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Social acceptance of nuclear power in Norway

Carl Emil Agbo Kristiansen
Renewable Energy

Preface

This master's thesis is my final assignment as part of my master's in renewable energy at the Norwegian University of Life Sciences (NMBU). The thesis was written during the spring of 2024. It has been challenging and frustrating at times, but it has remained an interesting and exciting experience.

I would like to thank those who helped me along the way. Thank you, Professor Erling Holden, for being my supervisor and guiding me along the way. Your knowledgeable input has been a great asset. Thank you, Yevgeniya Tomkiv for sharing your knowledge and giving me crucial advice about how to conduct interviews and how to analyze data. Thank you, Professor Kristin Linnerud for your feedback during the analysis. Thank you, Ole Christian Lind, for teaching me about the challenging topic that is nuclear power. Without your knowledge and interest, I wouldn't have been equipped to write about nuclear power. Thank you, my family, and my friends, for being patient, kind, accepting, and supportive during my five years at NMBU and especially during the last 5 months. Thank you, Truls Pedersen, for letting me bounce ideas off you and for your great feedback.

Abstract

This study's goal is to map what affects the Norwegian social acceptance of nuclear power in Norway. It will also look at what consequences the results can have on future power production in Norway. The study will highlight some measures that could increase and decrease the social acceptance of nuclear power.

This study explores 4 topics extracted from the analysis of the interview data.

- How the not-in-my-backyard mentality makes people's opinions change with distance.
- What sources there are for outdated knowledge and misinformation and how it affects people's view.
- How people's sentiment is affected by Norway's traditions, culture, and history, and how it creates bias.
- The exploration of people's prejudgment of risk, and how different measures can influence the perception of risk and benefit.

This study utilizes a qualitative method. Eight respondents were interviewed to gather data. The respondents are Norwegian citizens without any nuclear power experience. They act as representatives of the Norwegian people. There has been a focus on making sure that the respondents are well-suited to represent people across the country. The respondents were chosen based on gender, location, and age. The data was processed through thematic analysis. The data was first coded and then sorted into themes. The results show that most of the respondents are increasingly skeptical of nuclear power the closer they live to a planned power plant site. The results also show that the information the respondents base their answers on often is wrong or outdated, but that it does not necessarily make them less willing to make decisions. Norway's traditions and culture create a bias when identifying and weighing the consequences of power-generating technologies. And how risk-benefit can be influenced by public communication and how the perception of risk-benefit affects public acceptance.

Sammendrag

Denne studiens mål er å kartlegge hva som påvirker den norske sosiale aksepten av kjernekraft i Norge. Det skal også ses på hvilke konsekvenser resultatene kan få for fremtidig kraftproduksjon i Norge. Studien vil synliggjøre noen tiltak som kan øke og redusere den sosiale aksepten av kjernekraft.

Denne studien utforsker 4 emner hentet fra analysen av intervjudataene.

- Hvordan not in my backyard mentalitet får folks mening til å endre seg med avstand.
- Hvilke kilder det finnes for utdatert kunnskap og feilinformasjon og hvordan det påvirker befolkningens meninger.
- Hvordan folks følelser påvirkes av Norges tradisjoner, kultur og historie, og hvordan det skaper bias.
- Utforskning av menneskers forhåndsvurdering av risiko, og hvordan ulike tiltak kan påvirke oppfatningen av risk-benefit.

Denne studien benytter kvalitativ metode. Åtte respondenter ble intervjuet for å samle data. Respondentene er norske statsborgere uten erfaring innen kjernekraft. De opptre som representanter for den norske befolkningen. Det har vært fokus på å sikre at respondentene er godt egnet til å representere hele landet. Respondentene ble valgt ut fra kjønn, sted og alder. Dataene ble behandlet gjennom tematisk analyse. Dataene ble først kodet og deretter sortert i temaer. Resultatene viser at de fleste av respondentene er mer skeptiske til kjernekraft jo nærmere de bor et hypotetisk kraftverk. Resultatene viser også at informasjonen respondentene baserer svarene sine på ofte er feil eller utdatert, men at den ikke nødvendigvis gjør dem mindre beslutningsvillige. Norges tradisjoner og kultur skaper en skjevhet når man identifiserer og veier konsekvensene av kraftgenererende teknologier. Og hvordan risiko-nytte kan påvirkes av offentlig kommunikasjon og at oppfatningen av risk-benefit påvirker samfunnsaksept.

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1. Introduction

Norway mainly produces hydropower but has been aiming to increase the portion of onshore wind power. There was announced a concession stop for onshore wind power in April 2019 after a lot of backlash from the locals (energidepartementet, 2022). The backlash was caused due to several wind power projects being built against the wishes of the local population. And although the concession process is partially opened again, the lack of social acceptance remains. This has caused some municipalities such as Heim to consider other options. Nuclear power is one of the proposed options that has received a lot of attention. Norway does not have any history of producing nuclear power, and a lot of information specifically related to Norwegian nuclear power production is unknown. It will be beneficial for all parties affected to research how the Norwegian citizens perceive nuclear power and what affects their opinion, to avoid similar setbacks that wind power has faced. High social acceptance will be crucial if nuclear power is to gain a foothold in Norway. That is why this study will take a closer look at what affects the social acceptance of nuclear power in Norway. Eight Norwegian citizens have been interviewed as part of this qualitative study. The respondents were asked questions about their perception of nuclear power and how different scenarios would affect them. That data was then analyzed and compared to other studies.

1.1 Limitations

The topic of social acceptance is large and wide. This is a master's thesis and is therefore limited by time. The amount of data collected is more than what has been used and would allow for further analysis if given more time. More time would also allow for a larger sample size and possibly a survey to back up the results from the interviews. Time is the limiting factor.

[08]

2. Literature Study

2.1 Norway's Perception of Nuclear Power

Norway doesn't have any nuclear power plants, nor does it have a history of producing nuclear power. There is a lack of literature dealing with the social acceptance of nuclear power in Norway as a result. This study will compensate by using literature related to other countries' acceptance and compare them to this study's results. Although there is not a lot of relevant literature on Norwegian citizens' perception of nuclear energy, there have been conducted interviews by the Norwegian media. They are not scientific, but they have highlighted one of the core drivers for interest in Norwegian nuclear power. Several Norwegian municipalities have shown interest in nuclear power as an alternative to wind power. The public perception of wind power is very low and many find it to reduce the quality of Norwegian nature (Thobroe, 2024).

2.2 The Definition of Public Acceptance

It's important to define the term public acceptance to avoid misunderstandings. This study defines public acceptance of nuclear power as people's willingness to be provided with electricity generated from nuclear power plants within the country's borders (Kim et al., 2014). This definition will be used when referring to a single person such as a respondent as well as a group of people such as the citizens of a country. A group's acceptance will usually refer to their shared perception of nuclear power.

2.3 Perception and Risk-Benefit of Nuclear Power

The ratio between perceived risk and perceived benefit will be referred to as risk-benefit. Several studies find risk-benefit to be one of the biggest influences on social acceptance (Jang & Park, 2020). This study defines perceived risk as the degree to which a person or group of people believe that they will be harmed or be exposed to negative consequences directly related to nuclear power generation within the country's border. Perceived benefit is defined as the degree to which a person or group of people believe that they will be exposed to positive consequences directly related to nuclear power production within the country's border, such as financial gain. Public communication can have an indirect effect on social acceptance. The government's investment in safety technology and measures to educate the public about increased safety has a positive effect on social acceptance (Ho & Kristiansen, 2019). The effect only persists as long as the people trust the government. The government and industry's honesty and transparency contribute to an increased grade of public acceptance, detection of dishonesty and secrecy causes a reduction in public acceptance (Sun & Zhu, 2014).

The use of nuclear power has avoided 76 Gt CO₂ over the past 50 years ((UNECE), 2020). Nuclear power is a low-carbon technology and a key part of the United Nations (UN) strategy to combat global warming. Nuclear power generates 20% of the electricity in the UNECE region (United

Nations Economic Commission for Europe). Nuclear power has the potential to contribute to several of the UN's sustainability goals as shown below (Hjelmeland et al., 2023).

Nuclear powers beneficial effect on UN's sustainability goals	
 <p>2 ZERO HUNGER</p>	Nuclear power can produce low-carbon hydrogen for fertilizer, which will result in larger crops.
 <p>6 CLEAN WATER AND SANITATION</p>	Heat from nuclear power plants can be used to distill water in order to make it safe to drink.
 <p>7 AFFORDABLE AND CLEAN ENERGY</p>	Nuclear power plants are long term investments and generates low-carbon and stable energy without being dependent on weather resources.
 <p>8 DECENT WORK AND ECONOMIC GROWTH</p>	Nuclear power plants provide the local communities with jobs that pay well and that incentivizes education.
 <p>9 INDUSTRY, INNOVATION AND INFRASTRUCTURE</p>	Nuclear energy supports sustainable local industrialization. There is continuous research and development both in reactor design and waste management technologies.
 <p>10 REDUCED INEQUALITIES</p>	Nuclear power has high availability and low marginal price, this reduces the economical risk for low-income households that usually would be vulnerable against high/volatile electricity prices.
 <p>11 SUSTAINABLE CITIES AND COMMUNITIES</p>	Nuclear energy secures local energy supply without reducing air quality. 1.8 deaths caused by air pollution was preserved between the years 1971-2009 due to nuclear power plants.
 <p>12 RESPONSIBLE CONSUMPTION AND PRODUCTION</p>	Nuclear power has low impact on resource use such as materials and minerals when compared to alternatives. The technology used to recycle nuclear reactor fuel will improve with time further reducing the resources needed.
 <p>13 CLIMATE ACTION</p>	Nuclear power plants produce large amounts of low- carbon energy, making it possible to sustain an evolving world with energy without increasing the CO2 emissions, which contributes against global warming.
 <p>15 LIFE ON LAND</p>	Nuclear energy has the smallest impact on area usage per GWh. Reduced area occupation will contribute to preserve habitats and species.
 <p>17 PARTNERSHIPS FOR THE GOALS</p>	Nuclear power technology will improve faster through international collaboration. These partnerships can benefit the other sustainability goals and help solve other international energy challenges.

