HydroCen
NORWEGIAN RESEARCH CENTRE FOR HYDROPOWER TECHNOLOGY

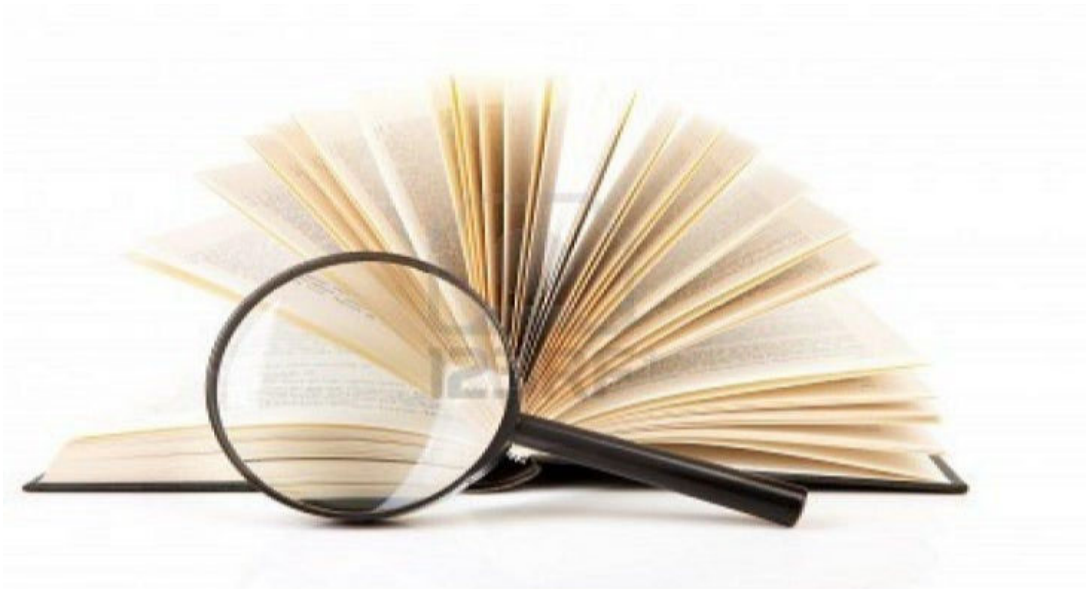
CENTRE FOR ENVIRONMENT-FRIENDLY ENERGY RESEARCH

HydroCen Report nr. 33

# "Gold Standard" for mitigating environmental impacts.

## Summary of literature review

Oddgeir Andersen, Sara Heidenreich, Berit Köhler, Gunnar Lamvik, Frode Thomassen Singsaas, Yosra Zouhar



**Literature Review**

NTNU SINTEF NINA

# HydroCen

The main objective of HydroCen (Norwegian Research Centre for Hydropower Technology) is to enable the Norwegian hydropower sector to meet complex challenges and exploit new opportunities through innovative technological solutions.

The research areas include:

- Hydropower structures
- Turbine and generators
- Market and services
- Environmental design

The Norwegian University of Science and Technology (NTNU) is the host institution and is the main research partner together with SINTEF Energy Research and the Norwegian Institute for Nature Research (NINA).

HydroCen has about 50 national and international partners from industry, R&D institutes and universities.

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The objective of the Research Council of Norway FME-scheme is to establish time-limited research centres, which conduct concentrated, focused and long-term research of high international calibre in order to solve specific challenges in the field.

The FME-centres can be established for a maximum period of eight years HydroCen was established in 2016.

# “Gold Standard” for mitigating environmental impacts.

## Summary of literature review

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Andersen, O., Heidenreich, S., Köhler, B., Lamvik, G., Singsaas, F. T., Zouhar, Y., 2023. „Gold Standard» for mitigating environmental impacts. HydroCen rapport 33. Norwegian Research Centre for Hydropower Technology

Trondheim, January 2023

ISSN: 2535-5392 (digital publikasjon, Pdf)
ISBN: 978-82-93602-34-7



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# Abstract

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This literature review identified 2513 articles, and after a screening process we were left with 64 European articles. We found that qualitative methods like literature/document analysis and interviews was used more often than quantitative methods like surveys or combinations of methods in Europe. Most studies were focusing on national or local levels, and most studies (58%) was published after 2016.

