonomy on the 22t July 2022, thus making it to the list of investments that are labeled sustainable (EC, 2022).

As for the power plants driven by natural gas, “Source” (2022) writes that with all the demands required for gas powered power plants to be defined as a green investment in the green taxonomy makes it uncertain how many of those types will be built. There have also

been discussions on the carbon friendliness of natural gas, since it does have a high share of CO2-emission compared to nuclear, wind or sun energy. But, compared to fossil alternatives such as coal and oil it is much less carbon intensive (IEA 2019).

When looking at nuclear energy power plants, different points of views and different angles give different answers on how environmentally friendly nuclear power is. If seen on the whole life cycle of a nuclear power plant from building to decommissioning, the carbon emission lies between solar powered and gas powered energy (Weber. 2021), while other sources show a total carbon emission same as wind and less than solar power according to World Nuclear News (2022), but this source is a **pro-nuclear** news site. The Germany Environment Agency however, (UBA) who is **anti-nuclear** states it has much higher CO2 equivalent emission then both solar and wind, but still less than energy produced from natural gas (Weber. 2021), concluding the subject that either way it has less emission than the best fossil fueled energy production, as seen on the picture 5.5.1.1



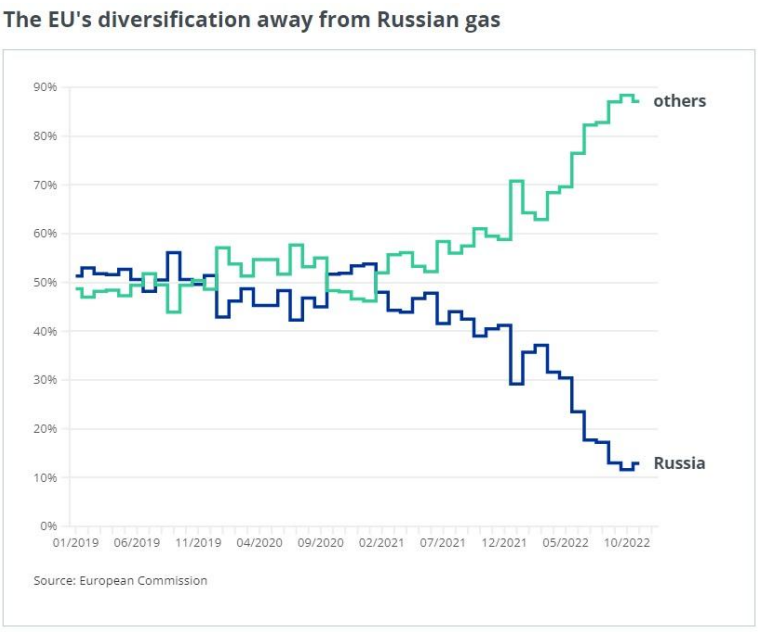
Picture 5.5.1.1 - How does electricity affect the environment (GEA / Weber. 2020

5.5.2 Energy usage in the EU after the conflict

According to Graaf et al. (2022) coal fired power plants will re-open in European countries during this energy crisis. Among those countries are Germany, Austria, France and Great-Britain (Schonhardt. 2022), but no countries have still revoked the Green Deal target of removing coal within 2030. To replace this power-plants energized by coal the sustainable alternatives are renewable energy, nuclear energy, and/or natural gas in accordance with the taxonomy regulations.

When all alternative fossil energy sources increase in price it becomes less attractive for investors. Thus investments in renewable energy could see an increased interest from stakeholders solely due to the increased price of the alternatives fossil fuels as seen below in chapter 5.6. In addition, renewable energy created from solar and wind is already the cheapest option, even before the conflict (IEA. 2021). The replacement of natural gas from pipelines also comes with an added cost since most of the new natural gas has to go through the phase of liquefying it as well as it needs to go through LNG terminals (IEA, 2022).

Even though the transition from fossil fuel to alternative energies will take time, the current trend of replacing the natural gas from the Russian Federation has accelerated as seen on picture 5.5.2.1 (EC. 2022). The decreased supply of natural gas imports from the Russian Federation has increased the price for energy (Trading economics. 2022), thus making alternative energy sources as renewable energy and nuclear energy more attractive (Eurostat. 2022).



Picture 5.5.2.1 - The EUs diversification away from Russian gas (EC. 2022)

5.5.3 RePowerEU

In May 2022 the EU published a plan on how Europe and the European Union was going to handle the energy crisis. Primary target was to be independent of Russian fossil fuel within 2027. This plan is divided into three main pieces. First is energy conservation, the second is energy production and the third is to diversify the energy supply (EC. 2022). In a press document sent from the EU in May (2022) it is written that there will be an acceleration in the replacement of fossil energy in exchange for renewable energy. This is the clearest indication that the conflict of Ukraine entailed an increase of focus on renewable energy.
In total the EU indicates that renewable energy is going further up from 40% to 45%, thus increasing renewable energy investments up to 1236 GW within 2030, from previous targets outlined in "fit for 55" where the target was 1067 GW.
One of the biggest investments would come in the solar energy sector where it within 2030 shall produce 600 GW, that is more than double of the current production. Also, concession rounds are to be more effective creating a shorter period between receiving an application to approving the application (EC, 2022).

It is estimated that the total amount needed to be independent of Russian fossil fuel imports will cost Euro 210 billion toward 2027, however Europe would be saving around Euro 100 billion in import of gas and oil if this is successful. (Euronews, 2022).
Of this Euro 113 billion is for renewable energy and hydrogen infrastructure, while the rest is divided on energy efficiency, acceleration on offshore wind production, a doubling of the use of heat pumps, adoption in the industry, increased biomethan production, upgrading the power grid, import sufficient LNG and pipeline gas and security of oil supply (EC, 2022).
This package will in the short term also increase carbon emissions from alternative fossil fuel as coal and oil. At the press conference 18. may 2022 Peter Liese stated "In times of crisis when we have to replace Russian gas, also partly with coal, we should be careful and do everything to increase the share of renewables, but that takes time," (Simon & Taylor. P. 1) while the EU climate director Frans Timmermans stated that "We have to be transparent, we have to be honest: we have a short-term serious problem because of the Russian [imports] that… cannot be replaced immediately by renewables. So we will have to go out there in the world and try to find alternatives to Russian gas,"(Simon & Taylor. P. 2). In May 2022 there was still a certain amount of Russian Natural gas being imported, thus it was said that within 2022, the EU should be ⅔ independent of Russian natural gas. This has since been reduced to zero import and they were forced to rethink the strategy again. The IEA (2022) writes that the

EU talked to approximately everyone that could deliver natural gas; either to create new contracts or expand the current one. The EU succeeded in filling up the storage and the combination with a mild winter and new contracts, the effect of decreased natural gas was less than expected (Bloomberg. 2023).

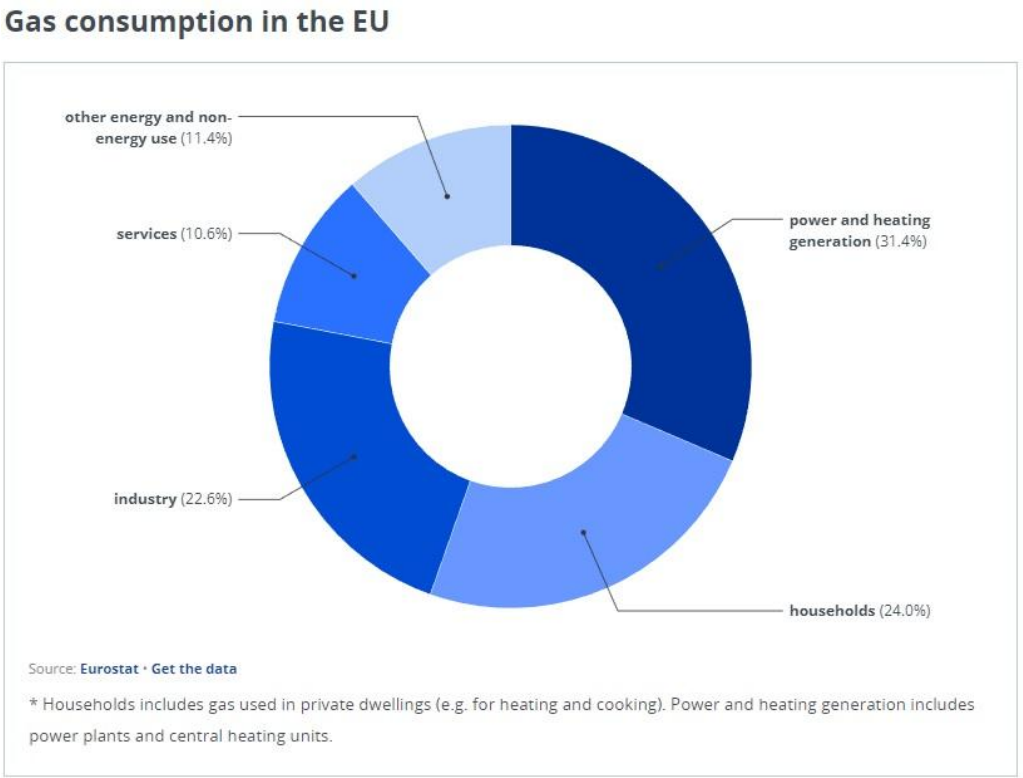
In July 2022 nuclear energy was voted into the taxonomy after many years of debating between different EU member states. This discussion is ongoing, but nuclear energy is now part of the taxonomy.
In the European Union, natural gas import from the Russian Federation are being replaced by alternative sources. A large part is coming from LNG and is explained below. There has also been more use of coal fired power plants but the main objective for the EU is to replace it with renewable energy.
In May 2022, The EU launched a new program called RePowerEu with a plan on how to become independent of the import from the Russian Federation. EU is increasing energy within target from 40% to 45% within 2030. Increasing this value from 1236 GW within 2030, from previous targets outlined in “fit for 55” where the target was 1067 GW.
Part of the reason why renewable energy has been highlighted is explained in the next chapter.

5.6 The fossil energy sector - after the conflict

5.6.1 The fossil energy sector - after the conflict

As the conflict between Ukraine and the Russian Federation exacerbated, the EU introduced sanctions towards the Russian Federation on part of the current imports and exports that existed between the Russian Federation and the Europe Union (EC, 2022). The first sanctions did not include a stop in import crude oil, petroleum products or natural gas. But in the sixth package seaborne imports of crude oil and petroleum product was banned, however some pipeline imports of crude oil are still accepted within a specified timeframe after agreements with Hungary, Slovakia & Czech Republic, as well as agreements with Bulgaria to continue import until end of 2024 and Croatia to continue their import until end of 2023 (CSIS, 2022).
From 2021 to 2022 the import of natural gas from the Russian Federation decreased from 41.2% in December 2021 to 12.9% in November 2022 (European Council, 2022). This implemented challenges to the European union's energy market (EC, 2022).

According to IEA (2022), the world has not been investing enough in energy. Annual investment in fossil fuels has averaged around USD 800 billion. In the renewable energy sector it has averaged at USD 300 billion. These numbers are much lower than what is needed to replace fossil fuel based energy, and at the same time the investments in fossil fuel has been at a level that corresponds to a world economy that stagnates or falls (IEA, 2022).
There has also been an increased focus and usage of natural gas in Europe in the last 20 years, as the energy created by natural gas has been seen as the transitional solution while building and scaling up renewable energy (IEA, 2019). This increased usage of natural gas, for example in Germany where gas was replacing nuclear power plants, is a major part of the reason for the current energy crisis according to Gillessen et al. (2019).
Natural gas has been seen as a better option than coal, thus increasing its popularity over the last decades. This is due to lower carbon emission equivalents that comes from natural gas and it was also seen as a stable and low priced fossil fuel resource (Trading economics, 2022).

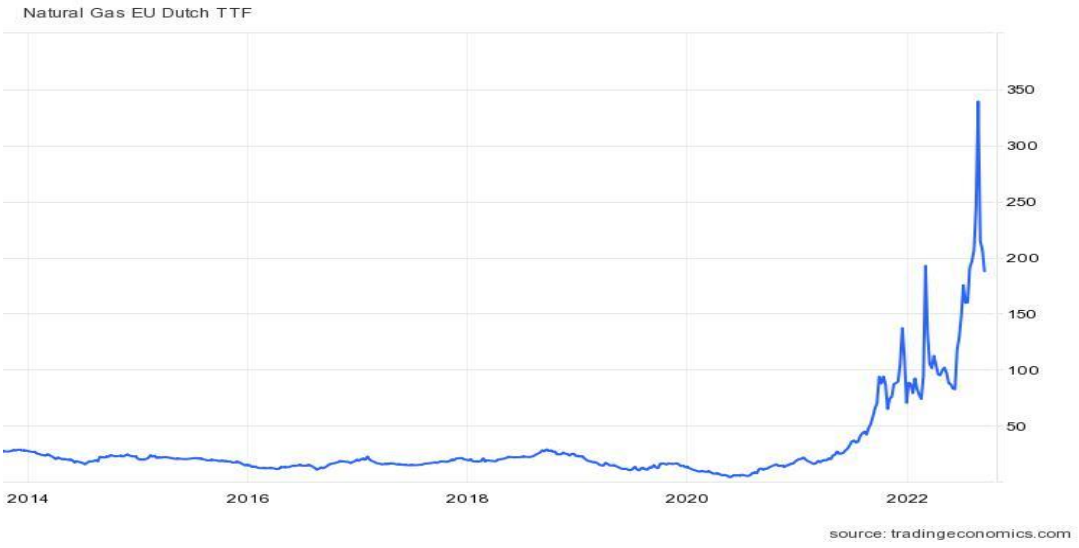


Picture 5.6.1.1 - Gas consumption in the EU (Eurostat. 2022)

The European Union is highly dependent on natural gas, not only for energy production, but also in the industry and in many European homes. This can be seen in the picture 5.6.1.1 where we see that over 24% of the gas usage comes from households while power and heating generation constitutes 31.4% and industry makes up 22.6%. (EC, 2022)

The EU was dependent on natural gas imports from the Russian Federation (WEO, 2022) as the import of natural gas decreased from 41.2% of the total EU natural gas supply in December 2021, and down to 12.9% in November 2022 (European Council, 2022). This created an imbalance between demand and supply that resulted in scorching gas prices (Trading Economics. 2022). The high gas prices and the lack of energy has several implications, but the most negative influence is that coal fired power plants were profitable and were put in production (Frost. 2022). This created a effect where carbon emission increases and more investments go towards coal powered power plants. Due to the almost doubling of carbon emissions created from coal powered power plants, more CO2 credits must be purchased, resulting in higher demand for the CO2 credits in the ETS system, this increases the price for the credits, which again increases the price for energy. Resulting in very high energy prices for consumers (Aam. 2022).