Figure 1: Nuclear powers beneficial effect on UN's sustainability goals.

All that is mentioned in the figure above are possible perceived benefits that may increase public perception.

One of the most effective ways to increase an uninformed individual's acceptance is to share additional accurate information with them (Sun & Zhu, 2014). High-income individuals tend to have lower acceptance of nuclear power plants near their homes. Age and education level also seem to have an effect; however, the effect is more varied. Countries with low social acceptance of nuclear power tend to mention the Chernobyl accident more often than countries with high acceptance (Ho & Kristiansen, 2019). Which can have a reinfusing effect, further reducing public acceptance.

2.4 Information Sources

The information in this study is mainly from online sources such as Google Scholar, The National Library, Science Direct, Research Gate, and Oria. Some physical books have also been utilized to collect information. All the resources can be found in the reference chapter.

3. Method

The following chapter will describe the whole process in detail and highlight the choices made in accordance with the chosen method required to answer the research question. The chapter will be divided into subchapters to give a complete overview of all the aspects of the method.

The first sub-chapter will discuss the choice of method.

The second sub-chapter describes the ethical challenges of the study and the measures taken to keep the respondents safe.

The third sub-chapter is about reliability and validity and will discuss the steps taken to maintain credibility.

The fourth sub-chapter describes the process of choosing respondents and measures taken in order to avoid researcher bias when choosing respondents.

The fifth sub-chapter details the planning proses before conducting interviews, as well as the interviews themselves.

The sixth sub-chapter involves the transcription procedure and a description of the tools used.

The seventh sub-chapter describes thematic analysis as a method and clarifies some of the choices. Included is a step-by-step introduction to the six phases of thematic analysis.

3.1 Selection of Method

This master's thesis is a qualitative study where thematic analysis has been chosen to present the study's findings. The study's data is collected through interviews with members of the Norwegian public. Thematic analysis is chosen to ensure a method capable of capturing the respondents' flowing train of thought as well as the responses to the more targeted questions. Thematic analysis also allows the collected data to be structured into codes and themes formed during the coding phase, which can help prevent the execution of important observations (Braun & Clarke, 2006).

After the interviews are done, they get sent to transcription, proofread, and edited. That text file goes through thematic analysis and interpretation. Thematic analysis can reveal the patterns in the interviews, which will help understand the respondent's feelings and opinions towards nuclear power. Through a careful review of the analyzed data, we can learn their understanding of nuclear energy, their stand on the future of Norwegian energy production as well as what they deem as necessary policies.

The study uses the semi-structured interview method (Paul & Lynne, 2001). The interviews are firmly based on the interview guide but are open and encourage the respondent to talk freely with reduced structure to gather the information that the interview guide might miss (Alshenqeeti, 2014). The information found outside of the interview guide is as important, if not more important than the information found as a direct response to the interview guide because it highlights opinions and phenomena not previously thought of or seen as too small to be included in the interview guide. The interview guide is however handy if there is a bad information flow in the interview. It can help the respondent give concrete answers on an unfamiliar topic and is a useful tool to keep the respondents on topic.

3.2 Ethical Considerations

The scope of a qualitative research project can present ethical challenges. Keeping the project as ethical as possible during qualitative research will not only better the safety and comfort of the respondent before, during, and after the interview, but will yield better, more open, and honest data. The respondents were sent an information letter before the interview. The information letter described the scope of the interview, the respondent's rights to pull their consent at any time, and that their participation was completely voluntary. Informed consent is important to ensure that the respondents understand how the interview may affect their privacy and what consequences their participation can have (Allmark et al., 2009).

I assess that this research project will have insignificantly small negative consequences, if any consequences at all on the respondent. The identity of the respondents will however be kept confidential to minimize the negative impact of their participation. The respondents also had the

opportunity to read and revoke the statements they made during the interview, in case they feel that the quotes presented don't reflect the original intent. It is important for the research project that the data reflects the respondent's original intent. The respondent in this case is a representative of the public and if the data does not match it can yield faulty results. This can also help remove some of the effects of the researcher's bias.

In order to conduct the interviews and process the data collected, an application must be approved by Kunnskapssektorens tenesteleverandør (Sikt). The application requires a description of the research project and ensures that the appropriate rules are being followed to uphold the law and respondent's rights. The interview phase cannot begin unless the application is approved. The application for this project was sent in on January 24th, 2024, and was approved on January 30th, 2024. It was then edited on February 29th, 2024, and was approved again on March 1st, 2024. The edit was done for two reasons, the first being that encrypted storage on secured and separate servers was seen as unnecessary. Since the data collected in the interviews are not easily traced back to the respondents. The second reason is that one of the age groups changed from 60 years and over to 60-67 years. This was done so that no member of the public over 67 years was interviewed since they would be considered as an elder by the law, and Sikt considers elders as a vulnerable group of the public. It would therefore require a more thorough application process that would have taken significantly more time, which didn't align with the timeline of the research project. Managing personal information from a particularly vulnerable group of the population would also require stricter rules from Sikt.

3.3 Reliability and Validity

The study's degree of validity is determined by how well it captures the concepts it set out to investigate. Internal validity describes the extent to which the investigation measured what it was supposed to measure. While external validity describes the degree of deviation related to the measurement method (Alshenqeeti, 2014). This study's goal is to find out what affects the Norwegian public perception of nuclear power. To do so it is critical that the information collected from interviews are presented truthfully. This study is done independently, and no external influence is present to force the results in a certain direction. To minimize the influence of the researcher's bias on the results, respondent validation will be used. Respondent validation is a method to ensure that the original meaning of the statement is reflected in the results, by letting the respondents read the analysis and give feedback. If the respondents are unhappy with the results due to misrepresentation, it is likely that the researcher has misinterpreted the data. All respondents who have participated in this study have had the opportunity to read and give feedback.

Reliability refers to the extent to which a study's result is repeatable if a similar study were to be done. While an interview is a great method for collecting rich data and is capable of great flexibility,

its weakness can be poor reliability and that it is easily affected by bias (Paul & Lynne, 2001). It's not unthinkable that a similar study could end up with different results. There are many factors that affect the study and its results, number of respondents being one of them. To truly get a repeatable result the study would have to be on a bigger scale and would benefit from triangulation supported by a survey to include a larger number of respondents (Patton, 1999). The results in this study will be compared to similar studies to highlight the similarities and differences. The differences could be caused by differences in data but could also be a result of differences in method.

3.4 Selection of Respondents

It can be useful to divide the selection process into steps shown in: (Hvordan gjennomføre undersøkelser?) By Dag Ingvar Jacobsen. The first step should be to get an overview of the group of potential respondents, which in this case is the entire Norwegian population (Jacobsen, 2005). The second step is to divide that group into subpopulations based on relevant factors such as age and gender. Step 3 is to choose criteria for possible respondents. It was important to cover as wide and varied part of the population as possible since it is impossible to represent the whole population, especially with 8 responders. One of the criteria chosen was therefore place of residence. At least one of the respondents would have to be from the east/west/north/south of the country, to better the chances of collecting area-specific data. The second criteria was that the person needed to have Norwegian citizenship since we were trying to find the Norwegian public's opinions. And out of this constructed pool of potential respondents, 8 people were chosen «randomly». True randomization is difficult to achieve when picking respondents. The approach relied on removing the researcher from the decision-making process. Friends and family were asked if they knew someone who would be able to partake in the interview. Only the necessary information was shared with the friends and family helping with finding volunteers. This information included what age group, gender, and place of residence was needed.

The selection of respondents will affect the results of the study, especially when the number of respondents is low. That is why this study focuses on the distribution when it comes to age and gender. The original plan was to interview 12 respondents, but due to time restrictions, only 8 people were interviewed. A selection of 5-25 respondents is sufficient when conducting a qualitative study (Kvale, 2015), and an upper limit of 20 interviews is more than enough (Jacobsen, 2005). The number of respondents would be greater if given more time, but 8 interviews are sufficient. The gender distribution was not shifted due to the reduction in respondents however it caused the skewed distribution of age groups shown in *Table 1*. This may affect the result.

Table 1: Overview of respondents based on age and gender.