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# Sammendrag

Andersen, O., Heidenreich, S., Köhler, B., Lamvik, G., Singsaas, F. T., Zouhar, Y., 2023. „Gold Standard» for mitigating environmental impacts. HydroCen rapport 33. Norwegian Research Centre for Hydropower Technology

Litteraturstudien identifiserte 2513 artikler, og etter en screening prosess satt vi igjen med 64 Europeiske artikler. Vi fant at i Europa var kvalitative metoder som dokumentstudier og intervjuer var mer brukt enn kvantitative metoder som spørreundersøkelser eller kombinasjoner av kvalitative og kvantitative metoder. De fleste studiene omhandlet nasjonalt eller lokalt nivå, og majoriteten av studiene var publisert i 2016 eller senere.

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# Content

## Innhold

# 1 Scope and objectives

The aim of the Gold Standard project is to develop a universal method (or refine existing methodology) for assessing and mitigating impacts from highly flexible hydropower regimes, related to the acceptance by local communities. This is done by synthesizing recent scientific literature and accumulated knowledge among social science. The project build on the “state-of -the-art” knowledge and be beneficial for the industry, authorities, stakeholders and public in general when it comes to social acceptance in cases with highly flexible hydropower regimes. The gold standard methodology shall cover all relevant aspects of a hydropower impact assessment and aims to identify and mitigate potential conflicts during the development and concession process in an efficient way. There are several suggested methods in the literature and the project will do in-depth analyses of the most relevant methods and make methodological refinements to improve current practice, which also includes stakeholder engagement. Here, we report preliminary results from a systematic review of the existing literature in 2020, focusing on Europe.

# 2 Methods and findings

We used Web of Science (WoS) and Scopus to identify studies containing search phrases as shown in table 1a and 1b. The NEAR/3 command instructs the search engine that word combinations should maximum be 3 words apart. Table 1a and 1b shows number of hits per search phrase. After combining search phrases in WOS and Scopus, we obtained (907+2418) 2513 articles. The selection and screening process is described in detail in table 2.

Table 1: Search phrases used in in Web of Science (WoS) and Scopus to identify (1a) source of energy production and (1b) articles with social acceptance content.

Table 1a.

| **Power source (or)** | **WoS** | **Scopus** |
|---|---|---|
| Hydro NEAR/3 (power OR electric* OR plant* OR energy) | 3501 | 15322 |
| Water NEAR/3 (power OR electric* OR plant* OR energy) | 80183 | 165351 |
| hydrobalanc* | 3 | 11 |
| "pumped hydro storage" | 259 | 437 |
| hydropeak* | 274 | 261 |
| hydropower | 9590 | 25132 |
| hydroelectric* | 6361 | 40990 |
| Dam NEAR/3 (power OR electric* OR plant* OR energy OR water OR hydro*) | 6064 | 13422 |
| **Sum** | 100166 | 229936 |

Table 1b.

| **Social acceptance (OR)** | **WoS** | **Scopus** |
|---|---|---|
| accept* NEAR/3 (social OR public OR local* OR resident* OR community) | 16593 | 29681 |
| opinion NEAR/3 (social OR public OR local* OR resident* OR community) | 22599 | 54163 |
| percept* NEAR/3 (social OR public OR local* OR resident* OR community) | 32734 | 63996 |
| trust* NEAR/3 (social OR public OR local* OR resident* OR community) | 11266 | 19036 |
| aware* NEAR/3 (social OR public OR local* OR resident* OR community) | 20924 | 38339 |
| support* NEAR/3 (social OR public OR local* OR resident* OR community) | 127178 | 219211 |
| opposit* NEAR/3 (social OR public OR local* OR resident* OR community) | 3230 | 5240 |
| engag* NEAR/3 (social OR public OR local* OR resident* OR community) | 33454 | 50094 |
| participat* NEAR/3 (social OR public OR local* OR resident* OR community) | 49037 | 93014 |
| resistan* NEAR/3 (social OR public OR local* OR resident* OR community) | 14094 | 19986 |
| conflict* NEAR/3 (social OR public OR local* OR resident* OR community) | 12768 | 20805 |
| "risk percept*" | | 42398 |
| Til sammen | 313475 | 598598 |
| **Table 1a and Table 1b combined with AND:** | **907** | **2418** |

