Scopus, PubMed (=Medline) en Embase 2017 tot 16-07-2018

1. The infrasound and low frequency noise and its impact on health. Almeida J, Alves-Pereira M, Nossa P Atencion Primaria. 2016;48:52.

✓ NOT Alleen abstract van conferentiebijdrage

Industrialization and the mobilization of human effort have led to increased noise output across the range of sound frequencies, leading to a global problem of human welfare reduction. The low frequency noise is a common component of occupational and environmental noise, and that has received little attention. This study aimed to make a reflection about infrasound and low frequency noise (ILFN), in particular as regards the major sources and symptoms that can be perceived by the exposed population. The ILFN has not shared characteristics with larger spectrum of noise. This type of noise is considered the superpower of frequencies by: having less attenuation by walls and other structures; vibrating walls and objects; travel long distances with little loss of energy due to atmospheric attenuation and soil; protective devices are much less effective; capable of producing resonance in the human body; and, to some extent, physiological responses in humans compared to medium and high frequencies, such as those that result in the vibroacoustic disease. It can be affirmed that the ILFN are always present in the environment. This type of noise can come from many sources, including, amongst other, sea waves, air, rail and road traffic and wind turbines. People who live near ILFN sources may have severe symptoms such as sleep disorders, headaches, tinnitus, dizziness and lack of balance (as a result of changes in the vestibular level), nausea, panic attacks, palpitations, fatigue and difficulty concentrating, feelings of intolerability and disability, disorientation, intestinal spasms and resonances in internal organs (such as the abdomen and heart), cardiovascular problems and musculoskeletal system, among others.
http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L621220523

2. How education orientation affects attitudes toward wind energy and wind farms: implications for the planning process. Betakova V, Vojar J, Sklenicka P Energy, Sustainability and Society. 2016;6(1).

✓ SOCIAL

Background: Three groups of stakeholders are mainly involved in the planning, assessment, and approval processes for wind parks: the planners, the public, and the responsible public authorities. These groups have varying aims, and there are various ways of looking at proposals to set up a wind park. In particular, the viewpoints of planners and government officers are likely to differ. Planners are likely to focus on technical aspects of a wind farm project, while the public authorities are likely to be oriented toward environmental considerations. Methods: The effect of respondents' characteristics on landscape perception was analysed using generalized linear mixed models (GLMM). Set of various landscape images with and without wind turbines (WTs) was evaluated on a 15-points scale. The evaluation was accomplished with additional questions about general attitude toward wind energy, willingness to live close to WTs and presence of WTs near respondents' homes. Results: Using a questionnaire presented to university students in technical study programmes and to students in environmental study programmes, it has been determined that educational orientation substantially influences people's perception of wind turbines (WTs). Respondents pursuing technical studies evaluated landscapes with WTs more positively than did students in environmentally oriented study programmes. In addition, the responses of students in environmental study programmes were influenced by their general attitude toward wind energy, unlike the responses of the technically oriented students. We also examined the influence of respondents' other characteristics on their perceptions of WTs in the landscape, including their general attitude toward wind energy and their willingness to live near WTs, toward the presence of WTs in the vicinity of their place of residence, and interactions among these factors. Conclusions: Our study indicates

the importance of education in planning wind parks. Sanctioning bodies should be able to evaluate each proposed project adequately and impartially, and to assess the potential level of impact of the proposal on the landscape and on landscape values, including aesthetic values, and on the population, and also other impacts caused by the construction and the functioning of WTs. This kind of professional knowledge is also very important for planners. One way to raise students' awareness and their professional knowledge could be through interdisciplinary coursework on this topic. © 2016, The Author(s).
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85013944836&doi=10.1186%2fs13705-016-0096-6&partnerID=40&md5=0046aa50fa0e0c4fa7d460564da96466

3. Is trust negotiable? Building a place-based general interest for the acceptance of the Saint Brieuc and Saint Nazaire offshore wind farms. Beuret JE Geographie Economie Societe. 2016;18(3):335-58.

✓ OFFSHORE

Building offshore wind farm creates a tension between global environmental stakes (related to climate change) and local environmental issues. Alongside those «green on green» oppositions (Warren and al., 2005), other tensions exist between environmental stakes and local and global economic issues. Project's local acceptance requires the construction of a territorial social contract, reflecting a «place-based general interest». Using the cases of Saint Nazaire and Saint Brieuc wind farm projects in Western France, we study this construction, specifically the conflict and concertative processes. This leads us to identify four recurrent mechanisms founding project's acceptance and agreement: the priorization of actors and stakes, project's adjustment, a transactions and compensations game between planners and local stakeholders, but also between local stakeholders, the construction of new organized proximities, vital to face economic and environmental uncertainties related to this type of projects. This leads to highlight uncertainties' weight and trust's importance, which is built by a game of proximities periodically challenged. © 2016 Lavoisier, Paris. Tous droits réservés.
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85019154091&doi=10.3166%2fges.18.335-358&partnerID=40&md5=74197f2bb31762c6fbf00c3cf16bd09f

4. Wind farms cumulative impact assessment. Bowdler D, Branney E, Cand M, Carmichael B, Carter R, Farmer L, et al. Acoustics Bulletin. 2016;41(1):44-8.

✓ EXPOSURE (meenemen invloed meerdere parken, niet relevant voor review)

ETSU-R-97 requires that noise from all wind farms cumulatively shall not exceed the limits derived in accordance with that document. It is generally agreed amongst us that all neighbouring wind farms that are operational or consented and all developments "ahead" of the application development in the planning queue should initially be considered. Wind farms that have been refused by the planning authority but are at appeal might also need to be considered but the status of these is a planning matter and needs to be discussed with the planning authority. It is always advisable that the exact extent of the cumulative assessment is agreed between the applicant and the planning authority. Once this is agreed, the next stage in the assessment process is to decide which existing, consented and proposed wind farms should be included because they are close enough to the application development to contribute to the cumulative impact. Depending on the number of developments in the area it might be appropriate to carry out an initial filter based on some sample calculations or on fixed distances based on experience. Combining tonal and non-tonal contributions from individual wind farms to give a cumulative result can be problematic. Different results can be obtained depending on whether the tonal penalty is included in the individual contributions that are summed or whether the individual contributions are added without the penalty and the appropriate penalty added to the cumulative sum. All methods also require that an appropriate notional cumulative noise limit is established. This should be done in accordance with ETSU-R-97 taking into account that some planning authorities have alternative limits.
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85014059723&partnerID=40&md5=72eaaf697b155eb496d07897ec9892f8

5. Low frequency noise and disturbance assessment methods: A brief literature overview and a new proposal C3 - Caniato M, Bettarello F, Patrizio F, Marsich L, Ferluga A, Schmid C. Proceedings of Meetings on Acoustics; 2016: Acoustical Society of America;28.

✓ LFN

Several studies have presented the effects of environmental noise on communities, focusing attention on sleep time events. The noise introduced into a dwelling is mostly evaluated using the A-weighted sound pressure level (LAeq) as the only parameter to determine the perceived disturbance. Nevertheless, if noise is produced by activities or sources characterised by a low frequency contribution, the measurement of LAeq underestimates the real disturbance, in particular during sleep time. The aim of this contribution is to analyse the low frequency disturbance phenomenon into technical and scientific literature and to investigate if any possible objective method is available in order to assess noise disturbance inside dwellings.

6. A review of Australian wind farm noise assessment procedures C3 - Evans T, Cooper J. 2nd Australasian Acoustical Societies Conference, ACOUSTICS 2016; 2016: Australian Acoustical Society;2: p. 898-907.

✓ EXPOSURE (vergelijking rekenprocedures, niet relevant voor review)

With the increase in wind energy projects in Australia over the past decade, most Australian States now have a wind farm noise assessment procedure either approved or in draft. Given that wind turbines operate under windy conditions and vary in noise level with the wind, these procedures necessarily vary from typical noise assessment methodologies applied to industry and transport sources. While there are differences between the wind farm noise assessment procedures within each State, in all cases the methodologies employed for the assessment of overall A-weighted noise levels are based on a modified version of that prescribed in the UK document ETSU-R-97 The Assessment and Rating of Noise from Wind Farms. With a higher level of attention around wind farm noise in comparison to other environmental noise sources and with some proposed assessment procedures in draft format, it is prudent to review these assessment procedures and consider their suitability. This paper reviews the approaches taken in the procedures to the assessment of wind farm and background noise, establishment of assessment criteria and the consideration of wind farm noise character. It is demonstrated that, while the assessment methodologies may appear fairly similar, relatively minor differences in procedure can have a significant impact on a noise assessment or developed noise objective.

7. Impacts of Industrial Wind Turbine Noise on Sleep Quality: Results From a Field Study of Rural Residents in Ontario, Canada. Lane JD, Bigelow PL, Majowicz SE, McColl RS J Environ Health. 2016 Jul;79(1):8-12.

✓ HE sleep; dit is uit 2016! We hadden al drie studies uit 2016 van dezelfde auteurs (Jalali et al)

The objectives of this study were to determine whether grid-connected industrial wind turbines (IWTs) are a risk factor for poor sleep quality, and if IWT noise is associated with sleep parameters in rural Ontarians. A daily sleep diary and actigraphy-derived measures of sleep were obtained from 12 participants from an IWT community and 10 participants from a comparison community with no wind power installations. The equivalent and maximum sound pressure levels within the bedroom were also assessed. No statistically significant differences were observed between IWT residents and non-IWT residents for any of the parameters measured in this study. Actigraphy and sleep diaries are feasible tools to understand the impact of IWTs on the quality of sleep for nearby residents. Further studies with larger sample sizes should be conducted to determine whether the lack of statistical significance observed here is a result of sample size, or reflects a true lack of association. https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=29257355

8. Noise and low-frequency sound levels due to aerial fireworks and prediction of the occupational exposure of pyrotechnicians to noise. Tanaka T, Inaba R, Aoyama A J Occup Health. 2016 Nov 29;58(6):593-601.