Overview of respondents		
Age	F	M
18-40	Woman (25)	Man (28)
	Woman (23)	Man (23)
40-60	Woman (59)	Man (40)
60-67	Woman (61)	Man (65)

3.5 Planning and Conducting Interviews

The interview guide has been reworked several times to make sure that the questions gathered as much relevant information as possible, in a neutral and non-leading way. The first draft was created as part of the course AOS340 Qualitative Methodology at NMBU. This draft was used to conduct a test interview, which helped highlight what needed to be changed. The changes involved, making some of the questions less leading, some questions were added and removed based on relevancy and the ability to extract information. After the changes were made, the guide was sent out to 3 professors at NMBU with different academic backgrounds. The professors gave feedback based on their specialist knowledge, which included power production, radioactivity, and qualitative methodology. The final changes were made based on their feedback. The finalized interview guide is included as *Appendix 1: Interview guide*. This study utilizes a semi-structured interview, which means that not all questions asked during the interview are included in the interview guide. These questions were spontaneous and varied based on the respondent and their answers. The respondents were allowed to talk freely and the questions from the guide were utilized when the respondent stopped talking about the topic so that the respondent could talk about what they felt were important as well as covering the topics prepared in the guide. There were situations where a few respondents went very off-topic for longer periods of time. In those cases, they were stopped and asked a question from the interview guide to direct them towards a relevant topic. The respondents knew the topic of the interview a couple of days in advance but were encouraged to not read up on the topic. The thought was that the respondents' opinions might change after reading up and that that would make them ill-fitting respondents to represent the public, based on the differences in knowledge level.

An information letter was sent out to the respondents a couple of days in advance. The information letter will be attached as *Appendix 2: Information letter*. It was seen as unethical to withhold the topic of the interview. That is why it was shared with the respondents in the information letter.

The letter included:

- The study's purpose
- Who is responsible for the research
- Why they were asked to participate in the interview
- What their participation would entail
- A clear message that participation is voluntary
- How their information would be handled and what will happen to it after the study is done.
- An explanation stating that their consent is what gives us the right to process their data
- Their rights during the study's duration
- Contact information for the responsible parties
- Declaration of consent

The interviews were all conducted and recorded digitally over Zoom. Some of the interviews utilized webcams, others did not. Physical interviews are better at collecting data, especially expressions and emotional data, but this would require a lot of time and funding, which was not available. Some data might be lost due to the choice of interview method, but digital interviews were the best available option to ensure data from respondents across the country. 1 hour was set aside for each interview, and it was possible to conduct supplementary interviews if needed, but none of the interviews went longer than the original 1-hour time limit. Before the interview started there was some small talk to make the respondent more comfortable. The interview started with some relevant questions about the respondents such as age, education, work experience, and if they had previous experience in nuclear energy production power production in general.

3.6 Transcription

The audio file was sent to Autotekst after the interview was concluded. Autotekst is a transcription service developed by Universitetet i Oslo. The service is safe enough to handle some red data types and is therefore safe for this study's data since it is qualified as green data. The text files were then quality-checked by reading through the text alongside listening to the audio file. Some changes were made, mainly because of misspellings and to remove unnecessary filler words and sounds such as «uh». There were some changes done to improve the text to make it easier to read. An example of this was when the respondent started a sentence and stopped halfway through. The quotes used in this study are translated from Norwegian to English. This is a potential source of bias and could change the quotes' original meaning. The respondent validation is a measure taken to avoid the researcher's bias.

3.7 Thematic Analysis

After the transcription was quality-checked, the analysis began. Thematic analysis is a method for finding, analyzing, and reporting patterns within data (Braun & Clarke, 2006) (Pascale, 2011). Braun

and Clarke further explain that thematic analysis minimally organizes and describes the data in rich detail. After the data is sorted into themes, thematic analysis allows the researcher to link data to relevant literature and theories. When the sorted data is compared to existing theories and literature, it not only helps describe the study's findings, but it makes the study more credible by revealing similarities and differences to existing studies. Analytic induction is the systematic investigation of similarities within and between cases in order to develop concepts, ideas, or theories (Pascale, 2011). This study will mainly look at the respondent's direct statement when analyzing the data and will refrain from reading between the lines. The direct statements will however be compared to each other and similar statements from other studies to give it context.

3.7.1 Nvivo

A basic subscription to the program Nvivo was purchased as a tool to assist the researcher during the analysis process. Nvivo allows the user to create cases for each of the respondents with the uploaded transcribed interview. After the interview is uploaded the researcher can begin the coding. Nvivo has several useful mechanics that help the researcher organize and keep track of the codes and themes. The interviews were coded one by one. During this process, both the transcribed interviews and the audio recording were utilized to ensure that there was no misunderstanding caused by intonation or writing errors. When the respondent made a relevant statement, the relevant text was marked and coded, either with an existing code or a new code. These codes were later organized into child and parent codes so that the data would be more organized and easier to work with. These codes were organized into teams after all the interviews were coded. Some of NVivo's more advanced features were only available with the more expensive subscriptions, which is why they were not utilized in this project. Similar features from other sources were used since they were cheaper. An example of one of these features was NVivo's transcription tool which was substituted by Autotekst by UiO.

3.7.2 Six Phases of Thematic Analysis

This analysis utilizes Braun and Clarke's 6 phases approach. Braun and Clarke describe thematic analysis as a non-linear process consisting of 6 phases (Clarke & Braun, 2013). It's described as non-linear because of the flexible work structure. They recommend that the researcher moves back and forth through the phases, instead of completing step one and then moving on to step two and so on. The 6 phases are presented below in Figure 1.

Phase	Description
1. Familiarize oneself with the data	Transcribing the data, removing errors, and noting down ideas.
2. Making initial codes	Finding interesting information in the data set through systematic processes, and collecting data for all the codes.
3. Searching for themes	Finding a connection between codes.
4. Reviewing themes	Quality checking the themes and making sure that there is coherence between the codes and the themes.
5. Defining and naming themes	Refining the themes, making sure that the story the data tells makes sense. Clarify the theme name and purpose
6. Presenting the results	The presentation of concrete and interesting data from the analysis and compare it to relevant literature.

Figure 2: Description of the 6 phases of thematic analysis (Braun & Clarke, 2006).

Phase 1: Getting to Know The Data

As the interview and transcription process were completed, the data from the interviews were well-known and had been read through several times. At the end of the coding process, all interviews were read at least 3 times and some ideas for codes were already beginning to form.

Phase 2: Generating Initial Codes

The coding process was done while reading the transcription and listening to the audio recording of the interview. This gave a better understanding of the meaning of the transcribed text. Nvivo made the coding phase more organized and quicker than if it had been done with pen and paper. The first codes were drafts and Nvivo made it easy to reorganize, rename, and otherwise edit and delete those codes to make more polished codes that were a better fit for the study and data. All the cases were systematically assigned draft codes in the beginning and were edited over time. A list of the initial codes is attached as *Appendix 3: original code book*. Some of these codes were too specific and didn't lead anywhere and some were too general or not relevant and needed to be edited or deleted in a later phase of the study. The priority in this early phase was to make sure that all the relevant data were included. This resulted in an abundance of codes that had to be merged, deleted, and organized into child/parent codes in a later stage to make the data more manageable. In this early stage of coding the total amount of codes were about 160 codes. Some codes were merged after a few rounds of reviewing so that the data set was reduced to 127 codes. Table 2 shows some examples of how the codes and corresponding quotes were set up.

Table 2: Examples of collected quotes. (Sentences spoken by the interviewer are underlined).

Code	Examples of quotes
Nuclear power is area friendly	It doesn't take up much space. Compared to a wind farm, it doesn't destroy nature as much as perhaps hydropower does (Man (23)).
Worried enough to move	<u>Will it be enough to make you think about moving further away? Is it something you have thought of?</u> Yes, I think it probably would. If it was built close, I think it would be an option. <u>How far would you move?</u> I don't know anything about safety zones, but I'll probably have moved a few miles, I think (Woman (61)).
Prefer other options over nuclear power - Hydropower	I think that Norway has so many other alternative energy sources that we could rather improve and invest in further. <u>Yes, like what?</u> I am particularly thinking of hydropower. Historically speaking, Norway is a nation that has invested heavily in hydropower. It started around 100 years ago. I think that many of the power plants that were built at that time are still running (Woman (61)).
Technological advancement	In the last ten years, I have realized that the development has gone incredibly well. The risk of unwanted pollution and emissions is incredibly small. I've gone from being very opposed to thinking it sounds like a sensible way to produce power (Man (65)).
Cheap operating cost	Once it's built, it's cheaper to run than some other things, as far as I've understood anyway (Man (28)).

Phase 3: Searching for Themes

After the first round of coding was finished, the process of searching for themes began. All the codes were systematically reviewed while simultaneously looking for context between the different codes. If a possible theme was found it was written down to be compared with the other themes to avoid too much overlap. Braun and Clarke Describe this phase as analyzing the codes themselves to tie them together into themes. Nvivo made it easier to move codes around and test different themes. This phase was revisited several times to improve the themes.

