Systematic and evidence informed environmental impact assessment for industrial projects

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Summary

This chapter is a summary written in danish. It contains a short explanation of the problem, how it is approached and the results of the study.

Miljøvurdering af projekter er et verdensudbredt værktøj til at vurdere miljøpåvirkninger af projektet, som bliver brugt i beslutningen omkring om projektet skal udføres og hvordan. Miljøkonsekvensrapporterne har en tendens til at blive større og mere uoverskuelige. I 2014 blev EU-direktivet ændret til nu at inkludere muligheden for en afgrænsning, for at kunne fokusere miljøkonsekvensrapporterne på de væsentlige påvirkninger. Dog er det påvist i anden forskning af afgræsningen ikke lever helt op til formålet og at der stadig inkluderes uvæsentlige påvirkninger i afgræsningen. Dertil er det bevist i det studie størrelsen af rapporterne stadig er stigende. Det påvirker borgerinddragelsen og beslutningstagningen, da det kan være svært at finde rundt i og forstå disse rapporter og hvilke miljøvirkninger som er de vigtigste. Derfor startede dette studie med at kigge ind lovgivning og vejledning omkring afgrænsningen og denne vurderingen af de forventede væsentligt påvirkning. Derudover blev der lavet er systematisk litteraturstudie, som undersøgte hvad tidligere forskningsresultater omkring erfaring og metoder for afgrænsningen og den forventede væsentlighedsvurdering. Dette viste at der var fire gennemgående diskussionsområder, som er følgende:

- Hvad skal tages med i afgrænsningen
- Væsentlighedsvurdering – dets betydning og metoder
- Væsentlighedsvurdering er subjektiv, politisk og værdi-afhængig
- Væsentlige miljøvirkninger skal være omtalt og rapporteret ensartet og transparent

Det førte til følgende problemformulering og undersøgelsesspørgsmål blev opstillet:
Hvordan kan afgræsningen af miljøvurderinger og den tilhørende væsentlighedsvurdering blive lavet mere bevis-informeret, effektiv og kvalificeret?

1. Hvad er den nuværende miljøvurderingspraksis for afgrænsning og dennes forventede væsentlighedsvurdering og hvorfor er den sådan?
2. Hvordan kan tidligere miljøvurderinger bruges som information af de fremtidige afgræsninger og forventede væsentlighedsvurdering?

Dette er blevet undersøgt et induktivt casestudie af industriprojekter, hvor der er blevet udført seks interviews, dokumentanalyse af 31 miljøkonsekvensrapporter, og et spørgeskema med 36 svar. Dette studie er lavet i samarbejde med DREAMS-projektet, hvor dette projekts database over miljøkonsekvensrapporter og nogle kontakter har været benyttet i dette studie. Interviewene var ligeligt fordelt på disse forskellige aktører af miljøvurderingspraksissen: myndighed, konsulent og bygherre. Spørgeskemaet var lavet i samarbejde med tre andre studiegrupper, som også arbejdede sammen med DREAMS-projektet. Dette var sendt ud til deltagerne på Det Danske Center for Miljøvurdering's (DCEA) efteruddannelse og på deres LinkedIn side.
Miljøkonsekvensrapporterne var udvalgt efter opstillede kriterier, hvilket endte med 31 rapporter fra bilag 1 nr 10: Anlæg til bortskaffelse af ikkefarligt affald ved forbrænding eller kemisk behandling. Dette var hovedsageligt biogasanlæg. Til dokumentanalysen blev programmet, TagTog, brugt til markingen og kommentering af rapporten og disse data blev udtrukket til et Excel ark, som gjorde det muligt at sortere og søge i dataene.

Interviewene og spørgeskemaet er brugt til at analyse af undersøgelsesspørgsmål 1, hvor diskussionsemnerne fra litteraturstudie er brugt til at opstille strukturen af analysen.

Denne viste at den danske miljøvurderingspraksis også har en tendens til at inkludere uvæsentlige påvirkninger i afgræsningen. Hovedårsager til dette er: at er ikke er god nok vejledning på området, usikkerhed omkring den forventede væsentlighed og forsigtighed overfor klager af ekskluderede miljøvirkninger. I den nuværende danske praksis er det ikke nogen gennemgående metode for den forventede væsentlighedsvurdering og selvom borgerinddragelsen er en lovbestemt del af afgræsning, bliver den ikke brugt aktivt. Derudover er der en tendens til politikere kan finde på at blande sig i væsentlighedsvurdering, selvom denne skal være baseret på eksperter vurdering. Generelt er der enighed omkring at afgrænsningen og vurderingen af den forventede væsentlighed skal være transparent, men der er ikke enighed omkring, hvordan det skal gøres, og det skaber nogle konflikter.

Dokumentanalysen af miljøkonsekvensrapporterne er brugt til at besvare undersøgelsesspørgsmål 2, hvortil strukturen af analysen er stillet op efter væsentlighedskategorierne. Det viste sig at 75% af 633 fundne miljøpåvirkninger er uvæsentlige. Dette viser der er stort potentiale for at gøre afgrænsningerne skarpere ved brug af viden fra de tidligere miljøvurderinger. Klimapåvirkningen er hovedsageligt positivt for biogasanlæggene, hvorimod natur- og sundhedspåvirkningerne hovedsageligt er negative og med nærmest ingen forbedringstiltag. Dertil er der fundet at påvirkningen fra trafik og højere udledninger af ammoniak og nitrogen er de påvirkninger, så oftest ses som relevant at undersøge nærmere og derfor inkluderes i afgrænsning.

Udfra disse resultater er det dannet 11 anbefalinger. Resultaterne og anbefaleringerne er diskuteret og fortolket gennem institutionel teori og 'sensemaking' teori. Heri bliver der set på hvordan resultaterne hænger sammen og hvorfor anbefalinger er lavet.

1. Brug tid om at få kendskab omkring vejledningsdokumenter, som EU-vejledningsdokument på afgrænsningen
2. Inddrag borgerne mere aktivt in afgrænsningen
3. Inddrag politikere i afgrænsningen, hvis de har tilbøjelighed til at ville blande sig
4. Brug alternativer og kumulative påvirkninger til at undersøge påvirkninger i det anderledes perspektiv
5. Gør lovgivningsbestemte betingelser tydelige
6. Gør afgrænsningsprocessen og dennes beslutninger transparent og tydelige
7. Forbedre påvirkninger hvor det er muligt og passende
8. Inkluder forventede væsentlige positive påvirkninger i afgrænsningen også selvom at disse er grundlaget for projektet
9. Naturpåvirkningen af højere ammoniak og nitrogen udledninger kan være relevant at inkludere i afgrænsningen
10. Påvirkningen af mere trafik kan være relevant at inkludere både i forhold til sundhed og natur
11. Lave mere forskning på erfaringer fra tidligere miljøkonsekvensrapporter og saml data på påvirkningers væsentlighed

Det er konkluderet at det er stort potentiale for at mere fokuserede afgrænsninger og at brug af overstående anbefalinger vil være med til at gøre afgræsningen og den tilhørende væsentlighedsvurdering mere bevis-informeret, effektiv og kvalificeret.

Table of Contents

Introduction 1

Environmental impact assessment (EIA) is a worldwide tool that evaluates the impacts a project, either public or private, has on the environment [European Parliament, 2011; Fonseca and Fernandez, 2019]. The impact assessment is made in the early planning stage, and its purpose is to investigate the significanct impacts and the possibility to mitigate them, which is used in the decision process of whether the project is carried out or not. The EIA is made as legislation in the European Union and was first seen in 1985 [European Commission, 2020]. The EIA Directive has a broad scope, as it relates to all projects that are possible to have significant impacts on the environment, so there is not used unnecessary resources on projects with little or no impact on the environment [European Parliament, 2014; European Commission, 2017c,b]. However, there is no clear definition of a significant impact [European Parliament, 2014; European Commission, 2017b], which struggles for the practitioners in scoping. If an impact is determined significant, it will be examined further in the EIA report [European Commission, 2017b; Lawrence, 2007b].

The unclear definition of significance is causing a tendency of scoping impacts in instead of out [Fonseca and Fernandez, 2019; Jalava et al., 2012]. It is a reason why the scopes on the EIAs tend to grow [Fonseca and Fernandez, 2019; Jalava et al., 2012]. When the scope and significance determination fails, then the EIA becomes unfocused and irrelevant impacts are included in the scope [Jalava et al., 2012]. Also, there generally is a tendency that the scope is too broad. Thus, EIA reports are getting longer, which also influences the decision-making [Lyhne et al., 2017; Fonseca and Fernandez, 2019; Jalava et al., 2012]. However, there is no defined or clear method for determining the significance of an environmental impact, yet, there are a lot of examples and research on it [Wood et al., 2006; Lawrence, 2007b; Thompson, 1988].

To examine this struggle, this research has formed the research question:
How can the scoping of environmental impact assessment and the related significance determination be made more evidence-informed, efficient, and qualified?

It is examined through a case study of industrial projects and EIAs. There is made document analysis of 31 industrial EIAs, conducted six interviews, and a questionnaire. This study is made in collaboration with the DREAMS project. In this collaboration a workshop of annotating the EIA reports was made. Likewise, the questionnaire was made together with the study groups from the collaboration.

As seen in the two figures below, this study confirms that the reports' size and the analysis are growing. This tendency is shown over only a six-year time frame, and still, the reports have increased by roughly 25 pages, and the annexes increased by approximately 40 pages. Thus, this research is essential.

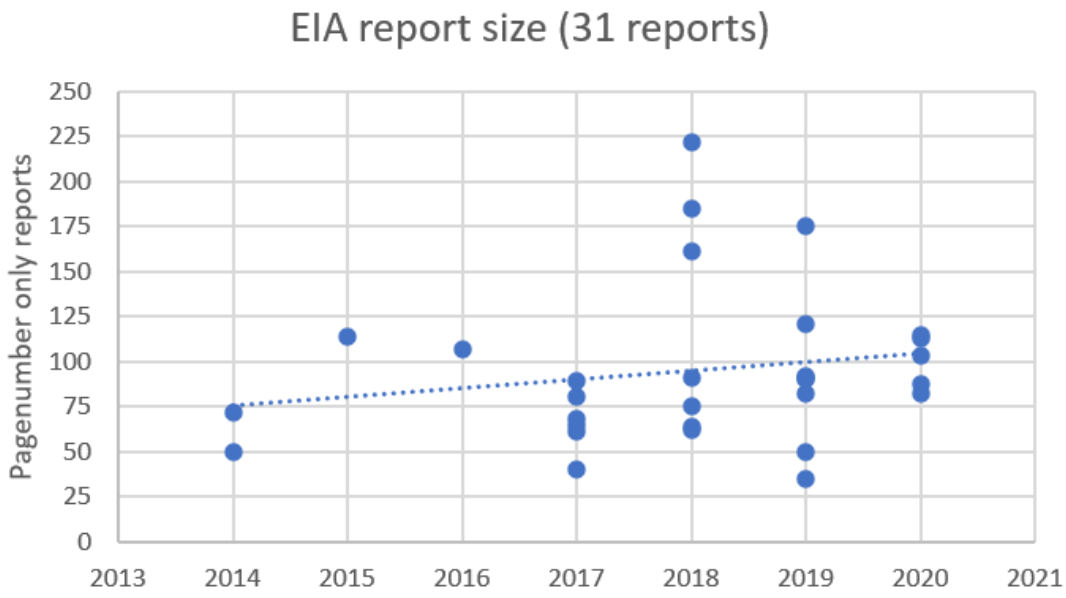


Figure 1.1: Size of the EIA reports without the annexes

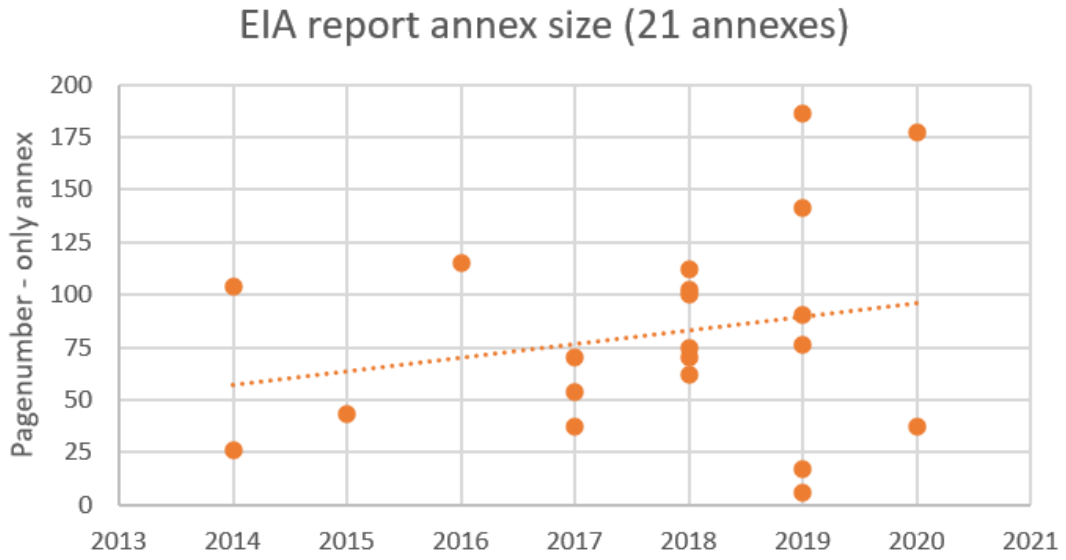


Figure 1.2: Size of the EIA reports' annexes

This report starts with making an overview of guidance, regulations, and research made on the EIA's scoping and significance determination, which end with the research question in section 2.3 on page 10. Afterward, there is an overview of how the report is structured in chapter 3 on page 12. Then the case is presented with how the data sources are selected in chapter 4 on page 14. The methods are then presented and explained as to how they are used to collect and analyze the data in chapter 5 on page 18. Next, there is made a presentation of the results in chapter 6 on page 23. The results are analyzed and discussed in chapter 7 on page 42. Lastly, the conclusion is in chapter 8 on page 46.

Scoping and the related significance determination 2

This chapter aims to get an overview and understanding of the EIA's scoping and the related significance determination. Firstly the regulations and the official guidance are presented. Afterward, the results of a systematic literature review of the research on this field are presented. The chapter ends with the research question.

2.1 Regulations and guidance

In the last amendment of the EIA directive, the scoping was included. It can either be implemented in the member states as a mandatory process, where it is required by the authority to make it, or a voluntary process, where the developer can request it from the authority European Parliament [2014]. The scoping was included in the regulation to improve the quality, simplify and streamline the processes [European Parliament, 2014].
This change was implemented a bit differently in the Danish regulation. In the Danish regulation, it is the authority's responsibility to make the scoping. However, the developer or his consultant can still give the authority a proposal to scoping, but it still needs approval by the authority [Miljø- og Fødevareministeriet, 2020]. Another difference between the EU- and the Danish regulation is the involvement of the public in the scoping process [Miljø- og Fødevareministeriet, 2020; European Commission, 2017b]. The EU-directive only demands to consult the environmental, local, and regional authorities with the scope before moving on, and not the public [European Commission, 2017b]. The Danish regulation does take the involvement a step further than demanded from the directive [European Commission, 2017b]. In the Danish regulation, there is made a hearing of the above-mentioned actors, where they can come with ideas and suggestions for the project and scoping (§35, stk. 1, nr. 2 [Miljø- og Fødevareministeriet, 2020]). Then the scoping document is made afterward.

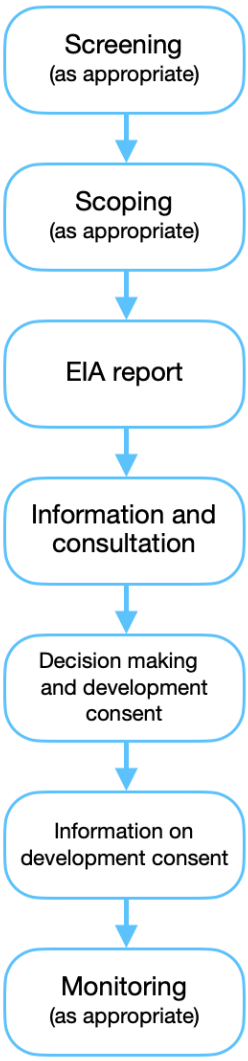


Figure 2.1: The EIA process [European Commission, 2017c].

Annex I projects starts directly with the scoping, as it is defined in the regulation that an EIA shall be made for these projects, and thus screening is not necessary. In the scoping, the first attempt to identify the expected significant impacts of the project is made. Here it is decided which impacts and how many of these will be included, and thus examined in the EIA report [European Commission, 2017b]. Determining the expected

significance is a big part of the scoping. It is meant to focus
the assessment on the impacts that are likely to be significant [European Commission, 2017b]. It saves time and money by only focusing on the relevant impacts of the project [European Commission, 2017b]. Yet, the legislation does not define what significance is [European Parliament, 2011, 2014].

Box 1: Context to understand the whole EIA process and how significance determination is a part of multiple steps.

The EIA-process can be seen in figure 2.1 on the previous page. Here, the first step of the process is **the screening**, regarding projects on annex II. This step is to decide whether there should be made an EIA or not [European Commission, 2017c]. The screening ensures that there is only an EIA on projects that have a possible significant impact on the environment [European Parliament, 2014]. Thus, significance determination is also a part of the screening. However, this significance determination is different because it focuses on the project as a whole [European Commission, 2017c,b]. The European Commission [2017c] has made a checklist for evaluating the significance of the project. This list is shown in appendix A on page 55. The competent authority makes the screening decision on whether the project should undergo an EIA process, and afterward, it is made public [European Commission, 2017c].

Jumping over the **scoping**, the next step in the EIA process is **the EIA report**, which is the final report of the assessment. The legislation sets specific requirements to which elements the EIA report as a minimum shall contain [European Parliament, 2014; European Commission, 2017a; Miljø- og Fødevareministeriet, 2020]. In this step, the significance of environmental impacts, included in the scoping, is examined and determined [European Parliament, 2014; European Commission, 2017a]. Those impacts that are found to have significant negative impacts will be monitored when the project is done [European Commission, 2017a].