✓ NOT

OBJECTIVES: This study investigated the actual situation of noise and low-frequency sounds in firework events and their impact on pyrotechnicians. METHODS: Data on firework noise and low-frequency sounds were obtained at a point located approximately 100 m away from the launch site of a firework display held in "A" City in 2013. We obtained the data by continuously measuring and analyzing the equivalent continuous sound level (Leq) and the one-third octave band of the noise and low-frequency sounds emanating from the major firework detonations, and predicted sound levels at the original launch site. RESULTS: Sound levels of 100-115 dB and low-frequency sounds of 100-125 dB were observed at night. The maximum and mean Leq values were 97 and 95 dB, respectively. The launching noise level predicted from the sounds (85 dB) at the noise measurement point was 133 dB. Occupational exposure to noise for pyrotechnicians at the remote operation point (located 20-30 m away from the launch site) was estimated to be below 100 dB. CONCLUSIONS: Pyrotechnicians are exposed to very loud noise (>100 dB) at the launch point. We believe that it is necessary to implement measures such as fixing earplugs or earmuffs, posting a warning at the workplace, and executing a remote launching operation to prevent hearing loss caused by occupational exposure of pyrotechnicians to noise. It is predicted that both sound levels and low-frequency sounds would be reduced by approximately 35 dB at the remote operation site.
https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=27725489

9. Consistent modelling of wind turbine noise propagation from source to receiver. Barlas E, Zhu WJ, Shen WZ, Dag KO, Moriarty P J Acoust Soc Am. 2017 Nov;142(5):3297.

? EXPOSURE (alleen modellering, niet relevant voor review)

The unsteady nature of wind turbine noise is a major reason for annoyance. The variation of far-field sound pressure levels is not only caused by the continuous change in wind turbine noise source levels but also by the unsteady flow field and the ground characteristics between the turbine and receiver. To take these phenomena into account, a consistent numerical technique that models the sound propagation from the source to receiver is developed. Large eddy simulation with an actuator line technique is employed for the flow modelling and the corresponding flow fields are used to simulate sound generation and propagation. The local blade relative velocity, angle of attack, and turbulence characteristics are input to the sound generation model. Time-dependent blade locations and the velocity between the noise source and receiver are considered within a quasi-3D propagation model. Long-range noise propagation of a 5 MW wind turbine is investigated. Sound pressure level time series evaluated at the source time are studied for varying wind speeds, surface roughness, and ground impedances within a 2000 m radius from the turbine.
https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=29195435

10. Energy and environmental intolerance: Electromagnetic hypersensitivity, wind turbine syndrome. What is the reality?
Énergie et intolérances environnementales: Électro-hypersensibilité, syndrome éolien, qu'en est-il vraiment? Bonnet-Belfais M, Lambrozo J, Souques M, Piotrowski A, Tossa P Environnement, Risques et Sante. 2017;16(2):141-50.

? SOCIAL (kan artikel niet via RUG-bieb krijgen; vergelijking met andere 'stoornis' weinig relevant)

The current debate about means of power generation, in the framework of the energy transition, must necessarily consider questions about different forms of idiopathic environmental intolerance, notably hypersensitivity attributed to electromagnetic fields and the wind turbine syndrome, which incriminates the low frequency- and infra-sound waves emitted by industrial wind turbines. This

article attempts to take stock of current knowledge about each of these conditions, highlighting their differences and similarities. Although the offending sources are different, the symptoms, variable and not specific to any particular disease, are very similar. Nor has any consensual clinical definition of these conditions or their diagnostic criteria been established. Despite the lack of objective diagnostic criteria, many studies have investigated the existence of a potential causal link between the symptoms and the environmental factors implicated, attempting to highlight a possible plausible underlying mechanism, either biological or psychological. Although there is no doubt about the reality or the potential severity of the symptoms of electromagnetic hypersensitivity, no causal link with electromagnetic fields has been demonstrated to date, and no biological mechanism appears plausible. For the wind turbine syndrome, no direct health effect on the ear or other organs due to the noise emission of wind turbines, including low frequency and infrasound waves, has been demonstrated. The frequently mentioned discomfort has most often been linked to a negative perception of wind turbines. Psychological mechanisms have been explored for both syndromes, including a potential nocebo effect. Studies are also beginning to investigate the weight of the collective and sociological aspects that might favor the emergence of these forms of intolerance. Finally, in terms of medical care, the article considers the relation of these emerging environmental sensitivities to functional disorders, already well known especially to internists.
http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L615856362

11. Effect of Wind Farm Noise on Local Residents' Decision to Adopt Mitigation Measures. Botelho A, Arezes P, Bernardo C, Dias H, Pinto LMC Int J Environ Res Public Health. 2017 Jul 11;14(7).

- ✓ HE (geen nieuws wat betreft HE, wel relevant door relatie tussen geluidniveau & hinder en maatregelen)

Wind turbines' noise is frequently pointed out as the reason for local communities' objection to the installation of wind farms. The literature suggests that local residents feel annoyed by such noise and that, in many instances, this is significant enough to make them adopt noise-abatement interventions on their homes. Aiming at characterizing the relationship between wind turbine noise, annoyance, and mitigating actions, we propose a novel conceptual framework. The proposed framework posits that actual sound pressure levels of wind turbines determine individual homes' noise-abatement decisions; in addition, the framework analyzes the role that self-reported annoyance, and perception of noise levels, plays on the relationship between actual noise pressure levels and those decisions. The application of this framework to a particular case study shows that noise perception and annoyance constitutes a link between the two. Importantly, however, noise also directly affects people's decision to adopt mitigating measures, independently of the reported annoyance.
https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=28696404

12. A pilot study to assess residential noise exposure near natural gas compressor stations. Boyle MD, Soneja S, Quiros-Alcala L, Dalemarre L, Sapkota AR, Sangaramoorthy T, et al. PLoS ONE. 2017;12(4).

- ✓ NOT (geen relatie met windturbines)

Background U.S. natural gas production increased 40% from 2000 to 2015. This growth is largely related to technological advances in horizontal drilling and high-volume hydraulic fracturing. Environmental exposures upon impacted communities are a significant public health concern. Noise associated with natural gas compressor stations has been identified as a major concern for nearby residents, though limited studies exist. Objectives We conducted a pilot study to characterize noise levels in 11 homes located in Doddridge County, West Virginia, and determined whether these levels differed based on time of day, indoors vs. outdoors, and proximity of homes to natural gas compressor stations. We also compared noise levels at increasing distances from compressor stations to available noise guidelines, and evaluated low frequency noise presence. Methods We collected indoor and outdoor 24-hour measurements (Leq, 24hr) in eight homes located within 750

meters (m) of the nearest compressor station and three control homes located >1000m. We then evaluated how A-weighted decibel (dBA) exposure levels differed based on factors outlined above. Results The geometric mean (GM) for 24-hour outdoor noise levels at homes located <300m (Leq,24hr: 60.3 dBA; geometric standard deviation (GSD): 1.0) from the nearest compressor station was nearly 9 dBA higher than control homes (Leq,24hr: 51.6 dBA; GSD: 1.1). GM for 24 hour indoor noise for homes <300m (Leq,24hr: 53.4 dBA; GSD: 1.2) from the nearest compressor station was 11.2 dBA higher than control homes (Leq,24hr: 42.2 dBA; GSD: 1.1). Indoor average daytime noise for homes <300m of the nearest compressor stations were 13.1 dBA higher than control homes, while indoor nighttime readings were 9.4 dBA higher. Conclusions Findings indicate that living near a natural gas compressor station could potentially result in high environmental noise exposures. Larger studies are needed to confirm these findings and evaluate potential health impacts and protection measures.
http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L615098276

13. Public acceptance of large-scale wind energy generation for export from Ireland to the UK: evidence from Ireland. Brennan N, Van Rensburg TM, Morris C Journal of Environmental Planning and Management. 2017;60(11):1967-92.

- ✓ SOCIAL (tegenover export windenergie geen locale voordelen)

Although international trade in energy may offer a flexible and cost effective means by which European countries could meet their renewable energy targets, developers in the exporting nation can face local opposition for reasons which are not always clear. Using focus groups and a public survey, we contrast perspectives between local stakeholders and wind farm operators and investigate the community impacts associated with large-scale wind energy for domestic use and export from Ireland to the UK. Although the export of renewable energy from Ireland to the UK is currently on hold, our findings suggest that significant investment is required by the state and wind farm operators in better information provision, trust building, effective instruments to internalise wind farm externalities and co-management arrangements before Ireland can fully capture the benefits of wind exports to the UK. © 2017 Newcastle University.
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85010684450&doi=10.1080%2f09640568.2016.1268109&partnerID=40&md5=c17937f31ebe8f1f1b6ab17cdb52fbb1

14. Welcoming Wind Turbines and the PIMBY ("Please in My Backyard") Phenomenon: The Culture of the Machine in the Rural American Midwest. Brinkman JT, Hirsh RF Technol Cult. 2017;58(2):335-67.