Table 2. Flowchart describing the selection and screening process.

| | **Identification of studies** | | |
|---|---|---|---|
| Identification | 2513 records identified from databases (WOS and Scopus) and imported to Rayyan. References was then distributed for classification based on title: Classification categories was (1) Include, (2) exclude or (3) maybe. Berit reviewed 630 articles, Oddgeir 630 articles, Gunnar 627 articles and Sara 626 articles.<br><br>All maybe articles (n=231) were then grouped in two groups and reviewed again by two reviewers; (Gunnar & Berit, Sara & Oddgeir). Finally, we ended up with 354 articles to screen.<br><br>Included: 354 references | → | Excluded: 2159 references |
| | ↓ | | |
| Screening | Records screened (n=354). Geographically, 109 references covered Asia, 88 references were from Europe, 72 references from South America, 46 in North America, 16 in Africa and 6 in Oceania. 19 references where on a global level. Given the number of references and the limited project budget, we decided to only focus on European cases. Then, we were left with 88 European references to review. | → | 266 references (not from Europe) was excluded from further review. |
| | ↓ | | |
| | Articles assessed for eligibility (n=88). After final screening, 24 articles were excluded and 64 articles was included in the final review. | → | Articles excluded (n=24)<br><br>Not available in full text/not found (n=6)<br>Not relevant (n= 15)<br>Not in english (n=3) |
| | ↓ | | |
| Included | Articles included in review (n=64) | | |