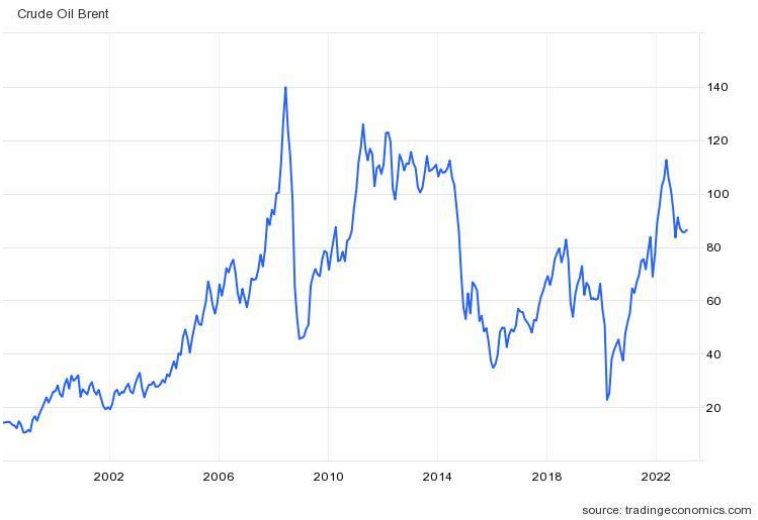
To understand the significant changes in the natural gas prices it must be compared to earlier years. In addition to the restrictions of natural gas from the Russian Federation there was also a reopening after the covid-19 pandemic. In the last 10 years, as seen on picture 5.6.1.2, the price has varied between approximately 5 Euro/MWh on the lowest to 28 Euro/MWh at the highest. But as the pandemic restrictions were removed the demand increased substantially. This is visible from the start of 2021, where a peak of 137 Euro/MWh in December 2021, several months before the conflict was initiated (Rowan. 2022).



Picture 5.6.1.2 - Natural gas prices (Tradingeconomics. 2022)

The price fell after this period before the price had a dramatic increase when the conflict exacerbated in February, with a peak of 194 Euro/MWh (Trading Economics. 2022). After the peak there was a slow reduction in the price before it skyrocketed up to 339 Euro/MWh when the natural gas was restricted through the natural gas pipeline "Nord Stream" (Lawson, 2022). From the low of 5 Euro/MWh to 339 Euro/MWh there is a 6700 % increase in price.
The almost complete restriction on natural gas via pipelines from the Russian Federation had a strong effect on the EU since the energy mix in the EU has a large part of electrical energy produced from natural gas powered power plants, and if transport, heating and generating electricity is summed together, this adds up to 34% of the total energy coming from natural gas (Eurostat. 2022). Most of this natural gas was replaced by liquefied natural gas (LNG). LNG from the US, Qatar and Nigeria made up 25%, Norway exported 25%, Algeria 12% and 13% from other countries and the remaining 25% came from the Russian Federation (European Council, 2023)

The oil price was also influenced by the removal of restrictions after the pandemic with prices on the way towards 100 dollar before the conflict exacerbated. When the sanctions from the EU had been implemented these prices rose to USD 127 per barrel, an approximately increase of 30 to 40%, before it stabilized itself at 90 to 100 dollar in October 2022 (Trading Economics, 2022).

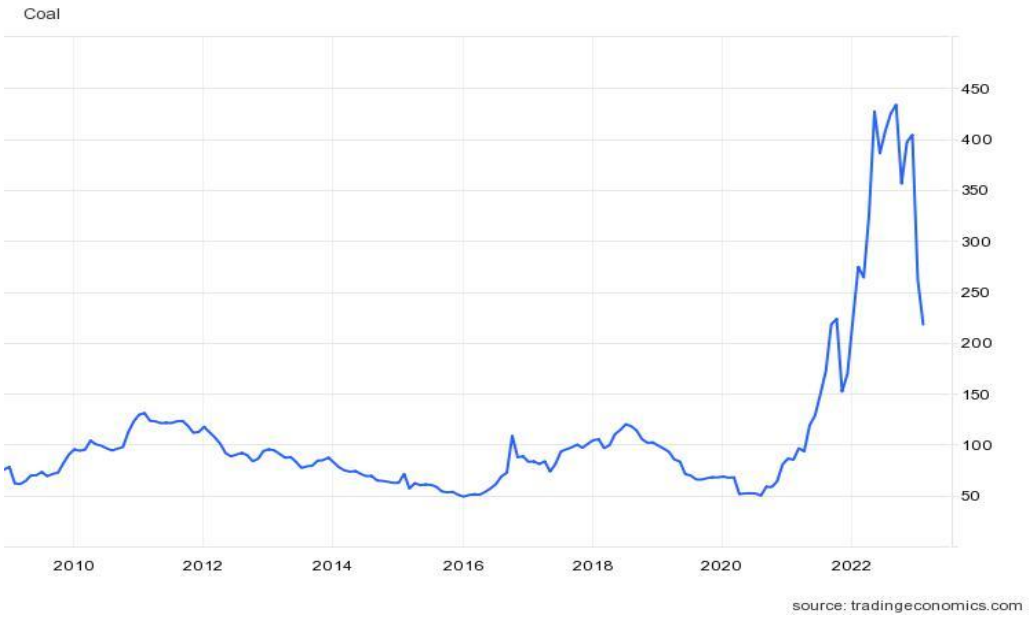


Picture 5.6.1.3 - Crude oil price. (Trading economics. 2022)

The oil price has seen similar peaks, both in 2008 and the latest in 2014 as seen on picture 5.6.1.3, so this was not something new as it was for natural gas (Trading economics. 2022).

Oil is also a product that can be more easily replaced on short notice from other producing countries and is thus not that affected by sanctions like the natural gas price is. The uncertainty still had an effect on oil prices in the European Union increasing it by approximately 30-40%. On the statistics from Energy Brainpool (2022) they state that 76 GW was produced from power plants in Europe in 2021 (power plants above 20MW). And, according to Eurostat (2020), the total energy mix including subjects like transports and petrochemical products, the oil constituted 34.5% in 2020 in the European Union. Of that 24.4% was imported oil from the Russian Federation (Eurostat. 2020).

For the coal industry in Europe this conflict has transpired to be a sort of renaissance for the sector. This can be seen on the pricing picture on picture 5.6.4.1. Pre-conflict and pre-pandemic the coal price had averaged at around 100 USD per ton. When Europe was opening up after the pandemic, this price increased to around 100 USD per ton. But, when the conflict in Ukraine escalated and the natural gas imports from the Russian Federation decreased, the price increased up to 433 USD per ton, approximately 4 times the normal cost. It did not have the extreme peak that the natural gas prices had due to the same arguments that is for oil - There are many countries with large reserves of coal, according to US Energy Information Administration (EIA) (2023).

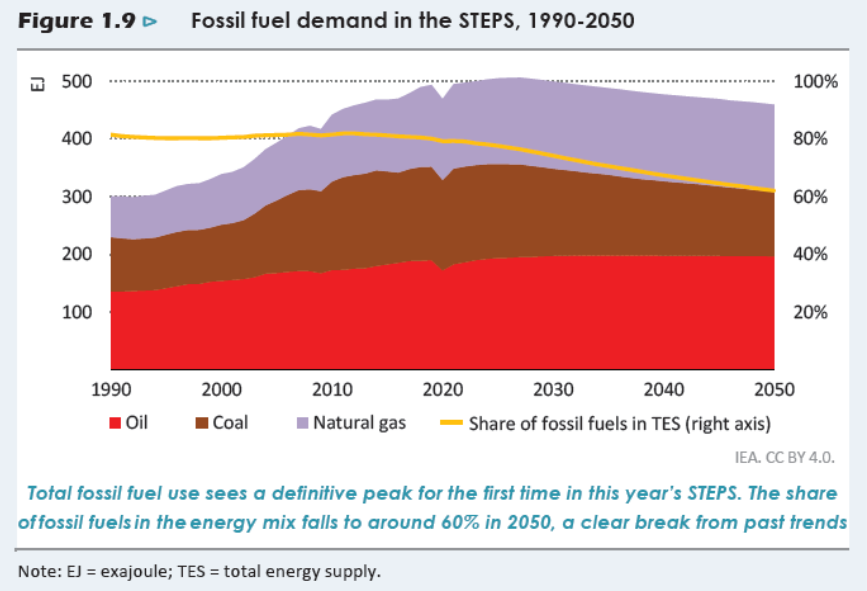


Picture 5.6.1.4 - Coal price. (Trading economics 2022)

Even though the price for coal increased substantially, and even though power plants driven by coal have higher operating costs it has still been economically viable to re-open old coal

powered power plants (Le Monde, 2022). Both due to the increased price for selling electricity and due to the necessity since the export of natural gas has diminished. But, the price for producing electricity by coal is normally so much higher than renewable energy and natural gas, that Peeters (2022) does not believe it will impact the targets in the European Green Deal, since it is expected that the production will decrease as soon as alternatives are coming in the market. This is also argued for in a report from Ember (2023) showing a rapid decrease in the use of coal.

Historically, increased investments in fossil energy sources are closely related to increased GNP according to IEA (2022), and the GNP has historically increased over time (World bank, 2023). But in IEA (2022) "Stated Policies Scenarios" as seen on picture 5.6.1.5 - that is the least ambitious scenario - they see this trend changing for the first time in history.
IEA (P.8, 2022) writes "For the first time ever, a WEO scenario based on today's prevailing policy settings – in this case, the Stated Policies Scenario – has global demand for every fossil fuel exhibiting a peak or plateau. In this scenario, coal use falls back within the next few years, natural gas demand reaches a plateau by the end of the decade, and rising sales of electric vehicles (EVs) mean that oil demand levels off in the mid-2030s before ebbing slightly to mid-century. This means that total demand for fossil fuels declines steadily from the mid-2020s to 2050 by an annual average roughly equivalent to the lifetime output of a large oil field. The declines are much faster and more pronounced in the WEO's more climate-focused scenarios."



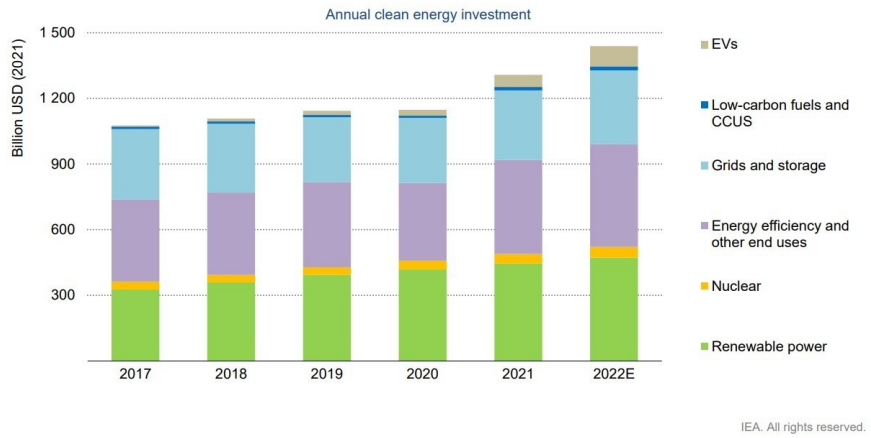
Picture 5.6.1.5 - Fossil fuel demand in the STEPS, 1990-2050

In summary, the decrease in natural gas imports had several effects. The combination of lessening in pandemic restrictions, the uncertainty of the conflict in Ukraine and the sanctions in combination with that most European Countries denied to pay in rubles, that again decreased the natural gas supply ended up making the natural gas price increase 6700% from the lowest price in 2020 to the highest price in 2022 while the coal prices increased almost 400% when comparing the prices at the lowest in 2020 to the highest in 2022.
The reduction in import of natural gas made the EU import LNG from other countries. LNG from the US, Qatar and Nigeria made up 25%, Norway exported 25%, Algeria 12% and 13% from other countries and the remaining 25% came from the Russian Federation (both LNG and pipeline) (European Council, 2023)
There were effects made in all parts of the fossil energy sector, but also the renewable energy sector experienced change.

5.7 - The sustainable and renewable energy sector - after the conflict

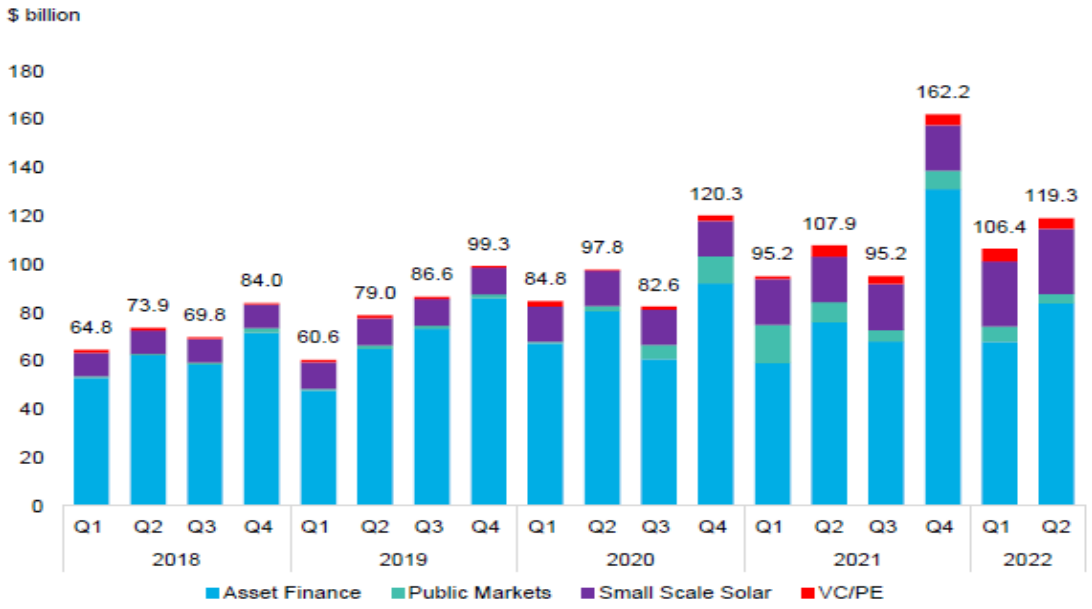
5.7.1 Renewable energy investments

BloombergNEF (2023) reported an increased investment in solar of 36% to USD 308 billion in 2022, while wind investment was stable at USD 175 billion world wide (BloombergNEF, 2023). The Investments estimated from IEA in their 2022 report, can be seen on picture 5.7.1.1. This graph shows clean energy investment in the world, where one part of the graph is renewable power investments. The graph from 2022 shows an estimate of increased investments in renewable energy. In the report from IEA (2022), it is estimated that investment in clean energy will be around USD 1 400 billion in 2022, as seen on picture 5.6.1.1. Of these USD 1400 billion, approximately 450 USD will go towards renewable energy.