- ✓ SOCIAL (interessant omdat het gaat over het verwelkomen van windparken)

This article argues that the welcoming of wind turbines in midwestern farming communities, the so-called PIMBY ("Please in My Backyard") phenomenon, constitutes only the most recent expression of a historical process of farmers forming an ultramodern identity, one that still goes largely unappreciated by relatively backward city residents. We conclude that farmers undertook a two-step process to develop a modern identity that incorporated rural values. In the first step, beginning early in the twentieth century, agrarians employed a discourse of rural capitalistic modernity to combat urban yokel stereotypes within the context of a broader rural-urban conflict. This rural capitalistic modernity strengthened during the cold war until it transformed, in the second step, into the current ultramodern discourse. Wind turbines, in addition to providing economic benefits, function ontologically to maintain an identity of rural citizens as savvy producers and users of technology, and to deflect stereotypes imposed by their urban cousins.
https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=28649111

15. [From the Experts Office: Hearing Impairment due Vibration, Infrasound, Ultrasound and/or Bodysound?]. Brusis T Laryngorhinootologie. 2017 May;96(5):316-8.

https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=28514800

✓ onduidelijk (lijkt editorial, Duits artikel niet via RUG-bieb verkrijgbaar)

16. Subjective perception of wind turbine noise C3 - Cooper SE. Proceedings of Meetings on Acoustics; 2017: Acoustical Society of America;30.

✓ NOT (alleen abstract)

The evaluation of wind turbine noise impacting upon communities is generally related to external noise environments and has a problem with separating wind turbine noise from ambient noise (which includes the presence of wind) which is not normally the case for general environmental noise. Subjective testing of wind turbine noise to examine amplitude modulation and subjective loudness has tended to use large baffle speaker systems to produce the infrasound/low-frequency noise and one high-frequency speaker - all as a mono source. Comparison of mono and stereo recordings of audible wind turbine noise played back in a test chamber and a smaller hemi-anechoic space provides a distinct different perception of amplitude modulation of turbines. A similar exercise compares use of high-quality full-spectrum headphones with the two different sound files applied to just the ears is discussed. © 2017 Acoustical Society of America.

17. Subjective perception of wind turbine noise - The stereo approach C3 -. Cooper SE, Chan C. Proceedings of Meetings on Acoustics; 2017: Acoustical Society of America;31.

✓ NOT (alleen abstract)

The conduct of stereo measurements for both playback in high-quality headphones and in a hemi-anechoic room has been undertaken for a number of wind farms and other low-frequency noise sources as an expansion of the material previously presented at the Boston ASA meeting. The results of the additional monitoring, evaluation, and subjective analysis of this procedure are discussed and identifies the benefits of monitoring noise complaints and assessments of wind farm noise in stereo. The laboratory mono subjective system was used to reproduce the audio wave file obtained in a dwelling. The test signal, being inaudible, was presented as a pilot double blind provocation case control study to 9 test subjects who have been identified as being sensitized to wind turbine noise and low frequency pulsating industrial noise. All test subjects could detect the operation of the inaudible test signal. The use of a stereo manikin to investigate detected inaudible "hotspots" is discussed. © 2018 Acoustical Society of America.

18. The role of public policy in the development of technological capabilities of companies in the wind energy sector and the impact on social and environmental performance. de Melo JMGN, Câmara SF, Farias FG, de Lima FN, de Freitas AAF International Journal of Energy Economics and Policy. 2017;7(3):58-65.

✓ SOCIAL

The object of this study was to analyze the role of public policies in the development of technological capacities in firms of the wind energy sector and the impacts of this development in social and environmental performances of these firms. The investigation was organized through semi-structured interviews with ten professionals of political policies in different Brazilian states and seven professionals of wind energy corporations in Brazil. The main implications in the field of public policies reveal they were fundamental for the sectors development, but were inefficient regarding the transfer of technology to Brazil, training and qualification of the workforce, development of the infrastructure to the wind energy sector, and the development of technological capacities of the firms. © 2017, Econjournals. All rights reserved.
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85025085150&partnerID=40&md5=63b8395683b688a62fff3ac00082de96

19. A blot on the landscape: Consensus and controversies on wind farms in rural Portugal. Delicado A, Truninger M, Figueiredo E, Silva L, Horta A. Research in Rural Sociology and Development: Emerald Group Publishing Ltd.; 2017;24: p. 179-95.

- ✓ VISUAL

In recent years, Portugal has witnessed the siting of 250 wind farms, particularly in mountainous and rural areas. Even though, unlike other European countries, general public consensus seemed at first to prevail, protests by local population and ENGOs have been increasing of late (many broadcast by the media) - the outcomes of Environmental Impact Assessments (EIAs) provide a good example. This chapter has two main objectives. On one hand, it examines how rural landscapes are discursively framed in the press when the Portuguese media picks up wind energy issues. On the other hand, by analysing EIA reports, it aims at identifying the social actors involved in the decision process of the siting of wind farms in rural or peri-urban areas, the arguments for and against the location of these facilities and how the (rural) landscape is framed and represented. The empirical material is drawn on three different sources: media analysis of the public discourse on landscape issues related to wind farms; an analysis of EIA reports regarding wind farms in Portugal and an analysis of official positions on this issue assessed through the Environmental Impact Declarations (EID) of EIA processes. It is concluded that despite the lack of media attention to landscape impacts' of wind farms, the existing discursive frames are often attached to dichotomized cultural meanings: it either deems wind farms as technological tools for landscape progressive transformation or as a risk to its pristine image. As to the EIA reports, landscape matters are more visible and important and at times sufficient to reject approval or change of the siting of a wind farm.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85021839447&doi=10.1108%2fS1057-192220170000024009&partnerID=40&md5=2be9ce2365033eb3ad43c8a58519d91f

20. Wind turbine noise at neighbor dwellings, comparing calculations and measurements C3 - I. Egedal R, Hansen MB, Søndergaard LS. INTER-NOISE 2017 - 46th International Congress and Exposition on Noise Control Engineering: Taming Noise and Moving Quiet; 2017: Institute of Noise Control Engineering;2017-January.

- ✓ EXPOSURE (goede overeenkomst metingen-berekeningen; afwijking door achtergrondruis wind)

Danish noise regulation for wind farms (currently BEK 1736) is based on calculated noise levels at residents from sound power level measurements at a wind speed of 6 and 8 m/s (10 m height). Doubt has been raised on whether the above-mentioned method gives the same results as actual measurements where residents live. The Danish Environmental Protection Agency (Danish EPA) has therefore initiated several projects with noise measurements at residents. DELTA has conducted one of the measurement campaigns where synchronized measurements were carried out both close to the turbines (IEC distance), at an intermediate position and at the residents - both indoor and outdoor. The project consists of two types of measurements, the first being highly surveyed short-term measurements of 2-3 hours and the second being long term continuous measurements. The two different approaches ensure that different ranges of wind direction and wind speed were included in the measurements and hence describe the noise around the turbines and not necessarily only in downwind direction. The short-term measurements ensure that part of the measurements is conducted in a close to controlled environment. The results of the measurements are compared with the calculated values. The calculations are carried out using the prescribed method in BEK 1736 and a more advanced model, in this project the Nord2000 model. The goal of the comparison is to clarify the following: I) Are there systematic differences between calculation and measurements both indoors and outdoors? II) What is the uncertainty using measurements contra calculation? III) Does other wind speeds than 6 and 8 m/s and other wind directions, cause the wind turbines to emit more pronounced tones or low frequent noise?

21. Do wind turbines affect the health and welfare of neighboring residents?
Hebben windturbines een weerslag op de gezondheid en het welzijn van omwonenden? Finoulst M, Vankrunkelsven P Tijdschrift voor Geneeskunde. 2017;73(6):373-6.

✓ HE (niet via RUG-bieb verkrijgbaar; lijkt me geen eigen studie, eerder soort review?)

http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L615288835

22. Landscape disruption or just a lack of economic benefits? Exploring factors behind the negative perceptions of wind turbines. Frantál B, Van Der Horst D, Kunc J, Jaňurová M Journal of Landscape Ecology. 2017;15(2):139-47.

✓ VISUAL

This paper provides new empirical evidence on the hypothesis that the perception of landscape disruption by wind turbines is a substantially subjective and relative matter. It is based on a survey involving nearly five hundred residents living in six different locations with operational wind turbines in the Czech Republic. Geographical and socioeconomic factors and sociodemographic characteristics that affect local community perceptions of landscape disruption are explored using correlations and a regression analysis model. The results suggest that the expressed perception of landscape disruption is not determined by the number of existing wind turbines, the proximity of residences to them and their visibility from the home but is significantly affected by the perception of the economic favourability of projects (benefits to local communities), perception of other negative impacts of wind turbines (particularly the noise annoyance) and the socio-cultural background of people (particularly the level of education).
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85041317757&partnerID=40&md5=e0b7873c8ce1d8b2f22a5ee1a13b850a

23. Stapes displacement and intracochlear pressure in response to very high level, low frequency sounds. Greene NT, Jenkins HA, Tollin DJ, Easter JR Hear Res. 2017 May;348:16-30.