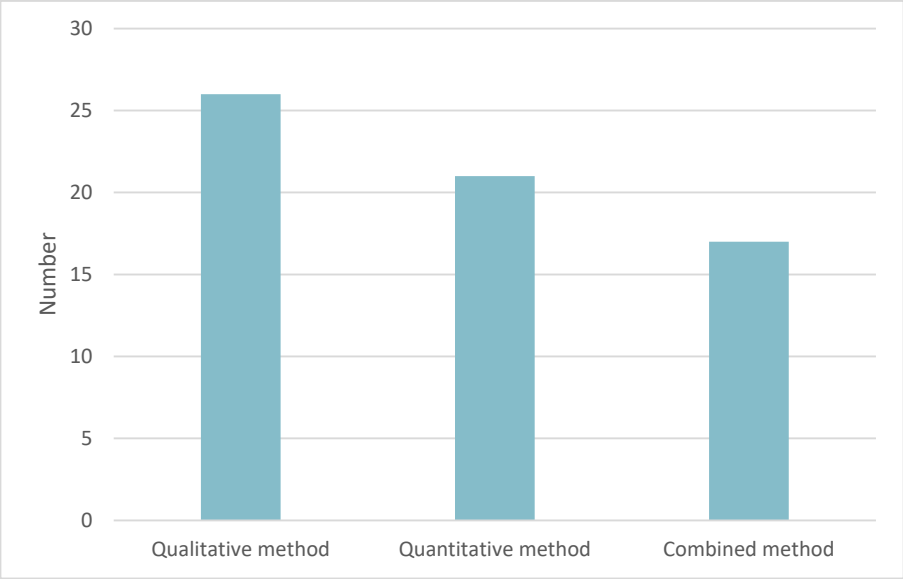


*Figure 1. Overview of methodology used in Europe.*

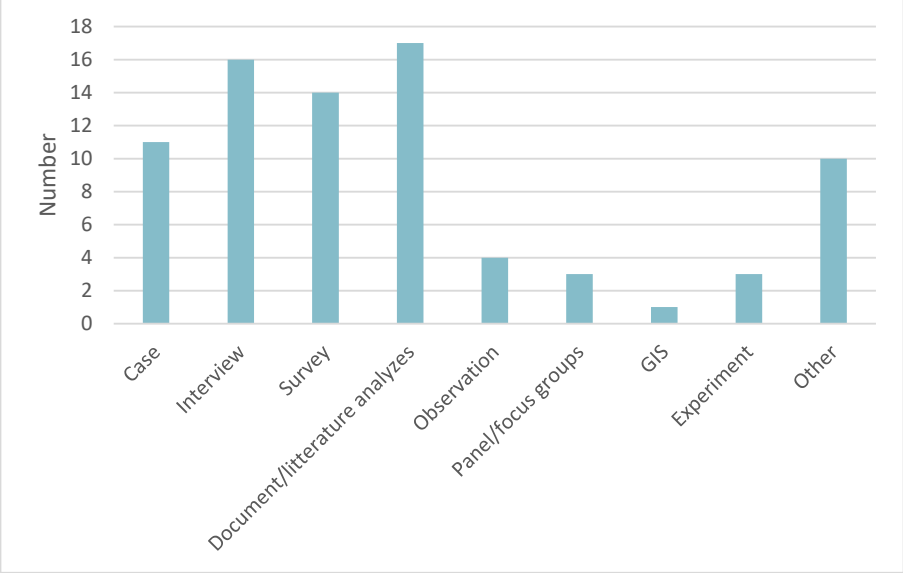


*Figure 2. Study design in the European studies.*

With regards to methodology, 40,6% used qualitative methods, while 32,8% used quantitative methods and 26,5% used a mix og qualitative and quantitative methods (figure 1). When it comes to study design, document/literature analyses were the most frequently used method (figure 2). Then, interviews (20%) and surveys (18%) were used more commonly than case-studies (14%). Less typical was observation, panel/focus groups, experiment and GIS-analyses. Other methods comprised 13% of the cases.