Picture 5.7.1.1 - Annual clean energy investments (IEA 2022)

According to BloombergNEF (2022) there has been investment of around USD 225 billion in the renewable energy sector in the first six months of 2022. This corresponds to the USD 450 billion for the whole of 2022 in investment, that is estimated from IEA (2022).
These investments are mainly from the private sector and are a record historically for the first six months of any year, however, it is still less than the last six months of 2021. In the overview from BloombergNEF (2022), trend is showing increased investments in the renewable sector world wide, as seen on picture 5.7.1.2.



Picture 5.7.1.2 - Renewable energy investments (BloombergNEF. 2022)

A new report from IRENA (2023) is reporting investment of around USD 1300 billion dollars going into energy transition technologies. This is an increase of 19% from 2021 numbers and 70% increase from pre-pandemic investment according to IRENA (2023). Even though the investment trends have shown a slight increase from a year to the next in many years, this substantial increase in investment from before pre-pandemic levels can give the impression of a herding mentality taking form.

5.7.2 Sustainable energy

According to IEA (2022), nuclear energy provides around 10% of the global electricity generation in the world and in the EU it constitutes over 25% (Eurostat. 2022). Nuclear energy has been a topic for discussion within the EU the last decade, but since the conflict in

Ukraine exacerbated and the inclusion of nuclear energy in the taxonomy was voted in, new nuclear reactors projects have been approved and old reactors extended their lifetime in both Belgium and France (IEA. 2022). While Sweden is considering investing more in nuclear energy (Moderaterna, 2022). On average between 2016 and 2021, there have been investments of USD 35 billion per year. In the IEA (2022) net zero scenario it is calculated that it needs investments of USD 107.9 billion when including nuclear energy in the green transition. Even though the policy and public opinion on nuclear energy has changed within parts of the European Union towards a more positive attitude, the investments have not reached new records as with renewable energy sources. According to BloombergNEF (2023) the investment grade has been almost flat compared to previous years. When looking specifically at the European Union's numbers in 2022 in electricity created by nuclear there is a drop compared to previous years. This was due to the need for infrastructure repair and the lack of cooling water for the reactors, reducing their output in 2022 (EC, 2022). To exemplify this, in 2020 the European Union's nuclear generation was 683 TWh, while in 2022 these numbers had been reduced to 613 TWh. While Germany has exceeded the usage of some of their nuclear energy production, it is still expected to fully shut down within 2024 (Ember. 2023). As mentioned earlier, several nations are expected to increase investments into nuclear energy, but so far this cannot be evidenced by the capital invested for 2022.

The investment in renewable energy has increased from approximately USD 300 billion to USD 450 billion for the world. When looking at the broader category of clean energy, investments have increased to USD 1300 billion, which according to IRENA (2023) is an increase of 71% of pre-pandemic levels. Investment in nuclear energy has not increased, however, many European countries are planning for a nuclear expansion.

6. Analysis & Discussion

6.1 Analysis introduction and information

The European Union were working towards their targets in the "European Green Deal" with natural gas as the transitional energy production (HBS, 2022), until 24th of February 2022, when the conflict in Ukraine exacerbated. This conflict created upheavals in the political situation in the EU (Carnegie, 2023) and as a result, an arguably greater change happened within the energy sector due to the lack of energy imports from the Russian Federation. Eurostat (2022) shows that the EU imported 25% of all their oil and 40% of all natural gas from the Russian Federation in 2020 and 2021 (EC, 2022). At that time over 60% of all energy production in the European Union came from oil, coal and gas. As the conflict continued in Ukraine the European Union introduced new sanctions on the Russian Federation. The EU stated that oil was to no longer be imported from the Russian Federation after a certain date (EC. 2022). Eventually this also led to that import of natural gas was reduced and over time was limited down to almost zero. According to the newspapers NeftegazRU (2022) "unfriendly countries" had to pay in rubles, something many of the EU nations denied to do (EC. 2022). At the time of February 2022 to June 2022, Eurostat (2022) could report that the energy prices increased substantially in the European Union and at the same time the inflation was increasing rapidly, also when excluding energy prices (Eurostat, 2022). This created a pressure on the energy market that again has resulted in the EU launching new measures to meet the new challenges with energy insufficiency. Measures that would both contribute towards the energy crisis but also towards the climate goals (EC, 2022).

6.2 Ripple-effects

The conflict in Ukraine created ripple effects that affected the energy system in the European Union. The direct effect was the discontentment of the conflict in Ukraine from the European Union. This led to restrictions, regulations and other measures. Relevant for this thesis was the sanctions created by the European Union towards imports and exports with the Russian Federation (EC. 2022)

As an indirect effect of the conflict, but as a direct effect of the sanctions from the European Union, there was a lack of natural gas imports from the Russian Federation (EC. 2022).

That means the sanctions together induced an effect that led to energy insufficiency and thus higher energy prices in 2022 (Eurostat 2022).
This became critical throughout 2022 when the import of natural gas from the Russian Federation decreased after most of the EU members refused to pay in rubles, something that was required from “unfriendly countries” (Neftgazru, 2022). The European Union has been dependent on natural gas in their energy production mix, but also in the households, for heating and in the industry (EC, 2022). This natural gas insufficiency induced several effects. In combination with reduced import and the removal of restrictions from the pandemic in 2021, made the natural gas price increase over 6700% from the lowest price in 2020 to the highest price in 2022 (Trading economics, 2022). The conflict in Ukraine also induced uncertainty in the market and an increased demand for alternative fossil energy sources such as coal where the increased demand made the price increase almost 400% at a time in 2022. Oil had a lower increase in price of approximately 30% to 40% at peak (Trading economics, 2022).
Due to the increase in price of natural gas other ripple effects came in effect in the European energy market. As the energy market works as a merit/order market, the energy that is the cheapest produces and sells first, if this does not meet the demand, the next cheapest alternative is produced and sold. This continues until the demand is met. Historically energy produced from natural gas has been the next energy with the lowest price, but when the natural gas price increased this induced a general energy price where coal became profitable. More coal fired power plants were either restarted or increased their capacity (Schonhardt. 2022). The coal fired power plants had higher CO2 emissions, this resulted in an increase demand for carbon credits that again increased the energy prices further (Aam., 2022). However, this has been seen as only a temporary event in forecasts from IEA (2022). And in a new report from Ember (2023) the usage of coal is seen as diminishing in the European Union.

The induced effect of energy insufficiency and increasing energy prices can also be argued to be a catalytic effect regarding new policies as it led the European Union to initialize the program “RePower-EU”.
In “RePowerEU” they set a three-piece strategy consisting of energy conservation, energy production and energy diversification (EC. 2022). In this program the renewable energy target for the European Union was increased from the original level of 1067 GW of renewable energy electricity production within 2030, to 1236 GW. This is an increase from 38-40% that

was stated in the fit-for-55 to 45% of renewable energy production within 2030 with solar energy expected to double, to a target of 600 GW (EC. 2022). This increase in target number from the EU, along with record-high investment from the private sector in 2022 where investment in clean energy increased 70% from pre-pandemic levels (IRENA. 2023), can be argued that it was created by both a herding mechanism by investors and ripple effects caused by the European Union's reactions to the conflict in Ukraine.
Another arguable catalyzing effect created by the induced effect coming from increasing energy prices and energy insufficiency was regarding the taxonomy. The European green deal that was set out in action in 2019 included a taxonomy where it was defined what was sustainable and climate friendly. There have been discussions regarding this taxonomy to include natural gas and nuclear energy production, where member states have had very different opinions and it was voted to not be included in 2019 (Simon & Taylor, 2022), but in July 2022 it was voted in favor for including nuclear energy and energy created by natural gas into the taxonomy (EC. 2022).

6.3 Herding effect

In the theory chapter the herding in the financial market was explained. To see how strong the ripple-effects are, it can potentially be useful to see effects in context with herding and investments from the financial markets - If the effects are strong, the financial markets will potentially increase investments substantially.
It is difficult to find exact numbers on how much has been invested in non-sustainable energy resources and sustainable resources as renewable, nuclear and natural gas energy that meet the demands within the taxonomy in the European Union in 2022, but there are estimates and new numbers that have been reported from IRENA & Ember (2023).
In Europe there has been increased investment in other fossil energy sources such as LNG, Coal and oil (EC, 2023). This is partly explained by the need of replacing natural gas that previously came from import via pipes, that now have moved over to the more competitive market of LNG where the whole world is competing for the same resources (IEA. 2022). However, in the latest estimates from IEA (2022) they see that this shock in the energy sector has become a turning point and IEA are stating that the renewable energy sector is being turbocharged by this event (IEA. 2022). This can also be evidenced by the numbers from IRENA (2023) that shows a global record investment with USD 1300 billion being invested into the energy transition technologies. This is an increase in investment of 70% when compared to pre-pandemic levels. This could be indications of an herding effect being

witnessed by the shock to the energy sector and the ripple effects of the conflict in Ukraine. This can be linked to the chapter of herding within finance where investors follow investors in times of crisis or shock, like the pandemic.

6.4 Discussion

In the literature Turner (2012) writes that shocks can come from physical constraints, peak in national and global production rate of oil, institutional constraint and physical constraint. Currently it is possible to argue that all of them were present in the energy situation that the EU experienced in 2022. The physical constraint was the reduced import of oil and natural gas due to sanctions and political measures, peak factors for oil has been estimated to have already been reached by RMI (2023), institutional constraints are set by the "European Green Deal" including both incentives for investing in sustainable energy along with added cost in form of carbon credit if investing in fossil fuel. In summary this could be used as evidence of a shock to the energy system. Usman, Alola & Akadiri (2021) say that general shocks lead to more renewable energy, this could support the IEA (2023) statement, that this "energy-crisis" has turbocharged the renewable energy sector. In a research from Alege, Oye & Adu (2019) they found that renewable energy had a positive ripple effect on the Nigerian economy due to that renewable energy was more labor intensive, thus could create an additional argument for investing in renewable energy. There are many indications that this is experienced as a shock in the European Union energy sector if looking at the literature, thus, the argument for this conflict has created an effect on the whole energy system that would eventually accelerate the renewable energy system, is present.

6.5 Paradeigma within the energy sector

The interest and the focus around the subject of renewable energy has had a linear development the last decade. But, the interest has now moved to an exponential increase if seen by using a google search: Searching for renewable energy 2010 creates 148 million hits. Searching for "renewable energy 2021" results in 289 million hits. Searching for renewable energy 2022 results in 452 million hits.

Thus, in one year the number of hits has increased almost the same as in the 10 previous years (Google. 2023). This increased interest in renewable energy can be seen in relation to several factors. One of them is the price development within renewable energy, however the price for producing renewable energy was already in 2019 fallen to a point where it was the most cost effective method of producing energy out of all energy production methods currently

available (IRENA. 2019). Other factors need to be added to explain the increased interest. One contributing factor could be the governmental measures along with international agreements such as the Paris agreement of 2016 and The European Green Deal in 2019. But, the major increase in interest did not peak before 2022. Thus, it can be argued that a probable cause is due to shock caused by the ripple effects coming from the European Union's reaction, to the exacerbation of the conflict between Ukraine and the Russian Federation, that eventually led the European Union into an energy insufficiency in 2022 (EC. 2022)

Thomas Kuhn (1962) argued in "The structures of scientific revolution" that science does not take step by step towards truth and enlightenment, but that you have paradigms, truths, that are constant until they can no longer prove new theories and phenomenons. According to Kuhn, paradigms happened through crisis, where one paradigm excludes an old paradigm and that is when the paradigm shift happens. For the last 100 years fossil energy has been used as the example on how to create energy in the industrialized society (Huber. 2009). Though, there are several publishments that has been made over the last 50 years that has highlighted the problem with the way the world operates, like Arne Næss's (1973) book, "deep ecology" where he argues that the modern society must fundamentally change if we are not to have an ecological collapse. Another example is the published report of "Our Common Future" (1987) that was published in 1987. This publication was one of the reports that set sustainability and environment on the agenda, but the publication did not result in any major changes in the energy sector. Even after that the price for renewable energy had fallen below the price of fossil energy. As Thomas Kuhn said, only under crisis paradigm-shifts would happen. Now the EU has experienced a shock to their energy system resulting in an energy insufficiency not experienced before. Could this shock to the energy system in the European Union be the crisis that is needed to create the paradigm-shift from fossil energy to renewable energy?

There are some reports that show this could become true. In the newest scenarios from the International Energy Agency, they have for the first time since they started their scenarios, seen that an increase in Gross National product **does not** increase the use of fossil energy sources (IEA, 2023). BloombergNEF (2022) states that for the first time in history, the investment in green technology is at the same level as fossil energy. The interest in renewable energy has had an exponential increase in interest (Google, 2023) and the investments in clean energy transition are reported to be 70% higher than pre-pandemic level (IRENA, 2023).

7. Conclusion

7.1 Answer to the thesis question

The question in the thesis was how did the conflict between Ukraine and the Russian Federation affect the energy situation and the transition to renewable energy in the European Union, and did it accelerate renewable energy investment.

The reactions from the European Union to the conflict in Ukraine created ripple-effects for the energy market within the European Union. The direct effect was condemnation and political measures that again created sanctions, something that can be seen as an indirect effect of the condemnations made from the European Union. This induced a ripple effect that resulted in lack of natural gas supply in the European Union that again created an energy insufficiency (EC. 2022). This induced an increase in energy price that again catalyzed an increased interest in nuclear energy and increased investment in renewable energy within the European Union (EC. 2022).

The European Union has also introduced new policies in the publication of RePowerEu, with new renewable energy targets. Nuclear energy was in July 2022 added to the EUs taxonomy, but it is not possible to conclude if this was due to political measures or effects coming out from the conflict, probably it would be a combination of several factors. Even though it is included into the taxonomy, this has so far not resulted in an increase in investments in 2022, according to latest reports from BloombergNEF (2023) and Ember (2023).

The ripple effects of the conflict has created an exponential increased interest in renewable energy. Combined with IRENA (2022) reporting 70% increased investment from pre-pandemic levels in renewable energy, and that IEA (2022) for the first time calculating that fossil fuel will not increase with Gross national Product (GDP), are indications of increased focus on renewable energy and a herding tendency within the European Union where the capital market are seeking more towards renewable energy.

7.2 Limitations and suggestion for further research

There are many factors that could affect the energy sector and thus also the herding tendencies within the capital markets. Additional factors for the increased investment in renewable energy could possibly also be related to the release of the pandemic restrictions, new rules, regulations and framework in the European Union, more sustainable investing, societal pressure, and/or the global economic situation. These factors are not thoroughly researched, creating a limitation to how strong the conclusion can be based on the empirical findings in this thesis.