✓ LFN

The stapes is held in the oval window by the stapedial annular ligament (SAL), which restricts total peak-to-peak displacement of the stapes. Previous studies have suggested that for moderate (<130 dB SPL) sound levels intracochlear pressure (PIC), measured at the base of the cochlea far from the basilar membrane, increases directly proportionally with stapes displacement (DStap), thus a current model of impulse noise exposure (the Auditory Hazard Assessment Algorithm for Humans, or AHAAH) predicts that peak PIC will vary linearly with DStap up to some saturation point. However, no direct tests of DStap, or of the relationship with PIC during such motion, have been performed during acoustic stimulation of the human ear. In order to examine the relationship between DStap and PIC to very high level sounds, measurements of DStap and PIC were made in cadaveric human temporal bones. Specimens were prepared by mastoidectomy and extended facial recess to expose the ossicular chain. Measurements of PIC were made in scala vestibuli (PSV) and scala tympani (PST), along with the SPL in the external auditory canal (PEAC), concurrently with laser Doppler vibrometry (LDV) measurements of stapes velocity (VStap). Stimuli were moderate (approximately 100 dB SPL) to very high level (up to approximately 170 dB SPL), low frequency tones (20-2560 Hz). Both DStap and PSV increased proportionally with sound pressure level in the ear canal up to approximately approximately 150 dB SPL, above which both DStap and PSV showed a distinct deviation from proportionality with PEAC. Both DStap and PSV approached saturation: DStap at a value exceeding 150 mum, which is substantially higher than has been reported for small mammals, while PSV showed substantial frequency dependence in the saturation point. The relationship between PSV and DStap remained constant, and cochlear input impedance did not vary across the levels tested, consistent with prior measurements at lower sound levels. These results suggest that PSV sound pressure holds constant relationship with DStap, described by the cochlear input impedance, at these, but perhaps not higher, stimulation levels. Additionally, these results indicate that the AHAAH model, which was developed using results from small animals, underestimates the sound pressure levels in the cochlea in response to high level sound stimulation, and must be revised.

https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=28189837

24. Application of electroencephalographic techniques to the study of visual impact of renewable energies. Grima Murcia MD, Sanchez Ferrer F, Sorinas J, Ferrandez JM, Fernandez E J Environ Manage. 2017 Sep 15;200:484-9.

✓ VISUAL (geen visueel effect WTs!?)

Much is currently being studied on the negative visual impact associated to the installation of large wind turbines or photovoltaic farms. However, methodologies for quantitatively assessing landscape impact are scarce. In this work we used electroencephalographic (EEG) recordings to investigate the brain activity of 14 human volunteers when looking at the same landscapes with and without wind turbines, solar panels and nuclear power plants. Our results showed no significant differences for landscapes with solar power systems or without them, and the same happened for wind turbines, what was in agreement with their subjective scores. However, there were clear and significant differences when looking at landscapes with and without nuclear power plants. These differences were more pronounced around a time window of 376-407 msec and showed a clear right lateralization for the pictures containing nuclear power plants. Although more studies are still needed, these results suggest that EEG recordings can be a useful procedure for measuring visual impact.

https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=28622651

25. WHO environmental noise guidelines for the European region: A systematic review on environmental noise and annoyance. Guski R, Schreckenberg D, Schuemer R International Journal of Environmental Research and Public Health. 2017;14(12).

✓ REVIEW WHO (only annoyance)

Background: This paper describes a systematic review and meta-analyses on effects of environmental noise on annoyance. The noise sources include aircraft, road, and rail transportation noise as well as wind turbines and noise source combinations. Objectives: Update knowledge about effects of environmental noise on people living in the vicinity of noise sources. Methods: Eligible were published studies (2000-2014) providing comparable acoustical and social survey data including exposure-response functions between standard indicators of noise exposure and standard annoyance responses. The systematic literature search in 20 data bases resulted in 62 studies, of which 57 were used for quantitative meta-analyses. By means of questionnaires sent to the study authors, additional study data were obtained. Risk of bias was assessed by means of study characteristics for individual studies and by funnel plots to assess the risk of publication bias. Main Results: Tentative exposure-response relations for percent highly annoyed residents (%HA) in relation to noise levels for aircraft, road, rail, wind turbine and noise source combinations are presented as well as meta-analyses of correlations between noise levels and annoyance raw scores, and the OR for increase of %HA with increasing noise levels. Quality of evidence was assessed using the GRADE terminology. The evidence of exposure-response relations between noise levels and %HA is moderate (aircraft and railway) or low (road traffic and wind turbines). The evidence of correlations between noise levels and annoyance raw scores is high (aircraft and railway) or moderate (road traffic and wind turbines). The evidence of ORs representing the %HA increase by a certain noise level increase is moderate (aircraft noise), moderate/high (road and railway traffic), and low (wind turbines). Strengths and Limitations: The strength of the evidence is seen in the large total sample size encompassing the included studies (e.g., 18,947 participants in aircraft noise studies). Main limitations are due to the variance in the definition of noise levels and %HA. Interpretation: The increase of %HA in newer studies of aircraft, road and railway noise at comparable L den levels of earlier studies point to the necessity of adjusting noise limit recommendations. Funding: The review was funded by WHO Europe.

http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L619594988

26. Scheduling structural health monitoring activities for optimizing life-cycle costs and reliability of wind turbines C3 -. Hanish Nithin A, Omenzetter P. In: Meyendorf NG, editor. Proceedings of SPIE - The International Society for Optical Engineering; 2017: SPIE;10171.

✓ NOT (technische staat WTs)

Optimization of the life-cycle costs and reliability of offshore wind turbines (OWTs) is an area of immense interest due to the widespread increase in wind power generation across the world. Most of the existing studies have used structural reliability and the Bayesian pre-posterior analysis for optimization. This paper proposes an extension to the previous approaches in a framework for probabilistic optimization of the total life-cycle costs and reliability of OWTs by combining the elements of structural reliability/risk analysis (SRA), the Bayesian pre-posterior analysis with optimization through a genetic algorithm (GA). The SRA techniques are adopted to compute the probabilities of damage occurrence and failure associated with the deterioration model. The probabilities are used in the decision tree and are updated using the Bayesian analysis. The output of this framework would determine the optimal structural health monitoring and maintenance schedules to be implemented during the life span of OWTs while maintaining a trade-off between the life-cycle costs and risk of the structural failure. Numerical illustrations with a generic deterioration model for one monitoring exercise in the life cycle of a system are demonstrated. Two case scenarios, namely to build initially an expensive and robust or a cheaper but more quickly deteriorating structures and to adopt expensive monitoring system, are presented to aid in the decision-making process. © 2017 SPIE.

27. Public health implications of environmental noise associated with unconventional oil and gas development. Hays J, McCawley M, Shonkoff SBC Science of the Total Environment. 2017;580:448-56.

✓ NOT (gaat niet over WTs)

Modern oil and gas development frequently occurs in close proximity to human populations and increased levels of ambient noise have been documented throughout some phases of development. Numerous studies have evaluated air and water quality degradation and human exposure pathways, but few have evaluated potential health risks and impacts from environmental noise exposure. We reviewed the scientific literature on environmental noise exposure to determine the potential concerns, if any, that noise from oil and gas development activities present to public health. Data on noise levels associated with oil and gas development are limited, but measurements can be evaluated amidst the large body of epidemiology assessing the non-auditory effects of environmental noise exposure and established public health guidelines for community noise. There are a large number of noise dependent and subjective factors that make the determination of a dose response relationship between noise and health outcomes difficult. However, the literature indicates that oil and gas activities produce noise at levels that may increase the risk of adverse health outcomes, including annoyance, sleep disturbance, and cardiovascular disease. More studies that investigate the relationships between noise exposure and human health risks from unconventional oil and gas development are warranted. Finally, policies and mitigation techniques that limit human exposure to noise from oil and gas operations should be considered to reduce health risks. http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L613977878

28. Health effects from wind turbine low frequency noise & infrasound: Do wind turbines make people sick? That is the issue. Hessler G, Leventhall G, Schomer P, Walker B Sound and Vibration. 2017;51(1):34-44.

✓ LFN

Do wind turbines make people sick? That is a contentious issue in licensing wind farms. In particular, low frequency sound emissions (infrasound and "pulsed" and steady low frequency sound) from wind turbines are blamed by opponents but vigorously denied by project proponents. This leads to an impasse of testifying "experts," and regulators must decide on the basis of witness credibility for

each project, leading to inconsistent findings. This article presents the opinions of four very experienced independent investigators with wind turbine acoustics over the past four decades. The latest Threshold-of-Hearing research down to 2 Hz is compared to today's modern wind turbine emissions. It is jointly concluded that infrasound (0-20 Hz) can almost be ruled out, subject to completion of recommended practical research, and that no new low frequency limit is required, provided adequate "A"- weighted levels are mandated.
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85017186514&partnerID=40&md5=4d0d021a31bf6d9ddafc6959e7329aef

29. Wind turbines , amenities and disamenities : A study of home value impacts in densely populated Massachusetts. Hoen B, Atkinson-Palombo C Journal of Real Estate Research. 2017;38(4):473-504.

- ✓ NOT (betreft huizenprijzen)

In this study, we investigate the effect of planned or operating wind turbines on urban home values. Previous studies, which largely produced non-significant findings, focused on rural settings. We analyzed more than 122,000 home sales, between 1998 and 2012, that occurred near 41 turbines in densely populated Massachusetts communities. Although we found the effects from various negative features (such as electricity transmission lines) and positive features (such as open space) generally accorded with previous studies, we found no net effects due to turbines in these communities. We also found no unique impact on the rate of home sales near wind turbines. © 2017, American Real Estate Society. All rights reserved.
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85019936631&partnerID=40&md5=7e4eda67bc932af684c618834a60bca6

30. Indoor noise annoyance due to 3-5 megawatt wind turbines-An exposure-response relationship. Hongisto V, Oliva D, Keranen J J Acoust Soc Am. 2017 Oct;142(4):2185.