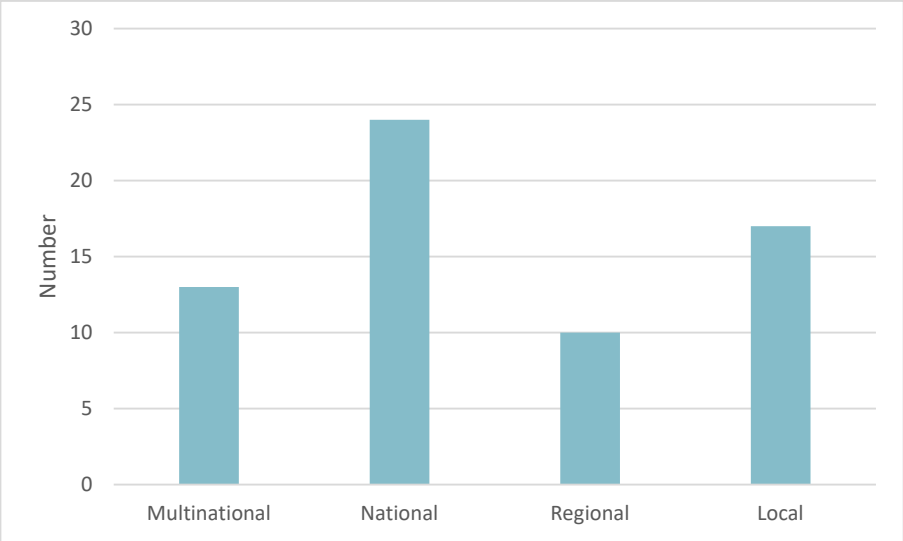


*Figure 3. Overview of the geographical scale of the European studies.*

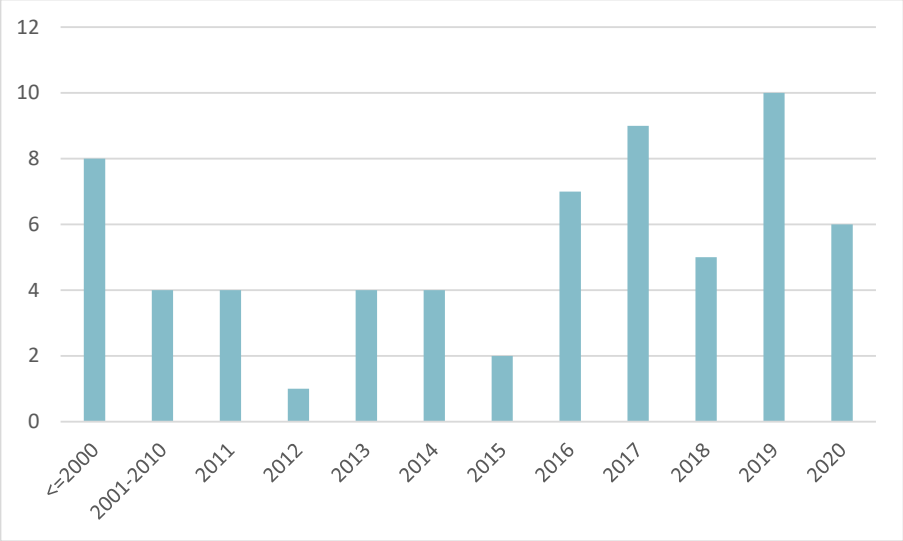


*Figure 4. Publication year of the Europeans studies included in the review.*

The geographical scale of the study was mainly on a national level (37,5%), while 26,5% was on a local level, 15,6% on a regional level and 20,3% on a multinational level (figure 3). The majority of studies (58%) was reported between 2016-2020 (figure 4).

# 3 Discussion and conclusion

This literature review identified 2513 articles, and after a screening process we were left with 64 European articles. We found that qualitative methods like literature/document analysis and interviews was used more often than quantitative methods like surveys or combinations of methods in Europe. Most studies were focusing on national or local levels, and the majority of studies (58%) was published after 2016.

To finish the gold standard project, it remains to: (1) assess/identify the most efficient methodology used to map relevant stakeholder groups and their opinions, (2) Identify topics/areas with conflict potential – (with focus on the most efficient methodology related to topic), (3) Identify the most relevant actions or methods used to reduce/mitigate potential conflicts and (4) Develop a "gold standard" method to identify conflict areas and mitigation actions between stakeholder groups, the hydropower operator and public in general that draws both on data from quantitative surveys and qualitative data.

How likely it is for the project team to finish step 1-4 above in the future, will depend on the team's ability to obtain sufficient economic funding to fulfil the tasks.

# 4 References

All European references are found in the Norwegian section (n=88)
References in red font (n=24) was excluded in the final step of the screening process.

# Norwegian version

# 5 Sammendrag

Målet med Gold standard prosjektet er å foreslå en universell metode, eller videreutvikle en eksisterende, for å identifisere og avbøte negative miljøeffekter av effektkjøring, og samtidig øke samfunnsaksepten for effektkjøring. Vi skal gjennomgå vitenskapelig litteratur og opparbeidet erfaring fra samfunnsfaglig forskning, og bygge videre på den best tilgjengelige kunnskap for industri, myndigheter, interessentgrupper og befolkning når det gjelder effektkjøring. Gold standard metoden har som mål å dekke alle relevante aspekter rundt konsekvensutredninger på en effektiv måte. Det er flere metoder som beskrives i litteraturen og vi vil gjøre en grundig analyse av de mest relevante metodene og foreslå forbedringer, der vi ser muligheter for det.

Her rapporteres de foreløpige resultatene fra litteraturgjennomgangen som er gjort med fokus på Europa.

# 6 Metode og resultater

Vi søkte i Web of Science (WOS) og Scopus med søkeord som omhandler hvordan kraften ble produsert (tabell 1a) og i tillegg hadde ofte brukte begreper om samfunnsaksept (Tabell 1b). Near/3 kommandoen angir at ordene må stå sammen med maksimalt 3 ords avstand i tittelen. Tabell 1a og 1b angir hvor mange treff vi fikk (i 2020) på hvert enkelt søkeord. Vi fikk 907 artikler som både inneholdt kriterier for kraftkilde og samfunnsaksept i WOS, mens Scopus ga 2418 artikler. Til sammen blir dette 2513 artikler.