The estimated capital investments and numbers that are used in the thesis is from internationally accredited energy agencies and companies, however the exact numbers for investment in 2022 is a calculation that has not been fully completed yet, and even when completed, there will be discrepancies between the agencies. This would be natural since they have different types of calculations, with different assumptions and expectations. Thus, it could be hard to create a quantified research on the subject without excluding information from some of the agencies.

To further study the impact of the conflict on the renewable energy sector in the form of investments, a quantified method by using an average of reported numbers can be a possible way to continue. However, the invested capital in renewable energy for 2023 is possibly even more accurate to use for a similar research like this, since much of the natural gas coming from pipelines in 2022 was replaced by LNG, creating a possibility that the investment in renewable energy will increase further in 2023.

Over time, more accurate information will be available, both from experts and from official information. To further study the impact of the conflict on the European Union's energy system, the author suggests that semi-structured interviews with experts should be done in combination with document analysis.

Definitions:

TTF:

Title Transfer Activity. A virtuel market used for trade of natural gas. Gas prices mentioned in the thesis is referred to as TTF as this is used as a reference point to understand the European Gas market and gives an indication of prices and the variation of prices over time.

EU:

European Union

EC:

European Commission

IEA:

International Energy Agency

IMF:

International Monetary fundation

IRENA:

International Renewable Agency

MWh / TWh

Mega Watt hour /Terra Watt hour

Taxonomy:

A taxonomy within the European Green Deal that define the sustainability in different actions and industries

Assumptions made in thesis

- Renewable energy is defined as solar, hydro, wind, geothermal
- Sustainable energy is defined as nuclear and gas driven power plants that follows the guidelines in the taxonomy

Interview guide:

1. EU hadde før invasjonen i Ukraina et veldig sterkt fokus på det grønne skiftet. Nå står vi midt oppi en energimangel i Europa. På hvilken måte tror du dagens situasjon vil påvirke satsingen på fornybar energi i Europa og EU sett mot 2030?

2. Hva tror du om Russland sin rolle som energieksportør i fremtiden frem mot 2030? Kan energisituasjonen i EU bli så dramatisk at det kan komme pragmatisk politikk? Tenker for eksempel på om EU eventuelt opphever sanksjoner mot Russland for å få gassen tilbake, evt. andre politiske grep?

3. Mangelen på energi merkes i store deler av EU. Hva tror du vil skje med satsingen på fossil-baserte kraftverk fremover sett i et tidsaspekt mot 2030? Kan det grønne skiftet lide av dette?
- Og, tror du det kan komme endringer i EU/EU-land sin politikk? Da tenker jeg på at de skrives langtidskontrakter på gass som strekker seg etter 2030, slik at incentivene for gasselskaper til å investere i gassutvikling blir høyere.

4. Energimangelen har også medført en kraftig økning i energiprisene. Merkes det en endring i investeringsviljen mot energiproduksjon? Tenker da her på både fornybar-energi sektoren og ikke fornybar sektoren. Samt både blant privat næringsliv men også statlige investeringer. - Kan dette eventuelt akselerere fornybar-energi satsingen?

5. Hva tror du vil skje med bruken av atomkraft fremover i Europa og EU?

6. Gasskraft har gått under den grønne paraplyen i taksonomien. Men, gasskraft er jo egentlig bare grønt i en relativ sammenheng. Kan dagens situasjon medføre at det grønne skiftet nå gjøres enda grønnere, altså, det blir mindre bruk av gasskraft i fremtiden og enda mer fornybar-energi?

7. “The European Green deal” har som delmål å redusere utslippene med 55% fra 1990 nivå i 2030. Hva tror du om dette målet sett ut i fra dagens situasjon?

8. Hvor mye av inflasjonen, gassprisen og oljeprisen i EU kan tilskrives krigen i Ukraina? Mye av dette var allerede på vei opp ettersom vi gikk ut av pandemien. Var det krigsfrykt som medførte dette, eller var det bare et resultat av null-renter og enorme stimuli-pakker, eller noe midt i mellom?

Sources

The sources are linked with their hyperlink in the extended source list below.

Aam, Sverre. (2022). Hvordan påvirker Europeiske kraft og gasspriser - norske kraftpriser.

Abnett, Kate - Reuters. (2022). EU Green shifts depend on mammoth investment in the energy grid.

Adom, Dickson & Hussein, Emad & Adu-Agyem, Joe. (2018). THEORETICAL AND CONCEPTUAL FRAMEWORK: MANDATORY INGREDIENTS OF A QUALITY RESEARCH. International Journal of Scientific Research. 7. 438-441.

Aggression against Ukraine : resolution / adopted by the General Assembly. 2022. United Nations Digital Library

Alege, Philip & Oye, Queen Esther & Adu, Omobola. (2019). Renewable Energy, Shocks and the Growth Agenda: A Dynamic Stochastic General Equilibrium Approach. International Journal of Energy Economics and Policy. 9. 160-167. 10.32479/ijeep.6953.

Ali, R. & Afzal, M. (2012). Impact of global financial crisis on stock markets: Evidence from Pakistan and India

Aspers, Patrik & Corte, Ugo. (2019). What is Qualitative in Qualitative Research. Qualitative Sociology. 42. 10.1007/s11133-019-9413-7.

BCC - Various climate organizations. (2022). Banking on climate chaos

Beck, T. & Levine, R. (2004). Stock Markets, Banks, And Growth: Panel Evidence

Bikhchandani, S., Sharma, S. (2000). Herd Behavior in Financial Markets

Bloomberg. (2021). Energy production Europe.

Bloomberg. (2023). Putin’s Energy Gambit Fizzles as Warm Winter Saves Europe

BloombergNEF. (2022). New Energy Outlook 2022

BloombergNEF. (2022). New Energy Outlook 2022

BloombergNEF. (2023). Energy Transition Investment Trends

Boqiang Lin, Oluwasola E. Omoju, Jennifer U. Okonkwo. 2016. Factors influencing renewable electricity consumption in China
Borkamo, Hanna. (2022). User acceptance and mental models – an exploration of citizens perceptions of autonomous buses in the Arctic region
Bowen, Glenn. (2009). Document Analysis as a Qualitative Research Method. Qualitative Research Journal. 9. 27-40. 10.3316/QRJ0902027.
Byrne, J. (2006) Modern Energy and Modern Society
Caruana, E. J., Roman, M., Hernández-Sánchez, J., & Solli, P. (2015). Longitudinal studies. Journal of thoracic disease, 7(11), E537–E540.
Chazdon, Scott & Emery, Mary & Hansen, Debra & Higgins, Lorie & Sero, Rebecca. (2017). A Field Guide to Ripple Effects Mapping.
China Daily - REN QI. (2022). Unfriendly countries' required to pay in rubles
China Daily - REN QI. (2022). Unfriendly countries' required to pay in rubles
Climate Champions / UN / Race to zero campaign. (2021). What’s the cost of net zero?
Climate Policy Initiative. (2015). Global Landscape of Climate Finance 2015
Cooper, Adrian & Smith, Phil. (2005). The Economic Catalytic Effects of Air Transport in Europe
CSIS - Center for strategic & international Studies. (2022). European Union Imposes Partial Ban on Russian Oil
de Vaus, D. (2001). Research Design in Social Research
Delardas, Orestis & Giannos, Panagiotis. (2022). The ripple effects of the energy crisis on academia: Europe’s energy crisis deepens concerns about the future of academia and research laboratories are in dire need of sustainable solutions. EMBO Reports. e56287. 10.15252/embr.202256287.
Demir, Ender & Gozgor, Giray. (2018). Are shocks to renewable energy consumption permanent or temporary? Evidence from 54 developing and developed countries. Environmental Science and Pollution Research. 25. 10.1007/s11356-017-0801-9.
DN - Dagens Næringsliv. (2022). Oljeprisen
EC - European Commission (2020). Offshore Renewable Energy strategy
EC - European Commission. (2019). The European Green Deal sets out how to make Europe the first climate-neutral continent by 2050, boosting the economy, improving people's health and quality of life, caring for nature, and leaving no one behind
EC - European Commission. (2019). What is the European Green Deal
EC - European Commission. (2021). Energy system factsheet

EC - European Commission. (2021). EU Energy Markets and Energy Prices
EC - European Commission. (2022). EU taxonomy for sustainable activities
EC - European Commission. (2022). European Climate Law
EC - European Commission. (2022). REPowerEU: A plan to rapidly reduce dependence on Russian fossil fuels and fast forward the green transition
EC - European Commission. (2022). REPowerEU: Affordable, secure and sustainable energy for Europe
EC - European Commission. (2022). REPowerEU: affordable, secure and sustainable energy for Europe
EC - European Commission. (2022). REPowerEU: affordable, secure and sustainable energy for Europe
EC - European Commission. (2022). The European Green deal
EC - European Commission. (2022). Sanctions adopted following Russia's military aggression against Ukraine
EC - European Commission. (2023). EU taxonomy for sustainable activities.
EC - European Commission. (2023). Fit for 55
EC - European Commission. 2022. The European Green deal
ECB - European Central Bank - Luis de Guindos. (2022). The euro area economy and the energy transition
ECB - European Central Bank. (2022). Two per cent inflation target.
EIA - US Energy Information Administration. (2023). Coal and coke reserves
EIA - US Energy Information Administration. (2023). Nuclear power plants generated 68% of France's electricity in 2021
Ember - Think Thank. (2023). European Electricity Review 2023
Ember Think tank - Dr Chris Rosslowe. (2022) New Generation: Building a clean European electricity system by 2035
Empirically grounded technology forecasts and the energy transition. (2022). Oxford University - Rupert Way, Matthew C. Ives, Penny Mealy, J. Doyne Farmer
Energy Brainpool. (2022). European Power Plant Database
European council. (2022). EU sanctions against Russia explained
European Council. (2022). Where does the EU's gas come from?
European council. 2022. EU sanctions against Russia explained
Euronews. (2022). Austria to take EU to court over 'greenwashing' of gas and nuclear
European Council. (2022). Energy prices and security of supply

European Council. (2023). Infographic - Where does the EU’s gas come from
European Parliament - EU. (2022). Taxonomy: MEPs do not object to inclusion of gas and nuclear activities.
Eurostat. (2019). Where does our energy come from?
Eurostat. (2021). Nuclear energy statistics
Eurostat. (2022). 25% of EU electricity production from nuclear sources
Eurostat. (2022). Electricity and gas prices in the first half of 2022
Eurostat. (2022). Electricity and gas prices in the first half of 2022
Eurostat. (2022). EU energy mix and import dependency
Eurostat. (2022). EU imports of energy products - recent developments
Eurostat. (2022). Euro area annual inflation up to 8.6%. 2022
Eurostat. (2022). Nuclear energy statistics
Eurostat. (2023). Annual inflation down to 9.2% in the euro area
Faheem Aslam, Paulo Ferreira, Haider Ali & Sumera Kauser. (2021). Herding behavior during the Covid-19 pandemic: a comparison between Asian and European stock markets based on intraday multifractality
Forbes. (2022). Do Higher Interest Rates Hurt The Stock Market? Here’s How Strategic Investors Adjust As Rates Go Up
Frick, Walter. (2022). What Causes Inflation?
Frost, Rosie. (2022). All the European countries returning to ‘dirty’ coal as Russia threatens to turn off the gas tap.
FT - Financial Times. (2023).
Gillessen, Bastian & Heinrichs, Heidi & Hake, Jürgen-Friedrich & Allelein, Hans-Josef. (2019). Natural gas as a bridge to sustainability: Infrastructure expansion regarding energy security and system transition. Applied Energy. 251. 10.1016/j.apenergy.2019.113377.
Golafshani, Nahid. (2003). Understanding Reliability and Validity in Qualitative Research. The Qualitative Report. 8. 597-607. 10.46743/2160-3715/2003.1870.
Gonzalo Escribano Francés, José María Marín-Quemada, Enrique San Martín González (2013). RES and risk: Renewable energy's contribution to energy security. A portfolio-based approach,Renewable and Sustainable Energy Reviews
Google. (2023). Google search “Renewable energy 2010/2015/2021/2022”. 2023. www.google.com
Growing Co2 levels despite Heightened Attention. 2016. Harvard Business Review & Worldometer.

Hem, Erlend. (2018). Inflasjon i paradigmer
Henriksen, J. T., Salamonsen, K. Solvoll, G. Sørnes, J. O. (2009) Ringvirkninger av Skarvutbyggingen, Del 1, 2006 – 2009.
Hossain, Mohammad Razib & Singh, Sanjeet & Sharma, Gagan & Apostu, Simona & Bansal, Pooja. (2023). Overcoming the shock of energy depletion for energy policy? Tracing the missing link between energy depletion, renewable energy development and decarbonization in the USA. Energy Policy. 174. 113469. 10.1016/j.enpol.2023.113469.
Huber, Matthew T. (2009). Energizing historical materialism: Fossil fuels, space and the capitalist mode of production
IAEA - International Atomic Energy Agency. (2022). IAEA Increases Projections for Nuclear Power Use in 2050. (2022)
IEA - International energy agency (2021), The cost of capital in clean energy transitions
IEA - International Energy Agency. (2019). The Role of Gas in Today's Energy Transitions
IEA - International Energy Agency. (2020). The world needs more diverse solar panel supply chains to ensure a secure transition to net zero emissions
IEA - International Energy Agency. (2021). CO2 Emissions
IEA - International Energy Agency. (2021). The cost of capital in clean energy transitions
IEA - International Energy Agency. (2021). World Energy outlook
IEA - International Energy Agency. (2022)- Nuclear Electricity
IEA - International Energy Agency. (2022). Average annual investment in nuclear power by country or region in the Net Zero Scenario, 2011-2030
IEA - International Energy agency. (2022). Coal in net zero transition
IEA - International Energy Agency. (2022). Renewable power investment, 2012-2020.
IEA - International Energy agency. (2022). Renewable power’s growth is being turbocharged as countries seek to strengthen energy security
IEA - International Energy Agency. (2022). World energy investment 2022
IEA - International Energy Agency. (2022). World energy investment 2021
IEA - International Energy Agency. (2022). World energy investment. Overview and key findings
IEA - International Energy Agency. (2022). World Energy Outlook 2022 shows the global energy crisis can be a historic turning point towards a cleaner and more secure future
IEA - International Energy Agency. (2022). World energy outlook 2022
IEA - International Energy Agency. (2022). Coal 2022

IMF - International Monetary Foundation - Ehlers, Torsten. Gardes-Landolfini, Charlotte. Natalucci, Fabio.Ananthakrishnan, Prasad. (2022). How to Scale Up Private Climate Finance in Emerging Economies
IMF - International Monetary fund: Jeromin Zettelmeyer. simone Tagliapietra. Georg Zachmann. Conall Heusaff. (2022). The EU needs a grand bargain that reduces demand, increases supply, and keeps energy markets open. International Money Fundation -
Interfax: Kremlin. (2022). Nothing but technological problems hindering gas supplies to Europe.
Interfax: Kremlin. (2022). Nothing but technological problems hindering gas supplies to Europe.
IRENA - International Renewable Energy Agency. (2020). Renewables Increasingly Beat Even Cheapest Coal Competitors on Cost
IRENA - International Renewable Energy Agency. (2023). Global landscape of renewable energy finance
IRENA - International Renewable Energy Agency. (2023). Investments in Renewables Reached Record High, But Need Massive Increase and More Equitable Distribution
IRENA - International Renwable Energy Agency. (2021). World Energy Transitions Outlook
Johannessen, A. Christoffersen, L. og Tufte, P.A. (2011). Introduksjon til samfunnsvitenskapelig metode.
Johnsen, R Burke. (2019). Examining the Validity Structure of Qualitative Research.
Journal of Environmental Economics and Management,Volume 70,2015, Pages 92-108,
Kagan, Julia - Investopedia. (2022.) What Is a Learning Curve? Formula, Calculation, and Example
Kakilla, Charles. (2021). Strengths and Weaknesses of Semi-Structured Interviews in Qualitative Research: A Critical Essay. 10.20944/preprints202106.0491.v1.
Kapinenko, Mykola. (2022). Russia’s war in Ukraine: How it started and where it could lead
Karolyi, A & Martell, R. (2006). Terrorism and the stock market
Kerner, Sean Michael. (2022). Greenwashing
Kjærland, F. Mathiasen, T. Solvoll, G. (2012) Verdsetting av ringvirkninger- et eksempel fra kraftbransjen. 2012
Kjærland, Frode; Mathisen, Terje A.; Solvoll, Gisle. (2010). Statkraft i Midt-Norge: Samfunnsnytte og lokal betydning
Kuhn, Thomas. (1962). The structure of scientific revolutions
Lawson, Alex. (2022) Nord Stream 1: Gazprom announces indefinite shutdown of pipeline.