The next step in the process is **information and consultation**. Here the EIA report is made available for the relevant authorities, interested organizations, and the public [European Commission, 2017a]. They are given the possibility to review and comment on the project and its impacts in a time frame of a minimum of 30 days [European Commission, 2017a; European Parliament, 2014]. The hearing answers on the project are used in the next step of **decision making and development consent**. The competent authority revisits the report and add the hearing answers and the comments to the report [European Commission, 2017a]. Then a conclusion of the EIA is made [European Commission, 2017a]. It discusses and examines the tools used to make the EIA and the information gathered, which the EIA is based on [European Commission, 2017a]. Next step is **information on development consent**, where the final decision based on the EIA report is published. The last step is **monitoring**, which means that the developer shall monitor the significant negative impacts of the project and the mitigation measures during the construction and operations [European Commission, 2017a].

The determination of significance related to the scoping mainly depends on experts [European Commission, 2017b], even though the interested parties and the public gets a chance to comment on the scope. The expert's determination of the significance depends on two things; value and context. Thus, it can nearly always be discussed if one or other experts see differently on the value and context [European Commission, 2017b]. The value dependency describes that every opinion is personal to some degree and can differ with the perspective, even though they are based on scientific data [European Commission, 2017b]. The context-dependency is about if the determination is made concerning the project's political, economic, and socio-cultural contexts [European Commission, 2017b]. In the guidance document for the scope, the European Commission [2017b] acknowledge that there is no standardized method for determining the significance of an impact, thus in good practice, it should be clear how the determination is made and on which criteria. However, the European Commission [2017b] presents two different methodologies for determining the significance of environmental impacts in the scoping; thresholds of significance or multi-criteria analysis.

Thresholds of significance

Thresholds can be used to determine the significance of an environmental impact [European

Commission, 2017b]. A threshold should be decided through legislation or scientific data, both quantitative and qualitative [European Commission, 2017b]. By deciding the threshold and afterward examining the environmental impact to see which side of the threshold is lying. If it is over the threshold, it is determined significant and if it under it is not determined significant.

The multi-criteria analysis
In this method, the environmental impact is analyzed by different criteria. Two criteria, which often are used to determine the significance, are [European Commission, 2017b]:

- **The magnitude** tells something about how the changes of the impact are happening, which can be the size, scale timing, and duration [European Commission, 2017b].
- **Sensitivity** tells something about how good or bad the environment is to handle changes [European Commission, 2017b].

When using this method, the two criteria should be described and explained. Thereafter, the importance of each criterion will be attached. These are then represented in a matrix which illustrates the significance of the impact. Below examples are shown in the figures of how to attach the importance and what a matrix can look like.

High	High importance and rarity, national scale, limited potential for substitution and low capacity to accommodate proposed form of change
Medium	Medium importance and rarity, national scale and limited potential for substitution. The receiving environment has some tolerance of the proposed change subject to design and mitigation
Low	Low or medium importance and rarity, local scale. The receiving environment is tolerant of the proposed change subject to design and mitigation

Figure 2.2: An example of how the importance of sensitivity can be attached to the environment [European Commission, 2017b]

Major	Loss of resource and/or quality and integrity of resource over a significant area; severe change/damage to key characteristics, features or elements for more than 2 years
Moderate	Loss of resource, but not adversely affecting the integrity over a significant area; partial loss of/damage to key characteristics, features or elements, for more than 6 months but less than 2 years
Minor	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements

Figure 2.3: An example of how the importance of the magnitude can be attached to the impact [European Commission, 2017b]

Impact magnitude	**Environmental sensitivity**		
	High	*Medium*	*Low*
Major	High	High	Moderate
Moderate	High	Moderate	Minor
Minor	Moderate	Minor	Negligible

Figure 2.4: An example of a matrix with the two criteria; Sensitivity and magnitude [European Commission, 2017b]

The European Commission [2017b] has also made a checklist for determining the significance of an impact, which can be seen in appendix A on page 55. This checklist can be used alone or together with the other methods of significance determination. The scoping's focus is to find the most significant impact. However, it should also consider other

aspects as shown in the figure below [European Commission, 2017b]. The determination of significance is linked with many of the other elements to consider doing the scoping.

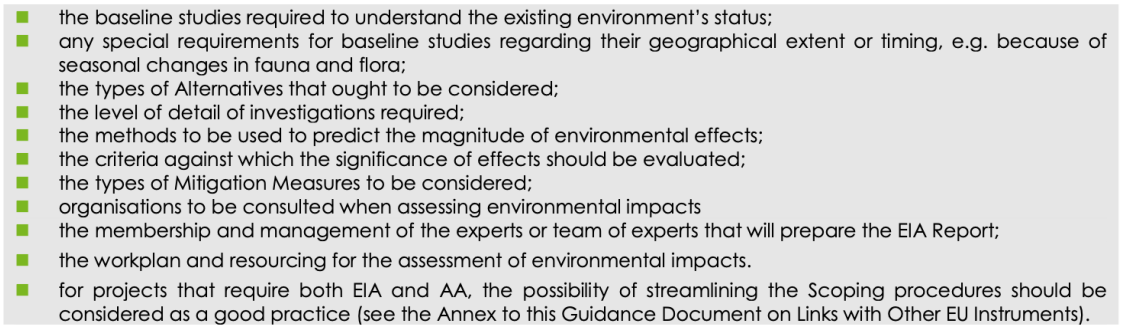

- the baseline studies required to understand the existing environment's status;
- any special requirements for baseline studies regarding their geographical extent or timing, e.g. because of seasonal changes in fauna and flora;
- the types of Alternatives that ought to be considered;
- the level of detail of investigations required;
- the methods to be used to predict the magnitude of environmental effects;
- the criteria against which the significance of effects should be evaluated;
- the types of Mitigation Measures to be considered;
- organisations to be consulted when assessing environmental impacts
- the membership and management of the experts or team of experts that will prepare the EIA Report;
- the workplan and resourcing for the assessment of environmental impacts.
- for projects that require both EIA and AA, the possibility of streamlining the Scoping procedures should be considered as a good practice (see the Annex to this Guidance Document on Links with Other EU Instruments).

Figure 2.5: European Commission [2017b]'s list of elements to consider in the scoping, besides finding the significant impacts.

It is shown that if either the scoping or the related significance determination goes wrong or gets too broad, it affects the rest of the EIA process. If the EIA report gets too long and filled with irrelevant information on non-significant impacts, it negatively influences the decision-process [Fonseca and Fernandez, 2019; Jalava et al., 2012]. It is also why the significance determination is seen as a necessary and crucial part of the scoping and EIA process [Lawrence, 2007b]. The goal of the significance determination is to make the EIA process more effective by only focusing on the relevant impacts by making a systematic, traceable and logical selection of the most significant environmental impacts from the project [Lawrence, 2007b]. Other than that the goal of the significance determination was that it should be adaptable to the different projects and environments [Lawrence, 2007b]. However, it is often the weakest part of the EIA process and the report, as it does not achieve the goal of focusing on the essential elements [L.A.Sandham et al., 2013; Lawrence, 2007b].

As the European Commission [2017b] also show, the significance determination depends on value and context, which means that politics and opinions also influence the result of the determination [Wood et al., 2006; Lawrence, 2007b]. The EIA process has hardly lived up to the goal of being systematic, traceable, and logical [Lawrence, 2007b], as it is glamorized as an unbiased, rational process, but it is actually close to the politics and valued opinions [Wood et al., 2006; Lawrence, 2007b]. That view of the process is misleading, and it influences the scoping and significance determination, which decides what gets the focus of the rest of the EIA process [Wood et al., 2006]. Hence there can be argued for a need for more clarity on scoping and significance determination, which is why there has been made a systematic review of the research on these topics.

2.2 Systematic literature review: Research on scoping and significance determination

Systematic literature review (SLR) is a method of going through research on a specific topic either because the topic is unclear or there is a need for a general picture to know where to point the future research [O'Brien and Guckin, 2016; Petticrew and Roberts, 2006; Higgins et al., 2020]. It can otherwise be used to map past research and methods in the development of new methods [O'Brien and Guckin, 2016; Petticrew and Roberts, 2006].

Box 2: The method of the Systematic Literature Review

SLR tries to collect all research that fits the pre-set criteria and answers a specific question using a systematic method of searching and going through the research afterward [Higgins et al., 2020; Zawacki-Richter et al., 2020]. The method and the steps taken to make this SLR have taken inspiration from Higgins et al. [2020], Zawacki-Richter et al. [2020], O'Brien and Guckin [2016] and Wolfswinkel et al. [2011]. The steps will now be presented and afterward described further:

1. Develop a review question
2. Make inclusion criteria
3. Develop a search strategy (The full search strategy is shown in appendix B on page 56)
4. Searching, selecting and documenting it
5. Using Grounded Theory to analyze the selected studies
6. Summarise and present the results

The review question

An SLR is a specified search in a decided direction [Cochrane, 2017; Zawacki-Richter et al., 2020]. To get this particular direction, there is a need to formulate a review question that manages the search [Cochrane, 2017; Zawacki-Richter et al., 2020]. For this study, the review question is formulated as: *What are the experiences and methods for scoping and significance determination of the environmental impacts in EIA?*

This review question is rather specific and thus gives the direction for the rest of the SLR. The first review question for this SLR was: *Which experiences are there with making EIAs, and what are the difficulties?* And it gave multiple thousands of hits and did not point the SLR in the direction needed for this study and further research. Also, the time frame of this SLR was very short as it was only a minor part of this study to make sure that it is state-of-the-art research.

Inclusion criteria

Before the search is done, it needs to be decided on which criteria the studies will be included in the SLR [Cochrane, 2017; Zawacki-Richter et al., 2020]. It is done to make the SLR systematic and transparent, so it is clear what criteria the studies have been included on and manage which studies are included [Zawacki-Richter et al., 2020]. E.g., the criteria can be that the studies only must be maximum a decade old to get the newest research in the SLR. Inclusion criteria can also be set to which country the study has happened or which language the study is in. The inclusion criteria for this study are:

- Shall to some degree answer and be relevant to the review question
- Shall be environmental research

The transparency of how the search strategy was made can be seen in appendix B on page 56. The final search resulted in 31 articles, where 14 of them were relevant for this SLR. Afterward, the 14 articles were read through, and primarily focused on the introduction, results, and conclusion. This resulted in 11 of the articles being relevant. The snowballing technique was then used on these 11 articles to find other relevant articles, and thus the article sample ended up with 17 articles. Using the snowballing technique, the additional article from the broadened out search, No 8, was also found again and then added in the sample.

A quality check of the articles was made before starting the article sample analysis. This was done by seeing if they were published in peer-reviewed journals, which they all were. That means the quality of the articles has a high standard, and they have been through relevant experts who had checked the content of the articles before they were published.

Using Grounded Theory to analyse the selected studies

Grounded Theory is an inductive method, which lets the themes from the literature reveal itself [Wolfswinkel et al., 2011; Eisenhardt, 1989]. Compared to a deductive method which test a specific theory, the Grounded Theory approach is much more open as it has no initials ideas [Wolfswinkel et al., 2011].

When the articles were read through as a part of selecting them for the article sample, everything relevant to the review question was marked in the text and copied to a new document. The analysis within the articles was the first part of the Grounded Theory approach [Eisenhardt, 1989; Wolfswinkel et al., 2011]. Next, the document with all the relevant quotes was gone through to find the consistent themes between the articles. The second part of the Grounded Theory approach was searching for patterns between the articles [Eisenhardt, 1989; Wolfswinkel et al., 2011]. When a theme appeared, it was put into a new document with the source of the article(s) and the quotes mentioning that theme. It resulted in these four themes, which were mentioned in several of the articles.

The next step was to discuss what the different articles tell about each theme and explore the logic's of the themes across the articles [Eisenhardt, 1989; Wolfswinkel et al., 2011]. It was done using the theme document, where all the relevant quotes from the different articles were added. This step also examines which articles were agreeing or disagreeing, and if some articles said something new, other articles did not mention, and so on.

The SLR can also be used if a topic still has unanswered questions even though there is a lot of research on it [O'Brien and Guckin, 2016; Petticrew and Roberts, 2006; Higgins et al., 2020]. More of these are reasons why SLR is used in this study. This SLR was used to get an overview of the topic, where there already is a lot of research, and find gaps in the research area, which provides the reason to make this study.

The results of the SLR were these four themes. The themes were discussed in multiple articles, which are listed after them.

1. **What should be included in the scoping?**: [Borgert et al., 2018; Jones and Morrison-Saunders, 2016; Dahlitz and Morrison-Saunders, 2014; Canter and Ross, 2014; Ross et al., 2012; Morrison-Saunders et al., 2014]
2. **Significance determination - meaning and methods**: [Jones and Morrison-Saunders, 2016; Dahlitz and Morrison-Saunders, 2014; Maclean et al., 2014; Lawrence, 2007a; Cloquell-Ballester et al., 2006; Rossouw, 2003; Piper, 2000; Canter and Canty, 1993; Thompson, 1988; Ehrlich and Ross, 2015; Lawrence, 2007b; Wood, 2007]
3. **Significance determination is subjective, political, and value-dependent**: [Dahlitz and Morrison-Saunders, 2014; Rossouw, 2003; Piper, 2000; Ehrlich and Ross, 2015; Lawrence, 2007b]
4. **Addressing significant impacts consistently and transparently**: Duarte and Sánchez [2020]; Jones and Morrison-Saunders [2016]; Lawrence [2007b]; Wood [2007]

What should be included in the scoping?

According to Borgert et al. [2018], the impacts included in the scope differ from the method used and the people involved. This statement is shared with Dahlitz and Morrison-Saunders [2014], who notes that different stakeholders have different views and goals. Thus, what they think is essential to include in the scoping will differ too. Likewise is Dahlitz and Morrison-Saunders [2014] stating that it is important to include impacts of the public's interest, as sometimes, the impacts the public points out, can be the real key impacts. Borgert et al. [2018] notes that there generally are two overall approaches for the scoping: the technical and the participatory. Following Canter and Ross [2014]'s statement, the scoping can not be made without all the stakeholders. Thus the participatory approach to the scoping is not optional. Also, Canter and Ross [2014] say the scoping should only focus on the impacts that actually matter to the decision on whether the project is going to be approved or not, and not try to include everything. This begs the question, how can the impacts which will affect the decisions made from the assessment be predicted? It is depended on each person's values and objectives.

Both Jones and Morrison-Saunders [2016], and Ross et al. [2012] points out that the scoping should only focus on the significant impacts, which is in agreement with the legislation. What significant impact is will be discussed further down in this literature review. Ross et al. [2012] also note that there seems to be a tendency to scope impacts in rather than scope them out, and even all-inclusive of impacts in some cases. They also comment that it will fill the report with irrelevant information on minor, not-important impacts and thus become little use in the decision-making. Lastly, as Morrison-Saunders et al. [2014] also points out, if the scoping goes wrong, it affects the rest of the assessment. However, what is right and wrong if it differs from the perspective and methods used? It is looked further into, by examining the significance determination, which purpose is to identify the expected significant impacts that targets the following EIA report. These expected significant impacts are the ones that should be included in the scope according to Jones

and Morrison-Saunders [2016], Ross et al. [2012], and the legislation [European Parliament, 2011, 2014]

Significance determination - meaning and methods

The significance determination is recognized as an important, central, and vital part of the EIA process [Ehrlich and Ross, 2015; Wood, 2007; Lawrence, 2007b]. Yet, both Lawrence [2007b] and Wood [2007] call it the least understood EIA activity. However, as Lawrence [2007b] explains, significance determination is a necessary activity. The assessment should be focused on the relevant impacts and gives the basis for the decision-making, which can also fit with the legislation [European Parliament, 2011, 2014]. Jones and Morrison-Saunders [2016] point out that some of the confusion around the concept of significance determination is caused by the legislation because the meaning differs through the different stages of the EIA process. Also, the legislation does not give a definition or explanation on significance determination [European Commission, 2017b; European Parliament, 2014], which makes a topic on how to understand significance determination, as four of the articles also discuss [Canter and Canty, 1993; Rossouw, 2003; Maclean et al., 2014; Lawrence, 2007b]. However, there is a broad consensus that significance determination is made from multiple values and varies between cases. The significance determination tries to explain the importance of the impact, which is dependent on the perspective and context. Like the scoping, significance determination is also dependent on values [Lawrence, 2007b; Rossouw, 2003; Ehrlich and Ross, 2015], which will be discussed further down the literature review.

Dahlitz and Morrison-Saunders [2014] and Jones and Morrison-Saunders [2016] point out there is a lot of guidance on how to determine the significance of an impact, yet there is no consistent method of doing it. As Maclean et al. [2014] says: *"The key problem associated with predicting the significance of impacts is the inconsistency in approaches used."* However, it can seem hard to choose one consistent method when the inputs differ between cases. Even if it is the same input, it will properly seem different anyway as it is in another context, perspective, and the location. It is why methods of significance determination are often discussed, as they have also been in 9 out of the 17 articles in this literature review. Six of the articles present specific methods, where the matrix- and threshold methods have been mentioned in more than one of the articles. One article tests a new approach by adapting a multi-criteria program to significance determination. However, Cloquell-Ballester et al. [2006]; Lawrence [2007a]; Rossouw [2003] agrees that is not sufficient to use only one method. Also, the significance determinations can not be made only by technical methods because they can miss the context, local values, and social impacts. Thus, there is a need for involving stakeholders and the public in a participatory approach [Lawrence, 2007a; Rossouw, 2003]. However, a consistent approach to determination significance is expert assessments, which have been spotted in five articles [Lawrence, 2007b; Piper, 2000; Borgert et al., 2018; Rossouw, 2003; Jones and Morrison-Saunders, 2016]. However, a problem with expert assessments is that they still are not total objective, and contributes to focusing more on global and national values rather than local [Lawrence, 2007b]. Again it points towards that two methods are necessary to determine the significance, like Lawrence [2007a] concludes: *"Combinations of approaches have the potential to counterbalance many of the negative tendencies of individual approaches. Potentially they can link and combine technical analysis and knowledge, community knowledge and perspectives, the qualitative and the quantitative, reason, analysis and methods, and multiple forms of expression."*

Significance determination is subjective, political, and value-dependent

As stated above, a significance determination can't be totally objective. Thus, values, perspectives, and contexts are a part of determining the significance, so it focuses on the specific case and includes the local views and values [Ehrlich and Ross, 2015; Rossouw, 2003; Lawrence, 2007b]. However, there is a need for a participatory method for this to work, so the value judgments are not focused on only one opinion [Rossouw, 2003; Piper, 2000]. Also, it has been mentioned by Lawrence [2007b] that significance determination is political, which often has not been acknowledged. However, it makes sense that politics influence the determination, as politics is a part of people's lives and values, and thus influences their perspectives, which influences the significance determination. Likewise, some communities and organizations can tend to lean more in one specific political direction. The solution to deal with this theme of subjectivity, political and value-dependent significance determinations, is discussed in the next section.