Tabell 1a. Søkeord brukt for å identifisere studier med vannkraft som energikilde

| **Kraftkilde (or)** | **WoS** | **Scopus** |
|---|---|---|
| Hydro NEAR/3 (power OR electric* OR plant* OR energy) | 3501 | 15322 |
| Water NEAR/3 (power OR electric* OR plant* OR energy) | 80183 | 165351 |
| hydrobalanc* | 3 | 11 |
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| hydroelectric* | 6361 | 40990 |
| Dam NEAR/3 (power OR electric* OR plant* OR energy OR water OR hydro*) | 6064 | 13422 |
| **Til sammen** | 100166 | 229936 |

Tabell 1b. Søkeord brukt til å identifisere samfunnsaksept.

| **Samfunnsaksept (OR)** | **WoS** | **Scopus** |
|---|---|---|
| accept* NEAR/3 (social OR public OR local* OR resident* OR community) | 16593 | 29681 |
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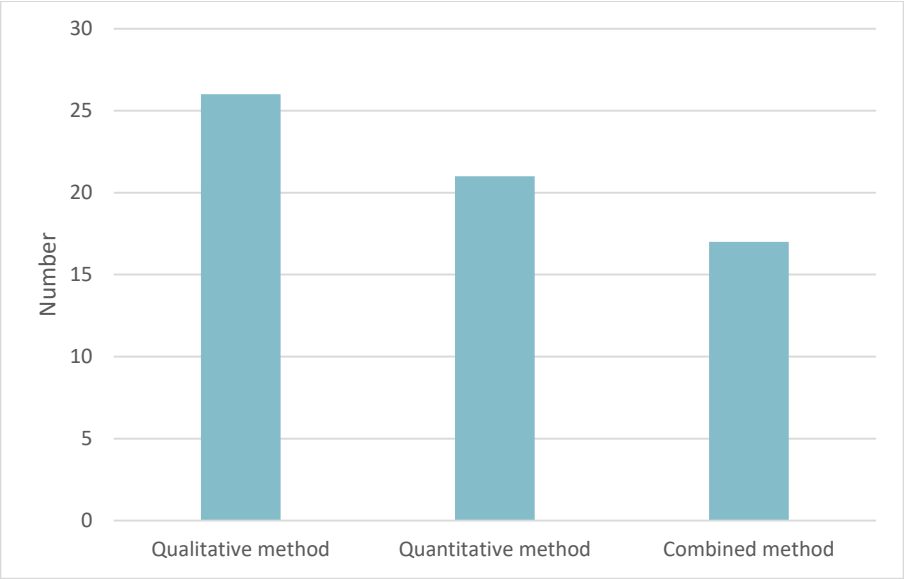
| "risk percept*" | | 42398 |
| Til sammen | 313475 | 598598 |
| **Til sammen - kombinert med AND:** | **907** | **2418** |

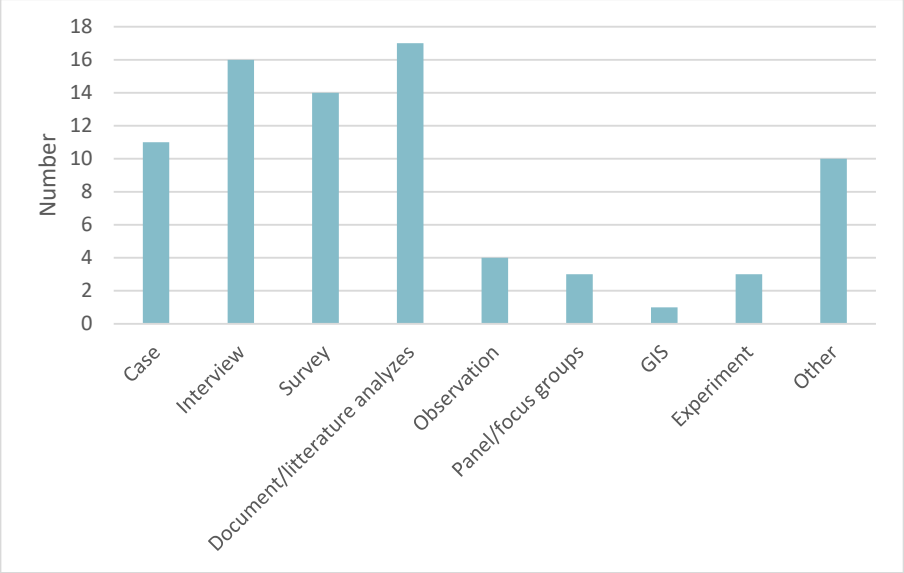
Screening og utvelgelsesprosessen er beskrevet i tabell 2.