Phase 4: Reviewing Themes

When the candidate themes were then reviewed, a decision was made to either keep the theme or to change or remove it. This phase was done in cooperation with a supervisor and another student. The themes were presented to the supervisor and the student and they asked questions and pointed out what they thought worked and what didn't work. The cooperation highlighted flaws in the themes and it was necessary to revisit phases 2 and 3 several times. Phases 3 and 4 were revisited after reviewing the themes as part of writing the report. Phase 4 needed to follow the guidelines of Patton's dual criteria of internal homogeneity and external heterogeneity. Data within themes should cohere together meaningfully, while there should be clear and identifiable distinctions between themes (Patton, 1990).

Phase 5: Defining and Naming Themes

Phase 5 consists of giving the names of the themes and defining their identity. Phases 3, 4, and 5 were revisited several times to refine the themes making their content clearer. The changes made are shown in Table 3 below.

Table 3: Illustrating the changes made to themes in between phase 4 and phase 5.

The evolution of the themes from Phase 4 to Phase 5					
	Original phase 4 themes		Improved phase 5 themes		Final phase 5 themes
No. 1	Environment and Climate	No. 1	Traditions and strong national feeling	No. 1	Traditions and sentiment
No. 2	Energy and economy	No. 2	High-risk High reward	No. 2	Not in my backyard
No. 3	Fear and uncertainty related to radioactivity			No. 3	Prejudgment of risk
No. 4	The importance of trust and information for the future of Norwegian nuclear power	No. 3	Outdated information and mistrust	No. 4	Outdated knowledge and misinformation

The decision to merge Energy and economy and Fear and uncertainty related to radioactivity was made to capture the complexity of what the respondents were saying. The interviews were rarely black and white but were more nuanced. The theme of high risk and high reward was supposed to highlight the complex topic in a more concrete way. The topic was however too broad and included too much at once. The theme was removed and some aspects of it were further evolved into the themes not in my backyard and prejudgment of risk. The changes in themes 1 and 2 were more subtle and mainly changed the name and the angle of approach.

Phase 6: Producing The Report

The sixth phase is producing a report of the results. The report's task is to describe the complicated story of the data in a way that convinces the reader of the merit and validity of the analysis. The analysis should be a concise, coherent, logical, non-repetitive, and interesting account of the story the data tells (Braun & Clarke, 2006). The results will be presented in the following chapter.

4. Results

This chapter contains the results from the analysis. The themes will be presented in separate subchapters and the themes that have subthemes will be divided into further subchapters. The results will be supported by literature and quotes from the interviews.

4.1 Not In My Backyard

The data show that most of the respondents find nuclear power to be a controversial technology. A couple of the respondents were mostly positive about the thought of having nuclear power in Norway. Saying that Norway has the necessary resources needed and that the increased power production could be an asset in the future. When asked if they thought that nuclear power would be necessary for the Norwegian energy mix, if we are to reach the climate goals, one of the respondents replied:

«Yes, I think so. Can you elaborate on that? To reach the climate goals, we'll have to change or scale back oil production or stop it. I also think that setting up enough wind farms will take a long time if it is to replace oil. I think the construction will go too slowly to meet the climate goals, considering that we'll have to replace the oil» (Woman (59)).

Six of the respondents said nuclear power was necessary for Europe to reach the climate goals. When asked if they thought that nuclear power would be necessary for the European energy mix, if we are to reach the climate goals, one of the respondents replied:

«I think so. I don't have research-based knowledge about it, but I think so considering that there is a large population that needs a lot of energy. There must be some nuclear power to be able to cover the energy demand. We have some nuclear power plants in Europe, we have Barsebek in Sweden, and several further down in Europe. Some power plants are producing, and some are out of operation. I think that the plants that are not in operation must start production again and that more nuclear power must be developed. I think so if we are to achieve the climate goals. I read a bit about that too. Both reports from the EU and UNESCO say that nuclear power cannot be overlooked to cover the energy demand in the coming years in Europe» (Woman (61)).

Most of the respondents were however more hesitant to the idea of Norwegian nuclear power, highlighting barriers such as radiation, waste management, high investment cost, and lack of competence and infrastructure. The respondents were asked how they would feel if Norway decided to produce nuclear power. There was a mixed response, a few were opposed to the idea while others thought it was a good idea. As a follow-up question, the respondents were asked how their opinions changed based on the distance between them and the power plant. The response showed that fewer respondents were comfortable with nuclear power the closer they were to the power plant. The question was structured as such: Would you be comfortable living in the same country, municipality,

town, and neighborhood as a nuclear power plant? One of the respondents replied as such when asked what they would have thought if the municipality they lived in chose to build a nuclear power plant:

«The first thing I would think of is would there be a thorough investigation, I would also like to know where they intended to build it. And I would have liked to know who was responsible, but otherwise, it would have been fine. I want us to avoid destroying nature, that is important to me. If it meets those criteria, I think it can be good if it helps to solve various energy problems» (Man (23)).

The same respondent gave this reply when asked if they would be comfortable with living in the same neighborhood as the power plant:

«Would you have been comfortable with having the power plant as a neighbor? How close to the house wall? Let's say the same neighborhood. I don't think I would have been. What makes you say that? The power plants are good, but it is conceivable that some minor mishaps could happen, that pollute the area around them. So, I wouldn't want to live right next to it» (Man (23)).

Respondent Man (23) says they feel differently based on proximity. The 23-year-old man talk about what criteria must be met for them to be comfortable with the power plant when it is further away. However, when the distance is shorter, it seems that the 23-year-old man isn't comfortable even if the previous criteria are met. It appears that there can't be thorough enough criteria when the power plant is within a certain distance of the person. Several of the respondents answered similarly when asked the two questions. Some of the reasons differed, but the pattern remained for most of the cases. The most talked about reason was concerns about accidental radiation. The respondents said that unnoticed pollution, malfunctioning power plants, and targeted attacks during war were possible scenarios where they could receive accidental radiation from the power plant. 2 respondents said that they weren't worried about the radiation but that they still wouldn't want the power plant close by where they lived due to visual reasons. When if they would be comfortable living in the same neighborhood as the powerplant, one of the respondents said:

«Maybe, but it's mostly the visuals. It's not pretty to look at, probably a square, heavy building with a lot of wires and masts. So, in terms of having a view of the fjord and a pretty green island, I would prefer to continue with that. But in terms of fear, for me to be exposed to some dangerous substances, I would have had no qualms about it» (Man (65)).

Another respondent replied similarly with:

«I probably wouldn't want to live directly nearby anyway, but in general I wouldn't want to live right next to a power plant or data storage center» (Woman (25)).

The respondents that would be uncomfortable with a nuclear power plant as a neighbor due to visual reasons, don't seem to have a problem with the nuclear part, but rather with the fact one of their

neighboring buildings isn't visually pleasing. A power plant or similar building can reduce the joy a person gets from the local view and could also have another effect such as reducing the housing prices in the area. Based on what the respondents say, this starts being a problem when the power plant is within the town border and becomes a bigger problem the closer the power plant is.

A couple of respondents said that the reason they wouldn't want the power plant as a neighbor was because they lived in a large city center and that they thought that wasn't a great location. When asked about it one respondent said:

«If they were going to build a nuclear power plant very close to the city center, I probably wouldn't be comfortable with that» (Man (28)).

«And the fact that it's probably a bit of a nuisance if you have a giant nuclear power plant right outside the city center» (Man (28)).

«I would have thought it was a bad idea to build it so close to the city center. To be completely honest. Then I might have become a little skeptical» (Man (28)).

When the same respondent was asked if they would be open to living near a nuclear power plant if they lived outside of the city center, they replied:

«If, for example, I had still lived where I grew up, I would have thought that it would have been perfectly fine» (Man (28)).

The interviews show that the two main concerns are the radiation and the visual. Both seem to become a bigger problem when the distance gets shorter. While most of the respondents thought that there could be many positives in producing nuclear power, these positives seem to stay mostly constant, while the negatives change based on location. This pattern was also present in a study done on Chinese university student's acceptance of nuclear power (Hao et al., 2019). The study showed that the students became less enthusiastic about nuclear power when the distance between them and the power plant was reduced. This could be a case of the NIMBY (not in my backyard) phenomenon. NIMBY is when a person objects to a new building or a similar project happening in their near vicinity when they would support it happening elsewhere. There are ways to reduce the chance of NIMBY, which will be mentioned in the next chapter.

4.2 Outdated Knowledge and Misinformation

The data show that the respondents' knowledge about nuclear power varied. While some respondents had educated themselves on the topic and had basic knowledge about nuclear power, others were less informed and admitted to guessing when answering questions. The respondents with high understanding rarely changed their minds during the interview. The respondents with less basic

knowledge changed their minds more often as well as answered in indecisive ways. It seemed that they often tried to be as neutral as possible. The respondents with a higher understanding were usually more direct.

When the respondents were asked where they had learned about nuclear power, they tended to list basic sources of information such as primary school, media, and other people. However, when asked where they would look for information about nuclear power they tended to list more advanced sources of information such as scientific articles, reports, literature, and Google Scholar.

«Where did you learn about nuclear power? I've learned about it in school and stuff, but it's been a long time, so I don't remember it. It must have been news and newspapers. And yes, that movie Chernobyl. I was alive when Chernobyl happened, so I paid attention when it happened. But I don't really know the technical stuff. But now I would look online and in newspapers» (Woman (59)).