Lazard. (2021). Lazards's levelized cost of energy analysis - version 15. 2021.
Le Monde. (2022). Despite climate commitments, the EU is going back to coal
Lehne, Stefan. (2023). After Russia's War Against Ukraine: What Kind of World Order?
Leung L. (2015). Validity, reliability, and generalizability in qualitative research. Journal of family medicine and primary care, 4(3), 324–327.
Lloyd, N. & Desjardins, G. (2022). Europe's energy future: the plan to cut Russian fossil fuels and speed up the green transition. 2022.
Masters, Jonathan. (2022). Ukraine: Conflict at the Crossroads of Europe and Russia.
Masterson, Victoria - WEO: World Economic forum. (2021) Renewables were the world's cheapest source of energy in 2020, new report shows.
Mckinsey. (2020). How the European Union could achieve net-zero emissions at net-zero cost
Mckinsey. (2022). Renewable-energy development in a net-zero world
Mertzanis, Charilaos & Allam, Noha. (2018). Political Instability and Herding Behaviour: Evidence from Egypt's Stock Market. Journal of Emerging Market Finance. 17. 097265271774808. 10.1177/0972652717748087.
Milosevich, Mira. (2021) Russia's Westpolitik and the European Union
Moderaterna. (2022). Direktiv sam arbetsprojekt Klim at och energi. Överenskom m else för S verige
Monaghan, John. - Luxtimes. (2022). Luxembourg protests against Belgium nuclear plans
Myllyvirta, Lari. (2022). EU ban on Russian oil: Why it matters and what's next
Næss, Arne. (1973). The Shallow and the Deep, Long-Range Ecology Movement. A Summary
Neftegazru. (2022). Putin says «unfriendly countries» have to pay for Russian gas in rubles
NHO - Næringslivets hovedorganisasjon. (2022). EUs taksonomi og handlingsplan for bærekraftig finans
NIBM - Norges bank investment management. (2022). Oljefondets markedsverdi
Nicoson, Christie. Uppsala University, & Nina von Uexkull, Uppsala University and PRIO Peace Research Institute Oslo (Humanitarian consequences of climate change). From the Norwegian Red Cross: Ida Haugen-Poljac (Syria in focus), Torben Henriksen (Afghanistan in focus, Pacific islands in focus), Thomas André Syvertsen (Somalia in focus, Mozambique in focus) and Morten Tønnessen-Krokan (Colombia in focus). Editor: Anette Bringedal Houge.). (2019). OVERLAPPING VULNERABILITIES : The impacts of climate change on humanitarian needs.

Nobles, James & Wheeler, Jessica & Dunleavy-Harris, Kirsty & Holmes, Richard & Inman-Ward, Alan & Potts, Alexandra & Hall, Jennifer & Redwood, Sabi & Jago, Russell & Foster, Charlie. (2021). Ripple Effects Mapping: Capturing the Wider Impacts of Systems Change Efforts in Public Health. 10.21203/rs.3.rs-1008063/v1.
OECD - Organization for Economic Co-operation and Development. (2022). Climate Finance and the USD 100 Billion Goal
Øvrebø, Olav A. (2022). Fit for 55: EUs grønne superpakke skal gjøre unionen klar for utslippskutt
Øvrebø, Olav A. (2022). Kvotemarked: EU og verden
Oxfam: Carty, Tracy. Kowalzig, Jan. (2022). Climate Finance Short-changed: The real value of the $100 billion commitment in 2019–2020
Patton, Michal Quinn. (2002). Qualitative Research & Evaluation Methods
Peeters, T. (2022). Does the EU move away from EU Green Deal in the wake of the Ukraine war?
Pradetto, August. (2022). Reactions of Germany, the EU, and NATO to the Ukraine War and their Global Implications. 10.48770/ker.2022.no2.15.
Pucker, Kenneth. P. (2021). Overselling Sustainability Reporting - We’re confusing output with impact
Putin, Vladimir. (2023). Presidential Address to Federal Assembly.
Renewable energy statistics. (2023). European Commission
Reuters. (2022). Russia's Gazprom tightens squeeze on gas flow to Europe
Reuters. (2022). Russia's Gazprom tightens squeeze on gas flow to Europe
Rinke, Andreas., Alkoussa, Riham. & Käckenhoff. (2022). Germany pushes to extend lifespan of three nuclear plants -letter
RMI. (2023). Peak Fossil Fuel Demand for Electricity
Roosevelt institute - Melodia, Lauren & Karlsson, Kristina. (2022). Energy Price Stability: The Peril of Fossil Fuels and the Promise of Renewables. 2022. Roosevelt Institute
Roser, Max - Our World in data. (2020). Why did renewables become so cheap so fast?
Rowan, Lisa. (2022). Gas Prices Were Already Rising Before Russia Invaded Ukraine. What’s Next?
Ruslin, Ruslin & Mashuri, Saepudin & Sarib, Muhammad & Alhabsyi, Firdiansyah & Syam, Hijrah. (2022). Semi-structured Interview: A Methodological Reflection on the Development of a Qualitative Research Instrument in Educational Studies Ruslin. Vol. 12. 22-29. 10.9790/7388-1201052229.

Schiermeier, Quirin. (2019). New EU chief makes bold climate pledges
Schonhardt, Sara. (2022). Reopening European coal plants won't sink climate goals
Schroder / Marsha,, Jo. (2020). Are investors more motivated by morals or money?
Schumpeter, J. A, 1934. The theory of economic development: An inquiry into Profits, Capital, Credit, Interest and the Business Cycle
Schunz, Simon. (2022). The 'European Green Deal' – a paradigm shift? Transformations in the European Union's sustainability meta-discourse. Political Research Exchange. 4. 10.1080/2474736X.2022.2085121.
Schwartzkopff, Julian - Heinrich-Böll-Stiftung European Union and Environmental Action Germany. (2022). The future role of gas in a climate-neutral Europe
Seghal, Divya. (2022). Renewable Energy - Investment Tracker, 2H 2022
Setia M. S. (2016). Methodology Series Module 3: Cross-sectional Studies. Indian journal of dermatology, 61(3), 261–264. https://doi.org/10.4103/0019-5154.182410
Shahi, Dharmendra. (2022). War in Ukraine: A Geopolitical Analysis. 2249-2496.
Shroder. (2017). Global perspectives on sustainable investing
Simon, F. & Taylor, K. (2022). EU unveils €300bn plan to quit Russian fossil fuels by 2027 and boost clean energy
Simon, Frederic & Taylor, Kira. (2021). The Green Brief: Gas, nuclear and the EU taxonomy saga
Simon, Frederik & Mousou, Nelly. (2021). EU's Simson calls for 'gearshift' in nuclear power investments
Singer, John. (2022). EU Lawmakers Remove Last Hurdle to Label Gas, Nuclear as Green
Snyder, Hannah. (2019). Literature review as a research methodology: An overview and guidelines. Journal of Business Research. 104. 333-339. 10.1016/j.jbusres.2019.07.039.
Statista. (2020). Value of renewable energy investment in Europe from 2004 to 2019
Store Norske Leksikon. (2022). Paradigme
The World bank. (2015). Private Sector - an Integral part of Climate Action Post-Paris
Timperley, Jocelyn. (2021). The broken $100-billion promise of climate finance - and how to fix it
Trading economics. (2022). Coal prices
Trading Economics. (2022). USA - BNP
Trading Economics. (2023). Carbon permits
Tradingeconomics. (2022). EU natural gas
Turner, G. (2012). Energy shocks and emerging alternative energy technologies

UN - World Commission on Environment and Development. (1987). Our common future
UNFCCC - Race to Zero campaign. (2021). Financing Roadmaps.
UNFCCC - United Nations Climate Change Council. (2016). The Paris Agreement
UNFCCC - United Nations Climate Change Council. 2005. What is the Kyoto Protocol?
UNFCCC - United Nations Climate Change. (2017). Private Investments Are Crucial to Achieve Paris Goals
Ursin, Lars - Intervju med Lars Sørgård. (2022). Blir strømmen billigere om vi frikopler gassen?
Usman, O. Alola, A. & Akadri, S. (2022). Effects of domestic material consumption, renewable energy, and financial development on environmental sustainability in the EU-28: Evidence from GMM panel-VAR. 2022.
Van de Graaf, Thijs & Bouckaert, Reinhilde & Van Coppenolle, Hermine & Vandenhole, Kimberley & Paredis, Erik & Praet, Jasper & de Jong, Moniek & Dejonghe, Marie & Blondeel, Mathieu & Vindevogel, Berk & De Ville, Ferdi & Van Doorslaer, Hielke & Vermeiren, Mattias & Bougrea, Anissa & Taghon, Servaas & Haesebrouck, Tim. (2023). The Global Energy Crisis.
Verdensbanken. (2022). Carbon Pricing Dashboard
Weber, Joshua - Deuche Welle. (2022). Fact check: Is nuclear energy good for the climate? 2022
WEF - World Economic Forum. (2021). 5 ways to boost renewable energy investment in developing economies. 2021.
WEO - World Economic Forum (2022). These charts show Europe’s reliance on gas before the war in Ukraine
WEO - World Economic Forum (2022). What was Europe’s dependence on gas prior to Russia’s invasion of Ukraine?
WEO - World economic forum. (2022). 6 ways Russia's invasion of Ukraine has reshaped the energy world
WEO: World Economic forum -Hall, Stephen. (2022). These charts show record renewable energy investment in 2022
Wettestad, Jørgen. (2017). Klimakvotene skjerpes: Hvorfor og hva så?
Wettestad, Jørgen. (2022). EUs ‘superkvoter’: unik kompleksitet, høy fart og betydelig turbulens
Wilson, Chauncey. (2014). Semi-Structured Interviews.
10.1016/B978-0-12-410393-1.00002-8.

WNA - World Nuclear Association. (2023). Nuclear Power in the European Union
WNA - World Nuclear Assosication. (2022). How can nuclear combat climate change?
World bank. (2023). GDP of the world graph.
Worldometers. (2022). Coal Reserves by Country
Yevheniia Antoniuk & Thomas Leirvik. (2021) Climate change events and stock market returns, Journal of Sustainable Finance & Investment,
Yin, Robert K. (2003). Case study research.
Z.Y.I. Abba, N. Balta-Ozkan, P. Hart. (2022). A holistic risk management framework for renewable energy investments, Renewable and Sustainable Energy Reviews
Zhen Lei, Anastasia V. Shcherbakova. (2015). Revealing climate change opinions through investment behavior: Evidence from Fukushima,

Sources - Abstract

EC - European Commission. (2022). The European Green deal
https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

Schunz, Simon. (2022). The ‘European Green Deal’ – a paradigm shift? Transformations in the European Union’s sustainability meta-discourse. *Political Research Exchange*. 4. 10.1080/2474736X.2022.2085121.
https://www.researchgate.net/publication/361332368_The_'European_Green_Deal'_-_a_paradigm_shift_Transformations_in_the_European_Union's_sustainability_meta-discourse

Gillessen, Bastian & Heinrichs, Heidi & Hake, Jürgen-Friedrich & Allelein, Hans-Josef. (2019). Natural gas as a bridge to sustainability: Infrastructure expansion regarding energy security and system transition. *Applied Energy*. 251. 10.1016/j.apenergy.2019.113377.
https://www.researchgate.net/publication/333395580_Natural_gas_as_a_bridge_to_sustainability_Infrastructure_expansion_regarding_energy_security_and_system_transition

Putin, Vladimir. (2023). Presidential Address to Federal Assembly.
http://en.kremlin.ru/events/president/news/70565

Kapinenko, Mykola. (2022). Russia’s war in Ukraine: How it started and where it could lead

https://www.europeanleadershipnetwork.org/commentary/russias-war-in-ukraine-how-it-started-and-where-it-could-lead/

IMF - International Monetary fund: Jeromin Zettelmeyer. simone Tagliapietra. Georg Zachmann. Conall Heusaff. (2022). The EU needs a grand bargain that reduces demand, increases supply, and keeps energy markets open. International Money Fundation - **https://www.imf.org/en/Publications/fandd/issues/2022/12/beating-the-european-energy-crisis-Zettelmeyer**

European Parliament - EU. (2022). Taxonomy: MEPs do not object to inclusion of gas and nuclear activities. https://www.europarl.europa.eu/news/en/press-room/20220701IPR34365/taxonomy-meps-do-not-object-to-inclusion-of-gas-and-nuclear-activities

EC - European Commission. (2022). REPowerEU: Affordable, secure and sustainable energy for Europe https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_en

IEA - International Energy Agency. (2022). Coal 2022 https://iea.blob.core.windows.net/assets/91982b4e-26dc-41d5-88b1-4c47ea436882/Coal2022.pdf

Sources - Introduction

Google. (2023). Google search “Renewable energy 2010/2015/2021/2022”. 2023. www.google.com