Tabell 2. Beskrivelse av de ulike trinnene I utvelgelsesprosessen.

| | **Identifisering av studier** | | |
|---|---|---|---|
| Identifisering | 2513 referanser funnet i databasene WOS og Scopus og importert til Rayyan. Referansene ble klassifisert, basert på tittel slik: (1) Inkluder, (2) ekskluder or (3) kanskje. Berit vurderte 630 artikler, Oddgeir 630 artikler, Gunnar 627 artikler og Sara 626 artikler.<br><br>Alle "kanskje" artikler (n=231) ble delt I to grupper og gjennomgått på nytt av to personer; (Gunnar & Berit, Sara & Oddgeir). Til slutt hadde vi 354 referanser å lese.<br><br>Inkludert: 354 referanser | → | Ekskludert: 2159 referanser |
| | ↓ | | |
| Screening | Referanser som ble gjennomgått (n=354). 109 referanser omhandlet Asia, 88 referanser var fra Europe, 72 referanser fra Sør-Amerika, 46 fra Nord -Amerika, 16 i Afrika og 6 i Oceania. 19 referanser var på globalt nivå. Gitt antallet artikler og begrenset budsjett, vi bestemte oss for å fokusere på referanser fra Europa (n=88). | → | 266 referanser (ikke fra Europa) ble utelatt. |
| | ↓ | | |
| | Europeiske artikler som ble gjennomgått (n=88). Etter gjennomgang ble 24 artikler ekskludert, og 64 artikler ble inkludert. | → | Artikler ekskludert (n=24), hvor<br><br>Ikke tilgjengelig/ikke funnet (n=6)<br>Ikke relevant (n= 15)<br>Ikke engelsk språk (n=3) |
| | ↓ | | |
| Inkludert | Artikler inkludert i studien (n=64) | | |