It seems that the respondents are more critical of their information sources when talking about possible future sources, than previous sources that they base their opinions on. This could be because it is easier to acquire knowledge now than it was in the past. It is also possible that the respondents recognize that their sources can be seen as less credible and that they want to convince the interviewer that they are critical of their sources. Another explanation could be that they see themselves making better choices in the future.

All the respondents mentioned the Chernobyl accident. Some followed the accident on the news as it happened, others had learned about it in school or by watching movies and series. Most of the respondents based their responses on the information they had about Chernobyl at some point or another during the interview. This could be problematic for several reasons, one being that entertainment rarely is a trustworthy source of information. Another problem is that the Chernobyl accident happened in 1986, and most information is outdated. This is an example that could highlight the need for increased public information if Norway chooses to invest in nuclear power. When asked if the respondent felt that their social circle was accepting of nuclear power they said:

«I think it has to do with the experiences that people who were adults in the mid-80s, with the pollution and the accidents that have occurred, and the consequences of that. That it can have completely fatal consequences for both the environment and people, and that it can lead to illness and death. So, I think a lot of objective information is required, so that people trust that this is correct and not just some sales gimmick» (Man (65)).

«I don't think there is any quick fix to convince the large majority in Norway that nuclear power is beneficial. I think it takes time and good information» (Man (65)).

Man (65) said that they used to be more skeptical towards nuclear power, but slowly over time, they had become more positive towards it. It could be beneficial for the interested parties/government to

make unbiased information easily available to the public. A study done in the areas around the Qinshan, Tianwan, and Hongyanhe nuclear power plants shows that public communication can affect public acceptance indirectly in three paths, but that public communication doesn't have any direct effect on public acceptance (Qi et al., 2020). They describe the three paths as:

- In the first path, public communication positively affects trust, trust positively affects perceived benefit, and perceived benefit positively affects public acceptance.
- In the second path, public communication positively affects trust, trust negatively affects perceived risk, and perceived risk negatively affects public acceptance.
- In the third path, public communication positively affects perceived benefit, and perceived benefit positively affects public acceptance.

The perception of risk-benefit has a great effect on public perception. Public communication can affect the perception, but if the process is not truthful, transparent, and fair, social trust and justice can become barriers blocking public acceptance (Wang et al., 2021). It is therefore important that the nuclear power industry learn from past mistakes related to transparency and honesty. Events such as the secrecy after the Chernobyl accidents and dishonesty related to the test results from the IFE research reactor in Halden (Ramsdal, 2021) can lead to a decrease in social acceptance.

4.3 Traditions and Sentiments

The respondents seemed to have considered what they wanted from an energy-producing technology. When asked if Norway should invest in nuclear power, most of them answered that they prefer another option, mainly hydropower. Norway has a long hydropower history dating back to the end of the 1800s (Energidepartementet, 2019). The arrangement giving the state ownership and power over the hydroelectric power plants is one of the reasons why hydropower is so popular in Norway. When asked if Norway should invest in nuclear energy one respondent said:

«I think that Norway has so many other alternative energy sources that we could rather improve and focus on further. Like what? I am mainly thinking of hydropower. Norway has been a nation that has invested heavily in hydropower, historically speaking. It started around 100 years ago. Many of the power plants that were built at that time are still running, I think» (Woman (61)).

It appears that most of the respondents are positive towards maintaining and improving current hydroelectric power plants, but they are aware that it involves some negatives. One respondent said:

«It will be devastating for a number of rivers that have to be piped if new hydropower is to be developed» (Man (65)).

The negative effect of hydropower seems to be downplayed because of its solid foothold in Norway. Hydropower has become part of the Norwegian culture and is treated differently than other technologies. Nuclear power is an alien technology in Norway and does naturally not receive the same cultural backing as hydropower. The interviews show that there is a fear aspect related unfamiliarity of nuclear power. The interviews also show that nuclear power is preferred over some other technologies, mainly wind power. One respondent said:

«There is far less natural disturbance. As I understand it, nuclear power plants today do not require that much land. While wind power requires a lot of land, especially in areas with wild nature. It destroys much of what is Norway's gold» (Man (65)).

Most of the respondents are quite critical of wind power. Nuclear power doesn't seem to be their first choice, but several of them prefer nuclear power over wind power. There has been increased news activity regarding people in Norway preferring nuclear power over wind power. Heim municipality has been one of the most talked about cases (Thobroe, 2024). Heim has made a site available to Norsk Kjernekraft AS as part of a partnership between the two parties (Johansen, 2023). The respondents shared the reasons why they dislike wind power, one said:

« The placement of nuclear power plants, I think that it can be less harmful to nature than, for example, wind turbines, which, on the contrary, are very harmful to nature» (Man (28)).

Climate measures were important to the respondents as well as nature conservation, both flora and fauna. This does fit the theory that culture and traditions affect the respondent's opinion of power-producing technologies. Norwegians have a national romantic outlook on nature, and this is reflected in the respondents' answers. The respondents were very clear when talking about nature, not just the conservation of life but also nature's appearance. One respondent was asked about how they would feel about living near a nuclear power plant, they replied:

« It's mostly visual. It's not pretty to look at, probably a square, heavy building with a lot of wires and masts. So, in terms of having a view of the fjord and a pretty green island, I will continue with that» (Man (65)).

Another respondent said:

«They also want to expand wind power and solar power to get even more electricity, as I understand it. I believe that there is a need for other sources of electricity other than just hydroelectric plants. I think that I am more positive about nuclear power plants than, for example, wind turbines that are set around in the wild» (Man (28)).

It can appear that the respondents feel that both wild turbines and nuclear power plants reduce the quality of nature with regards to appearance, but that some respondents prefer nuclear power plants

because they feel they have more of a choice when it comes to location. They feel they can reduce the visual disturbance and impact on nature, by building the nuclear powerplant in a more optimal location. It seems that the respondent's perception of onshore wind often is that it must be built in areas that are very visible and that ruins nature.

There was a mixed response from the respondents when they were asked if they would trust the industries that would be responsible for Norwegian nuclear power production and construction. One respondent replied:

« Yeah, I'd probably trust it if it was government-owned. Or that it was owned by a large well-known company, and in collaboration with the state. And that there weren't many small companies that own their own power plants» (Woman (59)).

It was important for the respondents that the state was involved in a large capacity. The arrangement making Norwegian hydropower production state-owned has secured the Norwegian state and people a lot of benefits and it makes sense that the people would look at this arrangement favorably. The respondents generally had a lot of confidence in the government. When asked if they trusted the government if Norway decided to invest in nuclear power, one respondent said:

«Yes, if they present a report, I trust that what is written there is true. It is another question whether they have given it enough priority or done it thoroughly enough. But I had not been afraid that it was propaganda» (Woman (25)).

The nuclear power industry could benefit from studying hydropower history and culture in Norway if it is to be accepted by the public. It could be challenging to make nuclear power a part of the Norwegian identity, but it is clear that it fits the profile of several of the respondents' criteria.

4.4 Prejudgment of Risk

Most of the respondents said that they felt uneasy about the radioactivity aspect of nuclear power. Those respondents saw radiation as a risk and a potential danger. They presented different exposure scenarios when talking about risk. One respondent felt that the human element was a problem and wanted it removed from the handling of radioactive material, saying:

«The limitation is that the risk is mostly linked to the person involved» (Woman (23)).

«It depends on what the process will look like, or where it will be set up, and if human risks can be reduced. I also heard that a technique had been found where the human part could be removed when destroying material. If there is a technique for that, I think it sounds like a good idea» (Woman (23)).

Another respondent was more worried about nuclear power plants being targeted during war. They highlighted that Europe is facing more political unrest now than before saying:

«Considering the unrest we have in Europe, I would think that a nuclear power plant would be an attractive target if there were to be a war in Norway» (Man (28)).

Nuclear accidents were the risks that were mentioned the most. Several respondents mentioned nuclear accidents, even when the topic was unrelated at the time. An explanation of why the respondents unprompted mentioned nuclear accidents, could be that it is a high-priority topic for them. One of the respondents had this to say when they were asked about living in a municipality that produced nuclear power:

«I wouldn't like that. I would have felt very unsafe. Knowing that there is a nuclear power plant in the area with thoughts on waste management and if an accident were to occur during production. I would have felt very insecure. Even though there are miles of safety zones and all that, I would have felt very unsafe» (Woman (61)).

When asked further about their unease and if it would make them move away, they replied:

«Yes, I think it probably would. I think it would be a possibility if the power plant was built very close to my house. How far away would you have moved? Now, I don't know anything about safety zones, but I would probably have moved a few miles, I think» (Woman (61)).

This sentiment about not wanting to live near a nuclear power plant was recurring. Another respondent said:

«It will affect where people live. Nobody wants to live anywhere near nuclear power. It is partly because of that fear» (Man (23)).

Another risk the respondents brought up was the possibility of accidental radioactive contamination of the local area of the power plant. These perceived risks are however somewhat misunderstood. Nuclear power is comparatively safe when compared to other alternatives. Figure 2 illustrates different technologies' safety during severe accidents and terrorist attacks by looking at fatalities/GWh.