Addressing significant impacts consistently and transparently

Both Duarte and Sánchez [2020] and Jones and Morrison-Saunders [2016] agree on, if significance as a term and the significant impacts are addressed consistently and transparently throughout the whole EIA report, then it will give a better basis for the decision-making. Because it is possible to see what the significance determination is based upon, e.g., values and politics. Also, Wood [2007], Lawrence [2007b] and Jones and Morrison-Saunders [2016] points out that the impact significance criteria and the framework for examination shall be clearly stated in the report to enhance the transparency. As Wood [2007] concludes: *"...the challenges for EIA and impact significance determinations do not lie simply in the realms of improved science and the pursuit of unfailing objective expert opinion, but rather that clarity of communication of the assessment to decision-makers and the broader stakeholder community is a vital ingredient of success. Thus, rather than conceiving of impact significance determination as a simple case of objectivity versus subjectivity, more realistically, it becomes an issue of "how well subjective judgments are substantiated"*

Through this review, it is shown that the scoping should preferably only include the significant impacts. However, it makes sense that the scoping differs with the methods and people involved, as does the expected significance determination. Also, it is stated in multiple articles that it is preferable if the significance determination is made in the scoping stage. Thus it makes sense the two EIA activities have similar or the same problems on the results being subjective and value-dependent. Likewise is the participatory methods necessary and not optional for both activities to get the inclusion of those values, which can not be pointed out from the more technical methods.

As presented in this review of the 17 articles, the solution to these problems could be addressing the term significance and thus the significant impact consistent and transparent through the EIA report, so it can be understood how the results of the report were made. However, the problem of which impacts to determine significant and of that were the correct ones which were included in the scope, is not solved.

2.3 Research question

The previous sections have led to this research question:

How can the scoping of environmental impact assessment and the related significance determination be made more evidence-informed, efficient, and

qualified?

This research question examines how the scoping and related significance determination in environmental impact assessment (EIA) can be made more effective, evidence-informed, and qualified. Here the evidence-informed means that the future scoping and related significance can be based upon past experiences from other EIAs and their results. Efficient is understood as, there is a possibility of having a resource-saving by being able to reach a faster, and thereby cost-effective, decision upon whether impacts should be part of the scoping or not. Lastly, by qualified scoping means, if the future scoping and related significance determination can use data from past EIAs, it removes some of the subjectivity because the decisions is based on experiences in past EIA reports. Thus, it is also easier to make the reasoning transparent than explaining the involved peoples' opinions, values, and political standpoint. Two sub-questions have been formulated to help the direction of the research, which can be seen below.

- 1. What is the practice of the EIA scoping and the related significance determination, and why is it as it is?

This sub-question is made to get an understanding of the practice. The practice, in this case, is how scoping and significance determination are working and practiced. The sub-question is answered by analyzing how the practice in EIA is manifested through the regulation, guidance documents and research. Yet, knowledge about how it works in real life for the practitioners in the EIA processes is also needed. So to get knowledge and understanding about the reasons behind the practice and the way it is shaped, the project also includes experiences from Danish EIA practitioners.

- 2. How can previous EIAs inform future scoping and significance determination?

The purpose of this sub-question is made to gather the data and results on past experiences, which will give the basis for making the future scoping and related significance determination more evidence-informed, effective, and qualified. Here is important to acknowledge that this significance determination is the one that is made in the EIA report and included in the historical EIA reports, and not the one related to the scoping. Using the significance determination made in the impact assessment compared to the one in the scoping is based on a larger knowledge foundation. Thus, it gives a better basis for future EIAs. Answering this sub-question is done through analyzing historical EIA reports focusing on the question: which impacts are found to be significant or not significant in the impact assessment?

Therefore, a further look into the research design, rapport structure and the methods used to examine and answer these questions is required.

Report structure 3

This chapter aims to give an overview of the report, its structure and show how the different sections and methods fit together.

Figure 3.1 shows an overview of the report structure. The big orange box shows that all of this study is based on inductive methodology. Then the light green boxes are the different types of data and their methods used to examine the research question. The blue boxes are the presentation and analyses of the data used to answer the two sub-questions. The red box presented the results and the recommendation for the future practice. The yellow box shows that the theory is being used to discuss the findings and explain the findings. The theory is brought in after the analysis and its results, because of the inductive methodology. In induction there is a need for some findings to base the theory on. Lastly, the big green box shows that the case study is not applied to the whole study.

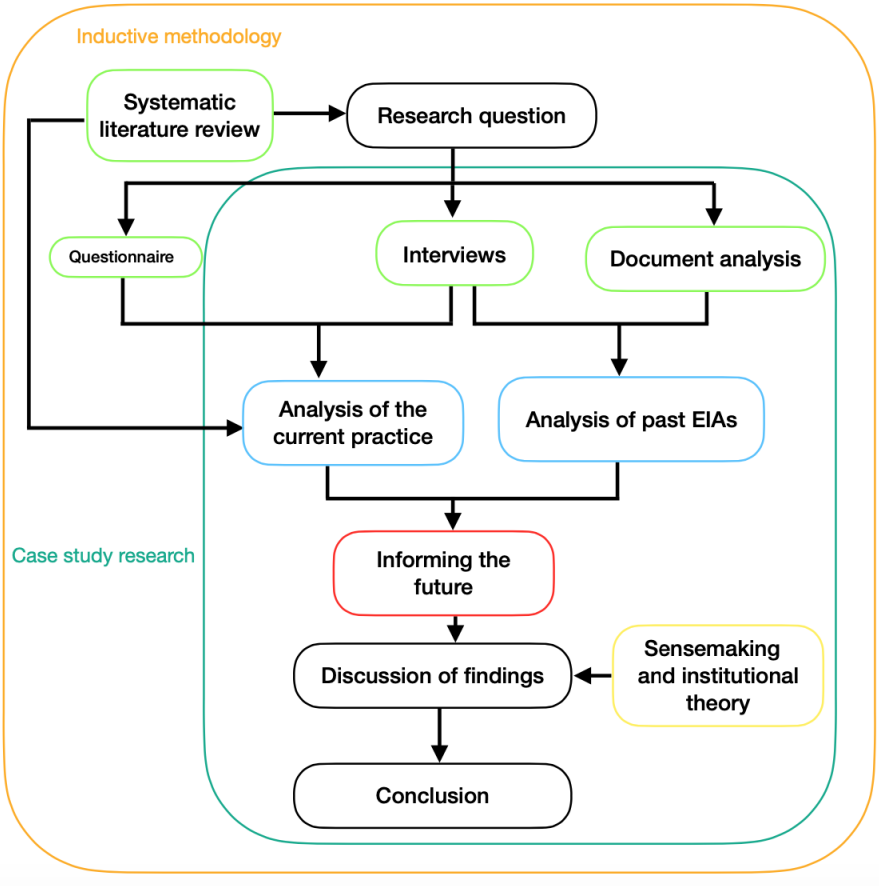


Figure 3.1: An overview of the report structure

The case study method is used to answer the research question (RQ). Thus the SLR is not a part of it, as it gives input to the RQ. The questionnaire is not a part of the case study method as it was not specifically targeted EIAs on industrial projects. The boxes placed horizontally illustrate the order of these sections does not matter for the result of the study.

Furthermore, the questionnaire box is smaller than the other data-method boxes because the questionnaire data is not equally important and has a smaller part in this study. With this understanding of the how report is structured and where methods are use, there is in the next two chapters described more about the methods, their application and how the data are selected.

The Case 4

This chapter aims to explain the case study method and how it is applied to this study. Furthermore, it explains what the case is and which criteria are used to select data.

The case study method is applied to most of this study as explained in chapter 3 on page 12. The case study method is used, as this study is explanatory and has created a "How"-research question. Likewise, this study does not require any control over the events happening, as it examines EIA reports that are already written. However, the examined issue is still current, which is a demand for a case study [Yin, 2014]. There have also been made interviews of EIA-practitioners to examine the EIA practice further. The case study research design is an embedded single-case design, which means that there is one case of the industrial projects and EIAs, but two analyses; one for each sub-question. The analyses is focused on finding experiences in past EIAs, which gives a better base for the future scoping and determination of significance. Using different sources of evidence and having two analyses reduces the risk of bias [Yin, 2014; Bowen, 2009].

4.1 Case selection and -criteria

The approach to selecting the cases was to focus on a subgroup of EIAs, which was decided to be industrial EIAs. A reason for this is that a sample of a subgroup can be used to generalize [Flyvbjerg, 2001]. The decision to focus the case study on a subgroup was made due to the study had a time frame of four months. Thus, there is a need to limit the sample size, so it is possible to go thorough through all the EIA reports in the sample.

The study focuses on industrial projects and not, e.g., infrastructure or energy projects because of the researcher's background. The researcher has the most experience working with environmental management systems in the industry. To utilize this knowledge, this study is focused on industrial projects. The researcher has had her internship and is working as a student worker at Niras in their industrial environmental department, where she received feedback and advice on this study. Two colleagues from this department have many years of experience within EIA and industrial projects, who have helped define what industrial projects are.

The definition of industrial projects is based on the legislation's annexes and classifies which points from both annexes can be defined as industrial projects. It was done by first going through the annexes in collaboration with one of the two colleagues. The result was looked over by the researcher and the other colleague. This was done to get two points of view on the definition, as some points can differ from case to case if they should and could be classified as an industry. It was also seen from the definitions made by the two colleagues, as one had a more broad view of the definition than the other. This definition of what can be defined as industrial projects is shown in appendix C on page 59.

This study is made in connection with the DREAMS project. This project is based on a triple helix constellation, which is a collaboration of the university, the industry, and the government [DREAMS, 2020]. The DREAMS project aims to make past experiences, reports, and data available for the environmental assessment (EA) practitioners, so the scoping gets more focused and the EA process more effective [DREAMS, 2020]. It is

done by integrating EA with digital tools, gathering EA reports into a database, and extracting the data to make it into a more searchable form. So the EA practitioners can easily find inspiration and look at past EA results [DREAMS, 2020]. Other than that, the DREAMS project wants to integrate the SDGs more into the EA process [DREAMS, 2020]. In total, there are four study groups collaboration with the DREAMS project but also each other. Two groups are on their master's studying Environmental Management and Sustainability Science at Aalborg University, one group on the second semester of this master's. One group is of their sixth semester on their bachelor studying 'By-, Energi- og Miljøplanlægning' at Aalborg University. The last one-person group is studying at SDU. The groups are looking at different areas of the EIA process.

4.1.1 EIA-report selection and -criteria

The definition of industry is too broad for this study to go in-depth with the EIA reports. There are therefore made some criteria for the selection for cases:

- **Pure industry projects**
  This means project types, that sometimes can be made in relation to industry and other times cannot, are cut off. It can be projects like pipelines and energy. This criterion is made to ensure the study is focused on industrial projects.
- **Critical volume of at least 20 projects in the project type**
  This criterion ensures that there are enough projects in the project type to give a reasonable amount of information to compare and analyze the scoping and significance determination and get an in-depth understanding of the problems.
- **Only annex I projects**
  This criterion is made to focus the analysis on projects on annex I as these projects have are likely to have an impact on the environment.

The 17th of March 2021, there were gathered 1017 EIA reports into the DREAMS' database, and the number grows as new reports are found. This database is where the industrial EIAs for this study have been found. Thus there is not much knowledge about the data collection and its methodology. However, the criteria for case-selection were used in this database to narrowing down which project types to focus this study on. The figures 4.1, 4.2 on the following page and 4.3 on the next page show the results after applying the criteria in the database. In this study, a project type is defined from the annexes' numbers, which means that annex I defines 29 project types, and annex II defines 13 project types [Miljø- og Fødevareministeriet, 2020]. Annex II has subcategories to the project types. These have caused the need to differentiate between these as well. Like in the application on the criteria of pure industry, the annex numbers removed was: annex I 16 pipelines, annex II 3 energy industry, and annex II 11c waste-water treatment plants, yet the number of project types only differs with two, as it was only a part of annex II 11 that was taken out. Also, in figure 4.2 on the following page, it is shown that after annex II 11c was taken out, the project type of annex II 11 only contained 11b.

17th March 2021	Number of reports	Divided on the number of project types
The database	1017	42
The whole industry definition	266	18
Pure industry	122	16

Figure 4.1: The difference in the number of reports and project types in the relation to the industry definition and pure industry.

Critical volume of minimum 20 reports of the project type	Report number
Annex I: 10 Waste disposal installations for the incineration or chemical treatment of non-hazardous waste	35
Annex II: 11 (b) Installations for the disposal of waste	24

Figure 4.2: The result after the criterion of critical volume have been applied.

Only annex I projects	Report number
Annex I: 10 Waste disposal installations for the incineration or chemical treatment of non-hazardous waste	35

Figure 4.3: The result after the criterion of only including annex I projects in this study.

1 report was of a plan	
2 reports did not work (it was not possible to mark only the needed words)	
1 report was missing from the database	
Reports analyzed in this study	**31**

Figure 4.4: The number of EIA reports analyzed.

4.1.2 Interviewee selection and -criteria

For the selection of interviewees, the broader industrial definition was used, which is seen in appendix C on page 59. The broader industrial perspective of the EIA practice was chosen to use to draw on different experiences from different businesses. Other than that, some criteria were made for selecting the interviewees, which are:

- **Experience with industrial projects and the associated EIAs**
  This criterion was made to make sure the interviewee had knowledge and experience appropriate for this study.
- **Worked on more than one EIA in the last five years**
  This criterion was made to make sure the interviewee did not only base their knowledge and experiences on a single case, which could have been a deviation of the normal practice. Also, it should have been in the time frame of the last five years to make sure the interviewee could remember their experiences. But also so they have experiences with working with the scoping as a regulatory-decided element in the EIA process.

It was decided to make six interviews divided into the different types of practitioners in the EIA process to explore different sides and experiences of the practice. Likewise, it was decided to have two of each type of actor to try to avoid sample bias and make the sample representative. To find and contact three interviewees, the DREAMS network was used. However, the other three were found and contacted outside the DREAMS network to avoid getting a biased sample. Below the different interviewees are listed:

- **Two authorities**
  Rene N. Antvorskov from Esbjerg Municipality
  Kirsten G. Nielsen from The Danish Environmental Protection Agency (EPA)
- **Two consultants**
  Lotte Weesgaard from Niras
  Ulf Kjellerrup from Cowi

- **Two developers**
  Niels Junge from Nature Energy
  Jacob Q. Christensen from Nymølle Stenindustrier

Below there is a presentation of the different interviewees with their background and experiences working with EIA. From now on, they will only be mention by their last name.

Rene N. Antvorskov from Esbjerg Municipality
Antvorskov is educated as a planner, and started working with agriculture supervision. He has worked in the county and has worked with EIA since 2005 but primarily with screenings. After the county closed, he has been in the municipality and has worked with EIA since. He was a part of a committee discussing the combining of the EIA and SEA in one legislation.

Kirsten G. Nielsen from The Danish Environmental Protection Agency (EPA)
Nielsen has been an engineer since 1989 and has worked with the industry since. She started working with EIAs in the early 90s. Besides that, she works with environmental allowances and -supervision.

Lotte Weesgaard from Niras
Weesgaard worked in the county of North Jutland until it closed, with industry and inputs to EIA's. Afterward, she had a year working in a municipality before she came to a consultancy firm. She worked with industry environment and agriculture, which had EIA as a part of it. From 2012 she has mostly worked with biogas plants and started making EIA's on them in 2014. She came to Niras in the early in 2015.

Ulf Kjellerrup from Cowi
Kjellerup is a qualified jurist, has written a Ph.D. about environmental assessment, and worked with EIA for over 30 years, both as a researcher and practitioner. Besides, he has made two large analyses about the environmental assessment directives and how these were implemented in national regulation in the EU member countries. He has also been a part of the ministry of the environment's committee and helped written the danish environmental assessment regulation. Lastly, he has helped to write the EU guidance documents ([European Commission, 2017c,b,a]).

Niels Junge from Nature Energy
Junge is a qualified engineer, and is a part of the business development in Nature Energy, where he has been since 2019. It is in Nature Energy he has worked with EIAs.

Jacob Q. Christensen from Nymølle Stenindustrier
Christensen is a qualified raw material geologist and has worked in Nymølle Stenindustrier for four years. He has worked with EIAs for about 20 years, started working as an authority, then became a consultant, and now is a developer.

This presentation of the interviewees shows that they have been selected because of their expertise in EIA, even though it was a real struggle finding two developers that could live up to the criteria. It has been presented why industrial EIAs are the chosen case for this project, with the selected data sources and their criteria. The methods of study, the data collection and how these are analyzed, are thereby presented.

Methods 5

The purpose of this section is to get an understanding of how the methods were utilized throughout this study.

5.1 Induction

The overall methodology of the case study is induction. The inductive approach focuses on the data and findings and uses that to make a theory [Bryman, 2016; Brooks, 2013]. So the theory follows the data in induction compared to deduction, where the theory comes first and is tested, thus the theory decides the scope for the data-collection [Bryman, 2016; Brooks, 2013]. In this study, the inductive methodology is seen in the SLR, where the grounded theory is used to analyze the articles. The outcome of the analysis was the theory that *the scoping and the related significance determination can be optimized.* From that theory, the research question was made.

The inductive method was then repeated. To answer the research question, the focus was put on gathering data; the interviews, the EIA reports, and the questionnaire. The inductive methodology is also shown as the gathered data produced findings. The connection between the methods, data, and which sub-question these are answering is seen below in table 5.1.

Method	**Data**	**Used in sub-question**
Semi-structured intervews	6 interviews	Sub-question 1 and 2
Document analysis	31 EIA-reports	Sub-question 2
Questionnaire	36 answers	Sub-question 1

Table 5.1: The connections between the methods, the collected data, and what sub-questions these answer

5.2 Document analysis method

A document analysis of the case selected EIA reports was chosen to gather data about how the practice is today and which is used to inform the future EIAs. A document analysis contains different steps, which often are finding, selecting, appraising, and synthesizing [Bowen, 2009]. As explained in section 4.1 on page 14, finding the EIA reports were done through access to the DREAMS-project's database. The same section explained the selection method of EIA reports. Because this study is a multi-method study, the appraising and synthesizing of the EIA reports are done with the interviews and questionnaire. The appraising done in the results made in chapter 6 on page 23 and the synthesizing is done in the discussion of findings in chapter 7 on page 42.