- ✓ HE annoyance (belangrijk: nieuwe veldstudie met vergelijking andere dosis-effect relaties; 'SPL enige objectieve factor voor overheid')

The existing exposure-response relationships describing the association between wind turbine sound level and noise annoyance concern turbine sizes of 0.15-3.0 MW. The main purpose of this study was to determine a relationship concerning turbines with nominal power of 3-5 MW. A cross-sectional survey was conducted around three wind power areas in Finland. The survey involved all households within a 2 km distance from the nearest turbine. Altogether, 429 households out of 753 participated. The households were exposed to wind turbine noise having sound levels within 26.7-44.2 dB LAeq. Standard prediction methods were applied to determine the sound level, LAeq, in each participant's yard. The measured sound level agreed well with the predicted sound level. The exposure-response relationship was derived between LAeq outdoors and the indoor noise annoyance. The relationship was in rather good agreement with two previous studies involving much smaller turbines (0.15-1.5 MW) under 40 dB LAeq. The Community Tolerance Level (CTL), CTL20 = 50 dB, was 3 dB lower than for two previous studies. Above 40 dB, a small number of participants prevented a reliable comparison to previous studies.
https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=29092540

31. Author response: Short-Communication: Revisiting conclusions of the report titled "The impact of psychological factors on self-reported sleep disturbance among people living in the vicinity of wind turbines by Jalali et al.", published in Environmental Research, Volume 148, July 2016, 401-410. Jalali L, Nezhad-Ahmadi MR, Gohari M, Bigelow P, McColl S Environ Res. 2017 May;155:403-5.

- ✓ HE sleep (commentaar weerlegd)

https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=28249689

32. The pros and cons of wind power - The holistic view of the cultural landscape dynamic is missing. Jedicke E Naturschutz und Landschaftsplanung. 2017;49(2):33.

✓ NOT (dit is een editorial, geen wetenschappelijke bijdrage)

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85011632726&partnerID=40&md5=f9e79b096dd453787f8c0739b3e812a5

33. A proposed metric for assessing the potential of community annoyance from wind turbine low-frequency noise emissions. Kelley ND [No source information available]. 2017.

✓ NOT (dit is een rapport uit 1987)

Annoyance caused by low frequency impulsive noise emissions from wind turbine installations was monitored. Interior environments resulting from acoustic loads radiated both from individual turbines and from groups of upwind and downwind turbines were simulated and the reactions of volunteers correlated with descriptors for the prediction of low frequency annoyance. Procedures for application in assessing the noise impact of wind turbine installations on communities were proposed.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85040895006&partnerID=40&md5=19d64f5462aa9b571a1fc826e5c78762

34. Wind Turbine and Local Acceptance in Southern Thailand C3 -. Kongprasit S, Waewsak J, Chaichana T. In: Waewsak J, S OT, Gagnon Y, Sangkharak K, editors. Energy Procedia; 2017: Elsevier Ltd;138: p. 380-5.

✓ SOCIAL

Wind power has been promoted as a clean energy. However, debate is ongoing with local residents who are not informed about what is occurring in their areas. Local acceptance for wind turbine installations was studied by means of a listening investigation with 729 participants in two districts (Hua Sai and Pak Phanang) in Nakhon Si Thammarat Province, Southern Thailand. The aim of the research was to evaluate the public attitude and its acceptance for wind farms. The studies at Pak Phanang showed that most participants (68.5%) did not know about the project details. However, most participants who lived in Hua Sai (84.1%) knew about the project. According to the informants, 91.5% of the residents in Hua Sai agreed to implementation of the construction, while in Pak Phanang only 45.6% of the residents were in agreement. The construction phase and operation of the wind turbine can have an impact on the environment. Our study revealed that the participants who were concerned about noise pollution were 65.5% and 66.7% in Hua Sai and Pak Phanang, respectively. Future research should be employed to investigate the social impact in both negative and positive ways. The potential harm to the local community particularly on noise and visual impact needs to be identified. The main lesson learnt from this study was that local acceptance is important for project development, particularly in Thailand where capitalism and Thai culture play a key role for project implementation. © 2017 The Authors. Published by Elsevier Ltd.

35. Evaluation of a Wind Noise Attenuation Algorithm on Subjective Annoyance and Speech-in-Wind Performance. Korhonen P, Kuk F, Seper E, Morkebjerg M, Roikjer M J Am Acad Audiol. 2017 Jan;28(1):46-57.

✓ NOT (dit gaat over windgeluid op het oor)

BACKGROUND: Wind noise is a common problem reported by hearing aid wearers. The MarkeTrak VIII reported that 42% of hearing aid wearers are not satisfied with the performance of their hearing aids in situations where wind is present. PURPOSE: The current study investigated the effect of a new wind noise attenuation (WNA) algorithm on subjective annoyance and speech recognition in the presence of wind. RESEARCH DESIGN: A single-blinded, repeated measures design was used. STUDY SAMPLE: Fifteen experienced hearing aid wearers with bilaterally symmetrical (</=10 dB) mild-to-moderate sensorineural hearing loss participated in the study. DATA COLLECTION AND ANALYSIS: Subjective rating for wind noise annoyance was measured for wind presented alone from 0 degrees and 290 degrees at wind speeds of 4, 5, 6, 7, and 10 m/sec. Phoneme identification performance was

measured using Widex Office of Clinical Amplification Nonsense Syllable Test presented at 60, 65, 70, and 75 dB SPL from 270 degrees in the presence of wind originating from 0 degrees at a speed of 5 m/sec. RESULTS: The subjective annoyance from wind noise was reduced for wind originating from 0 degrees at wind speeds from 4 to 7 m/sec. The largest improvement in phoneme identification with the WNA algorithm was 48.2% when speech was presented from 270 degrees at 65 dB SPL and the wind originated from 0 degrees azimuth at 5 m/sec. CONCLUSION: The WNA algorithm used in this study reduced subjective annoyance for wind speeds ranging from 4 to 7 m/sec. The algorithm was effective in improving speech identification in the presence of wind originating from 0 degrees at 5 m/sec. These results suggest that the WNA algorithm used in the current study could expand the range of real-life situations where a hearing-impaired person can use the hearing aid optimally. https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=28054911

36. Perceptions of wind energy projects in two coastal Massachusetts communities. Lamy J, Azevedo IML, Bruine de Bruin W, Morgan MG Electricity Journal. 2017;30(7):31-42.

✓ SOCIAL (minder negatieve perceptie van bestaand t.o.v. fictief project)

Using 15 semi-structured interviews of residents in two neighboring coastal Massachusetts communities, one of which recently installed an onshore wind project, a study sought to identify the specific characteristics that drive perceptions about the existing project as well as hypothetical new onshore or offshore projects. It found that economic benefits and visual aspects of the project were most important to participants, followed by noise, environmental benefits, hazard to wildlife, and safety concerns. © 2017 Elsevier Inc.
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85032498451&doi=10.1016%2fj.tej.2017.07.003&partnerID=40&md5=29c8054655945ddc2d011bfde4b8ea88

37. Public participation in wind energy projects located in Germany: Which form of participation is the key to acceptance? Langer K, Decker T, Menrad K Renewable Energy. 2017;112:63-73.

✓ SOCIAL (informatie belangrijker dan geld!)

It is widely recognized that social aspects play an important role in the implementation of wind energy projects. The energy transition in Germany can only succeed if the needs and expectations of local citizens are taken into account. Previous research has shown that public participation fosters the acceptance of wind energy by citizens. This study explores which form of participation citizens prefer with respect to wind energy projects. Opportunities for participation range from no participation, alibi participation, information, consultation, cooperation and financial participation. We used a hypothetical choice experiment in which people are asked to choose between different wind energy projects that were described by a number of attributes. The results show that the most important factors influencing the acceptance of wind energy projects are the sound level at the place of residence, the distance of the turbines to the place of residence and participation opportunities. With regard to participation, respondents prefer information over financial participation. The results suggest that citizens should be involved in informative and deliberative participation processes. © 2017 Elsevier Ltd
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85019132205&doi=10.1016%2fj.renene.2017.05.021&partnerID=40&md5=a7707e6e9b93a1ce31e9096b871eb953

38. Comments by the Academic Editors to Responses and Replies Concerning Mroczek et al.'s "Evaluation of Quality of Life of Those Living near a Wind Farm": Int. J. Environ. Res. Public Health 2015, 12, 6066-6083. Lercher P, Tchounwou PB Int J Environ Res Public Health. 2017 Mar 8;14(3).

✓ HE QoL (editors zijn het eens met critici wat betreft kwaliteit oorspronkelijke artikel)

https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=28282866

39. A turbine is not only a turbine: The role of social context and fairness characteristics for the local acceptance of wind power. Liebe U, Bartczak A, Meyerhoff J Energy Policy. 2017;107:300-8.