UNFCCC - United Nations Climate Change Council. 2005. What is the Kyoto Protocol? https://unfccc.int/kyoto_protocol

IEA - International Energy Agency. (2021). CO2 Emissions https://www.iea.org/reports/global-energy-review-2021/co2-emissions

UNFCCC - United Nations Climate Change Council. (2016). The Paris Agreement https://unfccc.int/process-and-meetings/the-paris-agreement

EC - European Commission. (2022). European Climate Law https://climate.ec.europa.eu/eu-action/european-green-deal/european-climate-law_en

IRENA - International Renewable Energy Agency. (2020). Renewables Increasingly Beat Even Cheapest Coal Competitors on Cost https://www.irena.org/publications/2020/Jun/Renewable-Power-Costs-in-2019

Schwartzkopff, Julian - Heinrich-Böll-Stiftung European Union and Environmental Action Germany. (2022). The future role of gas in a climate-neutral Europe https://eu.boell.org/sites/default/files/2022-06/Future_role_of_gas_EU_FINAL.pdf

Lehne, Stefan. (2023). After Russia's War Against Ukraine: What Kind of World Order? https://carnegieeurope.eu/2023/02/28/after-russia-s-war-against-ukraine-what-kind-of-world-order-pub-89130

Pradetto, August. (2022). Reactions of Germany, the EU, and NATO to the Ukraine War and their Global Implications. 10.48770/ker.2022.no2.15. https://www.researchgate.net/publication/362016351_Reactions_of_Germany_the_EU_and_NATO_to_the_Ukraine_War_and_their_Global_Implications

Eurostat. (2022). EU imports of energy products - recent developments https://ec.europa.eu/eurostat/statistics-explained/index.php?title=EU_imports_of_energy_products_-_recent_developments&oldid=571112#Main_suppliers_of_natural_gas_and_petroleum_oils_to_the_EU

EC - European council. (2022). EU sanctions against Russia explained https://www.consilium.europa.eu/en/policies/sanctions/restrictive-measures-against-russia-over-ukraine/sanctions-against-russia-explained/

Reuters. (2022). Russia's Gazprom tightens squeeze on gas flow to Europe

https://www.reuters.com/business/energy/kremlin-nord-stream-1-turbine-be-installed-volumes-will-adjust-2022-07-25/

China Daily - REN QI. (2022). Unfriendly countries' required to pay in rubles https://global.chinadaily.com.cn/a/202203/25/WS623d0686a310fd2b29e532b7.html

Neftegazru. (2022). Putin says «unfriendly countries» have to pay for Russian gas in rubles https://neftegazru.com/news/trade/731138-putin-says-unfriendly-countries-have-to-pay-for-russian-gas-in-rubles/

Interfax: Kremlin. (2022). Nothing but technological problems hindering gas supplies to Europe.
https://interfax.com/newsroom/top-stories/82664/

EC - European Commission. (2022). The European Green deal
https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

Eurostat. (2022). Electricity and gas prices in the first half of 2022
https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20221031-1

Eurostat. (2022). Euro area annual inflation up to 8.6%. 2022
https://ec.europa.eu/eurostat/documents/2995521/14644614/2-01072022-AP-EN.pdf/72dcf5e4-56cb-5b8c-1a1f-d342666b8657?t=1656592347325

EC - European Commission. (2022). REPowerEU: affordable, secure and sustainable energy for Europe
https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_en

Sources - Literature review

Snyder, Hannah. (2019). Literature review as a research methodology: An overview and guidelines. Journal of Business Research. 104. 333-339. 10.1016/j.jbusres.2019.07.039.

https://www.researchgate.net/publication/334848557_Literature_review_as_a_research_methodology_An_overview_and_guidelines

Delardas, Orestis & Giannos, Panagiotis. (2022). The ripple effects of the energy crisis on academia: Europe's energy crisis deepens concerns about the future of academia and research laboratories are in dire need of sustainable solutions. EMBO Reports. e56287. 10.15252/embr.202256287. https://www.researchgate.net/publication/364658491_The_ripple_effects_of_the_energy_crisis_on_academia_Europe's_energy_crisis_deepens_concerns_about_the_future_of_academia_and_research_laboratories_are_in_dire_need_of_sustainable_solutions

Byrne, J. (2006) Modern Energy and Modern Society https://www.researchgate.net/publication/256296792_Modern_Energy_and_Modern_Society

Turner, G. (2012). Energy shocks and emerging alternative energy technologies https://www.researchgate.net/publication/233219803_Energy_shocks_and_emerging_alternative_energy_technologies

RMI. (2023). Peak Fossil Fuel Demand for Electricity https://rmi.org/insight/peak-fossil-fuel-demand-for-electricity

Boqiang Lin, Oluwasola E. Omoju, Jennifer U. Okonkwo. 2016. Factors influencing renewable electricity consumption in China https://www.sciencedirect.com/science/article/abs/pii/S1364032115012538

Usman, O. Alola, A. & Akadri, S. (2022). Effects of domestic material consumption, renewable energy, and financial development on environmental sustainability in the EU-28: Evidence from GMM panel-VAR. 2022. https://www.researchgate.net/publication/356583297_Effects_of_domestic_material_consumption_renewable_energy_and_financial_development_on_environmental_sustainability_in_the_EU-28_Evidence_from_GMM_panel-VAR

Demir, Ender & Gozgor, Giray. (2018). Are shocks to renewable energy consumption permanent or temporary? Evidence from 54 developing and developed countries. Environmental Science and Pollution Research. 25. 10.1007/s11356-017-0801-9. https://www.researchgate.net/publication/321277247_Are_shocks_to_renewable_energy_consumption_permanent_or_temporary_Evidence_from_54_developing_and_developed_countries

Hossain, Mohammad Razib & Singh, Sanjeet & Sharma, Gagan & Apostu, Simona & Bansal, Pooja. (2023). Overcoming the shock of energy depletion for energy policy? Tracing the missing link between energy depletion, renewable energy development and decarbonization in the USA. Energy Policy. 174. 113469. 10.1016/j.enpol.2023.113469. https://www.researchgate.net/publication/367653797_Overcoming_the_shock_of_energy_depletion_for_energy_policy_Tracing_the_missing_link_between_energy_depletion_renewable_energy_development_and_decarbonization_in_the_USA

Alege, Philip & Oye, Queen Esther & Adu, Omobola. (2019). Renewable Energy, Shocks and the Growth Agenda: A Dynamic Stochastic General Equilibrium Approach. International Journal of Energy Economics and Policy. 9. 160-167. 10.32479/ijeep.6953. https://www.researchgate.net/publication/330074833_Renewable_Energy_Shocks_and_the_Growth_Agenda_A_Dynamic_Stochastic_General_Equilibrium_Approach/citation/download

Sources - Theoretical framework

Adom, Dickson & Hussein, Emad & Adu-Agyem, Joe. (2018). THEORETICAL AND CONCEPTUAL FRAMEWORK: MANDATORY INGREDIENTS OF A QUALITY RESEARCH. International Journal of Scientific Research. 7. 438-441. https://www.researchgate.net/publication/322204158_THEORETICAL_AND_CONCEPTUAL_FRAMEWORK_MANDATORY_INGREDIENTS_OF_A_QUALITY_RESEARCH

BloombergNEF. (2023). Energy Transition Investment Trends https://about.bnef.com/energy-transition-investment/

Chazdon, Scott & Emery, Mary & Hansen, Debra & Higgins, Lorie & Sero, Rebecca. (2017). A Field Guide to Ripple Effects Mapping.

https://www.researchgate.net/publication/321340208_A_Field_Guide_to_Ripple_Effects_Mapping

EC - European council. 2022. EU sanctions against Russia explained https://www.consilium.europa.eu/en/policies/sanctions/restrictive-measures-against-russia-over-ukraine/sanctions-against-russia-explained/

Nobles, James & Wheeler, Jessica & Dunleavy-Harris, Kirsty & Holmes, Richard & Inman-Ward, Alan & Potts, Alexandra & Hall, Jennifer & Redwood, Sabi & Jago, Russell & Foster, Charlie. (2021). Ripple Effects Mapping: Capturing the Wider Impacts of Systems Change Efforts in Public Health. 10.21203/rs.3.rs-1008063/v1. https://www.researchgate.net/publication/355865857_Ripple_Effects_Mapping_Capturing_the_Wider_Impacts_of_Systems_Change_Efforts_in_Public_Health

Henriksen, J. T., Salamonsen, K. Solvoll, G. Sørnes, J. O. (2009) Ringvirkninger av Skarvutbyggingen, Del 1, 2006 – 2009. https://nordopen.nord.no/nord-xmlui/handle/11250/141067

Kjærland, Frode; Mathisen, Terje A.; Solvoll, Gisle. (2010). Statkraft i Midt-Norge: Samfunnsnytte og lokal betydning https://nordopen.nord.no/nord-xmlui/handle/11250/141093?locale-attribute=en

Kjærland, F. Mathiasen, T. Solvoll, G. (2012) Verdsetting av ringvirkninger- et eksempel fra kraftbransjen. 2012 https://ntnuopen.ntnu.no/ntnu-xmlui/handle/11250/283811

Mckinsey. (2022). Renewable-energy development in a net-zero world https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/renewable-energy-development-in-a-net-zero-world

Schumpeter, J. A, 1934. The theory of economic development: An inquiry into Profits, Capital, Credit, Interest and the Business Cycle

http://compaso.eu/wpd/wp-content/uploads/2013/01/Compaso2012-32-Croitoru.pdf

Reuters. (2022). Russia's Gazprom tightens squeeze on gas flow to Europe
https://www.reuters.com/business/energy/kremlin-nord-stream-1-turbine-be-installed-volumes-will-adjust-2022-07-25/

China Daily - REN QI. (2022). Unfriendly countries' required to pay in rubles
https://global.chinadaily.com.cn/a/202203/25/WS623d0686a310fd2b29e532b7.html

Neftegazru. (2022). Putin says «unfriendly countries» have to pay for Russian gas in rubles
https://neftegazru.com/news/trade/731138-putin-says-unfriendly-countries-have-to-pay-for-russian-gas-in-rubles/

Interfax: Kremlin. (2022). Nothing but technological problems hindering gas supplies to Europe.
https://interfax.com/newsroom/top-stories/82664/

Eurostat. (2022). Electricity and gas prices in the first half of 2022
https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20221031-1

IEA - International Energy Agency. (2021). The cost of capital in clean energy transitions
https://www.iea.org/articles/the-cost-of-capital-in-clean-energy-transitions

Ali, R. & Afzal, M. (2012). Impact of global financial crisis on stock markets: Evidence from Pakistan and India
https://www.e3journals.org/cms/articles/1342846725_Afzal.pdf

Beck, T. & Levine, R. (2004). Stock Markets, Banks, And Growth: Panel Evidence
https://www.nber.org/system/files/working_papers/w9082/w9082.pdf

Bikhchandani, S., Sharma, S. (2000). Herd Behavior in Financial Markets

https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3923377

Cooper, Adrian & Smith, Phil. (2005). The Economic Catalytic Effects of Air Transport in Europe
https://www.eurocontrol.int/publication/economic-catalytic-effects-air-transport-europe

Faheem Aslam, Paulo Ferreira, Haider Ali & Sumera Kauser. (2021). Herding behavior during the Covid-19 pandemic: a comparison between Asian and European stock markets based on intraday multifractality
https://link.springer.com/article/10.1007/s40822-021-00191-4

Karolyi, A & Martell, R. (2006). Terrorism and the stock market
https://deliverypdf.ssrn.com/delivery.php?ID=143119101106096074122066013124108064029078039067056007087007125097103096090075110077049049044034012025110022100019121004007014013013047076085006087106103087065035012067079075027091085023124099007103127084025006107118092112106029071071076008006083&EXT=pdf&INDEX=TRUE

Milosevich, Mira. (2021) Russia's Westpolitik and the European Union
https://www.csis.org/analysis/russias-westpolitik-and-european-union

Masters, Jonathan. (2022). Ukraine: Conflict at the Crossroads of Europe and Russia.
https://www.cfr.org/backgrounder/ukraine-conflict-crossroads-europe-and-russia

Mertzanis, Charilaos & Allam, Noha. (2018). Political Instability and Herding Behaviour: Evidence from Egypt's Stock Market. Journal of Emerging Market Finance. 17. 097265271774808. 10.1177/0972652717748087.
https://www.researchgate.net/publication/323368416_Political_Instability_and_Herding_Behaviour_Evidence_from_Egypt's_Stock_Market/link/5eaaf7b8299bf18b958a55e4/download

Yevheniia Antoniuk & Thomas Leirvik. (2021) Climate change events and stock market returns, *Journal of Sustainable Finance & Investment*,
https://www.tandfonline.com/doi/full/10.1080/20430795.2021.1929804

Zhen Lei, Anastasia V. Shcherbakova. (2015). Revealing climate change opinions through investment behavior: Evidence from Fukushima,
Journal of Environmental Economics and Management, Volume 70,2015, Pages 92-108, https://doi.org/10.1016/j.jeem.2015.01.004.

Sources - Research methodology

de Vaus, D. (2001). Research Design in Social Research

Yin, Robert K. (2003). Case study research.

Johannessen, A. Christoffersen, L. og Tufte, P.A. (2011). Introduksjon til samfunnsvitenskapelig metode.