The data extracted from the EIA reports are:

- **The significance of the impacts; nature, climate, and human health**
  Focus was placed on three environmental impacts to enable a thorough review of the

reports, and see which parts of the impacts were significant. It was chosen to use the same ontology as the DREAMS project, which focuses on these three impacts.
- **The significance determination of these impact or part of them**
  The information of the different impacts' significance determination are used to inform the future EIA reports scoping.

The human health impacts in some reports were closely linked with societal impacts, and in other reports, they were totally separated. Thus, it was hard in those cases where they were linked to only focus on the health part. Some societal impacts in the seen data may have been mentioned more times than registered due to some reports being structured differently.

A program called TagTog was used for the data extraction from the EIA reports. TagTog is a program that can pre-annotate from the ontologies it is given. It means, when a document is uploaded in TagTog, it marks the word, which has been added in its dictionary and thus makes it easier to find and connect the relevant elements in the report. The three other study groups collaborating with the DREAMS project and their supervisors used this program and expanded its dictionary together.
To extract meaningful data from TagTog, when annotating keywords, they need to be connected. Underneath, there are shown two examples on this is done.

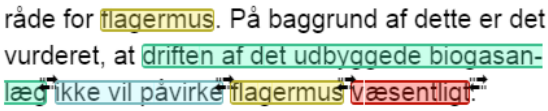


Figure 5.1: An example on keyword-connection in TagTog from the EIA report on Vaarst Biogas plant

Here *driften af det udbyggede biogasanlæg* is marked as the activity that is impacting the environment. To this marking, it was annotated that the activity was happening doing the operation of the biogas plant. It is beneficial if it could not be marked together, like in this case. This marking is connected to the *ikke vil påvirke* saying it is not impacting the environment, which in this case are the bats, *flagermus*. They are also connected. The marking of the bats is also annotated as an insignificantly negative impact. Thus the output from TagTog is the connection string of words and not the single words or markings, which gives the whole meaning for the significance determination of the impact from the biogas plant. It is advantageous when the key-word or meanings are spread in different sentences if there is no clear conclusion on the significance determination, like in this example.

A workshop was made, where all the groups and the two supervisors got together to initiate the annotation of the EIA reports. The reason for this day was to get annotations more aligned with each other. To work on this, each person annotated the same piece of text from an EIA report. The result from the two tests was that the different people annotated the words a bit differently, but the overall extraction of information and meaning was the same. Thus, it can be said to a good method for looking into the significance of these impacts.

All the reports were then annotated, and the data transfered to excel. An example of the data-sheet is seen in figure 5.2 on the following page. The extraction showed that 636 strings of related words were made. The data-sheet was used to sort the data either by significance or by impact to make the data more understandable and manageable. The result of the data extraction can be seen in section 6.2 on page 31.

Column3	Column4	Column5	Column6	Column8	Column9
Sub-activity	Phase	Predicate	Impact	Significance	Mitigation measure
etableringen	2. Construction	Påvirkningen	parrings- og yngleperioden	Væsentlig og negativ	holde marsvinene på af
oplag af ensilage	3. Operation	medføre	lugtgener	Væsentlig og negativ	overdæk- kes lagrene
fast husdyrgødning	3. Operation	medføre	lugtgener	Væsentlig og negativ	overdæk- kes lagrene
Gaskedlen, den ældste bi	3. Operation	påvirke	menneskers	Væsentlig og negativ	

Figure 5.2: An example of the data-sheet sorted by negative significant impacts

5.3 Semi-structured interview

The second source of evidence in this study is semi-structured interviews. The interviews were chosen to be semi-structured to make it possible to focus the attention of the interview in the direction that gives the relevant knowledge for this study [Brinkmann, 2013; Halkier et al., 2010]. Compared to an unstructured interview, the focus in the interview was decided beforehand [Brinkmann, 2013]. However, the semi-structured interview was also chosen to give the interviewer the possibility to ask follow-up questions to new aspects, which is not possible with a fully structured interview [Brinkmann, 2013; Halkier et al., 2010]. An interview guide was prepared beforehand, to make sure the required knowledge from the interview was attained. [Brinkmann, 2013; Halkier et al., 2010]. The interview guide can be seen in figure 5.3 below.

Figure 5.3: The interview guide.

The interview guide was made this way with bubbles to illustrate that semi-structured interviews are not linear, and the questions are often not answered in the same order. This

interview guide made it easier to keep the overview of the interview questions because it was made with only keywords and bubbles, compared to a traditional interview guide where all questions are listed in complete sentences and questions. The interview guide worked in that way that the interview started with the rectangular box at the top. From there, the interviewee explained how an EIA is made. The interviewer then needed to make sure that every thin-lined bubble was answered to the two thicker-lined bubbles, which are the scoping and significance determination.
Besides that, it was chosen to do the interviews in Danish as it is the interviewees' natural language, and thus it gave more qualified and in-depth answers as they did not have to translate their answers.

The interviews were made as individual interviews. It makes it easier to steer the interview in the direction that makes sense to the study, which is more challenging in a group interview [Brinkmann, 2013]. The interviews were done online using Microsoft Teams due to Covid-19. It made it possible to have interviewees from different parts of the country compared to face-to-face interviews, which would have been more resource-consuming [Brinkmann, 2013].

The interviews were not fully transcribed as it was too time-consuming to do alone. Instead, it was transcribed by note-taking the answers. However, a weakness of this method is that it is not possible to get the complete picture of the answers. It was taken into account when the note-taking was made, trying to note all the relevant elements of the answers. No notes were taken when the interviewee sidetracked.
A quality check was made of how the interviews were interpreted and used. It was done by sending the section 6.1 on page 23 where the interviews are analyzed to the interviewees. The interviewees replied with corrections and additional discussion points. All the interviewees approved the section. There were also sent translated quotations to some interviewees for them to approve to ensure their quotations were not misunderstood and translated correctly.

The presentation of the results of the interview is made in section 6.1 on page 23 together with the questionnaire data.

5.4 Questionnaire

The questionnaire was made together with the other three groups, collaborating with the DREAMS project. There was a shared document where all of us came with input to the questionnaire and reviewed each other's elements. The questionnaire was made together as the groups properly had the same target group of EIA practitioners to answer the questionnaire and prevent the participants from having more questionnaires to answer. The target group was the different types of EIA practitioners, as authorities, developers, and consultants. Before it was distributed, the collaborating groups went through the questionnaire to test it and check it for mistakes.

The questionnaire was distributed to the EIA-practitioners, who are a part of the DREAMS project. It was also sent out with mail to present and previous participants of The Danish Centre for Environmental Assessment's (DCEA) postgraduate course, which the supervisors are a big part of. Lastly, the questionnaire was shared on the DCEAs LinkedIn page. It resulted in 36 answers.

The questionnaire was made in Survey-xact, which also was used to make the statistics over the answers.

Through this chapter, the methods of how this study is conducted have been presented. In the next chapter, the results of the data collection are presented.

Results 6

The purpose of this chapter is to present the results of the collected data. It is split up between the interviews together with the questionnaire data, and then data from the EIA reports.

The first section presents the results from the interviews and the questionnaire. The discussion themes from the SLR in section 2.2 on page 6 isboth used to structure these results into different categories and to see how the current danish practice is working compared to the international research articles' tendencies and struggles.
The second section presents the results from the data extraction of the EIA reports, which is structured after the different significance categories.
The last and third section sums up the essential results and composes recommendations, which are used to inform the future practice of EIAs.

6.1 The current practice of the scoping and significance determination

In Danish regulation, the scoping became a mandatory element after the regulatory reform in 2017 (§23 [Miljø- og Fødevareministeriet, 2020]). Kjellerup from Cowi and Weesgaard from Niras mention that the scoping becoming a regulatory demand has been called for. The EIA reports should focus on the significant impacts and not drown in the insignificant impacts. The EIA reports are easier to read through when you only have to read about the significant impacts [Weesgaard, 2021]. It makes the number of pages shorter and focuses on the relevant parts [Weesgaard, 2021]. The scoping is also used to discuss how comprehensive and detailed the following EIA report shall be (§23 stk 1 [Miljø- og Fødevareministeriet, 2020]). Therefore not all elements in the following report need to be equally important to focus on the relevant aspects. When making the scoping and the related significance determination, some actors must be involved because of the regulation [Miljø- og Fødevareministeriet, 2020]. These actors are the competent authority (§17), the developer (and his consultant)(§19), the other relevant authorities (§35 stk 1 nr. 2), and the public (§35 stk 1 nr. 2). The competent authority is responsible for the scoping (§23) [Miljø- og Fødevareministeriet, 2020]. The requirement for involving the public is a part of the Danish regulation but not in the EU directive. Two documents is produced doing the scoping. One is used in the involvement of the public and relevant authorities to present the project and informs about other element presented in §35 stk 2 [Miljø- og Fødevareministeriet, 2020]. It gets published in connection to the involvement. The other is scoping document, which gets finished after the involvement. There is no requirement of publishing the scoping document. Both Kjellerup and Antvorskov say that it is hard to involve the real and diversified public and not only one segment of the public. Kjellerup points out that it is important to be open and make all the information available when involving the EIA actors and the public. Communication should likewise, be clear and straightforward [Kjellerup, 2021]. Besides the regulatory demands of involvement, Weesgaard and Antvorskov mention, they also include experts in the scoping. Antvorskov also tries to involve the politicians in the scoping. Christensen from Nymølle Stenindustrier says it can be hard to work with the public and politicians in the scoping. The discussion, if not careful, ends up being for or against the project instead of taking a decision on an

informed basis in favor of the environment [Christensen, 2021]. It is an interesting fact Christensen mentions, as it could be a sign that it is more infrequent that the public gets involved through meetings in the scoping, than after the EIA report is done.

The two consultants, Kjellerup and Weesgaard, agree that a challenge of the scoping and its related significance determination is that it is made early in the process, where there is often not much information on the project. Antvorskov from Esbjerg Municipality agrees with them and adds that it is hard, as a decision is made on the elements that are first known later in the process. With respect to this challenge, Junge from Nature Energy explains that they solve it by adding flexibility into their project design, as it is impossible to know all the information early in the process, and there are always made changes. However, Christensen explains that this challenge is made on purpose, so the project design is not locked. Thus it is easier to make changes to the project to protect the environment [Christensen, 2021]. He states that this is also why the developer should be a big part of the scoping and the significance determination, as it is he who has the power to make the big changes in favor of the environment [Christensen, 2021]. Yet, he understands the dilemma, as making the EIA and its scoping with little information on the project is not easy.

Kjellerup explains that the scoping document and its decisions on the significance and inclusion of impacts in the EIA report are not binding but more process guidance. The authority can always ask to get more elements examined. Christensen says that it is causing some risks, as it can slow or even stop the process when the authority asks for extra examination on impacts. He adds that the extra information and assessment can also be caused by politics being involved in the EIA. For Christensen, as developer, it is a disadvantage that the scoping is not yet more streamlined. Thus it makes the EIA and their investments risky, as it is rare to figure out the process beforehand. Even though Christensen would like the process more streamlined, it is complex as the EIA as a tool, has a broad focus on different projects. Thus it cannot be totally streamlined, as it should be possible to fit the EIA to the various project types. Also, it differs from the project in which environment it is located, which causes problems with streamlining the process. Likewise, can project adjustments made under the EIA process cause other impacts to need to be examined. It is also directly stated in the regulations that the authority can always ask for supplementing information. The European Parliament [2014] states (article 5 no 3c): *where necessary, the competent authority shall seek from the developer supplementary information, in accordance with Annex IV, which is directly relevant to reaching the reasoned conclusion on the significant effects of the project on the environment.* It is however unknown if the cases where Christensen has been asked for extra information have been caused by the right reasons as the regulation says; it shall impact the reasoned conclusion of the EIA. To look further into scoping practice, an extra look is taken into what to include in the scoping and how it works in today's practice.

6.1.1 What should be included in the scoping?

Following the directive article 5 paragraph 1 and the guidance documents; "*Scoping is primarily focused on identifying the most significant effects, to be assessed in-depth at a later stage, and on determining the scope and level of detail of information to be provided in the EIA Report; however, it may also address other additional matters.*" [European Commission, 2017b]. Additional matters could be alternatives, and mitigation measures, which also are linked with the significance determination. Two interviewees mention that some additional matters get too little attention in the scoping. Christensen mentions alternatives, and Antvorskov mentions cumulative effects as elements that need more attention earlier in the process. Focusing more on cumulative effect in the scoping can help

identify the expected significant impacts, as some impacts only become significant when viewed through how they are interrelated with similar impacts in the near environment. Alternatives can be used to remove some of the significance of impact by considering these early and making adjustments. Both elements could affect what impacts should be included in the scoping, e.g., a traffic impact is maybe not significant by itself, but examining it cumulatively, it becomes significant as the road capacity is nearly full. Likewise, adding in the alternative of a different route maybe change the significance again. Thus, these are the good elements to help form the scope.

The SLR showed in section 2.2 on page 6, what impacts are included, differs depending on who is involved in the scoping and which method is used. The questionnaire also showed that 76% thinks that there is a tendency to include impacts rather than exclude impacts in the scoping. Weesgaard, Christensen, Nielsen, Antvorskov and Kjellerup also agree with this tendency. As there is no requirement of publishing the scoping document, it is not clear in the report why impact gets excluded, if it is not voluntary published. Thus, some reports make smaller sections of insignificant impact to explain why these are excluded from the scope. Still, they were mentioned in the reports, therefore it can be discussed if they were included or excluded in the scope. It means that the scoping does not yet live up to the goal in the regulation, focusing the following EIA report on the significant impacts. Weesgaard prefers to input the scoping document in the EIA report so the scoping's reasoning for the included and excluded impact is a part of the report. Christensen explains he does not input the scoping document in the report, there are made a section describing the scoping and its decisions.

A statement from the questionnaire says: *There is no clear guidance on what the scoping shall include or how it shall be made.* 73% did agree or highly agree with that statement. Either these actors do not know the guidance documents or think it is insufficient and too much on a general level. Weesgaard does not know the EU guidance documents and explains it is hard to find time to become acquainted with the different guidance documents. Weesgaard knows the danish guidance document, Miljøstyrelsen [2018], but thinks it is insufficient as it still is a draft, and the approved Danish guidance is about the old regulation. Doing this study has revealed three guidance documents from different authors; the European Commission [2017b], Miljøstyrelsen [2018], and The Environmental Protection Agency (Ireland) [2017]. The European Commission [2017b]'s is only focused on the scoping process, and thus, it can seem like it is because the practitioners do not know these guidance or they does not have the time to become acquainted with these documents, as in Weesgaard's case. There is therefore a big potential of using the existing documents. Antvorskov explains that he sees a correlation between the scoping's quality and the actor's, who did the scoping, experience, which means that those with a lot of scoping experience make better scopings. Thus, by using the guidance documents more, it raises the general quality of the scopings.

Weesgaard does also experience this uncertainty in the authorities when they make the scoping document. They often have a middle course between expected significant or not significant, which is 'can be significant' or 'should be examined' [Weesgaard, 2021]. There is most often more impacts are placed in that middle course rather than determine them insignificant or significant. She adds that the authorities are doing it because the authority wants to be on the safe side so the public thinks it has been properly examined [Weesgaard, 2021]. As an authority, Antvorskov agrees with the reason and adds, when they add these insignificant impacts in the examination, if they get complaints, they have their arguments ready, as it already has been properly examined. However, Antvorskov also acknowledges that it is why the reports are getting bigger and more complex.

Weesgaard tells that sometimes the authority wants a small section about the impacts that they have investigates as insignificant. It makes no sense to include insignificant impacts in the scoping, to write a method section, describe the environment before and after the project in a small section about an insignificant impact [Weesgaard, 2021]. It giver a better overview to refer to the scoping document, which she inputs in the EIA report, so the reasoning behind the excluded impacts is explained and a part of the EIA report [Weesgaard, 2021]. The scoping document already explains why the impact is insignificant and should not be included, and if the public want to know this reason, they can look in the scoping document. However, Nielsen, an authority, thinks it is fine with the small sections to insignificant impact, which she knows is vital to the public, to show that they are aware of the impact, but it is not significant in the particular case. It is done to make the reasoning more transparent and explain why the impacts are excluded, as the scoping document is not published [Nielsen, 2021].
Furthermore, Nielsen experiences that the consultants tend to do more of these small sections of excluded impacts in the EIA report. In contradiction, Weesgaard says the impacts in the EIA report should either be described thoroughly or not at all, and the excluded impact should be explained in scoping document, which is attached to the EIA. Thus it seems like the scoping's element of agreeing on how comprehensive and detailed the following EIA report shall be (§23 stk 1) does not work as intended. Or at least there are different views on what that means and how it should be done. Besides, the European Commission [2017a] say: "*If Scoping has been carried out, the significance of effects may have been either indicated or, in some cases, already determined at the Scoping stage and, therefore, practitioners should refer to the Guidance Document on Scoping.*" It is interesting to see how different the process of making the excluded impact transparent is and how it is handled. However, it can seem a unnecessary work to explain the reasons behind the excluded impacts again in the report, thus it must be to prefer to include the scoping document and referring to that, as suggested from the European Commission [2017a].

Weesgaard also thinks there is still an adaption happening for those of us who have been an EIA actor many years before the regulatory reform. The carefulness around the significance determination is also confirmed in the questionnaire. 75% agree or highly agree with the statement: *There is a tendency that impacts get included due to uncertainty about the significance.* The EIA regulation builds on the precautionary principle and protecting the environment. Still, it seems like it is taken even further in the EIA and its scoping when looking at the questionnaire data and answers from the interviewees.

It is shown that the Danish scoping practice is follows the tendency seen in the international research (section 2.2 on page 6). There is a tendency to include insignificant impacts in the scope. This tendency is caused by the lack of known good guidance on the scoping, the uncertainty of impacts' significance, and the cautiousness of complaints about excluded impacts. Even though the scoping document gets published in some cases, it does not seem normal in the practice. Publishing the scoping document could focus the EIA, as there would not be a need to include small sections about the excluded insignificant impacts to make the reasons behind them transparent.

There are some impacts that the interviewees repeatedly say are included in the scoping. In contradistinction, Antvorskov says that he does not see the same impacts included, but it differs in relation to the project. Thus it is also worth mentioning that Junge and Weesgaard are working with biogas plants, and Christensen is working with raw material extracting. The impacts that were mentioned by two or three of the interviewee were:

- Noise

- Traffic and transport
- Nature
- Landscape
- Air and smell

The questionnaire data shows that the most often included scoping impacts differ greatly, and there is no absolute consistency in the answers. However, three impacts that got the highest percentage got 36% or 39% of the answers: Human health, climate, and material goods. Also, the 29% answer that it is project-specific, so it differs between projects.