✓ SOCIAL (bij bestaande WTS meer acceptatie)

To gain acceptance for renewable energy production sites, it is not sufficient to develop the appropriate technology without taking the social context and fairness concerns into account. Using a factorial survey experiment, we investigate the influence of both on the local acceptance of wind turbine developments in Germany and Poland–two countries differing in installed wind power capacity. Respondents were surveyed with hypothetical situations describing the construction of wind farms varying in the opportunity to participate in the planning process (participatory justice), the distribution of turbines across regions (distributive justice), and ownership, among other characteristics. We find higher acceptance levels in Poland than in Germany. Respondents in both countries are willing to accept new turbines in their vicinity if they can participate in decision making, the turbines are owned by a group of citizens, and if the generated electricity is consumed in the region instead of being exported. Overall, participatory justice is more important than distributive justice. Confirming previous results, we also find that respondents who already have turbines in their vicinity show higher acceptance levels than those who are not yet affected. Thus, the negative externalities are likely to be overestimated in the planning and implementation process. © 2017 Elsevier Ltd

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85018788745&doi=10.1016%2fj.enpol.2017.04.043&partnerID=40&md5=8bee3996b9ec0932e48ab1ec20012fb5

40. What Is the Benefit of Community Benefits? Exploring Local Perceptions of the Provision of Community Benefits from a Commercial Wind Energy Project. Macdonald C, Glass J, Creamer E Scottish Geographical Journal. 2017;133(3-4):172-91.

✓ SOCIAL (door verkeerd proces negatievere perceptie)

Where community ownership of renewable energy projects is not feasible, there remains potential for residents to profit from locally sited projects through a 'community benefits' package from a commercial developer, usually as an annual cash payment to a community organisation. Despite support from policy-makers and developers for community benefit packages, the relationship between the benefit package and acceptance of renewable energy projects is not straightforward. Drawing on semi-structured interviews with local residents and other community actors near a wind development in central Scotland, this paper examines the 'process' and 'outcome' dimensions of the design and provision of community benefits, and considers how the relationship between these two dimensions affects local perceptions of the benefit of community benefits. Analysis of interviewees' perceptions of the community engagement 'process' at the planning stage and the community benefit package 'outcome' reveals how a poorly defined engagement process, combined with a benefits package that is not deemed suitable for the needs of the community, can lead to negative perceptions of the project, even when these were initially positive. These findings have implications for renewable energy policy in Scotland, particularly as there is currently no legal obligation for developers to consult communities on community benefit arrangements. © 2017 Royal Scottish Geographical Society.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85035102033&doi=10.1080%2f14702541.2017.1406132&partnerID=40&md5=63328e0d4fc0fa79eafc2085aa1ead68

41. Offshore wind turbines visual impact estimation C3 -. Maslov N, Wang T, Tang T, Claramunt C. In: Wang T, Li X, Brosset D, Claramunt C, editors. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics): Springer Verlag; 2017;10181 LNCS: p. 169-77.

✓ OFFSHORE

The objective of this paper is to present a method that qualifies the degree of visibility of an offshore wind farm from an observer located along the coast. In many cases, the deployment of an offshore wind farm leads to public opposition. This entails the need for the development of appropriate methods that might present in the most intelligible way the impacts of an offshore wind farm. Amongst many factors to take into account, the visual impact of such farms is surely a factor to take into account. We introduce a visual operator that integrates several parameters that mainly depend on the distance of the wind farm to the cost. We apply a measure that evaluates the horizon surface impact modulated by the number of distinguishable turbines and an aesthetic index based on turbine alignments. The whole method is implemented on top of a Geographical Information System (GIS) and provides a decision-aid mechanism oriented to decision- makers. The whole approach is experimented in the context of a wind farm in North West France.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85018870121&doi=10.1007%2f978-3-319-55998-8_11&partnerID=40&md5=116ebd94eaef8ca23e23a1600d4980c3

42. Response to Shepherd Comment on Mroczek et al. Evaluation of Quality of Life of Those Living Near a Wind Farm. Int. J. Environ. Res. Public Health, 2015, 12, 6066-6083. Mroczek B, Banas J, Machowska-Szewczyk M, Kurpas D Int J Environ Res Public Health. 2017 Feb 1;14(2).

- ✓ HE QoL (reactie op kritiek studie Mroczek et al; zie ook 38 en 48)

In response to the reservations, I would like to list the differences between the article [...].
https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=28157147

43. Short-Communication: Revisiting conclusions of the report titled, "The impact of psychological factors on self-reported sleep disturbance among people living in the vicinity of wind turbines," by Leila Jalali, Mohammad-Reza Nezhad-Ahmadi, Mahmood Gohari, Philip Bigelow, & Stephen McColl, published in environmental research, volume 148, July 2016, 401-410. Palmer WK Environ Res. 2017 May;155:401-2.

- ✓ HE sleep (andere interpretative resultaten; weerlegd in 31)

The research report concluded, "It appears that self-reported sleep reported of participants may be associated to the indirect effects of visual and attitudinal cue and concern about property devaluation rather than distance to the nearest WT's or noise as itself." Careful reading of the report shows that the conclusions presented are not supported by the data provided in the report.
https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=28342524

44. Annoyance to wind turbine noise – influence of different acoustical characteristics C3 - Schäffer B, Pieren R, Schlittmeier SJ, Brink M, Heutschi K. INTER-NOISE 2017 - 46th International Congress and Exposition on Noise Control Engineering: Taming Noise and Moving Quiet; 2017: Institute of Noise Control Engineering;2017-January.

- ✓ NOT (intussen peer-reviewed artikel verschenen –zie 83)

Due to the growing production of wind energy worldwide, increasing portions of the population are exposed to wind turbine noise. Results of field and laboratory studies show that wind turbine noise is more annoying than transportation noise at comparable sound pressure levels. This effect might be caused by various properties of wind turbines, such as their visibility or their acoustical characteristics (e.g., amplitude modulation). However, knowledge on the annoyance effects of wind turbine noise alone, i.e., without confounders such as visibility, is still scarce. In the present study, the short-term annoyance to different sound scenarios was investigated in laboratory listening tests under fully controlled conditions, which allowed for exclusion of potential confounders like visual effects present in field surveys. The sound scenarios comprised different situations of wind turbine and other broadband sounds, covering different acoustical characteristics. In particular, the impact of

three variables on annoyance ratings were tested, namely, spectral shape, depth of periodic amplitude modulation, and occurrence (or absence) of random amplitude modulation due to atmospheric turbulence. The sound scenarios were generated by sound synthesis. Participants were exposed to the sound scenarios reproduced via loudspeakers at a sound pressure level LAeq of 40 dB, and their ratings on subjectively perceived annoyance were collected. The factorial design of the experiment allows for separation of the individual contributions of the above three variables to the annoyance ratings. Further, semantic differentials and questionnaires are used to interpret and discuss the findings. Here we present the setup of the listening tests, the most important results including a preliminary comparison with the psychoacoustic parameter loudness, and possible implications for future research and applications.

45. Patterns of acceptance and non-acceptance within energy landscapes: Acase study on wind energy expansion in Austria. Scherhaufer P, Höltinger S, Salak B, Schauppenlehner T, Schmidt J Energy Policy. 2017;109:863-70.

✓ SOCIAL

Wind energy is a key technology in the transition toward a low-carbon society, but acceptance is considered to be a constraining factor in achieving ambitious wind deployment targets. Based on an Austrian case study, this paper investigates eight decisive patterns of acceptance and non-acceptance of wind energy. We apply qualitative research methods, such as interviews, focus groups, and WorldCafé discussions, with stakeholders on the national level and with citizens and local decision-makers at potential wind power expansion sites. The results show that local opposition to wind energy cannot be explained by single factors but is caused by a complex set of individual and collective preferences rooted in institutional and socio-political arrangements. The problem concerning these conflicting patterns is that they are trapped in often opposing or confronting policy core beliefs, which are unlikely to change. Hence, it is necessary to appeal to overarching targets like the claims of environmental justice to counterbalance the impacts of wind energy. We conclude that there is a strong demand for fair decision-making processes and an equal distribution of environmental and economic gains and losses.
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85020130920&doi=10.1016%2fj.enpol.2017.05.057&partnerID=40&md5=368bc4a3f750bde18dc53a3d728c8712

46. What is wrong with Nimbys? Renewable energy, landscape impacts and incommensurable values. Schwenkenbecher A Environmental Values. 2017;26(6):711-32.

✓ SOCIAL

Local opposition to infrastructure projects that implement renewable energy (RE), such as wind farms, is often strong even if state-wide support for RE is strikingly high. The slogan 'Not In My Backyard' (NIMBY) has become synonymous for this kind of protest. This paper revisits the question of what might be wrong with those who are NIMBYs about RE projects, and how best to address them. I will argue that local opponents to wind farm (and other RE) developments do not necessarily fail to contribute their fair share to producing a desirable public good (clean energy). In fact, with landscape concerns being at the heart of much protest, the question of fair burden distribution becomes sidelined: landscape impacts cannot be distributed nor compensated for. Protests may be attempts to express a true conflict of (incommensurable) values. Understanding them as such will help us better address NIMBY concerns and overcome such opposition through ensuring procedural justice.
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85033589255&doi=10.3197%2f096327117X15046905490353&partnerID=40&md5=c8a973f211d39303d692d8f0f14412a5

47. Research on characteristic of annoyance perception of low-frequency noises in densely populated cities C3 Shao Z, Zhang W, Zhou Y, Zhu W. In: Gibbs B, editor. 24th International Congress on Sound and Vibration, ICSV 2017; 2017: International Institute of Acoustics and Vibration, IIAV.