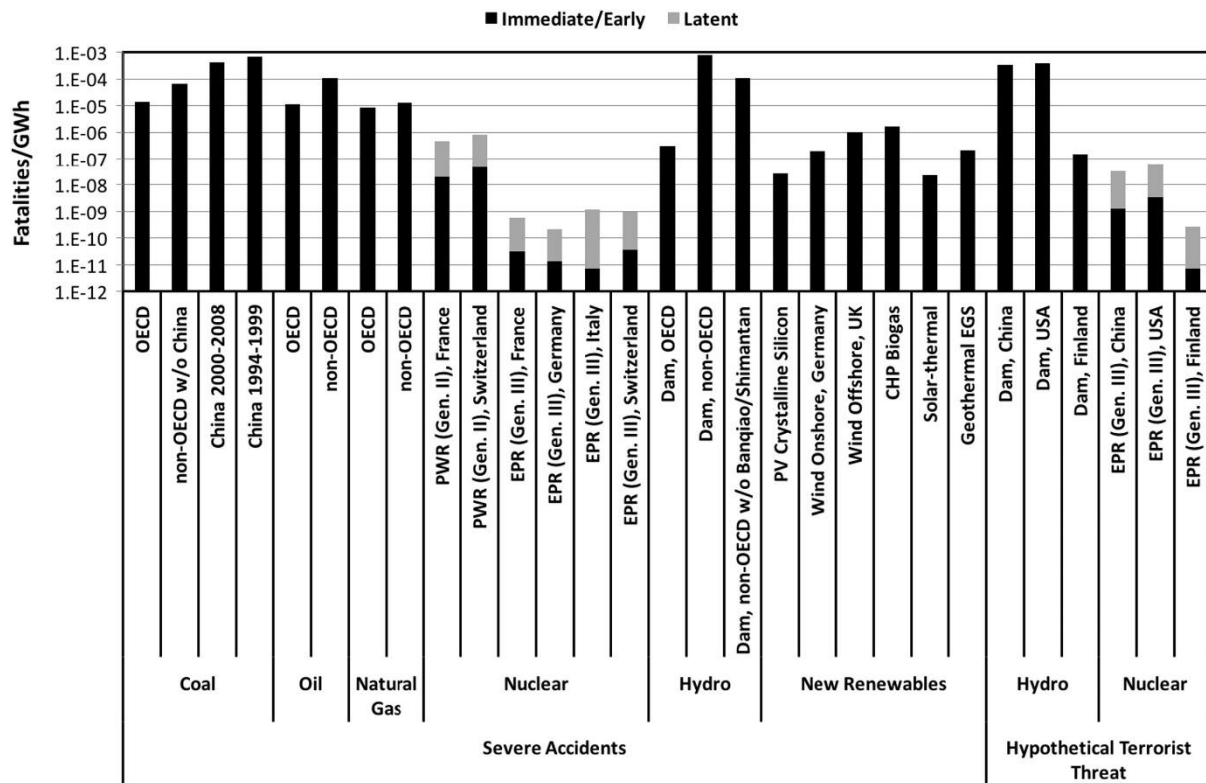


Figure 3: Mortality expressed in fatalities per GWh due to severe accidents and terrorist attacks. Immediate mortality applies to severe accidents in all energy chains and latent mortality to nuclear accidents (Hirschberg et al., 2016).

Nuclear power should be preferable when looking at safety but is generally seen as a risky technology by the respondents. Nuclear has few fatalities in both the severe accident scenario and the terrorist threat scenario when compared to the other technologies. One of the respondents had this to say when asked if they had something that they wanted to add to the interview before it ended:

«I think in a way that nuclear power has gotten a bad reputation because we've had some terrible accidents. And those accidents have been so rare, and they have been when everything has gone wrong. But they become so disastrous. They become very present in our memory, and they are compared to atomic bombs. And it's so incredibly devastating when things go wrong, but it's been a long time since an accident happened and there has been enormous technological development in the last 20, 30, 40 years. This makes me think that we could pretty much guarantee that an accident won't happen. I think the positive aspects outweigh the microscopic possibility of something going wrong» (Man (28)).

Man (28) highlights that there have been few major nuclear accidents. The data from the interviews points out that the fear is less connected to the frequency of the accidents and more related to the maximum consequences. Figure 3 below illustrates the relation between different technologies' lethality measured in fatalities/GWh and the maximum consequences of their accidents.

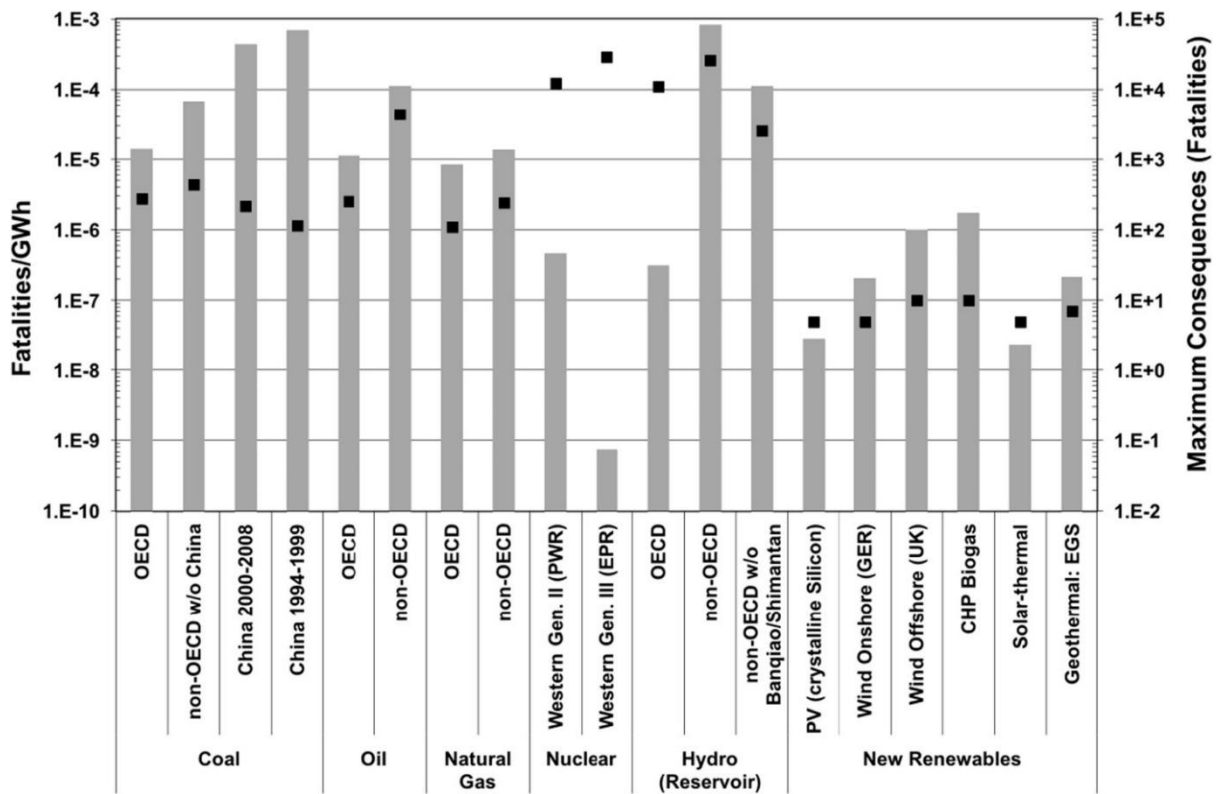


Figure 4: An overview of fatalities/GWh and maximum consequences of accidents related to different technologies measured in number of fatalities (Hirschberg et al., 2016).

As shown in Figure 3, there are few fatalities/GWh connected to nuclear power, especially third third-generation power plants, the maximum consequences however are very large. The analysis of the data points to this being the main reason why nuclear power is so feared. As the 61-year-old woman mentioned: There have been few accidents, but the consequences can be very large and most importantly memorable. Chernobyl was so memorable because one accident affected all of Europe. Figures 2 and 3 only account for fatalities, but there are a lot of other factors that could make an impression on a person. A study looking at what affects Chinese college students' acceptance of nuclear energy concluded with this:

«Given that safety perception has a positive effect on the acceptance of nuclear energy, the government should increase investment in nuclear power technology to improve the level of nuclear power safety technology. Moreover, the government should disclose relevant information in time to enhance college students' perception of the safety of nuclear power» (Hao et al., 2019).

The study seems to correspond with what some of the respondents are saying. It isn't enough to just reduce the fatality of accidents to achieve a high degree of social acceptance. To reduce the people's fear, the government and industry would have to make the negative effects of nuclear accidents disappear. And the simplest way of achieving that would be to make the technology so safe that accidents don't happen as the study claims.

A couple of the respondents said that they thought that they could get used to nuclear power with time, though they were uncomfortable with the thought now. One said:

«I think in a way I would have been a bit nervous at the start, to be honest. It's a bit like flying, you know. It's incredibly unlikely that your plane will crash, but when the plane takes off, you still get a little scared. So, I think maybe it would have been a bit like that with a nuclear power plant. But I had been relatively comfortable with it and had settled into it over time» (Man (28)).