The other way around is Weesgaard, Christensen and Junge point out that there are no impacts that get excluded more often than others. As too many impacts get included in the scoping, the significant impacts drown in between all the insignificant ones. It is also confirmed in the questionnaire, as 78% agree that there is no tendency to exclude some impacts rather than others. It is interesting to see how most practitioners agree that there is a tendency to include rather than exclude, but not the other way around. It fits with the theory of that the practitioners takes the precautionary principle even a step further. To answer the question in the headline of this section, those elements that should be included in the scoping, are the expected significant impacts and their additional matters, which could be relevant. Thus, it is project specific, however, working in one industry, there will be some consistent impacts, that are expected significant. It is important not to repeatedly include the same impacts in the scoping to get it as project specific as possible. Even though it is the similar project, it is placed in a new location, which can change some impacts. This is a reason why the significant determination discussion is important so that the reports can be focused on the essential impacts.

6.1.2 How to do the significance determination?

In the SLR, it was discovered that there was a need for using at least two different methods to make the significance determination. A technical method and a participatory method, where the last mentioned is not optional. This is due to the need to include local values in the determination. The participatory approach is included in the danish regulation as a hearing of the public on ideas and suggestions (§35 stk 1 nr 2 [Miljø- og Fødevareministeriet, 2020]). As an authority, Nielsen experiences very differently how much the public engages in this hearing. She explains: "*If the company already has a good dialog with the neighbors, there are often no or only a few neighbors' complaints. Other times there comes many hearing answers. However, it is most often if there already are some problems*" [Nielsen, 2021]. It is a natural element of people; if they are met with a good attitude, there is less room for conflict. Larsen et al. [2017] made a study of improving dialog and reduce conflict in the EIA process to renewable energy project. It suggests that if the public is included in early planning and listened to, it reduces the possible conflict between the developer and the public. Also, there is a need for acknowledging the public concerns [Larsen et al., 2017], which means that some impacts get included in the scoping due to the public's concerns about the expectation of them being significant. There should otherwise be a dialog of why the impact is not significant and reduce the public's uncertainties about the project [Larsen et al., 2017].

Kjellerup questions why only two methods should be used, as he explains different methods cover other angles that can be relevant to the significant determination of the various impacts. Yet, Nielsen means she covers the most, making an overlay analysis using, e.g., *Miljøportalen*, and thereby checks what is in the project's proximity. She supplements that with complaints from similar projects and research results. Weesgaard also uses an overlay analysis and supplements it with the municipality's plans, visualization programs,

and expert knowledge. Antvorskov, Junge, and Kjellerup also mention experts as a go-to, when doing the significance determination, but the experts decide the methods themselves. Antvorskov says that they use a multi-criteria analysis, like the one in the EU guidance document (shown in figure 2.5 on page 6), but they are using different criteria than the EU example. The criteria Antvorskov is using are probability and consequence. It is an interesting approach and different from the others as it is possible to use this method on all impacts. It will, however, need to be properly backed up with other methods like the ones mentioned above. Antvorskov included beforehand, the matrix in the document to give a more visual of the significance determination. Yet, they stopped showing the matrix in the reports because of many complaints, as people did not read the belonging text explaining mitigate measure of the significant impact. Thus, they are now only writing it as a text in the report, and only using the matrix internally [Antvorskov, 2021]. One of the results from the SLR was that a standardized method of the significance determinations was wanted. The multi-criteria analysis could be an example of a standardized method. Thus it is interesting that Antvorskov tried such a method and it ended with poor experiences. It is also unknown in which cases Antvorskov used that method, and if other elements could be the reasons of the complaints. Christensen says that their choice of method depends on what point of view is to be examined, but it often ends with mostly being a discussion back and forth between him as developer and the authority. So they do not have a specific method for the significance determination.

Christensen points out that developers shall be a big part of this process because they can make the big project adjustments and mitigation measures. He says that the developer sometimes gets a bit excluded from the process, and the EIA process is just between the authority and the developer's consultant. Nielsen, Weesgaard, and Kjellerup also mentions the developer as a big part of the scoping. Besides that, Kjellerup, Christensen, and Weesgaard explain that the public is important in significance determination to get local and social values included. However, it can be hard to engage the diversified public. Christensen's experiences with involving the public in meetings is best in a small coffee meeting rather than a more extensive public meeting. The bigger public meetings often end up being managed by a few citizens with obvious agendas, and are usually not the closest neighbors. These meetings often end up being for or against. The small coffee-meetings with neighbors are much more constructive, getting the best solution for the environment. Christensen's reasoning by using more resources on the public is that their line of business (raw material extraction) and biogas plants are very typically 'Not in my backyard'-projects, and thus, closedness is not helping to get the public's acceptance. It can be tricky as it can differ a lot between people, what is enough to get their acceptance. Christensen says: "*Yes, we are different - we, as engineers, are good at determining significance. However, the EIA is also about involvement, understanding, and acceptance - and you do not get the acceptance if the process is closed. It must be communicated openly and with transparency, along with they (the public) shall have the opportunity to participate. However, your communication shall be clear and set a framework for the participation.*" To this, Antvorskov mentions an alternative way for involving the public to an "open wind turbine" event, which uses the principle of "open house"-events. Following the Larsen et al. [2017]'s results, Antvorskov and Christensen are on the right track of getting a better dialog with the public, and thus minimising the risk of conflict. Based on Christensen's experiences on involving the public early in the process, it indicates that starting the dialog with the public early is not really evolved.

It is shown that the expected significance determination is made from many different methods, where involving experts is a big part. The involvement of the public in the scoping is a requirement in the regulation. However, it does seem to be actively used

in the general practice. There are good experiences involving the public more actively doing the scoping, as it gives the public the possibility to express their concerns and form the following EIA process. For this involvement to succeed, it requires open and explicit communication. The future scoping should focus on involving the experts to get the highest quality and focused scoping. Likewise, more active involvement of the public should be a part of the scoping to start an open dialog and listen to their concerns.

6.1.3 Scoping and significance determination is subjection, political, and value-dependent

A finding from the SLR was that the significance determination is impossible to make completely objective. Junge says, he sees the significance determination is objective, as it builds upon expert knowledge, as the subjectivity is removed to some extend with natural science arguments [Junge, 2021]. However, it is shown by Lyhne and Kørnøv [2013] that even experts notice different elements. It was illustrated by an experiment where nine experts were given a case, where they found different impact significant [Lyhne and Kørnøv, 2013]. Kjellerup states that if the reasons and arguments behind the methods, choices, and decisions are clear, then it removes some subjectivity. Junge says that he experiences the hearing-answers from the public sometimes are more constructive than objective. Yet, the questionnaire data shows that 75% agree or highly agree with the statement: *The different actors have a tendency to focus on their personal concerns*, which means that the actors are not objective. Weesgaard experiences, especially the scoping as a subjective step in the EIA process, as the municipality often has the best knowledge about what shall be included in the scoping even then Weesgaard has made a draft of the scoping for the municipality to approve. She elaborates that the regulatory threshold value removes some of the subjective for those impacts that have used decided values. Besides, Weesgaard tells, that they try to have methods for the impacts that do not have the regulatory thresholds values, so no matter who uses the methods, it will give the same result. Thus, it also removes some subjectivity. She says, however, that there is still subjectivity about whether the project looks nice or not, and about the noises a company makes, even when they respect the threshold values. Nielsen agrees with Weesgaard and adds that her job as an authority is to look after all interests. Thus it sometimes takes up more place than the developer or his consultant thinks is needed. Nielsen does not see a solution for this challenge about the subjectivity. According to Christensen, the EIA is also used in politics to throw some light on an impact they think is essential. He says: "*Sometimes it is caused by politics. We experience that the politicians even interfere with the details in the scoping document. It is also a democratic process, but there is a need to remember that the significance determination of different impacts is a specialist task.*" According to Christensen, this subjectivity and political involvement are a problem as it makes it impossible to see through the EIA process, making it risky for him as a developer to know if the investment should be made. Antvorskov explains, that he tries to involve the politicians in the scoping, so they can express their concerns and point of view. Then they do not come later in the EIA process, causing the need for extra information, examination, and delays.

The answers just presented in this section all come by introducing the interviewees to the same statement, which is also this section's heading. Thus it also shows how differently they interpret the statement and the significance determination. The statement (heading) was also presented in the questionnaire, where 42% (highly) disagree, and 31% (highly) agree. The guidance documents, Miljøstyrelsen [2018] and European Commission [2017b], express that the significance determination shall be an assessment made by experts. However, it can still never be objective, as experts also interpret things differently [Lyhne and

Kørnøv, 2013]. Therefore is it shown that the Danish scoping practice is consistent with the international research in the SLR. How to handle this is looked further into now.

6.1.4 Addressing significant impacts consistently and transparently

As mentioned in the last section Kjellerup's solution to the subjectivity of the scoping and significance determination is to make the choices and decisions clear and transparent, so it can be understood why some impacts are included or excluded in the scoping. Antvorskov agrees that the process should be transparent in the scoping and the following EIA report. Weesgaard adds that she always makes sure that the methods and hearing answers are obvious in EIA report to make it transparent. Christensen explains that project adjustments also should be made transparent throughout the EIA process, or else it ends up being misleading as the report only shows the result of the impact being insignificant, where it was actually a significant impact when the project started. This transparency is important to understand to process behind the EIA, and as stated before, no one wants to read about insignificant impacts. Therefore, if it was significant, it is important to tell and explain what changes were made to make it relevant to the report and why it was included.

Besides that, Kjellerup explains that if the EIA report shall be well-arranged and understandable, there is a need for systematizing and structuring the content and keeping it short and precise. It starts in the scoping with the impact that gets included and determined significant [Kjellerup, 2021]. Weesgaard agrees with this and adds that it gets even harder to engage the public if the reports are long and contain many insignificant impacts. Nobody wants to read about irrelevant impacts [Weesgaard, 2021]. Antvorskov points out that he sees a need to structure and address the impact consistently as the analysis gets more complicated and difficult to understand. The proportions of the analyses get bigger, and the reports get longer, which results in them getting more complex and harder to understand [Antvorskov, 2021]. Antvorskov experiences the consequence of that as the people who get mad over the projects get even madder as it is hard to understand. Interestingly, they point out the report as a barrier to involving the public. Still, the dialog between the EIA practitioners and the public could start way before there is a report. Of course, the report should still be structured and understandable. Yet, it seems like the option of creating a dialog earlier is not an option even though it is one of the initiatives that could reduce the risk of conflicts [Larsen et al., 2017].

Kjellerup tells that the EIA is a good tool as it can be used for all kinds of projects. However, it also makes it hard to streamline and make actual guidelines as it differs in relation to the project [Kjellerup, 2021]. Christensen agrees and adds that understanding the EIA as a tool gets even more complicated when different conceptions on what it should be used for, and how to do it. There is also the challenge of, if the project is too fixed, then the EIA cannot reach an environmentally better solution, and thus it does not achieve the goal [Christensen, 2021]. Weesgaard experiences the opposite, that the project has not been detail-designed many years before it can be built, and it is hard to make the EIA due to not knowing the information. They will not use expensive engineer-hours to detail-designed the project when they do not know the environmental circumstances in the chosen location [Weesgaard, 2021]. Thus she explains, that the general project design is often made with the EIA, but the detailing is first made afterward. Project changes always come, and it can be hard to know if there is a need for a new screening or full EIA, or if necessary none [Weesgaard, 2021]. Christensen agrees and adds that he has never known the whole EIA process beforehand, as it constantly changes, and mentions he has tried making two EIAs for the same project. Christensen and Weesgaard see different problems, which spring from the same basis, that things change, which causes the risk

of making an additional or new EIA. Junge adds that it is a problem when the authority requires the developer to be too specific in the later EIA reports, causing risks of needing to make additional EIA because of changes on the project after the EIA process. It removes focus from avoiding environmental damage to project specifics, e.g., where the buildings should be placed [Junge, 2021]. However, the regulation defines that the EIA shall be made before there can be given permission to the developer to start constructing the project (§15 [Miljø- og Fødevareministeriet, 2020]). The precautionary principle, as mentioned early, is the reason behind this, as its purpose is to avoid irreversible and major environmental impacts. Thus, the EIA needs approval before the project can be done. The project is often between not planned at all, which causes problems because of the little information about the project, or the project is fully designed, causing no room for changes to favor the environment.

The knowledge about the current practice is now used to look further into how it can be used later on. A lot of good knowledge is found in the EIA´s, but there is no knowledge about whether these were correct in their predictions. Nielsen proposes: "*You can look at how often they get complaints and of what. It is my experience that the scoping, and thus also the reports, rarely misses.*" Suppose there are no complaints when it can be assumed that the EIA was correct. Based on this, she experienced that the scoping and the EIA report rarely miss the significant impacts. Weesgaard's opinion is that it is because (nearly) all impacts are getting included, and thus, it cannot miss. This way of examining it does not say anything about how correct the EIA´s predictions are, because of the subjectivity there can come complaints over noise and smell even though the requirements are complied with. Kjellerup states that nobody cares for the project after the decision is made. Likewise, there are even fewer that care about if the EIA predictions were correct or not [Kjellerup, 2021]. The results of the examination of the earlier EIAs is presented in the next section. What parts of the three selected impacts are significan/not significant, which is used for the future EIA´s, will also be addressed.

6.2 Information from the past EIAs

In this section, the appraising of the document analysis is made, which means that the EIA reports and its data extraction are evaluated. The significance determination the three selected impacts; nature, human health, and climate is addressed. In this section the significance determination looked into, is the one examined in the EIA reports. The pattern, if any, in the determination from the 31 reports will be looked into. this can be used as the foundation to make the future scopings more evidence-informed. To make sense of the results presented below, the 30 reports were of biogas plants and one of a biofuels refinery, thus is in the following sections the specific impacts to this industry are discussed. The section of these was presented in section 4.1 on page 14. Below there are two figures. One shows how many of the 31 EIA reports included the three selected impacts (figure 6.1). The other one shows the result of the annotation of 31 EIA reports (figure 6.2 on the next page).

Nature	Human health	Climate
27	26	23

Figure 6.1: The number of reports that included the impacts.

Here it is shown that 27 reports have included nature as either significant or should be examined in the scoping. The same goes for 26 reports with human health and 23 reports

with climate. Here it is interesting that climate is scoped out most times, as it contradicts the results of the questionnaire, as 39% say that there is a tendency to scope climate in rather than out. Still, 23 of 31 reports scope climate in, so it is still over two-thirds of the reports.

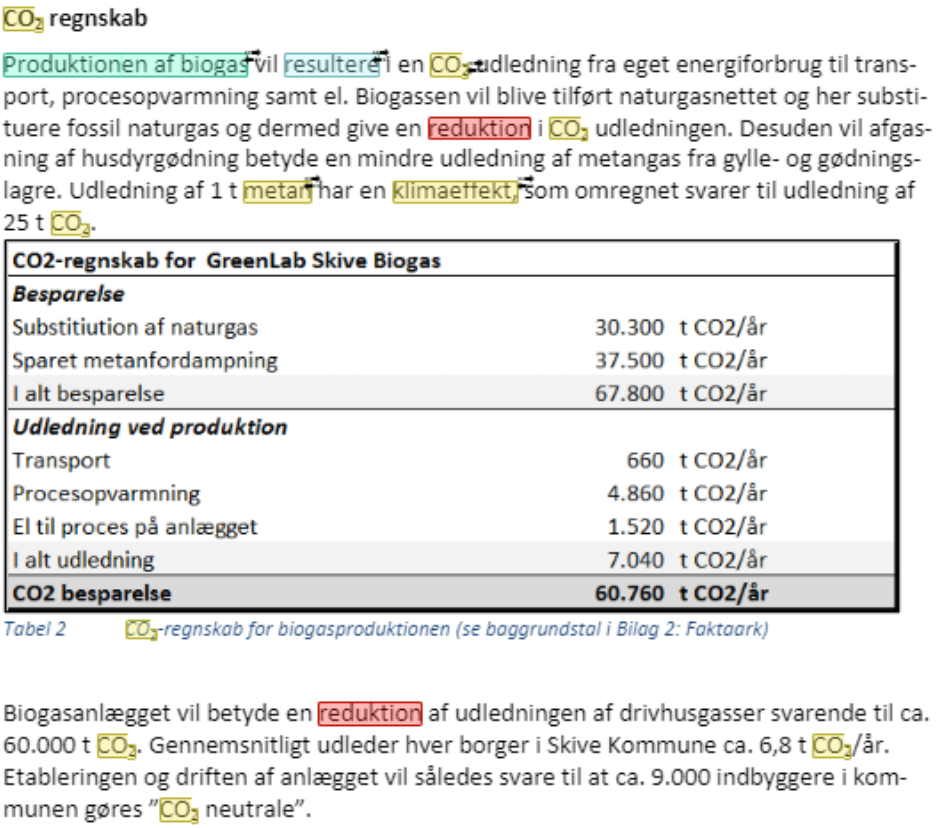
Significance/impacts	Nature	Human health	Climate	In all
Significant (positive)	0	0	35	35
Unknown significance (positive)	1	10	21	32
Not significant (positive)	1	1	0	2
Not significant (neutral)	3	7	0	10
Not significant (negative)	300	155	10	465
Unknown significance (negative)	48	21	1	70
Significant (negative)	10	9	0	19
In all	363	203	67	633

Figure 6.2: The result of the significance determination of the 31 EIA reports biogas plants and one biofuels refinery

Here it is interesting to see how the positive impacts are focused around the climate impact. Furthermore, the climate impact is the impact, which was included in the fewest reports. It shows however, a tendency in the reports, that are including climate to show that the project has a positive impact. Compared to the number of negative impacts on nature and human health, there is not much focus on how the projects positively contribute. However, it can be said that there is a focus on including and handling the social and human impacts, even though it is not a positive focus. Still, by including the human health impacts in the reports, it shows the public that they are aware of them, which is a start to getting the public's acceptance [Larsen et al., 2017]. A closer look is now taken at the different impacts of the significance categories.