✓ LFN (gaat niet over WTS; omgevingsgeluid hinderlijker met meer LFN)

People in densely populated cities are usually exposed to many artificial low-frequency noise sources. Although the human auditory system is not so sensitive to low-frequency noises, many researches have indicated that the low-frequency noises are more annoying than the mid and high frequency noises when they are equally loud. Yet there is still no consensus on how to evaluate the low-frequency noises, especially on whether A-weighted sound pressure level is adequate for that. This research set up the database of machinery and transportation noise sources in the typical densely populated cities such as Shanghai via collecting and classifying samples of several kinds of low-frequency noise sources, including ventilation, air-conditioners, transformers, and pumps around residential area as well as vehicles, light rails, and trains. With the semantic differential (SD) method, the annoyance of these samples which were adjusted to the same A-weighted sound pressure levels was subjectively evaluated. The results of both machinery and transportation groups suggest that the more dominant the low-frequency content, the more annoying the sample. This implies that when the subjective annoyance of noises, whose low-frequency content is dominant, are evaluated, the A-weighted sound pressure level is apparently inadequate. According the subjective results, the relationship of annoyance and the ratio of low-to-mid/high frequency content was derived.

48. Comment on Mroczek et al. Evaluation of Quality of Life of Those Living near a Wind Farm. Int. J. Environ. Res. Public Health, 2015, 12, 6066-6083. Shepherd D Int J Environ Res Public Health. 2017 Feb 1;14(2).

? HE QoL (kritiek studie Mroczek et al; zie ook 38 en 42)

An article published in the International Journal of Environmental Research and Public Health indicated that, far from degrading health, noise from wind turbines may actually be associated with positive health outcomes. Such a finding is counter to that reported elsewhere for general and wind turbine noise. This Commentary sets out to explore alternative explanations of these differences. https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=28157146

49. Wind farms and rural tourism: A Portuguese case study of residents' and visitors' perceptions and attitudes. Silva L, Delicado A Moravian Geographical Reports. 2017;25(4):248-56.

✓ SOCIAL

Residents' and visitors' perceptions of and attitudes towards existing wind farms, as well as the perceived impact of wind farms on tourism, are examined in this article with reference to a built heritage site in the Portuguese countryside. Based on a set of semi-structured interviews, the paper sheds light on the positive impact that the community's or local actors' involvement in the constitution, management and decision-making processes has on the residents' perceptions and attitudes regarding wind farms, and also on the trade-off with the perceived effect of wind farms on local tourism. Moreover, it shows that although most visitors criticised the proximity of wind turbines to medieval architecture, a clear majority of them accepted their presence and virtually all of them stated that these facilities had no impact on their choice of destination. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85039770361&doi=10.1515%2fmgr-2017-0021&partnerID=40&md5=f6b64c32373a1d2e3d0eb1f06787ddda

50. Local and socio-political acceptance of wind farms in Germany. Sonnberger M, Ruddat M Technology in Society. 2017;51:56-65.

✓ SOCIAL

In this study, we tested how attitudes toward the German energy transition, the perceived fairness of decision-making processes and their outcomes, the perceived risks and benefits of wind energy, and the trust in key actors (federal government, local government, large energy companies, and

municipal utilities) affect both the general acceptance and local acceptance (acceptance of wind farms situated 500 m from the respondents' home) of wind farms in Germany. The respective data were gained from a representative random survey (n = 2.009) in Germany. The findings show that most of the aforementioned predictors significantly influence the public acceptance of wind energy. Perceived risks and fairness become (more) important in the context of both general and local acceptance of onshore wind farms, while the general attitude toward the energy transition is of greater relevance in the context of the general acceptance of offshore wind farms. Furthermore, trust in large energy companies plays a mixed role concerning general and local acceptance. Our results provide valuable insights for understanding public reactions toward wind energy projects. © 2017 Elsevier Ltd
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85026665033&doi=10.1016%2fj.techsoc.2017.07.005&partnerID=40&md5=03c8f745f565d35b38e71023534e576f

51. Study on the relationship between unpleasantness and perception of vibration in the head of subjects exposed to low-frequency noise C3 - Takahashi Y. INTER-NOISE 2017 - 46th International Congress and Exposition on Noise Control Engineering: Taming Noise and Moving Quiet; 2017: Institute of Noise Control Engineering;2017-January.

✓ LFN

Induction of vibratory sensation is one of the unique characteristics of low-frequency noise, and the vibratory sensation could be a significant contributor to unpleasantness of persons exposed to low-frequency noise. We previously found that the head was the most sensitive part of the body to vibratory sensation induced by low-frequency noise, and have been studying the perceptual characteristics of "vibration perceived in the head". The aim of the present study was to examine the relationship between the perception of "vibration perceived in the head" and the subjective unpleasantness of persons exposed to low-frequency noise, based on a hypothesis that the perception of "vibration perceived in the head" contributes to the perception of unpleasantness. Subjects were exposed to 6 low-frequency pure tones (16, 20, 25, 31.5, 40, and 50 Hz). Hypothesizing that the degree of unpleasantness in performing a mental task while being exposed to low-frequency noise could be categorized as either of 4 grades ("not annoying", "slightly annoying", "very annoying", and "too annoying to work"), we measured the sound pressure levels corresponding to 3 boundaries between the unpleasantness grades. For comparison, the hearing threshold levels, the threshold levels for "vibration perceived in the head", and the threshold levels for unpleasantness were also measured. As a result, the threshold levels for unpleasantness were higher than those for "vibration perceived in the head" at all of the test frequencies. But the frequency-dependences of the two threshold levels were similar to each other. In addition, the sound pressure level corresponding to the boundary between "not annoying" and "slightly annoying" was close to the threshold level for "vibration perceived in the head". These results supported our basic hypothesis that the perception of "vibration perceived in the head" contributes to the subjective unpleasantness. © 2017 Institute of Noise Control Engineering. All rights reserved.

52. Determinants of annoyance from humming sound as indicator of low frequency noise C3 - Van Kamp I, Breugelmans O, Van Poll R, Baliatsas C, Van Kempen E. In: McMinn T, Duncan A, editors. Proceedings of ACOUSTICS 2017 Perth: Sound, Science and Society - 2017 Annual Conference of the Australian Acoustical Society, AAS 2017; 2017: Australian Acoustical Society.

✓ LFN

The level of concern and health complaints related to low frequency noise (LFN) seems to be increasing, not only in the Netherlands, but also at international level. There is evidence suggesting an association between LFN and symptomatic effects such as annoyance and sleep disturbances. A systematic evaluation of the literature which we recently performed, focusing on epidemiological studies on residential sources of LFN in relation to various symptoms and well-being indicators confirms these findings. However, it is still hard to make a valid estimate of the burden of disease

due to LFN. Therefore, based on several Dutch datasets we estimated the prevalence of health complaints due to low frequency noise or attributed to it. The available data only concerned perceived exposure rather than actual measurements of LFN, preventing to link the exposures to these effects. It was concluded that the number of complaints and the percentage highly annoyed has increased. Large differences were found between cities, regions and in particular neighbourhoods. This paper explored the relation between contextual, situational and personal features with the level of annoyance due to low frequency sounds, based on secondary analysis of existing data.

53. Sound propagation from a ridge wind turbine across a valley. Van Renterghem T Philos Trans A Math Phys Eng Sci. 2017 Apr 13;375(2091).

✓ EXPOSURE

Sound propagation outdoors can be strongly affected by ground topography. The existence of hills and valleys between a source and receiver can lead to the shielding or focusing of sound waves. Such effects can result in significant variations in received sound levels. In addition, wind speed and air temperature gradients in the atmospheric boundary layer also play an important role. All of the foregoing factors can become especially important for the case of wind turbines located on a ridge overlooking a valley. Ridges are often selected for wind turbines in order to increase their energy capture potential through the wind speed-up effects often experienced in such locations. In this paper, a hybrid calculation method is presented to model such a case, relying on an analytical solution for sound diffraction around an impedance cylinder and the conformal mapping (CM) Green's function parabolic equation (GFPE) technique. The various aspects of the model have been successfully validated against alternative prediction methods. Example calculations with this hybrid analytical-CM-GFPE model show the complex sound pressure level distribution across the valley and the effect of valley ground type. The proposed method has the potential to include the effect of refraction through the inclusion of complex wind and temperature fields, although this aspect has been highly simplified in the current simulations.This article is part of the themed issue 'Wind energy in complex terrains'.
https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=28265027

54. The effects of sound source visibility on noise annoyance C3 -. Xu JM, Chau CK, Tang SK. INTER-NOISE 2017 - 46th International Congress and Exposition on Noise Control Engineering: Taming Noise and Moving Quiet; 2017: Institute of Noise Control Engineering;2017-January.

✓ VISUAL (gaat over zicht/hoorbaarheid wegverkeer en water)

Among all the multi-sensory interactions, audio-visual interaction is one of the topics which has attracted the greatest attention in relation to human sound perceptions. Previous studies indicated that road traffic or wind turbine noise would invoke higher noise annoyance ratings if the road or wind turbine was visible. Up to now, most of these studies were mainly focused on unwanted sounds. However very few investigated the effect of the visibility of wanted sound sources (e.g. water sound) on noise annoyance responses. The aim of the study is to reveal the effect of visibility of different types of neighborhood sceneries on noise annoyance responses at different sound pressure levels. In addition, it aims to investigate whether noise annoyance responses will differ if the types of sound perceived by individuals do not match with the visible sound sources. In this study, both wanted (water sound) and unwanted (road traffic) sound have been studied through a series of laboratory experiments. The results of the study found that the effect of source visibility on noise annoyance differed at different sound pressure levels of road traffic. Noise annoyance ratings would be higher if the sound source (irrespective of wanted sound or unwanted sound) was visible and when sound pressure level of traffic was at 65 dBA. The results of the study can provide valuable insights for building designers and urban planners to make use of visibility of sound sources to provide better acoustic environment and mitigate noise annoyance induced by road traffic.