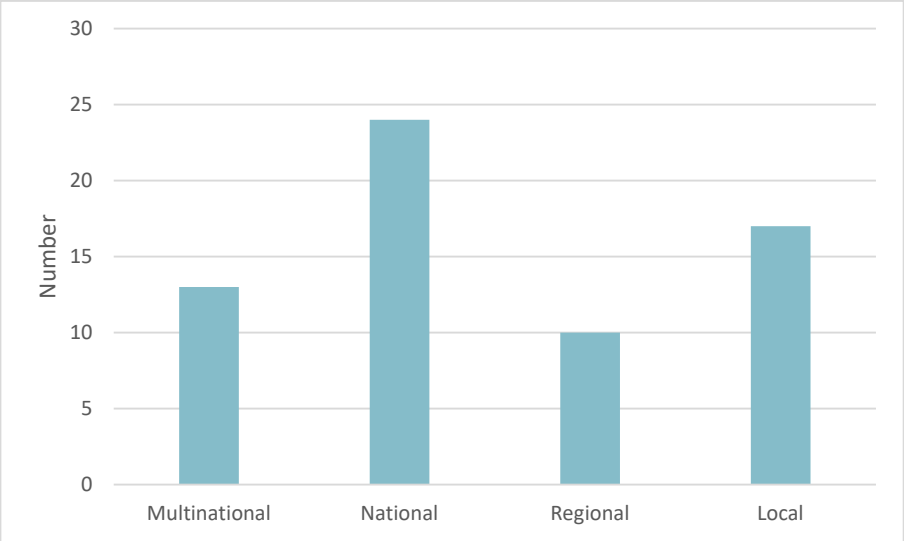



*Figur 1. Oversikt over metodologi som er brukt.*

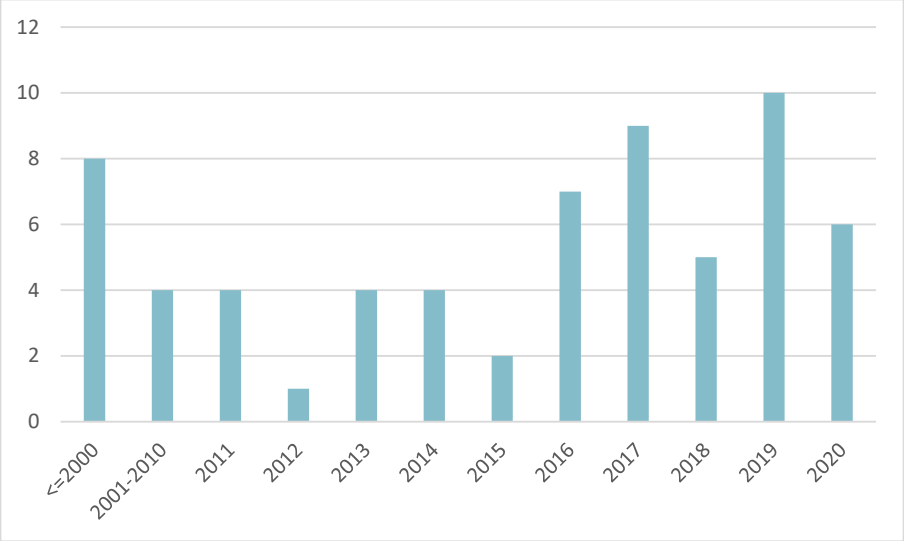



*Figur 2. Studiedesign brukt I de europeiske studiene*

Når det gjelder metoder, brukte 40,6% as studiene kvalitative metoder, mens 32,8% brukte kvantitative metoder og 26,5% kombinerte disse metodene (figur 1). Når det gjelder studiedesign, var dokument/litteratur studie (22%) og intervjuer (20%) mest brukt (figur 2). Deretter kom spørreundersøkelser (18%) og case-studier (14%). Mindre vanlig var observasjonsstudier, panel/fokus grupper, eksperiment og GIS-analyser. Andre metoder ble benyttet i 13% av referansene.




*Figur 3. Den geografiske skalaen studiene fokuserte på.*




*Figur 4. Publiseringsår for de Europeiske studiene som er med i gjennomgangen.*

De fleste studiene var på nasjonalt nivå (37,5%), eller lokalt nivå 26,5% (figur 3). Bare 15,6% var på regionalt nivå, mens 20,3% var på flernasjonalt nivå. Mesteparten av studiene var publisert i 2016 eller senere (figur 4).

# 7 Diskusjon og konklusjon

Litteraturstudien identifiserte 2513 artikler, og etter en screening prosess satt vi igjen med 64 Europeiske artikler. Vi fant at i Europa var kvalitative metoder som dokumentstudier og intervjuer mer brukt enn kvantitative metoder som spørreundersøkelser eller kombinasjoner av kvalitative og kvantitative metoder. De fleste studiene omhandlet nasjonalt eller lokalt nivå, og majoriteten av studiene var publisert i 2016 eller senere.

For å fullføre alle faser i Gold standard prosjektet, gjenstår det å; (1) identifisere den mest effektive metode for å kartlegge interessentgrupper og deres holdninger, (2) identifiserer tema/områder med størst konfliktpotensial, (3) identifisere de mest effektive konfliktforebyggende metodene, (4) utvikle selve «Gold standard» prosedyren. Hvor sannsynlig det er for prosjektgruppen å fullføre oppgave 1-4 over, vil avhenge av at gruppen klarer å finne finansiering til de gjenstående arbeidsoppgavene.

# 8 Referanser i fra Europa

Referanser med rød skrift ble ekskludert i løpet av Screening-prosessens siste fase.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2. Arabatzis, G. and D. Myronidis, *Contribution of SHP Stations to the development of an area and their social acceptance.* **15**(8): p. 3909-3917.
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9. Botelho, A., et al., *Discrete-choice experiments valuing local environmental impacts of renewables: two approaches to a case study in Portugal.* **20**: p. 145-162.
10. Botelho, A., et al., *Social sustainability of renewable energy sources in electricity production: An application of the contingent valuation method.* **26**: p. 429-437.
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21. Engstrm, R.E., M. Howells, and G. Destouni. *Water impacts and water-climate goal conflicts of local energy choices - notes from a Swedish perspective*. 2018.
22. Eren, A., *The political ecology of uncertainty: the production of truth by juridical practices in hydropower development.* 2017. **24**: p. 386-405.
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ISSN: 2535-5392
ISBN: 978-82-93602-34-7

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