Borkamo, Hanna. (2022). User acceptance and mental models – an exploration of citizens perceptions of autonomous buses in the Arctic region

Johnsen, R Burke. (2019). Examining the Validity Structure of Qualitative Research. http://s3-euw1-ap-pe-ws4-cws-documents.ri-prod.s3.amazonaws.com/9780815365662/Appendix.pdf

Aspers, Patrik & Corte, Ugo. (2019). What is Qualitative in Qualitative Research. Qualitative Sociology. 42. 10.1007/s11133-019-9413-7. https://www.researchgate.net/publication/331387557_What_is_Qualitative_in_Qualitative_Research

Bowen, Glenn. (2009). Document Analysis as a Qualitative Research Method. Qualitative Research Journal. 9. 27-40. 10.3316/QRJ0902027. https://www.researchgate.net/publication/240807798_Document_Analysis_as_a_Qualitative_Research_Method

Kakilla, Charles. (2021). Strengths and Weaknesses of Semi-Structured Interviews in Qualitative Research: A Critical Essay. 10.20944/preprints202106.0491.v1. https://www.researchgate.net/publication/352565661_Strengths_and_Weaknesses_of_Semi-Structured_Interviews_in_Qualitative_Research_A_Critical_Essay

Caruana, E. J., Roman, M., Hernández-Sánchez, J., & Solli, P. (2015). Longitudinal studies. Journal of thoracic disease, 7(11), E537–E540. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4669300/

Setia M. S. (2016). Methodology Series Module 3: Cross-sectional Studies. Indian journal of dermatology, 61(3), 261–264. https://doi.org/10.4103/0019-5154.182410 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4885177/

Golafshani, Nahid. (2003). Understanding Reliability and Validity in Qualitative Research. The Qualitative Report. 8. 597-607. 10.46743/2160-3715/2003.1870. https://www.researchgate.net/publication/261773489_Understanding_Reliability_and_Validity_in_Qualitative_Research

Patton, Michal Quinn. (2002). Qualitative Research & Evaluation Methods https://us.sagepub.com/en-us/nam/qualitative-research-evaluation-methods/book232962

Leung L. (2015). Validity, reliability, and generalizability in qualitative research. *Journal of family medicine and primary care*, 4(3), 324–327. https://doi.org/10.4103/2249-4863.161306/

Sources - Empirical findings

Bloomberg. (2023). Putin’s Energy Gambit Fizzles as Warm Winter Saves Europe https://www.bloomberg.com/news/articles/2023-01-08/warm-winter-helps-europe-overcome-the-worst-of-russia-s-energy-squeeze

Eurostat. (2021). Nuclear energy statistics https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Nuclear_energy_statistics

Eurostat. (2022). 25% of EU electricity production from nuclear sources https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20220111-1

Nicoson, Christie. Uppsala University, & Nina von Uexkull, Uppsala University and PRIO Peace Research Institute Oslo (Humanitarian consequences of climate change). From the Norwegian Red Cross: Ida Haugen-Poljac (Syria in focus), Torben Henriksen (Afghanistan in focus, Pacific islands in focus), Thomas André Syvertsen (Somalia in focus, Mozambique in focus) and Morten Tønnessen-Krokan (Colombia in focus). Editor: Anette Bringedal Houge.). (2019). OVERLAPPING VULNERABILITIES : The impacts of climate change on humanitarian needs.
https://www.rodekors.no/globalassets/_rapporter/humanitar-analyse-rapporter/norwegian-redcross_report_overlapping-vulnerabilities.pdf

Timperley, Jocelyn. (2021). The broken $100-billion promise of climate finance - and how to fix it
https://www.nature.com/articles/d41586-021-02846-3

OECD - Organization for Economic Co-operation and Development. (2022). Climate Finance and the USD 100 Billion Goal
https://www.oecd.org/climate-change/finance-usd-100-billion-goal/

Oxfam: Carty, Tracy. Kowalzig, Jan. (2022). Climate Finance Short-changed: The real value of the $100 billion commitment in 2019–2020
https://policy-practice.oxfam.org/resources/climate-finance-short-changed-the-real-value-of-the-100-billion-commitment-in-2-621426/

IMF - International Monetary Foundation - Ehlers, Torsten. Gardes-Landolfini, Charlotte. Natalucci, Fabio.Ananthakrishnan, Prasad. (2022). How to Scale Up Private Climate Finance in Emerging Economies
https://www.imf.org/en/Blogs/Articles/2022/10/07/how-to-scale-up-private-climate-finance-in-emerging-economiesfe

Mckinsey. (2020). How the European Union could achieve net-zero emissions at net-zero cost
https://www.mckinsey.com/capabilities/sustainability/our-insights/how-the-european-union-could-achieve-net-zero-emissions-at-net-zero-cost

IEA - International energy agency (2021), The cost of capital in clean energy transitions

https://www.iea.org/articles/the-cost-of-capital-in-clean-energy-transitions

IRENA - International Renwable Energy Agency. (2021). World Energy Transitions Outlook https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2021/Jun/IRENA_World_Energy_Transitions_Outlook_2021.pdf?rev=71105a4b8682418297cd220c007da1b9

BloombergNEF. (2022). New Energy Outlook 2022 https://about.bnef.com/new-energy-outlook/

NIBM - Norges bank investment management. (2022). Oljefondets markedsverdi https://www.nbim.no/no

Trading Economics. (2022). USA - BNP https://no.tradingeconomics.com/united-states/gdp

Climate Champions / UN / Race to zero campaign. (2021). What's the cost of net zero? https://climatechampions.unfccc.int/whats-the-cost-of-net-zero-2/

UNFCCC - Race to Zero campaign. (2021). Financing Roadmaps. https://assets.bbhub.io/company/sites/63/2021/10/NZFRs-Key-Messages.pdf

UNFCCC - United Nations Climate Change. (2017). Private Investments Are Crucial to Achieve Paris Goals https://unfccc.int/news/private-investments-are-crucial-to-achieve-paris-goals

BCC - Various climate organizations. (2022). Banking on climate chaos https://www.bankingonclimatechaos.org/

IEA - International Energy Agency. (2022). World energy investment 2022 https://iea.blob.core.windows.net/assets/db74ebb7-272f-4613-bdbd-a2e0922449e7/WorldEnergyInvestment2022.pdf

IEA - International Energy Agency. (2022). World energy investment 2021

https://iea.blob.core.windows.net/assets/5e6b3821-bb8f-4df4-a88b-e891cd8251e3/WorldEnergyInvestment2021.pdf

World bank. (2023). GDP of the world graph. https://data.worldbank.org/indicator/NY.GNP.MKTP.CD

Gordon, Meghan. & Weber, Maya. US Energy Information Administration. (2021). Global energy demand to grow 47% by 2050, with oil still top source: https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/oil/100621-global-energy-demand-to-grow-47-by-2050-with-oil-still-top-source-us-eia

IEA - International Energy Agency. (2020). The world needs more diverse solar panel supply chains to ensure a secure transition to net zero emissions https://www.iea.org/news/the-world-needs-more-diverse-solar-panel-supply-chains-to-ensure-a-secure-transition-to-net-zero-emissions

Gonzalo Escribano Francés, José María Marín-Quemada, Enrique San Martín González (2013). RES and risk: Renewable energy's contribution to energy security. A portfolio-based approach,Renewable and Sustainable Energy Reviews https://www.sciencedirect.com/science/article/pii/S1364032113003924?casa_token=x6DZ2w30DHAAAAAA:0s0csOfNUr8TzlrpnQscoZEyr3sH0EdzgsAtImL3zWWhsZiybCzgCxC7TBA66OtmhQV49cvCb1A

Z.Y.I. Abba, N. Balta-Ozkan, P. Hart. (2022). A holistic risk management framework for renewable energy investments, Renewable and Sustainable Energy Reviews https://www.sciencedirect.com/science/article/pii/S1364032122002210?casa_token=iEGa08NVhcEAAAAA:QmHe_Z2qX0c-21SzXbA0nQ5D-e1cAG79RVhKKRnYT8keIiJf9yV9pf_hQOxE_u8Ci5dH9BCZhoU

WEF - World Economic Forum. (2021). 5 ways to boost renewable energy investment in developing economies. 2021. https://www.weforum.org/agenda/2021/06/boost-renewable-energy-investment-in-developing-economies/

The World bank. (2015). Private Sector - an Integral part of Climate Action Post-Paris https://www.worldbank.org/en/news/feature/2015/12/30/private-sector-an-integral-part-of-climate-action-post-paris

Wettestad, Jørgen. (2017). Klimakvotene skjerpes: Hvorfor og hva så? https://energiogklima.no/meninger-og-analyse/kommentar/klimakvotene-skjerpes-hvorfor-og-hva-sa/

Verdensbanken. (2022). Carbon Pricing Dashboard https://carbonpricingdashboard.worldbank.org/map_data

IEA - International Energy Agency. (2022). Average annual investment in nuclear power by country or region in the Net Zero Scenario, 2011-2030 https://www.iea.org/data-and-statistics/charts/average-annual-investment-in-nuclear-power-by-country-or-region-in-the-net-zero-scenario-2011-2030

Schroder / Marsha,, Jo. (2020). Are investors more motivated by morals or money? https://www.schroders.com/en/insights/global-investor-study/are-investors-more-motivated-by-morals-or-money/

Shroder. (2017). Global perspectives on sustainable investing https://prod.schroders.com/hu/sysglobalassets/digital/insights/2017/pdf/global-investor-study-2017/schroders_report_sustainable-investing_final.pdf

Pucker, Kenneth. P. (2021). Overselling Sustainability Reporting - We’re confusing output with impact https://hbr.org/2021/05/overselling-sustainability-reporting

Growing Co2 levels despite Heightened Attention. 2016. Harvard Business Review & Worldometer. https://hbr.org/data-visuals/2021/05/growing-co2-levels-despite-heightened-attention

Climate Policy Initiative. (2015). Global Landscape of Climate Finance 2015

https://climatepolicyinitiative.org/wp-content/uploads/2015/11/Global-Landscape-of-Climate-Finance-2015.pdf

Ember Think tank - Dr Chris Rosslowe. (2022) New Generation: Building a clean European electricity system by 2035
https://ember-climate.org/insights/research/new-generation/

Wilson, Chauncey. (2014). Semi-Structured Interviews.
10.1016/B978-0-12-410393-1.00002-8.
https://www.researchgate.net/publication/288196101_Semi-Structured_Interviews

Ruslin, Ruslin & Mashuri, Saepudin & Sarib, Muhammad & Alhabsyi, Firdiansyah & Syam, Hijrah. (2022). Semi-structured Interview: A Methodological Reflection on the Development of a Qualitative Research Instrument in Educational Studies Ruslin. Vol. 12. 22-29.
10.9790/7388-1201052229.
https://www.researchgate.net/publication/358906376_Semi-structured_Interview_A_Methodological_Reflection_on_the_Development_of_a_Qualitative_Research_Instrument_in_Educational_Studies_Ruslin

Frick, Walter. (2022). What Causes Inflation?
https://hbr.org/2022/12/what-causes-inflation

Eurostat. (2023). Annual inflation down to 9.2% in the euro area
https://ec.europa.eu/eurostat/documents/2995521/15725179/2-18012023-AP-EN.pdf/e301db8f-984c-27e2-1245-199a89f37bca

ECB - European Central Bank. (2022). Two per cent inflation target.
https://www.ecb.europa.eu/mopo/strategy/pricestab/html/index.en.html

ECB - European Central Bank - Luis de Guindos. (2022). The euro area economy and the energy transition
https://www.ecb.europa.eu/press/key/date/2022/html/ecb.sp221104~b1fcbec7e6.en.html

Forbes. (2022). Do Higher Interest Rates Hurt The Stock Market? Here's How Strategic Investors Adjust As Rates Go Up
https://www.forbes.com/sites/qai/2022/09/20/do-higher-interest-rates-hurt-the-stock-market-how-do-smart-investors-adjust-as-rates-go-up/?sh=181568c5b0fd

Roosevelt institute - Melodia, Lauren & Karlsson, Kristina. (2022). Energy Price Stability: The Peril of Fossil Fuels and the Promise of Renewables. 2022. Roosevelt Institute
https://rooseveltinstitute.org/publications/energy-price-stability/

Empirically grounded technology forecasts and the energy transition. (2022). Oxford University - Rupert Way, Matthew C. Ives, Penny Mealy, J. Doyne Farmer
https://www.cell.com/joule/pdf/S2542-4351(22)00410-X.pdf

-
Statista. (2020). Value of renewable energy investment in Europe from 2004 to 2019
https://www.statista.com/statistics/1066269/renewable-energy-investment-europe/

Eurostat. (2022). Nuclear energy statistics
https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Nuclear_energy_statistics

Trading Economics. (2023). Carbon permits
https://tradingeconomics.com/commodity/carbon

WNA - World Nuclear Association. (2023). Nuclear Power in the European Union
https://www.world-nuclear.org/information-library/country-profiles/others/european-union.aspx

IRENA - International Renewable Energy Agency. (2023). Investments in Renewables Reached Record High, But Need Massive Increase and More Equitable Distribution
https://www.irena.org/News/pressreleases/2023/Feb/Investments-in-Renewables-Reached-Record-High-But-Need-Massive-Increase-More-Equitable-Distribution

IRENA - International Renewable Energy Agency. (2023). Global landscape of renewable energy finance
https://www.irena.org/Publications/2023/Feb/Global-landscape-of-renewable-energy-finance-2023

Simon, Frederik & Mousou, Nelly. (2021). EU's Simson calls for 'gearshift' in nuclear power investments
https://www.euractiv.com/section/energy/news/nuclear-getting-ever-so-close-to-being-featured-in-eu-green-taxonomy/

IEA - International Energy Agency. (2022). Renewable power investment, 2012-2020.
https://www.iea.org/data-and-statistics/charts/renewable-power-investment-2012-2020

IEA - International Energy Agency. (2022)- Nuclear Electricity
https://www.iea.org/reports/nuclear-electricity

EC - European Commission. (2023). Fit for 55
https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/

Renewable energy statistics. (2023). European Commission
https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Renewable_energy_statistics#Share_of_renewable_energy_more_than_doubled_between_2004_and_2021
https://ec.europa.eu/info/news/focus-renewable-energy-europe-2020-mar-18_en

Roser, Max - Our World in data. (2020). Why did renewables become so cheap so fast?
https://ourworldindata.org/cheap-renewables-growth

Kagan, Julia - Investopedia. (2022.) What Is a Learning Curve? Formula, Calculation, and Example
https://www.investopedia.com/terms/l/learning-curve.asp

Schiermeier, Quirin. (2019). New EU chief makes bold climate pledges
https://www.nature.com/articles/d41586-019-02204-4

Eurostat. (2019). Where does our energy come from? https://ec.europa.eu/eurostat/cache/infographs/energy/bloc-2a.html#:~:text=In%202019%2C%20the%20energy%20mix,fossil%20fuels%20(both%2013%20%25)

Bloomberg. (2021). Energy production Europe. https://www.bloomberg.com/toaster/v2/charts/7051a98298b445fe91287874ef73eae0.html?brand=markets&webTheme=markets&web=true&hideTitles=true

FT - Financial Times. (2023). https://www.ft.com/content/b0d3e7e3-a8ae-457b-9482-3282d32973be

Moderaterna. (2022). Direktiv sam arbetsprojekt Klim at och energi. Överenskom m else för S verige https://moderaterna.se/app/uploads/2022/10/Tidoavtalet-Overenskommelse-for-Sverige.pdf

EC - European Commission. (2019). What is the European Green Deal https://ec.europa.eu/commission/presscorner/detail/en/fs_19_6714

EC - European Commission. (2019). The European Green Deal sets out how to make Europe the first climate-neutral continent by 2050, boosting the economy, improving people's health and quality of life, caring for nature, and leaving no one behind https://ec.europa.eu/commission/presscorner/detail/en/ip_19_6691

EC - European Commission (2020). Offshore Renewable Energy strategy https://ec.europa.eu/commission/presscorner/detail/en/FS_20_2099

EC - European Commission. (2021). Energy system factsheet https://ec.europa.eu/commission/presscorner/detail/en/fs_21_3672