5. Discussion

This chapter is divided into two sub-chapters. The first sub-chapter discusses the results, while sub-chapter two discusses the validity, reliability, and quality of the study.

5.1 Research Question

This study set out to find which factors affect Norwegian citizen's perception of nuclear power in Norway. This sub-chapter describes the results and themes from the analysis.

5.1.1 Proximity to the Power Plant Affects Acceptance

The respondents were less enthusiastic about nuclear power when the distance was shorter. The same pattern was present in other studies. Some considerations are critical if Norway is going to invest in nuclear power. The location of the power plant will be important since distance is such an influencing factor in social acceptance. It will be beneficial to include the public during decision-making related to nuclear power. Further research would be required to find areas for nuclear power production optimal for increasing acceptance, but the results show that it should be away from people and large city centers.

5.1.2 Potential to Influence Perception Through Public Communication

The respondents had varying degrees of knowledge about nuclear power, and it affected the way they answered questions. The government should take measures to educate the public on modern nuclear power if Norway is to invest in nuclear power. This could increase the degree of acceptance. The results show that several of the respondents lack knowledge or are misinformed about nuclear power. The perceived risk was high for the individuals who stated social media as their information source. The same was the case for respondents who stated movies and series as sources, especially Chernobyl-related media. The government and industry could change perception by presenting the technological change that has occurred over the past 38 years since the Chernobyl accident. The investment in safety technology and then advertising has a strong effect on social acceptance. Risk-benefit influences public acceptance to a high degree. Manipulation of perceived risk-benefit could be a useful tool in the future for nuclear power projects to gain acceptance.

5.1.3 The Importance of How Other Technologies Are Perceived

Norway has a lot of hydropower, and its presence is part of Norwegian history and culture. The respondents showed a high degree of acceptance towards it. When nuclear power was presented as an alternative to hydropower, the respondents showed low acceptance of nuclear power. The respondent's acceptance of wind power was low. When nuclear power was presented as an alternative to wind power, the respondents' acceptance improved. If Norway is to invest in nuclear energy, it will be important to present it in the right way. Nuclear power will receive more resistance depending on what technology people perceive as the alternative.

5.2 Research Quality & Reliability

This sub-chapter highlights possible bias and discusses the study's validity, reliability, and quality.

5.2.1 Researchers bias

There have been taken steps to protect the analysis of the collected data from the researcher's bias. These steps are described in Chapter 3: Method. The method of procedure was heavily influenced by Clarke and Braun's work. The respondents were sent a draft of the method and result in chapters for them to read and give feedback on, in order to reduce the influence of the researcher's bias on the respondent quotes. The thought behind respondent validation is for the respondent to highlight where the researcher might have misunderstood or misrepresented the respondent. There is however no guarantee against the researcher's bias, and the transcription, translation, and analysis might be affected as a result.

5.2.2 The Respondents' Ability to Represent The Population of Norway

This study does not have a large enough sample size for the results to be applied to the entire population of Norway. The goal of this study was to discover what factors affect the Norwegian population's perception of nuclear power and to find all the relevant factors a larger sample size is needed. The respondents although few, had a varied view of nuclear power. The respondents weren't required to have any qualifications related to nuclear energy, since they represented the population which have varying levels of knowledge. Four out of the eight respondents were between 18-30, creating an imbalance when it comes to age. The distribution of gender was four women and four men. At least one person was from the east, south, west, and north of the nation, which hopefully gave a point of view that represented the most common values specifically related to that part of the country. For further information about the selection of respondents see Chapter 3: Method. The respondents did not have anything to gain by being dishonest, however, there is a suspicion that some of them felt they didn't know enough and that it affected their statements to present themselves as more knowledgeable towards the interviewer.

5.2.3 The Effect of Using International Studies

This study has utilized international studies to compensate for the lack of Norwegian nuclear power research. Norway is mentioned in some literature, but not in depth and the information is usually related to nuclear accidents rather than nuclear power production. The literature has been treated as if it is viable to apply to the scenario of this study, but there are potential sources of error related to this. Most of the literature is from and/or about nations with nuclear power such as England, Japan, and China. The effects on perception could be different in Norway than it is in these countries.

6. Conclusion

The results of this study show how complex the topic of social acceptance of nuclear power is. A single factor won't affect everyone's perception. Factors may change the perception of one person positively and another's perception negatively. The respondents have shown that they have changed, or that they are willing to change their perception with time. The acquisition of new truthful knowledge could have a reinforcing effect on a person's willingness to change over time.

Hydropower was popular with the respondents, and they presented hydropower as a superior alternative. Wind power, however, was unpopular with the respondents and several of the respondents were more positive towards nuclear power. The respondents valued nature, biodiversity, reduced area occupation, and view of the landscape. Wind power was seen as a threat to those values. Nuclear power while having its challenges, was perceived to conserve those values in a higher grade than wind power.

Nuclear power's biggest barrier is its perceived risk. While nuclear power causes the fewest deaths when compared to other energy-producing technologies, its accidents can be large-scale, destructive, long-lasting, and memorable. Several of the respondents said that they would feel uncomfortable if they had to live near a nuclear power plant. The respondents that were uncomfortable living in the same municipality as a nuclear power plant said it was caused by their perception of risk. The respondents that was comfortable with living in the same town as the power plant, but uncomfortable with having the powerplant as their neighbor, said it was because it wouldn't look nice and that it would reduce their enjoyment of nature near their home.

More research is needed to map the total public acceptance in Norway. Larger more thorough studies could be conducted if more information becomes available.

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Appendix

Appendix 1: Interview guide

Appendix 2: Information letter

Appendix 3: Original code book

Intervjuguide

Informasjon om respondenten

- Hva jobber/ har du jobbet med?
- Hvilken utdanning har du?
- Hvor gammel er du/når er du født?
- Har du bakgrunn innen kjernekraft/kraftproduksjon?

Respondentens forhold til Kjernekraft

- Hva er dine tanker om kjernekraft i Norge?
- Hva er fordelene og ulempene med kjernekraft?
- Hvor mye kan du om kjernekraft?
- Føler du at du er tilstrekkelig informert til å danne et bra kunnskapsgrunnlag om kjernekraft?
- Hvilke kilder har gitt deg kunnskap om kjernekraft?
- Er kjernekraft en nødvendig del av den norske energi miksen for å nå klimamålene?
- Er kjernekraft en nødvendig del av den europeiske energi miksen for å nå klimamålene?
- Ønsker du å vite mer om kjernekraft?
- Ville du stolt på industriene som hadde hatt ansvaret for kjernekraft produksjon, og hvorfor?
- Ville du stolt på de statlige organene som hadde hatt ansvaret for kjernekraft produksjon, og hvorfor?
- Har Norge nok kompetanse til å produsere kjernekraft, hvis nei, hvordan skal vi anskaffe kompetansen?

Samfunnsaksept av kjernekraft

- Synes du Norge burde satse på kjernekraft?
- Oppfatter du at det er aksept av kjernekraft i din omgangskrets?
- Hva hadde du tenkt om din kommune hadde bygget kjerne kraftverk?
- Hvor nære et atomkraftverk kunne du ha bodd?
- Hva synes du om å lagre avfall fra kjernekraft i Norge?
- Ville det vært bedre å lagre avfall fra kjernekraft utenlands?

Respondentens tanker

- Er det noe du har sakt som du vil legge til, rette opp, trekke fra transkriberingen?
- Er det noe vi ikke har snakket om som du vil si eller som du føler er viktig å få med?

Vil du delta i forskningsprosjektet

Samfunnsaksept av Kjernekraft i Norge?

Dette er et spørsmål til deg om å delta i et forskningsprosjekt hvor formålet er å kartlegge hva medlemmer av den norske befolkning mener om kjernekraftproduksjon i Norge. I dette skrivet gir vi deg informasjon om målene for prosjektet og hva deltakelse vil innebære for deg.

Formål

Dette intervjuet er tilknyttet en mastergradsoppgave utført ved Norges miljø- og biovitenskapelige universitet (NMBU). Intervjuets formål er å kartlegge befolkningens forskjellige meninger og synspunkter rundt kjernekraft i Norge.

Hvem er ansvarlig for forskningsprosjektet?

Norges miljø- og biovitenskapelige universitet med veileder Erling Holden, Fakultet for miljøvitenskap og naturforvaltning er ansvarlig for prosjektet.

Hvorfor får du spørsmål om å delta?

For å dekke en bredere del av befolkningen er deltagerne fordelt på alder og lokasjon. Vi er ute etter folkets mening og under intervjuet vil du være en representant for din aldersgruppe og landsdel. Du er en av 9-12 deltagere.

Hva innebærer det for deg å delta?

Om du skulle ønske å delta i prosjektet, vil du bli invitert til å gjennomføre et intervju med lengde på opptil 60 minutter om dine meninger rundt kjernekraft i Norge. Skulle intervjuet vare lenge vil du få mulighet til å delta på ett tilleggsintervju. Tilleggsintervjuet vil skje ved en senere anledning. Merk at du ikke forplikter deg til å delta.