6.2.1 Significant positive impacts

An interesting element is that it is only the climate impact that has significant positive impacts. These impacts are from the favorable climate effect from the substitution of fossil fuels with biogas. Meaning minor CO_2-, methane-, and nitrous oxide-emissions or, in more general terms, fewer greenhouse gasses. Besides this, some of the significant positive impacts are from recirculating nutrients, as the farmer uses degassed biomass instead of artificial fertilizer. Making the substitution with degassed biomass saves the emissions from the production and transport of the artificial fertilizer. Using the degassed biomass does reduce the washout of nitrogen compared to when the farmer spread normal slurry. All 35 impacts are in these categories. A typical example of how the EIA reports are presenting their CO_2 account is shown in figure 6.3 on the following page. In the conclusion related to this example, it is written directly that it has a significant positive impact. In the cases where the saved emissions are compared to the CO_2 emissions from citizens, it has been decided as a significant impact, as it is the developer that tries to make the result more tangible when the public is reading it.



CO_2 regnskab

Produktionen af biogas vil resultere i en CO_2-udledning fra eget energiforbrug til transport, procesopvarmning samt el. Biogassen vil blive tilført naturgasnettet og her substituere fossil naturgas og dermed give en reduktion i CO_2 udledningen. Desuden vil afgasning af husdyrgødning betyde en mindre udledning af metangas fra gylle- og gødningslagre. Udledning af 1 t metan har en klimaeffekt, som omregnet svarer til udledning af 25 t CO_2.

CO2-regnskab for GreenLab Skive Biogas		
Besparelse		
Substitiution af naturgas	30.300	t CO2/år
Sparet metanfordampning	37.500	t CO2/år
I alt besparelse	67.800	t CO2/år
Udledning ved produktion		
Transport	660	t CO2/år
Procesopvarmning	4.860	t CO2/år
El til proces på anlægget	1.520	t CO2/år
I alt udledning	7.040	t CO2/år
CO2 besparelse	**60.760**	**t CO2/år**

Tabel 2 CO_2-regnskab for biogasproduktionen (se baggrundstal i Bilag 2: Faktaark)

Biogasanlægget vil betyde en reduktion af udledningen af drivhusgasser svarende til ca. 60.000 t CO_2. Gennemsnitligt udleder hver borger i Skive Kommune ca. 6,8 t CO_2/år. Etableringen og driften af anlægget vil således svare til at ca. 9.000 indbyggere i kommunen gøres "CO_2 neutrale".

Figure 6.3: An example from the Greenlab Biogas report of a how they present their CO_2 account

The CO_2 accounts look like they are only made of biogas plants' operations, which shows a big saving of CO_2 by substituting fossil fuels with biogas. The result will look different if it was instead made from a life cycle perspective, but how much different is hard to know. Also, the specific way of calculating these results is not always transparent. It will nevertheless, depend much on what there is used as biomass in the plants. Most reports mention manure as the primary source of biomass, if they use that and there is a security of supply, then it is correct that it is CO_2 neutral, because only using manure for biogas production has a positive impact [Schmidt and Brandão, 2013]. An analysis presented by Energistyrelsen [2020] shows that 64% of the biomass used for biogas in 2018 were trees, straw, and decomposable waste, and around half of that were imported trees. Thus, it sounds like the security of the supply of manure could need to be mentioned in the reports. 9 of the analyzed 31 reports were between 2014 to 2017, thus was a part of the analysis of the types of biomass used in biogas production. Likewise, the decision of making more biogas plants is a part of bigger planning of the transition to renewable energy. This decision is made on the basis of biogas plants having a more positive climate impact than fossil fuels. Thus it can seem as a bit irrelevant to include the climate impact into the scope, so it gets examined in the EIA report. Besides, it is shows that biogas production can have as many emissions as fossil fuels if the wrong biomass is used for production [Schmidt and Brandão, 2013]. Thus, the biogas plants' climate impact depends on what is used to make the biogas, which is relevant to point out in the EIA.

The above mentioned is important to acknowledge if the climate impact includes in future scopings. If the project is decided on the basis of being environmentally better than fossil fuels, it can seem irrelevant and insignificant to include climate in the scoping as it not an

efficient use of resources to prove it again. Besides, this result, of the climate impact is generally positive, and cannot be directly a foundation to the future scopings, as there is too many unknowns in calculation methods and the security of correct biomass supply. The other way around, the impact being significantly positive could be the reason to include it in the scoping. The climate impact is significant positive is the drive behind the decision to do the project. Thus, by including it in the scope, it shows the project's positive impacts, making the EIA more diversified on both negative and positive impacts. It helps make the EIA of the project more transparent as it focuses on all significant impacts.

6.2.2 Unknown significance positive impacts

The climate impacts of unknown significance are the same impacts as described in the section above. Yet, in these 21 cases, the impact has not directly been said to have a significant impact or compared to citizens' emissions.

Besides, there are 10 positive impacts on human health, but with an unknown significance. Among these 10 impacts, there are impacts like the locals and how they gets environmental and societal advantages; reducing emissions, local waste treatment, security of energy supply, and more jobs. The jobs are mentioned twice in the 10 impacts. Furthermore, a biogas plant's work environment is mentioned, as they have a big focus on the safety of their employees. Besides that, it is stated that it is a low-priced method of producing biogas by using domestic animal manure. These 10 impacts come from four reports, meaning only four of the 26 reports, that scoping in human health, has focused on the benefits for the society of getting the biogas plants. Thus, it can be said that there definitely is room for improvement to focus more on positive health impacts. Focusing on social and health benefits minimize the risk of adversity from the public [Larsen et al., 2017].

Lastly, the one nature impact with an unknown positive impact is that making a plantation belt bigger may create a place where the bats can find food.

6.2.3 Insignificant positive impacts

There are two insignificant positive impacts. The first of them is a nature impact: planting a windbreak makes more habitat for small birds and insects. Sadly enough, there are only two positive nature impacts, this one and the one above of unknown significance. It seems therefore, that the Danish biogas plant industry practices very little the enhancing of nature around the projects. Another study of Danish EIA reports also showed this tendency of little use of enhancing mitigation [Larsen et al., 2018]. There is definitely room for improvement in enhancing mitigation of nature impacts.

The second insignificant positive impact is by setting up information signs by walking and cycling paths. It provides the possibility to read information about the biogas plant.

The positive impact sections above, show that there is limited focus on the positive and enhancing nature and health impacts. Focusing on enhancing social and health impacts will reduce the risk of conflict with the public, as it shows locals interest. Still, the inclusion of the health impact is a good start. Also, enhancing nature could be a favorable element in getting the public's acceptance, as it shows that the developer is using the opportunity to improve the nearby environment. Thus, there is room for improvement of positive nature and health impacts. This result of limited focus on positive impacts can be used in the future scopings to consider other elements, which can have enhancing effects. However, there should not be included impact in the scoping to show their positive impact, which most reports have done with the climate impact in this case. However, with regards to the impacts included in the scoping with significant effects, both positive and negative,

there should be focus on how these can contribute positively. If help is needed to consider how the included impacts could positively contribute, then the public would properly be a good place to start, as they know the area.

6.2.4 Insignificant neutral impacts

In total, there are 10 insignificant neutral impacts. First, there are the seven human health and society impacts. Here it is mentioned twice that house prices do not get impacted. Other than that, neighbors, noise, and recreational areas get mentioned. Besides, it is stated that the biogas plant does not use poisonous materials or any sorts of heavy metals. Thus there is no health risk with these. Lastly, the visual aspect was also mentioned. It did not impact the neighbors or users of recreational areas as it, in this case, was only an extension of the existing biogas plant.

There are three nature impacts - one of which is neither the establishment nor operations of the biogas plant, impacted otters or their habitat, as this was 1,5km away. The other two are impacts on the stream, where the impacts are the nearby field operations and the operations and possible accidents on the biogas plant.

6.2.5 Insignificant negative impacts

The insignificant negative impacts are the biggest of the categories, with a total of 465 impacts. To make it more visual, how the different negative insignificant impacts are allocated, the nature impact, and the human health impact is set up in tables.

The nature impacts have 300 impacts, which are insignificant negative impacts. In figure 6.4 it can be seen how they are allocated and what they are impacted by. Suppose the impacts (Habitats, plants, and animals) are added together. In that case, the number will not give 300 as there are more general impacts, as nature, nature types, habitat, animals, flora, and fauna, which refer to the impacts shown in the table.

Impacts		
Habitats	**Plants**	**Animals**
Natura2000 (x 29)	Engkarse (x2)	Forskellige slags flagermus (x 19)
Beskyttede naturtyper, § 3 (x 19)	Almindelig Star (x 2)	Forskellige slags frøer (x 15)
Habitat naturområder (x 16)	Dynd-padderok (x 2)	Markfirben (x 9)
Ammoniak-følsom skov (x 9)	Fladstjerne	Stor vandsalamander (x 6)
Mose (x 9)	Kær-snerre	Odder (x 4)
Eng (x 8)	Knold star	Gås (x 2)
Sø (x 3)	Næb star	Sæl (grå eller plettet) (x 2)
Vandløb (x 3)	Ålegræs	Tudse
Hede (x 2)	Gul iris	Troldand
Hav	Eng-kabbeleje	Snegl
Løvskov		Marsvin
Rigskær		
Askeskov		
All of the above is impacted by:		
Construction work (Noise, dust, vibrations, heavy traffic, establishment of gas pipeline) (x 97)		
Operation: Traffic and noise (x 106) Light (x 1) Operation: Higher pollution of ammoniac, nitrogen or both (x 94)		

Figure 6.4: The allocation of the nature impacts and what they are impacted by.

Here it is worth noticing that the higher pollution of ammonia and nitrogen from the operations stands for around a third of the impacts on nature. Also, it is shown that there not the same attention on plants compared to animals and habitats.
After going through these impacts again, while making this overview, some of these negative insignificant nature impacts may also have been placed under insignificant neutral impacts. This is possible, as some of the reasoning behind the EIA reports was that, e.g., the Natura2000 was placed a long distance away from the project, and thus it was not impacted no matter what. They are placed in negative and not neutral insignificant because if the project impacted the Natura2000, the impact would be negative.

There were 155 human health and society insignificant negative impacts. The overview over these is seen in figure 6.5. Again, if the impacts are added together, the number will be too high due to some of these impacts are connected, and thus two appear in one word-string in the datasheet. Other impacts are connected to a more general term as the project, which makes impact-meaning more indirect, e.g., the impact smell indirectly tells it impacts the neighbors.

Impacts:	**Impacted by:**
Human health (x 38)	Noise (x 37)
Society (x 23)	Traffic (x 27)
Neighbors (x 14)	Smell (x 24)
House prices (x 3)	Accidents / disaster (x 7)
Vacation houses (x 3)	Dust (x 6)
Camping (x 3)	Visual (x 5)
Tourists (x 2)	Fire (x 3)
Recreative areas (x 2)	Light (x 2)
Groundwater (x 2)	Air pollution (x 2)
Church protection	

Figure 6.5: The allocation of the human health and society impacts and what they are impacted by.

It is interesting how the house prices are both mentioned as insignificant neutral and negative impact. It was presented differently in the reports causing this slight variation in significance, which can be caused by different subjectivity of the persons that made the sections of house prices.

So many insignificant negative impacts makes one wonder if some of these have been more significant earlier in the EIA process. As some of the interviewees mentioned, some impacts become insignificant because of project adjustments and changes. However, it is not transparent in the reports, which make it hard to use to inform future scoping processes.

Moving onto the ten climate negative impacts. These climate impacts are focused on the electricity consumption under the operations, CO_2 emissions of the construction work, CO_2 emission to process heating doing the operation, and lastly CO_2 emission of the transport and fuel for transport of the biomass doing the operation. These are found insignificant as they compared to the CO_2 savings from the projects, are minor impacts. Yet, the exact methods of the report's calculations are not known, and if a life cycle perspective was used. However, it does seem like it, and it could be interesting to examining these impacts through the life cycle perspective to see how it would change the result.

6.2.6 Unknown significance negative impacts

Unknown significance of negative character are there in all 70 impacts. Of these, there are 48 nature impacts. Far most of these are caused by higher pollution of ammonia and nitrogen. These can change the state of the habitats and thus impact the animals that live there. Besides that, there is one impact from the vibrations and noise from the construction works, which can affect the harbor porpoise. Furthermore, another report mentions that the increased traffic can cause more road kills of animals.
It seems like higher pollution of ammonia and nitrogen is a core nature impact from a biogas plant. It had a third of the insignificant negative impact and most of the 48 negative impacts with unknown negative significance. Thus, it can be used in the scoping process of future EIA, as there is a tendency towards the pollution of ammonia and nitrogen can be a significant impact, if not handled correctly.

Looking into the human health and societal negative impacts of unknown significance, there are 21. Neighbors and local society get impacted by the construction of the biogas plants, as there are risks of traffic, noise, and dust. Under the biogas plants operations, the impacts are mostly smell and traffic. It is also mentioned that the increase in the traffic, especially of big trucks, is creating insecurity among the more vulnerable road users. In future scoping process this information can be used, as it here is shown that it can be important to examine human health in connection with biogas plants. Even though the most cases are insignificant, there can be cases where it is relevant.

The climate impact has one impact of unknown negative significance: If there occurs a bigger need for biomass, it will cause the trucks to drive further to get the needed biomass and increase the amount of fuel and the CO_2 emissions. There could also be a risk of using different types of biomass than manure. It can be a bit strange that only one report mentions this. As explained in the significant positive climate impact section, the biogas plant's climate impact depends on the type of biomass used in production. Thus, this information can be used in the scoping process in the future, if the climate impact get included, it is relevant also to examine the security of supply.

6.2.7 Significant negative impacts

Lastly, the significant negative impacts. There are 10 nature impacts:

- The timing of the construction work may coincide with the season of mating for the harbour porpoises. If that happens there will be a need for putting up a barrier to minimize the noise and vibrations.
- Half of the location for a biogas plant is placed in a selected space for ecological passages, as a part of the plan *Grønt Danmarkskort*. Thus if the plant, its silos and the roads are cutting off any of the ecological passages, new ones should be made, so it is still connected and it does not stop the animals possibility to spread.
- A biogas plant had a too high disposition of nitrogen oxide to the near environment and thus the smoke stack was made higher so it could spread more.
- Another biogas plant had a too high deposition of ammoniac and nitrogen and added a filter.
- A building was placed too close to protected nature and caused shadowing, which changed the habitat of some annex 4 protected animals. A demand to create at least twice as much replacement nature was made.
- A part of a biogas plant location included a part of a lake. If the biogas plant needs to remove this part of the lake, a demand for creating a least twice as much replacement nature was made.

- An increase in traffic in an areas the green toad wander - a demand for amphibian-fencing beside the roads was made.
- The risk of leakage of tanks has caused the demand for a mound to stop outlet going to the nearby §3 protected areas and annex 4 animals.

Moving on to the 9 health impacts of significant negative characteristics.

- To minimize the impact of smell on the public and neighbors, the biomass stock will be covered.
- The increase in traffic impacts the road capacity, and thus the local community. It also causes noise and insecurity for the neighbors.
- The old noisy kettle at a biogas plant is placed indoors or in an isolated container to minimize the noise.
- The risk of gas concentration raising causes the employees to wear a gas sensor all the time for their safety.
- The visual impact on neighbors and locals caused the firm to make a hedge around the biogas plant.

Another interesting element from this data is, that there is only one significant health impact of smell with the mitigation of covering the biomass stock. The experience from the reports and interviews is that it is a normal component in biogas construction and operations. It was also made a requirement in *Best available technology* (BAT) regulation in 2018 [European Commission, 2018]. However, it is only presented once as a mitigated significant impact. Another significant health impact is employee safety, which is mitigated as the employees should wear gas detectors to avoid the risk of them being in a high gas concentration. If gas, especially methane, gets out, it also has a climate impact. It is only mentioned as an significant impact once, which is probably caused of people's different interpretations of what is important. Of course, the employees' safety is important, but it seems normal that the system is monitored, alerting if there is any gas leak. The monitoring of the system of leaks is also a part of the BAT-demand from 2018. Thus it can seem a bit double to demand the employees to wear the gas detectors too. The EIA report, it was written in, was from 2020 and it was about an expansion of a biogas plant.

Some of the significant negative nature impacts too high emissions of nitrogen oxide and nitrogen, which are mitigated with raised smock stack and filters. Besides, a significant nature impact was the risk of leakage from tanks, which was mitigated with a demand of a mould around to stop the outlet, if it happened. All these impacts are part of the BAT demands that the biogas plants must live up to, posing the question as to why it has been determined significant and mitigated, as it is already regulated. All these reports, which have been mentioned concerning the BAT demands, are from 2018 or newer. Thus, they knew about this regulation, which was about to be implemented, or just had been implemented. It could appear that they tried to inform citizens about these impacts. It was however, not visible in the reports that they were also BAT demands.

This information tells us that most of the significant impacts from biogas plants are already regulated through the BAT demands to keep the overall environmental impact low. It can also be why there is not found any more significant impacts, as they are handled through the regulations. There is therefore no space spared for it in some the reports. The increase in traffic cannot be regulated and mitigated, but it is possible to improve this, such as a bicycle track to make the road safer, or fences to keep animals off the road. There were three significant nature impacts caused by bad locating of biogas plants. It could however be, that these locations were the best possible. With dispensation, they were allowed to

impact or remove nature. These impacts were mitigated on the condition that twice as much nature be replaced.

This knowledge about which impacts are negative significant, can be used in future scoping if there are similar cases. It is shown that both nature and human health can be impacted significantly from biogas plants. To this, it is important that there in future scopings requirements, that BAT demands, should be transparent in the EIA rapport, otherwise it could be misleading.

All results have now been presented. The nature and health impacts showed that the same impacts often recur from the insignificant negative category that becomes more significant in other cases. The climate impact is mostly used to show how a biogas plant or a biofuels refinery can positively impact the environment.

6.3 Informing the future

Results and analysis have been presented in the previous two sections. The following section presents the essential results, and forms recommendations, that should be used in the future scoping process, and its related significance determination.

A tendency to include insignificant impact in scoping has been found, causes the size and complexity of the following EIA reports to grow. This tendency is created by lack of known sufficient guidance on the scoping, uncertainty of the impacts significance and cautiousness of complaints over excluded impacts. Politicians tend to get involved in the EIA process, if they can use it for their own political goal. It causes to be included irrelevant impacts and it gets too much attention.

The examination of biogas plant EIA reports showed that by far the most impacts are insignificant. The climate impacts were primarily positive and there were found significant negative impacts on both human health and nature. The following recommendations are formed from these findings, and can be used to inform the future scoping process.