Ember - Think Thank. (2023). European Electricity Review 2023 https://ember-climate.org/insights/research/european-electricity-review-2023/

Øvrebø, Olav A. (2022). Fit for 55: EUs grønne superpakke skal gjøre unionen klar for utslippskutt
https://energiogklima.no/nyhet/fit-for-55-eus-gronne-superpakke-skal-gjore-unionen-klar-for-utslippskutt/

Wettestad, Jørgen. (2022). EUs 'superkvoter': unik kompleksitet, høy fart og betydelig turbulens
https://energiogklima.no/meninger-og-analyse/kommentar/eus-superkvoter-unik-kompleksitet-hoy-fart-og-betydelig-turbulens/

Ursin, Lars - Intervju med Lars Sørgård. (2022). Blir strømmen billigere om vi frikopler gassen?
https://energiogklima.no/to-grader/ekspertintervju/blir-strommen-billigere-om-vi-frikopler-gassen/

Lazard. (2021). Lazards's levelized cost of energy analysis - version 15. 2021.
https://www.lazard.com/research-insights/levelized-cost-of-energy-levelized-cost-of-storage-and-levelized-cost-of-hydrogen-2021/

Øvrebø, Olav A. (2022). Kvotemarked: EU og verden
https://energiogklima.no/klimavakten/kvotemarked-eu-og-verden/

Wettestad, Jørgen. (2022). EUs 'superkvoter': unik kompleksitet, høy fart og betydelig turbulens
https://energiogklima.no/meninger-og-analyse/kommentar/eus-superkvoter-unik-kompleksitet-hoy-fart-og-betydelig-turbulens/

EC - European Commission. (2022). EU taxonomy for sustainable activities
https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/eu-taxonomy-sustainable-activities_en

Kerner, Sean Michael. (2022). Greenwashing
https://www.techtarget.com/whatis/definition/greenwashing

NHO - Næringslivets hovedorganisasjon. (2022). EUs taksonomi og handlingsplan for bærekraftig finans
https://www.nho.no/tema/energi-miljo-og-klima/artikler/eus-taksonomi-og-handlingsplan-for-barekraftig-finans/

Simon, Frederic & Taylor, Kira. (2021). The Green Brief: Gas, nuclear and the EU taxonomy saga
https://www.euractiv.com/section/energy-environment/news/the-green-brief-gas-nuclear-and-the-eu-taxonomy-saga/

Singer, John. (2022). EU Lawmakers Remove Last Hurdle to Label Gas, Nuclear as Green
https://www.bloomberg.com/news/articles/2022-07-06/eu-lawmakers-remove-last-hurdle-for-gas-nuclear-as-green

IEA - International Energy Agency. (2019). The Role of Gas in Today's Energy Transitions
https://www.iea.org/reports/the-role-of-gas-in-todays-energy-transitions

IEA - International Energy Agency. (2022). World Energy Outlook 2022 shows the global energy crisis can be a historic turning point towards a cleaner and more secure future
https://www.iea.org/news/world-energy-outlook-2022-shows-the-global-energy-crisis-can-be-a-historic-turning-point-towards-a-cleaner-and-more-secure-future

Rinke, Andreas., Alkoussa, Riham. & Käckenhoff. (2022). Germany pushes to extend lifespan of three nuclear plants -letter
https://www.reuters.com/business/energy/germany-create-legal-basis-extend-lifespan-three-nuclear-plants-letter-2022-10-17/

Monaghan, John. - Luxtimes. (2022). Luxembourg protests against Belgium nuclear plans
https://www.luxtimes.lu/en/luxembourg/luxembourg-protests-against-belgium-nuclear-plans-62361f2ede135b92360f6bc8?utm_source=en_daily&utm_medium=email&utm_content=newsLink&utm_campaign=dailyNewsletter

EIA - US Energy Information Administration. (2023). Nuclear power plants generated 68% of France’s electricity in 2021

https://www.eia.gov/todayinenergy/detail.php?id=55259

Euronews. (2022). Austria to take EU to court over 'greenwashing' of gas and nuclear https://www.euronews.com/my-europe/2022/07/13/austria-to-take-eu-to-court-over-greenwashing-of-gas-and-nuclear

EC - European Commission. (2023). EU taxonomy for sustainable activities. https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/eu-taxonomy-sustainable-activities_en

Weber, Joshua - Deuche Welle. (2022). Fact check: Is nuclear energy good for the climate? 2022 https://www.dw.com/en/fact-check-is-nuclear-energy-good-for-the-climate/a-59853315

Le Monde. (2022). Despite climate commitments, the EU is going back to coal https://www.lemonde.fr/en/economy/article/2022/09/02/despite-climate-commitments-the-eu-is-going-back-to-coal_5995594_19.html

WNA - World Nuclear Assosication. (2022). How can nuclear combat climate change? https://world-nuclear.org/nuclear-essentials/how-can-nuclear-combat-climate-change.aspx

Kapinenko, Mykola. (2022). Russia’s war in Ukraine: How it started and where it could lead. https://www.europeanleadershipnetwork.org/commentary/russias-war-in-ukraine-how-it-started-and-where-it-could-lead/

Aggression against Ukraine : resolution / adopted by the General Assembly. 2022. United Nations Digital Library https://digitallibrary.un.org/record/3959039

EC - European Commission. (2021). EU Energy Markets and Energy Prices https://ec.europa.eu/commission/presscorner/api/files/attachment/870207/Factsheet%20-%20EU%20Energy%20Market%20and%20Energy%20Prices.pdf.pdf?ssp=1&darkschemeovr=1&setlang=nb-NO&safesearch=moderate

EC - European Commission. (2022). Sanctions adopted following Russia's military aggression against Ukraine
https://ec.europa.eu/info/business-economy-euro/banking-and-finance/international-relations/restrictive-measures-sanctions/sanctions-adopted-following-russias-military-aggression-against-ukraine_en

CSIS - Center for strategic & international Studies. (2022). European Union Imposes Partial Ban on Russian Oil
https://www.csis.org/analysis/european-union-imposes-partial-ban-russian-oil

European Council. (2023). Infographic - Where does the EU's gas come from
https://www.consilium.europa.eu/en/infographics/eu-gas-supply/

European Council. (2022). Energy prices and security of supply
https://www.consilium.europa.eu/en/policies/energy-prices-and-security-of-supply/

WEO - World Economic Forum (2022). These charts show Europe's reliance on gas before the war in Ukraine
https://www.weforum.org/agenda/2022/11/europe-gas-shortage-russia/

WEO - World Economic Forum (2022). What was Europe's dependence on gas prior to Russia's invasion of Ukraine?
https://energypost.eu/what-was-europes-dependence-on-gas-prior-to-russias-invasion-of-ukraine/

Frost, Rosie. (2022). All the European countries returning to 'dirty' coal as Russia threatens to turn off the gas tap.
https://www.euronews.com/green/2022/06/24/all-the-european-countries-returning-to-dirty-coal-as-russia-threatens-to-turn-off-the-gas

Aam, Sverre. (2022). Hvordan påvirker Europeiske kraft og gasspriser - norske kraftpriser.

https://blogg.sintef.no/sintefenergy-nb/politikk/hvordan-pavirker-europeiske-kraft-og-gasspriser-norske-kraftpriser/

Solar Power Europe. (2022). EU Market Outlook For Solar Power https://api.solarpowereurope.org/uploads/5222_SPE_EMO_2022_full_report_ver_03_1_319d70ca42.pdf?updated_at=2022-12-19T08:21:34.541Z

IEA - International Energy Agency. (2019). The Role of Gas in Today's Energy Transitions. https://www.iea.org/reports/the-role-of-gas-in-todays-energy-transitions

Rowan, Lisa. (2022). Gas Prices Were Already Rising Before Russia Invaded Ukraine. What's Next? https://www.nasdaq.com/articles/gas-prices-were-already-rising-before-russia-invaded-ukraine.-whats-next

Tradingeconomics. (2022). EU natural gas https://tradingeconomics.com/commodity/eu-natural-gas

Lawson, Alex. (2022) Nord Stream 1: Gazprom announces indefinite shutdown of pipeline. https://www.theguardian.com/business/2022/sep/02/nord-stream-1-gazprom-announces-indefinite-shutdown-of-pipeline

Myllyvirta, Lari. (2022). EU ban on Russian oil: Why it matters and what's next https://energyandcleanair.org/eu-ban-on-russian-oil-why-it-matters-and-whats-next/

Energy Brainpool. (2022). European Power Plant Database https://www.energybrainpool.com/en/analysis/europeanpowerplantdatabase.html

DN - Dagens Næringsliv. (2022). Oljeprisen https://investor.dn.no/#!/Ravare/C1/BrentSpot

Eurostat. (2022). EU energy mix and import dependency

https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Archive:EU_energy_mix_and_import_dependency

https://www.iea.org/news/the-world-s-coal-consumption-is-set-to-reach-a-new-high-in-2022-as-the-energy-crisis-shakes-markets

EIA - US Energy Information Administration. (2023). Coal and coke reserves https://www.eia.gov/international/data/world/coal-and-coke/coal-reserves?pd=1&p=0000000000000000000000000000000000000000000001&u=0&f=A&v=mapbubble&a=-&i=none&vo=value&&t=C&g=0000000000000000000000000000000000000000000001&l=249-ruvvvvvfvtvnvv1vrvvvvfvvvvvvfvvvou20evvvvvvvvvvvnvvvs0008&s=1199145600000&e=1609459200000

Worldometers. (2022). Coal Reserves by Country https://www.worldometers.info/coal/coal-reserves-by-country/

Trading economics. (2022). Coal prices https://tradingeconomics.com/commodity/coal

Peeters, T. (2022). Does the EU move away from EU Green Deal in the wake of the Ukraine war? https://behorizon.org/does-the-eu-move-away-from-eu-green-deal-in-the-wake-of-the-ukraine-war/

Schonhardt, Sara. (2022). Reopening European coal plants won’t sink climate goals https://www.eenews.net/articles/reopening-european-coal-plants-wont-sink-climate-goals/

Van de Graaf, Thijs & Bouckaert, Reinhilde & Van Coppenolle, Hermine & Vandenhole, Kimberley & Paredis, Erik & Praet, Jasper & de Jong, Moniek & Dejonghe, Marie & Blondeel, Mathieu & Vindevogel, Berk & De Ville, Ferdi & Van Doorslaer, Hielke & Vermeiren, Mattias & Bougrea, Anissa & Taghon, Servaas & Haesebrouck, Tim. (2023). The Global Energy Crisis. https://www.researchgate.net/publication/368653998_The_Global_Energy_Crisis

IEA - International Energy Agency. (2021). World Energy outlook
https://www.iea.org/reports/world-energy-outlook-2021

IEA - International Energy Agency. (2022). *World energy investment.* Overview and key findings
https://www.iea.org/reports/world-energy-investment-2022/overview-and-key-findings

EC - European Council. (2022). Where does the EU's gas come from?
https://www.consilium.europa.eu/en/infographics/eu-gas-supply/

WEO - World economic forum. (2022). 6 ways Russia's invasion of Ukraine has reshaped the energy world
https://www.weforum.org/agenda/2022/11/russia-ukraine-invasion-global-energy-crisis/

BloombergNEF. (2022). New Energy Outlook 2022
https://about.bnef.com/new-energy-outlook/

Seghal, Divya. (2022). Renewable Energy - Investment Tracker, 2H 2022
https://assets.bbhub.io/professional/sites/24/BNEF-2H-2022-Renewable-Energy-Investment-Tracker_Final-ABRIDGED.pdf

WEO: World Economic forum -Hall, Stephen. (2022). These charts show record renewable energy investment in 2022
https://www.weforum.org/agenda/2022/07/global-renewable-energy-investment-iea/

IEA - International Energy Agency. (2022). World energy outlook 2022
https://iea.blob.core.windows.net/assets/9d0a2db4-965a-4e80-83da-562f038ff514/WorldEnergyOutlook2022.pdf

EC - European Commission. (2022). REPowerEU: affordable, secure and sustainable energy for Europe
https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_en

EC - European Commission. (2022). REPowerEU: A plan to rapidly reduce dependence on Russian fossil fuels and fast forward the green transition https://ec.europa.eu/commission/presscorner/detail/en/IP_22_3131

Lloyd, N. & Desjardins, G. (2022). Europe's energy future: the plan to cut Russian fossil fuels and speed up the green transition. 2022. https://www.euronews.com/next/2022/07/06/europes-energy-future-the-plan-to-cut-russian-fossil-fuels-and-speed-up-the-green-transiti

Simon, F. & Taylor, K. (2022). EU unveils €300bn plan to quit Russian fossil fuels by 2027 and boost clean energy https://www.climatechangenews.com/2022/05/19/eu-unveils-e300bn-plan-to-quit-russian-fossil-fuels-by-2027-and-boost-clean-energy

Shahi, Dharmendra. (2022). War in Ukraine: A Geopolitical Analysis. 2249-2496. https://www.researchgate.net/publication/361098792_War_in_Ukraine_A_Geopolitical_Analysis

Abnett, Kate - Reuters. (2022). EU Green shifts depend on mammoth investment in the energy grid. https://www.reuters.com/business/sustainable-business/eus-green-shift-depends-mammoth-investment-energy-grid-draft-2022-09-23/

IEA - International Energy agency. (2022). Renewable power’s growth is being turbocharged as countries seek to strengthen energy security https://www.iea.org/news/renewable-power-s-growth-is-being-turbocharged-as-countries-seek-to-strengthen-energy-security

Sources - Conclusion and discussion

Kuhn, Thomas. (1962). The structure of scientific revolutions

IAEA - International Atomic Energy Agency. (2022). IAEA Increases Projections for Nuclear Power Use in 2050. (2022) https://www.iaea.org/newscenter/pressreleases/iaea-increases-projections-for-nuclear-power-use-in-2050

IEA - International Energy agency. (2022). Coal in net zero transition https://iea.blob.core.windows.net/assets/4192696b-6518-4cfc-bb34-acc9312bf4b2/CoalinNetZeroTransitions.pdf

Huber, Matthew T. (2009). Energizing historical materialism: Fossil fuels, space and the capitalist mode of production https://www.sciencedirect.com/science/article/abs/pii/S0016718508001516

Næss, Arne. (1973). The Shallow and the Deep, Long-Range Ecology Movement. A Summary https://iseethics.files.wordpress.com/2013/02/naess-arne-the-shallow-and-the-deep-long-range-ecology-movement.pdf

UN - World Commission on Environment and Development. (1987). Our common future https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf

Masterson, Victoria - WEO: World Economic forum. (2021) Renewables were the world's cheapest source of energy in 2020, new report shows. https://www.weforum.org/agenda/2021/07/renewables-cheapest-energy-source/