Intervjuet vil skje ved fysisk oppmøte eller digitalt om ønskelig. Det vil bli tatt opp lydopptak av intervjuet slik at intervjuet senere kan transkriberes. Det vil bli tatt notater underveis i intervjuet.

Om du ikke ønsker svare på et spørsmål har du rett til det og det vil bli tatt hensyn til. Materiale fra intervjuet vil bli lagret elektronisk og vil kun bli behandlet av intervjuansvarlig. Materialet fra intervjuet vil kun bli brukt til masteroppgaven og vil bli slettet etter sensurering. Om du tillater er det mulig at jeg benytter anonymisert direkte sitat. Om dette er tilfelle vil du bli kontaktet og få muligheten til å se over sitatet og eventuelt trekke uttalelsen dersom dette skulle være relevant.

Det er frivillig å delta

Det er frivillig å delta i prosjektet. Hvis du velger å delta, kan du når som helst trekke samtykket tilbake uten å oppgi noen grunn. Alle dine personopplysninger vil da bli slettet. Det vil ikke ha noen negative konsekvenser for deg hvis du ikke vil delta eller senere velger å trekke deg.

Ditt personvern – hvordan vi oppbevarer og bruker dine opplysninger

Vi vil bare bruke opplysningene om deg til formålene vi har fortalt om i dette skrevet. Vi behandler opplysningene konfidensielt og i samsvar med personvernregelverket.

Det kun jeg (Carl Kristiansen) som vil behandle materialet fra intervjuet. Informasjonen vil bli håndtert etter personvernsregelverket og er konfidensielt.

Hva skjer med personopplysningene dine når forskningsprosjektet avsluttes?

Prosjektet vil etter planen avsluttes 7.juni 2024. Etter godkjenning av oppgaven vil datamaterialet med dine personopplysninger bli anonymisert og opptakene slettes.

Hva gir oss rett til å behandle personopplysninger om deg?

Vi behandler opplysninger om deg basert på ditt samtykke.

På oppdrag fra NMBU har Sikt – Kunnskapssektorens tjenesteleverandør vurdert at behandlingen av personopplysninger i dette prosjektet er i samsvar med personvernregelverket.

Dine rettigheter

Så lenge du kan identifiseres i datamaterialet, har du rett til:

- innsyn i hvilke opplysninger vi behandler om deg, og å få utlevert en kopi av opplysningene
- å få rettet opplysninger om deg som er feil eller misvisende
- å få slettet personopplysninger om deg
- å sende klage til Datatilsynet om behandlingen av dine personopplysninger

Hvis du har spørsmål til studien, eller ønsker å vite mer om eller benytte deg av dine rettigheter, ta kontakt med:

- **Carl Kristiansen**
Email: carl.emil.agbo.kristiansen@nmbu.no
Tlf: 97782511
- **Veileder: Erling Holden**
erling.holden@nmbu.no
Tlf: 67231741
- **Personvernombud: Hanne Pernille Gulbrandsen**
Email: personvernombud@nmbu.no
Tlf: 402 81 558

Hvis du har spørsmål knyttet til vurderingen som er gjort av personverntjenestene fra Sikt, kan du ta kontakt via:

- Epost: personverntjenester@sikt.no
Tlf: 73 98 40 40.

Med vennlig hilsen

Carl Kristiansen

Erling Holden

Samtykkeerklæring

Jeg (deltakeren i intervjuet) har mottatt og forstått informasjon om prosjektet *Samfunnsaksept av Kjernekraft i Norge* og har fått anledning til å stille spørsmål.

Jeg samtykker til å delta på intervju og at mine opplysninger behandles frem til prosjektet er avsluttet.

(Signert av prosjektdeltaker, dato)

Appendix 3: Original code book

Name	Files	References
Area usage	5	8
Nuclear power is area friendly	3	3

Name	Files	References
Movies	1	2
Newspaper	3	3

Placement is important	2	2
Renewables take up a lot of space	2	2
We have more choice in where to build nuclear power plants compared to renewables	1	1
Bad reputation	3	3
Compared to nuclear accidents	2	2
Controversial in media	1	1
Believes that Norway has enough expertise in nuclear power	1	1
Believes that nuclear power is necessary in Europe if we are to achieve the climate goals	6	7
Believes that nuclear power is necessary in Norway if we are to achieve the climate goals	2	2
Believes that nuclear power is necessary in the world if we are to achieve the climate goals	2	3
Cheap operating costs	1	2
Concern about high electricity prices	1	1
Concerned about nuclear waste management	6	16
Has to be stored for a long time	1	1
Worried about contamination from the nuclear power plant	1	1
Demonstrations against nuclear power	1	2
Does not trust the government bodies responsible for nuclear energy	1	1

Other people	2	2
Radio	1	1
Low operating costs	1	1
Minimize risk	1	2
Remove the human element from the process	1	2
Needs the state to decide over the companies for there to be trust	1	1
Negative about having a nuclear power plant as a neighbour	2	3
Negative about the storage of nuclear waste abroad	5	6
Negative to living in a town with a nuclear power plant	1	1
Negative to living in a municipality with a nuclear power plant	2	2
Negative towards nuclear energy	1	2
Takes too long to get operational	1	1
Negative towards storing nuclear waste in Norway	1	1
Negative towards wind power	1	2
Norway could acquire more knowledge about nuclear power	7	11
Education	1	1
Norway can conduct independent research on nuclear power	1	1

Does not trust the industries that would have been responsible for the construction of nuclear power plants in Norway	0	0	Norway should learn from other countries in order to acquire knowledge about nuclear power	7	9
They may lie about important matters in order to make more money	1	1	Norway should stick to what we are good at	1	1
Doesn't believe that nuclear power is necessary for Norway to reach the climate goals	2	3	Not worried by nuclear waste	1	2
Don't believe in climate change	1	2	Nuclear powerplant produce a large amount of energy	1	1
Don't believe that Norway has enough expertise in nuclear power	2	3	Nuclear powerplants don't look nice	3	3
Don't need to know more about nuclear power	2	3	Perceives that there is acceptance of nuclear energy in their circle of friends	5	5
Don't want nuclear powerplant near big cities	2	6	Perceives that there is low acceptance of nuclear power in their circle	2	2
Energy efficient	4	5	Perception of nuclear energy has changed over time	2	3
Enough knowledge of NP for now, but need to learn more if needed	2	2	Positive about having a nuclear power plant as a neighbour	1	1
Environmental considerations	6	9	Positive about living in a municipality with a nuclear power plant	4	4
Environmentally friendly technology	5	6	Positive about living in a town with a nuclear power plant	5	6
Little nature disturbances	2	3	Positive towards nuclear power	5	9
Low emissions	1	2	Long term only	1	1
Fear	6	25	Many small nuclear power plants	1	1
Fear of nuclear accidents	6	13	Positive towards storing nuclear waste abroad	0	0
Exclusion zone	1	1	Only if it is a technically better solution	3	3

Chernobyl	4	5
Fear of nuclear powerplant being targeted in war	1	4
General risk	1	1
Learn to live with it	1	1
Negative media attention	1	1
Worried enough to move	1	1
Good for the economy	0	0
Creates jobs	1	1
Governmental ownership	1	2
High investment cost	2	2
High risk, high reward	1	1
Increasing demand for electricity	6	12
Needs a substitute for fossil energy sources	2	2
Needs large amounts of electricity to produce hydrogen	1	1
Insufficient knowledge	1	1
It is important that Norway has different energy sources	1	1
It is important that nuclear power is transparent and truthful	2	2
Knowledge	0	0
Knowledge from news	4	4

Positive towards storing nuclear waste in Norway	6	9
Prefer other options over nuclear power	2	4
Energy conservation measures	1	2
Hydro energy	1	1
Improve the capacity of existing hydropower plants	1	3
Improve energy efficiency	1	1
Prefers nuclear power over other energy sources	4	9
Prefers nuclear power over fossil energy sources	1	1
Prefers nuclear power over onshore wind	4	7
Public perception	1	1
Young people seem more positive towards nuclear energy	1	1
Reliable energy source	1	1
More stable than renewable energy sources	1	1
Responsible for our own nuclear waste	6	8
Technological advancement	1	1
Safer than before	1	1
Trust professionals	2	2
Trusts the government bodies responsible for nuclear energy	7	7
Trusts the industries that would have been responsible for the construction of nuclear power plants in Norway	5	5

Knowledge from school	5	6
Literature	1	1
Media articles	4	5
Would look for information in research articles	2	2
Would look for information on learning platforms	1	1
Would look for information on the internet	3	3

Uncertain whether Norway has enough expertise in nuclear power	2	2
Uncertain whether Norway should invest in nuclear power	2	2
Uncertain whether nuclear power is necessary in Europe to reach the climate goals	1	1
Uncertain whether nuclear power is necessary in Norway to reach the climate goals	2	2
Visually nicer than other options	1	1
Wants to know more about nuclear energy	7	12
Would look for information in forums	1	1



Norges miljø- og biovitenskapelige universitet
Noregs miljø- og biovitenskapelige universitet
Norwegian University of Life Sciences

Postboks 5003
NO-1432 Ås
Norway