1. **Use time on getting to know the EU guidance document on the scoping ([European Commission, 2017b])**
   Even though time is a valuable resource, using it to get an overview of the guidance on the scoping will help raise the quality of the scoping.
2. **Involve the public more actively in the scoping**
   The public should be involved by using explicit and open communication to set up a framework which focuses on their concerns, project ideas, and forming the following EIA process. By involving, listening to, and having a dialog with the public in the scoping, can make the process more efficient. It also reduces the risk of conflicts and complaints. The scoping process becomes more qualified since the public has knowledge about the local area and values, which must be included and considered in the following EIA report.
3. **Involve politicians in the scoping if they tend to get involved in the EIA process and want to affect the significance determination of the impacts**
   By actively involving politicians in the scoping, gives them the chance to discuss the expected significance determination and understand the reasoning behind inclusion and exclusion. This reduces the risk of them wanting to change the significance determination and get impacts included in the scope to get them examined in the following report.
4. **Use alternatives and cumulative effects to examine the impacts in different perspective**

It can help determine the expected significance of the impacts and which impacts should be included in the scope. It can make scoping accurate as some impacts only become significant by the view through these different perspectives. It reduces the risk of needing more information later in the process. Here it is important that the developer is a solid part of the scoping, as it is his decision which alternatives are possible.

5. **Make regulatory demands to the project explicit**
   It is misleading when the presented mitigation measures are regulatory demands. It seems like it is written as a mitigation measure to show the good they are doing for the local environment, the mitigation is not made by choice.
6. **Make the scoping process and the reasoning behind decisions transparent and clear**
   There are different practices on publishing the scoping document or not. It is recommended either publish the scoping document or make a resume of it, to avoid small sections in the EIA report about insignificant impacts. By doing this and make the reasoning transparent and clear, it is raising the quality. Also, it can make the process more efficient, as the reasoning behind it is clear, it is more understandable why impacts have different significance or even excluded. Thus, there is no need for making small sections explaining the reasoning of the excluded impacts. By making it transparent, it reduces the risks of complaints of insufficient scoping.
7. **Enhance impacts where it is possible**
   Advice and ideas to that can come from the public being actively involved in doing the scoping. Showing interest in the local area and wanting to enhance, will also help reduce conflicts with the public.
8. **Include impacts in the scoping, if they are expected significant, even though it being positive is the reasoning behind the project**
   Including positive impacts, even though it is politically decided, can help get the public's acceptance of the project, as it is presented in a diversified light. Even though it can seem as double work to examine the impacts, that is the reason for why the project is happening. It also makes the process more qualified as the projects' impacts are transparent.
9. **The nature impact of higher pollution and emissions can be relevant to include in the scope**
   The nature impact depends on the local nature's tolerance and how high the background pollution is from other activities in the local area. In the case of biogas plants, the impact of higher pollution of ammonia and nitrogen made up a third of the insignificant negative nature impacts, dominant in the unknown significance category of the nature impact and in part the significant negative nature impacts.
10. **The impact of increasing traffic can be relevant to include in the scope in proportion to both human health and nature**
    This impact is seen as significant in both impacts but fills most in the human health as it also is a big part of the unknown significance negative. The increase in traffic, especially of big trucks, creates insecurity among the more vulnerable road users. Likewise, the noise from the traffic impact human health. The impact on nature is mostly from the increase in risks on more road-kills because of the increase in traffic, otherwise there are not seen impacts on nature. Thus it can be can be relevant, depending on the neighbors, local society, and the nature and animals in the local area.
11. **Do more research examining experiences in past EIA reports and gathering data on the significance determinations**
    It will remove some subjectivity as evidence from past EIAs is the foundation of the scoping. Likewise, it will focus the scoping and following EIAs more on the significant

impacts, make the authority more certain on the scoping's decisions, and reduce the developer's risk of getting asked for additional information and examinations.

In the next chapter, the results and these recommendations are discussed and interpreted in relation to institutional and sensemaking theory.

Discussion of findings 7

The purpose of this chapter is to interpret and discuss the results in relation to institutional theory and sense making theory

The results and recommendations from the previous chapter are now inputted in the context of institutional and sensemaking theory to interpret and discuss the results in a different light.
The institutional theory looks into how the regulatory, normative, and cultural cognitive pillars of how the institutions impact processes, e.g., the EIA. These institutions can explain and analyze the problems in the process, and what elements are needed to make the work better [Scott, 2013]. The normative pillar is about social obligations, routines, habits, expectations, what role to take in a situation, and the appropriate way to act here, where the cultural cognitive pillar is about culture, shared beliefs, and understandings [Scott, 2013]. Within the regulatory pillar of the EIA there is the regulation and its determined rules of the process. The competent authority is a part of the regulatory pillar, as they enforce these rules, which gives them another form of power compared to the other actors. The sensemaking theory is based on the presumption that people interpret things differently [Weick and Sutcliffe, 2006; Weber and Glynn, 2006]. That presumption is backed up in the SLR, where many of the articles agree that the scoping and its related significance determination are subjective, value-dependent, and political.

The first recommendation is that the EIA practitioners should take time to get an overview of the scoping guidance. The recommendation is based on a difficulty in the regulatory pillar, as the EIA regulation is based on the precautionary principle, but the scoping should be focused on the significant impacts. It is a difficulty of the regulatory pillar because on one side, it says to be cautious, and on the other side, it should be focused on the relevant impacts. Thus, it is a fine balance. From the questionnaire, the practitioners express that insignificant impacts get included in the scoping as there is insufficient guidance on how to make an adequate scoping. This means it should cover the precautionary principle and identify the significant impacts, but without taking it too far, including insignificant impacts. The normative pillar also affects this recommendation, as some practitioners explain that they cannot find the time to get this overview. It is caused by normative elements and the expectations to them, their role, and jobs in the process, making it hard to find extra time to the guidance documents. However, it is believed that using the guidance documents will raise the quality and efficiency of the scoping, especially for less experienced practitioners, as there are presented many suggestions of how to make a good scoping process. Before the regulation reform, the practice was to include all impacts in the EIA report. Because the culture does not change as fast, the regulation is causing the tendency of still including irrelevant impacts in the scope. Thus, changes in the normative and cultural cognitive pillar are still happening after the regulatory pillar changed back in 2017.

The guidance documents can be seen as a part of the normative pillar, where a part focuses on appropriate behavior, habits, and routines. The guidance documents explain the appropriate, good practice and how this can be accomplished through different methodologies, which is a different light can be routines and habits. In the cultural cognitive pillar, it is explained that the cultures can be different between actors and

organizations [Scott, 2013]. It is especially seen between municipalities that the culture is different [Christensen, 2021; Weesgaard, 2021]. Thus, the practitioners in the different organizations knowing and using the same guidance could help make the scoping process more easy-going because it would be more standardized.

The sensemaking theory explains that people interpret things differently [Weick and Sutcliffe, 2006]. Meaning that even though the practitioner used the same guidance documents, it can be interpreted differently. It is shown that experts focus and interpret impact's significance differently [Lyhne and Kørnøv, 2013]. An element of the sensemaking theory is, that the focus shall not only be on the individual decision of including or excluding an impact, but also the context and reasoning behind [Weick and Sutcliffe, 2006]. It explains the tendency towards the inclusion of insignificant impact, as it is, to some degree in current practice, caused by external pressure and expectations. This explains that the decision is not only made by the authority, which has the responsibility for the scoping.

The next two recommendations can be explained with the sensemaking theory's element of focusing the context and reasoning behind, and not directly the decision. Thus, there is a need for the involvement of the public and the interested politicians. The authority and their experts, the public, and politicians, the different interpretations of the project's impacts can be discussed and used to determine the expected significance. These actors need to get more involved in the scoping because there is much unknown subjectivity and politics in the current practice. Thus, to make it known, the actors need to be involved.
In the Danish culture, involving the public is a big part of it. Like the Danish regulation implementation, additional involvement of the public in the scoping is not a part of the EU directive. However, this involvement is not really used but is more seen as a formality. Therefore it can be said there is a misalignment between the pillars. Changing the normative pillar's habits and routines of involving the public more actively is the missing link in aligning the pillars more, as it would link the. It can create new constructive dialog habits with the public. It could be interesting if the public, over time, went from complaining and trying to stop projects, to helping the authority and the developer in making the scope and following the EIA report more precisely and with more focus.

The reason for involving the politicians in the scoping is to give them a possibility to express their thoughts on the impacts of the projects. Examining the politicians' actions of wanting to change, the expert decided significance determination cannot be seen as appropriate because of their politics. They are giving the developer extra expenses. Thus, by including the interested politicians in the scoping, they get the opportunity to express their concerns and discuss the expected significance determination. However, it is the authority's scoping, and their experts should assess the expected significance determination. The politicians must then accept the reasoning behind this or come with non-political arguments of why it should be examined in the EIA report.

Recommendation number four considers alternatives and cumulative effects in the scoping, as it can affect the expected significance determination. Using the recommendations mentioned above, involving the public and politicians makes diverse involvement of actors to examine different possibilities of alternatives and cumulative effects. Also, discussing these elements can give other perspectives of the actors' interpretations of the impacts and the project. Thus, using the fact that people interpret things differently is positive in finding alternatives, as people will have different ideas. Alternatives and cumulative effects are both a part of the regulatory pillar as annex 7 in the Danish regulation [Miljø- og Fødevareministeriet, 2020]. These are pointed out in the interviews to have a weaker part in the normative pillar in the scoping. There are not standardized habits and routines

of using these in the scoping. Thus, this recommendation is made to affect the normative pillar of these elements.

As mentioned, the cultural cognitive pillar describes how organizations' cultures are different, even though the same work is happening. It explains why one of the interviewees experiences a culture in current practice, where the developer is not as equally involved as the authority and the consultant in the scoping. Still, three other interviewees mention the developer is also a big part of the scoping. However, in examining the alternatives, cumulative effects, and the expected significance determination, the developer should be included in the discussion. The developer makes the alternatives possible and wants a focused, precise scoping. Thus, the considered alternatives can exclude impacts due to the alternative changing the impact to insignificant. In the normative pillar, it can be said that because of the developer's role in doing the project and that the EIA reports are his responsibility, it is only appropriate that he is an equal part of the scoping.

The fifth recommendation is to make regulatory requirements explicit, so they cannot be interpreted as voluntary mitigation measures. It was shown in the analysis of the EIA reports that some regulatory requirement was presented as mitigation measures. A reason for this is found in the sensemaking theory, as it was interpreted as an important measure to secure low emissions. It could also be to show the public and authority the effective measures, which were implemented. Regardless of this, it should be made explicit which measure came from the regulatory requirements to ensure transparency and understanding. Besides this, through the sensemaking theory, it can be explained why the most impacts were insignificant, as they were already regulated. Thus, most reports did not seem to consider the impacts as significant, as it is not possible to avoid implementing the mitigation measure. This could be explained through the cultural cognitive pillar, as there are different cultures of presenting and using the requirements in the EIA reports. However, to be able to use past EIAs to inform the next processes, the normative pillar should be changed so there become standardized routines of making the requirements explicit.

The sixth recommendation is about making the scoping document and the reasoning behind its decision transparent and clear. There is a need to understand the scoping's decision of inclusion and exclusion of impacts. As explained in the sensemaking theory, before getting an understanding of the decision, the focus must be on the context of the decision [Weick and Sutcliffe, 2006; Ancona, N.D.]. The current practice shows that there are different cultures on how to do this, as there are no standardized routines or requirements from the regulation of publishing the scoping document. Therefore this recommendation is made to help align the pillars, so there becomes a more standardized routine of publishing the scoping document. It will make the scoping and the following EIA process more efficient, as people will understand the reasoning. Thus, it minimizes the risk of complaints caused by missing the understanding of the choices. Also, it can remove some subjectivity of the scoping process, as the decisions made are followed by the reasoning. It makes the scoping more qualified. However, the normative pillar needs to change, or it could be made as a requirement in the regulation, which is noticed that it can be discussed if it already is or not. Publishing the scoping document was misinterpreted at the start of this study to be a regulatory requirement. It has been seen others also interpret it that way, so it can be discussed.

Recommendation number seventh is to enhance impacts where it is possible. As shown in the document analysis, enhancing impacts, it not really evolved. A reason for this is that it is not a requirement in the regulation [Miljø- og Fødevareministeriet, 2020], but it is mentioned as good practice in the EU guidance [European Commission, 2017a]. Besides, non of the guidance documents give examples or guidance on enhancement of

impacts [European Commission, 2017b,a; The Environmental Protection Agency (Ireland), 2017; Miljøstyrelsen, 2018]. Thus, it suddenly makes sense why there is no culture for enhancement, as it is neither an evolved part of the regulatory or normative pillar. Suppose the developer and his consultant change their habits and routines to focus more on enhancing the impacts included in the scoping. In that case, it can affect the public's cultural cognitive pillar to creating a more accommodating culture. Thus, the developer can contribute positively and show interest in the locals and local area. This will make scoping, and the following EIA process more efficient, as the public is more interested in participating. However, it can create other conflicts if not careful because people interpret things differently, as explained in the sensemaking theory. As the locals have different interpretations of what is important to enhance, it can create disappointment if their enhanced measure was not implemented. Likewise, the locals should not have unrealistic expectations of what enhancement measure the developer should make. The developer should implement the enhancement which is suitable for his project and its impacts.

The eighth recommendation is that the project shall include and examine an impact if it is expected significant, even though it is the foundation to why the project was politically decided to be done. The recommendation is partly based on the regulatory pillar, where the plan of making more biogas plants is legally sanctioned to affect the change to renewables. The developers work within the normative pillar to show the public how the biogas plant is appropriate because of its positive impacts. By presenting how positive an impact the project has, makes it easier to get the public's acceptance. The public has a culture of making resistance to typically 'Not in my backyard'-projects, as biogas plants. Thus, it needs to be transparent in the EIA report that such a project has significant positive impacts. Even though it can seem insufficient, getting the public's acceptance, ultimately saves time.

Recommendations nine and ten inform about which impacts were mostly relevant from the analyzed biogas plant EIA reports. The impacts are the nature impact of higher pollution and emissions, and the other is the increase in traffic impacting both human health and nature. The missing transparency of the insignificant impacts was caused by project adjustments, alternatives, or BAT demands. It made it hard to find any evidence from the past EIAs, which could inform future processes. Likewise, the fact that they are interpreted differently and presented differently made it hard to find patterns that can be used as evidence in the future. These two impacts were chosen as they dominated the negative significance categories. Thus they must at some point be relevant to consider. But they cannot just be used as evidence as it is depended on the project and the surroundings. There are only two impacts that seem relevant to consider in the future, which also shows how scattered the rest of the impacts, as it was not possible to find more solid data patterns. The current culture of EIA includes too many insignificant impacts. However, changing the normative pillar, doing more research like this study to gather data, which the practitioners should use as the foundation to their scoping. Making new habits of using evidence and research of past EIAs as the foundation in the future scoping will make the scopings and following EIA reports more focused. More focused reports can also help change the public culture to want to participate more in the involvement. It removes some pressure on the public, as the reports will be easier to understand and shorter, thus reducing the time needed for reading and understanding the report. Besides, using evidence as the foundation will remove some subjectivity and make the scoping more objective because it hard to argue against evidence gathered from many different EIA reports. Thus the last recommendation is to do more research examining experiences in past EIA reports and gathering data on the significance determinations.

Conclusion 8

The size of the EIA reports grow and cause them to be both more complex and difficult to understand. The complexity affects the involvement of the public and the decision-making. The systematic literature review (SLR) showed that a reason for this is that irrelevant impact gets included in the scope. The 31 EIA reports analyzed in this study showed that the reports have increased in length by around 25 pages, and the annexes by approximately 40 pages. This growth is only measured over a six-year time frame. Furthermore, it was found in the SLR that there is no clear definition or method for the significance determination, which also was found to be subjective, political, and value-dependent. A solution for that was found in the SLR to be addressing the significant impact consistently and transparently. The following research question was therefore made.
How can the scoping of environmental impact assessment and the related significance determination be made more evidence-informed, efficient, and qualified?

This study contains six interviews with different EIA practitioners, document analysis of 31 EIA reports on biogas plants, and a questionnaire. This shows a tendency in the Danish practice of including irrelevant impacts in the scoping, rather than excluding them. The document analysis focused on the nature impact, climate impact, and health impact to make a thorough review of the reports. It was found that 75% of 633 impacts were insignificant. This result indicates a potential for limiting the scope of future EIAs. Through the interviews, the following reasons was found to explain why such a big quota was insignificant; the lack of sufficient known guidance on the scoping, uncertainty of the impacts' significance, and cautiousness caused by complaints about excluded impacts.

Thus, it can be concluded that, taking the time to get acquainted with sufficient guidance, e.g. the [European Commission, 2017b], will raise the quality of the scoping. The interviews pointed out that the scoping, and its related expected significance determination, are affected by the practitioners' experience. Therefore, it is especially the practitioners with only a few years of experience, that will make their scoping more qualified by using the guidance documents.

To remove some of the uncertainties about the impacts' significance, it is recommended to do more research examining the experiences made in past EIAs, as it will give an evidence-informed basis, which can be used in future scopings. This study focused on three impacts, and the analyzed EIA reports were primarily of biogas plants and the expansion of these. By making similar research focused on different impacts and project types, a database of knowledge on the significance determination from past EIA reports will grow, and thereby focus on future scoping. Thus, it can be concluded that doing this will make the future scopings more evidence-informed, focus the following EIA reports on the relevant impacts, and stop the growth of size and complexity of the EIA reports.

The last reason for including irrelevant impacts is the cautiousness of complaints about excluded impacts. The interviews found, that to avoid complaints about excluded impacts,

the excluded impacts were included as smaller sections in the report or the scoping document was published. This study recommends publishing the scoping document or making a resume, so the reasoning behind the scoping's decisions is transparent and clear, instead of making small sections about the excluded impacts. It gives an understanding of why some impacts are excluded from the scope, and it minimizes the risk of conflicts over excluded impacts, especially if it is combined with more research of past EIAs to find more evidence. Furthermore, the study recommends that the public are more actively involved in the scoping, plus the politicians, who would like to use the EIA in their politics. The public knows their local area, which is needed to determine the expected significance of the specific impacts in the local area. It can be concluded that the public and politicians need to be involved, as it is a subjective process. Letting them express their concerns and ideas in the scoping and dialog about the expected significance determination makes the following EIA process more efficient, as it minimizes the risk of complaints and delays caused of more information and examinations. Still, the expected significance determination should rely on the experts' assessments to make it more qualified and focused on the relevant impacts, as stated in the regulation.

The document analysis found that one impact was primarily included to show it was significantly positive. In this case, with regard to biogas plants, it was the climate impact. There was found 35 significant positive impacts and 21 positive impacts of unknown significant out of 67 climate impacts. The climate impact being positive for biogas plants is also the main reason behind the political decision, and why the projects are initiated. Even though it can seem insufficient to examine this impact again on the specific project, it makes the EIA more diversified on both negative and positive impacts. Thus, it can be concluded that including significant positive impacts helps to make the EIA on the project more transparent, as it focuses on all significant impacts, and it makes the EIA more qualified. It shows the positive impact for that specific project, and this can help get the public's understanding and acceptance of the project, even though they are not happy being neighbors to the project.

The document analysis showed no culture of enhancement of the impacts included in the scoping. Besides the positive climate impacts, there was found one positive nature of unknown significance and ten positive health impacts of unknown significance. Besides this, there was one of each nature and health insignificant positive impact. Therefore, it is recommended to focus more on enhancement, as it shows interest for the locals and their area. It will make the public more cooperative in the participation of the process and properly happy to help enhance the area.

Through the document analysis of the 31 EIA reports on biogas plants, the most relevant impacts found to include in future scopings are the impact on nature of higher pollution of ammonia and nitrogen and the impact of increased traffic on both nature and health. The nature impact of higher pollution of ammonia and nitrogen has 94 out of 300 insignificant negative impacts, 44 out of 48 negative impacts of unknown significance, and three of ten significant negative impacts. The impact of increased traffic 50 out of 300 insignificant negative nature impacts and 40 out of 155 insignificant negative health impacts. It has four out of 21 health impacts of unknown significance and one out of 48 nature impacts of unknown significance. Lastly, the increase in traffic has two out of nine significant negative health impacts and one of ten significant negative nature impacts. As the traffic impact was the second impact mostly present in all the significance categories, it showed how scattered the impacts are. However, it can be concluded that the impacts of higher pollution and emissions and the increase of traffic are those that are most relevant to include in the scope, in this case on the industrial projects.

The SLR made in this study found that the scoping and the related significance determination are subjective. For the Danish practice, this was confirmed in the interviews and the questionnaire. The subjectivity was also found in the analyzed EIA report, as many of the same impacts were found in different significance categories. Some of those are caused by subjectivity, and others because they are project-specific. 73,5% of impacts were found insignificant negative, but it is unknown if the reasons behind were transparent. Through the interviews, it was explained that some impacts became insignificant due to project adjustment or alternatives. However, this was not shown in the reports, or else it did not happen in any of the 31 reports, which seems unlikely. It makes it difficult to use this information in future scoping processes. In the document analysis, it was also found that some regulatory demands, in this case, BAT demands of biogas plants, were not always made explicit. Some of the regulatory demands were written as a mitigation measure, even though it was not a decision made through the EIA. Therefore it is concluded that the regulatory demand should be made explicit in the EIA report to make it transparent.

This study has formed 11 recommendations, which are presented below.

1. Use time on getting to know and use the EU guidance document on the scoping ([European Commission, 2017b])
2. Involve the public more actively in the scoping
3. Involve politicians in the scoping if they tend to get involved in the EIA process and want to affect the significance determination of the impacts
4. Use alternatives and cumulative effects to examine the impacts in a different perspective
5. Make regulatory demands to the project explicit
6. Make the scoping process and the reasoning behind decisions transparent and clear
7. Enhance impacts where it is possible
8. Include impacts in the scoping if they are expected significant, even though it being positive is the reasoning behind the project
9. The nature impact of higher pollution and emissions can be relevant to include in the scope
10. The impact of increasing traffic can be relevant to include in the scope in proportion to both human health and nature
11. Do more research examining experiences in past EIA reports and gathering data on the significance determinations

75% of the examined nature-, climate-, and health impacts are determined insignificant, thus the scopings and the EIA reports cannot be called focused on the significant impacts. It can be concluded that this study cannot be used alone as evidence for future scoping, but it shows the need for why more research, examining the experiences made in past EIAs, should be made. Also, as it is not transparent in the reports if the impacts have been significant before project adjustments and alternatives, it is hard to use the results directly to inform future scoping. Monitoring the significant impacts can support the evidence used in future scopings, as it would show how significant the impacts actually are and make the evidence more solid. Looking at monitoring was out of the scope for this study, but looking into it can benefit the results and evidence used in future scopings. Thus, it is concluded that more research is needed to increase the amount of evidence gathered. Likewise, the next research should focus on other types of impacts and project types to make it possible to use the data to make project-specific scopings. Doing this and using the recommendations made in this study will make the scoping and its related significance determination more evidence-informed, efficient, and qualified.

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The European Commission's checklist for determining the significance

A

Questions to be Considered
1. Will there be a large change in environmental conditions?
2. Will new features be out-of-scale with the existing environment?
3. Will the impact be unusual in the area or particularly complex?
4. Will the impact extend over a large area?
5. Will there be any potential for transboundary impact?
6. Will many people be affected?
7. Will many receptors of other types (fauna and flora, businesses, facilities) be affected?
8. Will valuable or scarce features or resources be affected?
9. Is there a risk that environmental standards will be breached?
10. Is there a risk that protected sites, areas, features will be affected?
11. Is there a high probability of the effect occurring?
12. Will the impact continue for a long time?
13. Will the effect be permanent rather than temporary?
14. Will the impact be continuous rather than intermittent?
15. If it is intermittent will it be frequent rather than rare?
16. Will the impact be irreversible?
17. Will it be difficult to avoid, or reduce or repair or compensate for the effect?

Figure A.1: The European Commission [2017b,c]'s checklist for evaluating the significance of a project or an environmental impact.

Transparency of the systematic literature review

B

B.1 The search strategy:

The search strategy is made to make a plan on how to find the relevant research [Zawacki-Richter et al., 2020]. Also, it helps to make the SLR even more specified, and if it is well documented, it contributes to the transparency of the SLR [Higgins et al., 2020]. To develop the search strategy, there is taken inspiration in a checklist from O'Brien and Guckin [2016]. This search aims not to find all primary literature but to locate a gap in the research area, which explains why there only one database is used. Here the steps are taken to make the search strategy:

1. **Define key words**
   The keywords from the review question are: Experiences, methods, scoping, significance determination, EIA
2. **Determine synonyms for the key words** (Some words have been crossed out, as they were later removed from the search string, due to too many hits on irrelevant articles.)
   ~~Experience~~: practice, learning, knowledge
   ~~Method~~: procedure, technique
   Scoping: no synonym
   Significance: importance
   Determination: ~~evaluation~~
   EIA: no synonym
3. **Control for different spellings or using appropriate truncations**
   EIA: Environmental impact assessment
   Scoping: Scope
4. **Identify relevant databases**
   Scopus.com
5. **Perform test search**: these are seen below, and the rest of the steps was made throughout the whole search
6. **Check if all words are spelled correctly**
7. **Perform search test again**

Search No.	Test searches = made without synonyms Search string (searches made in title, abstract, and keywords)	Hits
1	(eia OR "environmental impact assessment") AND ("determination off significance" OR "significance determination") AND (method* OR experience*)	9
2	(eia OR "environmental impact assessment") AND (scope OR scoping) AND (determining) AND (method* OR experience*)	22
3	(eia OR "environmental impact assessment") AND (significance OR scope) AND (determining) AND (method*) OR (experience*)	50

Figure B.1: Test searches - made without synonyms

B.1.1 Searching, selecting and documenting it

The first two searches made with the synonyms was search no. 4 and 5, which can be seen below. Also it was here is was decided to focus on environmental science and not e.g. social sciences, medicine or engineering.

Search No.	Search string (searches made in title, abstract, and keywords)	Hits
4	(eia OR "environmental impact assessment") AND (significance OR importance OR scope OR scoping) AND (determining OR evaluation) AND (method* OR procedure OR technique) OR (experience* OR practice OR learning OR knowledge)	673
5	(eia OR "environmental impact assessment") AND (significance OR importance OR scope OR scoping) AND (determining OR evaluation) AND (method* OR procedure OR technique) OR (experience* OR practice OR learning OR knowledge)) AND (LIMIT-TO (SUBJAREA , "ENVI"))	427

Figure B.2: Search No 4 and 5

Afterward, it was decided to delete the synonym *evaluation* as in added to many irrelevant articles, and by deleting it the number of articles was changed from 427 to 93, which also can be seen below.

Search No.	Search string (searches made in title, abstract, and keywords)	Hits
6	(eia OR "environmental impact assessment") AND (significance OR importance OR scope OR scoping) AND (determining) AND (method* OR procedure OR technique) OR (experience* OR practice OR learning OR knowledge)) AND (LIMIT-TO (SUBJAREA , "ENVI")	93

Figure B.3: Search No 6

The next step done was going through the articles and finding relevant ones. It was done by going through the articles' keywords and abstracts in this first round.
After going through the newest 20 articles in search no 6, keywords as Methods* and Importance found too many irrelevant articles. Thus a new search was done without these two words, which reduced the number of articles to 31.

Search No.	Search string (searches made in title, abstract, and keywords)	Hits
7	(eia OR "environmental impact assessment") AND (significance OR importance OR scope OR scoping) AND (determining) AND (procedure OR technique) OR (experience* OR practice OR learning OR knowledge)) AND (LIMIT-TO (SUBJAREA , "ENVI")	31

Figure B.4: Search No 7

By going through the 31 articles on Scopus, 14 of them were relevant to the review question, and they ranged from the year 1988 to 2020.

However, a test search was made to see if search no. 7 was too narrow. The test search was done like this:

Search No.	Search string (searches made in title, abstract, and keywords)	Hits
8	(eia OR "environmental impact assessment") AND (significance OR importance OR scope OR scoping) AND (determining) AND (LIMIT-TO (SUBJAREA , "ENVI")	67

Figure B.5: Search No 8

Search no. 8 resulted in 67 articles. Yet, after going through half of them and only finding only one new article that was not in search no. 7. It can be concluded that search no. 7 was fitting for the review question, as the point of this review is not to find every primary research made but to get an overview of what research is done on the topic.

The definition of industrial projects C

In this chapter the definition of industrial project is made based upon the danish and EU regulation on EIAs [Miljø- og Fødevareministeriet, 2020; European Parliament, 2011, 2014]. As there are small differences between the regulations, the few elements written in danish are only present in the Danish regulation.

Annex I

- 1. Crude-oil refineries (excluding undertakings manufacturing only lubricants from crude oil) and installations for the gasification and liquefaction of 500 tonnes or more of coal or bituminous shale per day.
- 4. (a) Integrated works for the initial smelting of cast iron and steel;
  (b) Installations for the production of non-ferrous crude metals from ore, concentrates or secondary raw materials by metallurgical, chemical or electrolytic processes.
- 5. Installations for the extraction of asbestos and for the processing and transformation of asbestos and products containing asbestos: for asbestos-cement products, with an annual production of more than 20 000 tonnes of finished products, for friction material, with an annual production of more than 50 tonnes of finished products, and for other uses of asbestos, utilisation of more than 200 tonnes per year.
- 6. Integrated chemical installations, i.e. those installations for the manufacture on an industrial scale of substances using chemical conversion processes, in which several units are juxtaposed and are functionally linked to one another and which are:
  (a) for the production of basic organic chemicals;
  (b) for the production of basic inorganic chemicals;
  (c) for the production of phosphorous-, nitrogen- or potassium-based fertilisers (simple or compound fertilisers);
  (d) for the production of basic plant health products and of biocides;
  (e) for the production of basic pharmaceutical products using a chemical or biological process;
  (f) for the production of explosives.
- 9. Waste disposal installations for the incineration, chemical treatment as defined in Annex I to Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste under heading D9, or landfill of hazardous waste, as defined in point 2 of Article 3 of that Directive.
- 10. Waste disposal installations for the incineration or chemical treatment as defined in Annex I to Directive 2008/98/EC under heading D9 of non-hazardous waste with a capacity exceeding 100 tonnes per day.
- 14. Extraction of petroleum and natural gas for commercial purposes where the amount extracted exceeds 500 tonnes/day in the case of petroleum and 500 000 cubic metres/day in the case of gas.
- 16. Pipelines with a diameter of more than 800 mm and a length of more than 40 km: (Can be an industry project)

(a) for the transport of gas, oil, chemicals;
(b) for the transport of carbon dioxide (CO2) streams for the purposes of geological storage, including associated booster stations.

- 18. Industrial plants for the production of:
  (a) pulp from timber or similar fibrous materials;
  (b) paper and board with a production capacity exceeding 200 tonnes per day.
- 19. Quarries and open-cast mining where the surface of the site exceeds 25 hectares, or peat extraction, where the surface of the site exceeds 150 hectares.
- 20. Råstofindvinding fra åbne brud med en samlet indvindingsperiode på mere end 10 år med undtagelse af indvinding indenfor de i en endeligtvedtaget råstofplan udpegede graveområder.
- 21. Installations for storage of petroleum, petrochemical, or chemical products with a capacity of 200 000 tonnes or more.
- 22.Storage sites pursuant to Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide.
- 23.Installations for the capture of CO2 streams for the purposes of geological storage pursuant to Directive 2009/31/EC from installations covered by this Annex, or where the total yearly capture of CO2 is 1,5 megatonnes or more.
- 24. Anlæg til opsamling af CO2-strømme fra anlæg omfattet af dette bilag med henblik på geologisk lagring i medfør af direktiv 2009/31/EF, ellerhvor den samlede opsamling af CO2årligt ligger på 1,5 megatons eller derover.
- 25. Anlæg med direkte henblik på frakturering udelukkende i forbindelse med efterforskning eller udvinding af skifergas.
- 26. Råstofindvinding på søterritoriet og kontinentalsoklen i internationale naturbeskyttelsesområder, jf. bekendtgørelse om udpegning ogadministration af internationale naturbeskyttelsesområder samt beskyttelse af visse arter.
- 27. Råstofindvinding på søterritoriet og kontinentalsoklen, som årligt eller samlet er større end den hidtil tilladte, i fællesområder, jf. råstoflovens§ 20, stk. 2, nr. 2, hvor der er en gældende tilladelse til indvinding, som ikke er meddelt på basis af konkrete feltundersøgelser af miljøet.
- 28. Råstofindvinding på søterritoriet og kontinentalsoklen af mængder over 10.000 m3 om året eller 50.000 m3 i alt i andre områder end de i nr. 27nævnte, hvor der ikke tidligere er tilladt råstofindvinding på basis af konkrete feltundersøgelser af miljøet.

Annex II

- 2. Extractive industry
  (a) Quarries, open-cast mining and peat extraction (projects not included in Annex I);
  (b) Underground mining;
  (c) Extraction of minerals by marine or fluvial dredging;
  (e)Surface industrial installations for the extraction of coal, petroleum, natural gas and ores, as well as bituminous shale.
- 3. Energy industry
  (Can be an industry project)
  (a) Industrial installations for the production of electricity, steam and hot water (projects not included in Annex I);
  (b) Industrial installations for carrying gas, steam and hot water; transmission of electrical energy by overhead cables (projects not included in Annex I);
  (c) Surface storage of natural gas;
  (d) Underground storage of combustible gases;
  (e) Surface storage of fossil fuels;
  (f) Industrial briquetting of coal and lignite;

(g) Installations for the processing and storage of radioactive waste (unless included in Annex I);
(h) Installations for hydroelectric energy production;
(i) Installations for the harnessing of wind power for energy production (wind farms);
(j) Installations for the capture of CO2 streams for the purposes of geological storage pursuant to Directive 2009/31/EC from installations not covered by Annex I to this Directive.

- 4. Production and processing of metals
  (a) Installations for the production of pig iron or steel (primary or secondary fusion) including continuous casting;
  (b) Installations for the processing of ferrous metals:
  (i) hot-rolling mills;
  (ii) smitheries with hammers;
  (iii) application of protective fused metal coats;
  (c) Ferrous metal foundries;
  (d) Installations for the smelting, including the alloyage, of non-ferrous metals, excluding precious metals, including recovered products (refining, foundry casting, etc.);
  (e) Installations for surface treatment of metals and plastic materials using an electrolytic or chemical process;
  (f) Manufacture and assembly of motor vehicles and manufacture of motor-vehicle engines;
  (g) Shipyards;
  (h) Installations for the construction and repair of aircraft;
  (i) Manufacture of railway equipment;
  (j) Swaging by explosives;
  (k) Installations for the roasting and sintering of metallic ores.
- 5. Mineral industry
  (a) Coke ovens (dry coal distillation);
  (b) Installations for the manufacture of cement;
  (c) Installations for the production of asbestos and the manufacture of asbestos products (projects not included in Annex I);
  (d) Installations for the manufacture of glass including glass fibre;
  (e) Installations for smelting mineral substances including the production of mineral fibres;
  (f) Manufacture of ceramic products by burning, in particular roofing tiles, bricks, refractory bricks, tiles, stoneware or porcelain.
- 6. Chemical industry (Projects not included in Annex I)
  (a) Treatment of intermediate products and production of chemicals;
  (b) Production of pesticides and pharmaceutical products, paint and varnishes, elastomers and peroxides;
  (c) Storage facilities for petroleum, petrochemical and chemical products.
- 7. Food industry
  (a) Manufacture of vegetable and animal oils and fats;
  (b) Packing and canning of animal and vegetable products;
  (c) Manufacture of dairy products;
  (d) Brewing and malting;
  (e) Confectionery and syrup manufacture;
  (f) Installations for the slaughter of animals;
  (g) Industrial starch manufacturing installations;
  (h) Fish-meal and fish-oil factories;
  (i) Sugar factories.

- 8. Textile, leather, wood and paper industries
  (a) Industrial plants for the production of paper and board (projects not included in Annex I);
  (b) Plants for the pre-treatment (operations such as washing, bleaching, mercerisation) or dyeing of fibres or textiles;
  (c) Plants for the tanning of hides and skins;
  (d) Cellulose-processing and production installations.
- 9. Rubber industry: Manufacture and treatment of elastomer-based products.
- 11. Other projects
  (b) Installations for the disposal of waste (projects not included in Annex I);
  (c) Waste-water treatment plants (projects not included in Annex I)(Can be an industry project);
  (e) Storage of scrap iron, including scrap vehicles;
  (f) Test benches for engines, turbines or reactors;
  (g) Installations for the manufacture of artificial mineral fibres;
  (h) Installations for the recovery or destruction of explosive substances;
  (i) Knackers' yards.