55. Research of the assessment system of low frequency environmental noises in residential areas along the traffic trunk C3 - Zhang W, Shao Z, Zhu W. INTER-NOISE 2017 - 46th International Congress and Exposition on Noise Control Engineering: Taming Noise and Moving Quiet; 2017: Institute of Noise Control Engineering;2017-January.

✓ NOT (betreft wegverkeer; wel weer (zie 47): meer LF = hinderlijker)

Traffic noise is always one of the main environmental problems in megacities. Middle and high frequency (MHF) components of traffic noises are greatly attenuated by the low-noise pavements, noise barriers and air absorption, etc., so low frequency (LF) components become dominant. Considering that A weighted sound pressure level underestimates the annoyance of low frequency noises, researchers have tried to assess the low frequency noise with new indicators and amend the relevant limits of environmental noise. This research collected 11 noise samples at the spots 30 meters away from typical traffic trunk in Shanghai, A weighted levels of which were all adjusted to 70 dB(A), then 27 volunteers were recruited to assess the annoyance of them. The results showed that the difference between the level of LF band (20~315 Hz) and that of MHF band (0.4~20 kHz) was highly relevant to the subjective annoyance (R2>0.85), and when the difference was more than 13 dB, over 50% of subjects felt highly annoyed. In addition, noise samples were collected in 13 residential areas along the typical traffic trunk, for which the proportion of LF band energy was over 90%, and the same volunteer group assessed the annoyance of these samples. The results indicated that when A weighted level was more than 56 dB(A), over 50% of subjects felt highly annoyed, and as A weighted level increased 1 dB(A), the proportion of subjects feeling highly annoyed increased about 20%. Consequently, from the perspective of subjective annoyance, more proper indicator should be adopted to assess low frequency noises, and stricter environmental noise limits should be made to promote people's satisfaction of environment.

56. Trade-offs between wind energy, recreational, and bark-beetle impacts on visual preferences of national park visitors. Arnberger A, Eder R, Allex B, Preisel H, Ebenberger M, Husslein M Land Use Policy. 2018;76:166-77.

✓ NOT (betreft toeristische perceptie)

Recreation pressure on natural resource settings, as well as the demand for new wind-energy production sites, is growing. In addition, extensive outbreaks of tree-killing insects are globally increasing. Protected-area managers are facing conflicts on proper land uses in and around their areas, and need information on visitor preferences for developing a land use policy for their area, accepted by the public. So far, little research has examined national park visitors' responses to windmills and recreational infrastructures, visual changes in forest recreation settings resulting from forest insect infestations, high use pressures, and how visitors weigh trade-offs between these technical, biophysical, and socio-environment factors. This study explored national park visitor preferences with a discrete choice experiment that photographically simulated spruce forest stands with varying levels of recreational and technical infrastructures including the presence of windmills, bark beetle outbreaks, forest management practices, and visitor use levels. On-site surveys were conducted with visitors to the Bavarian Forest National Park in Germany (N = 514). Results revealed that the condition of the forest surrounding, followed by the presence of windmills, was the most important variable influencing visitors' landscape preferences. Visitors preferred healthy mature forest stands and disliked forests with substantial dead wood, many windmills close to the viewpoint and high visitor numbers. Findings suggest that forest conditions and technical infrastructure are important concerns in addressing landscape preferences for forested protected areas and that trade-offs among these variables exist.
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85046697111&doi=10.1016%2fj.landusepol.2018.05.007&partnerID=40&md5=4782fdda396b5b792506d43ba561cb83

57. Using residential proximity to wind turbines as an alternative exposure measure to investigate the association between wind turbines and human health. Barry R, Sulsky SI, Kreiger N J Acoust Soc Am. 2018 Jun;143(6):3278.

? HE (verband afstand-QoL; later weerlegd –zie)

This analysis uses data from the Community Noise and Health Study developed by Statistics Canada to investigate the association between residential proximity to wind turbines and health-related outcomes in a dataset that also provides objective measures of wind turbine noise. The findings indicate that residential proximity to wind turbines is correlated with annoyance and health-related quality of life measures. These associations differ in some respects from associations with noise measurements. Results can be used to support discussions between communities and wind-turbine developers regarding potential health effects of wind turbines.
https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=29960435

58. WHO environmental noise guidelines for the european region: A systematic review on environmental noise and effects on sleep. Basner M, McGuire S International Journal of Environmental Research and Public Health. 2018;15(3).

? REVIEW WHO (only sleep)

To evaluate the quality of available evidence on the effects of environmental noise exposure on sleep a systematic review was conducted. The databases PSYCINFO, PubMed, Science Direct, Scopus, Web of Science and the TNO Repository were searched for non-laboratory studies on the effects of environmental noise on sleep with measured or predicted noise levels and published in or after the year 2000. The quality of the evidence was assessed using GRADE criteria. Seventy four studies predominately conducted between 2000 and 2015 were included in the review. A meta-analysis of surveys linking road, rail, and aircraft noise exposure to self-reports of sleep disturbance was conducted. The odds ratio for the percent highly sleep disturbed for a 10 dB increase in Lnight was significant for aircraft (1.94; 95% CI 1.61–2.3), road (2.13; 95% CI 1.82–2.48), and rail (3.06; 95% CI 2.38–3.93) noise when the question referred to noise, but non-significant for aircraft (1.17; 95% CI 0.54–2.53), road (1.09; 95% CI 0.94–1.27), and rail (1.27; 95% CI 0.89–1.81) noise when the question did not refer to noise. A pooled analysis of polysomnographic studies on the acute effects of transportation noise on sleep was also conducted and the unadjusted odds ratio for the probability of awakening for a 10 dBA increase in the indoor Lmax was significant for aircraft (1.35; 95% CI 1.22–1.50), road (1.36; 95% CI 1.19–1.55), and rail (1.35; 95% CI 1.21–1.52) noise. Due to a limited number of studies and the use of different outcome measures, a narrative review only was conducted for motility, cardiac and blood pressure outcomes, and for children's sleep. The effect of wind turbine and hospital noise on sleep was also assessed. Based on the available evidence, transportation noise affects objectively measured sleep physiology and subjectively assessed sleep disturbance in adults. For other outcome measures and noise sources the examined evidence was conflicting or only emerging. According to GRADE criteria, the quality of the evidence was moderate for cortical awakenings and self-reported sleep disturbance (for questions that referred to noise) induced by traffic noise, low for motility measures of traffic noise induced sleep disturbance, and very low for all other noise sources and investigated sleep outcomes.
http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L621248630

59. Positive energies? An empirical study of community energy participation and attitudes to renewable energy. Bauwens T, Devine-Wright P Energy Policy. 2018;118:612-25.

✓ NOT (niet relevant voor review)

It has been suggested that participation in community energy initiatives may play an important role in enabling a transition towards renewable energy (RE) deployment by fostering positive attitudes toward renewables. Yet, little is known about how members of community energy initiatives differ from non-members in terms of energy attitudes and whether different profiles of community energy members exist. This article empirically analyses the relations between community energy

membership and attitudes toward RE and onshore wind energy. Based on statistical analyses of a large-scale quantitative dataset from an original survey (N = 3963) conducted with two energy cooperatives in Belgium, it contrasts different groups of cooperative members with each other and a comparison group of non-members. Results show that members have significantly more positive attitudes towards RE than non-members. Results also suggest that non-members tend to be more indifferent or more uncertain, not more objecting, than members to wind power. Finally, significant differences among cooperative members are highlighted, illustrating the contrast between communities of place and communities of interest. The findings suggest a novel perspective on the benefits of community energy membership – to overcome indifference or uncertainty – that is relevant to foster a rapid and socially acceptable low carbon transition. © 2018 Elsevier Ltd
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85046347328&doi=10.1016%2fj.enpol.2018.03.062&partnerID=40&md5=2a25a0439093b32bf14c31f1c6442011

60. Residential noise from nearby oil and gas well construction and drilling. Blair BD, Brindley S, Dinkeloo E, McKenzie LM, Adgate JL Journal of Exposure Science and Environmental Epidemiology. 2018:1-10.

- ✓ NOT (betreft geen WTs)

Public concern about oil and gas (O&G) operations in residential areas is substantial. Noise from construction and drilling related to O&G operations may be greater than other phases of O&G operations; yet the impacts of audible and low-frequency noise during these operations are not extensively explored nor the effects on health well understood. This study documents the noise levels at a multi-well O&G well pad during construction and drilling in a residential area in Colorado. A-weighted (dBA) and C-weighted (dBC) noise measurements were collected at four locations during development over a 3-month period. The maximum 1-min equivalent continuous sound levels over a 1-month period were 60.2 dBA and 80.0 dBC. Overall, 41.1% of daytime and 23.6% of nighttime dBA 1-min equivalent continuous noise measurements were found to exceed 50 dBA, and 97.5% of daytime and 98.3% of nighttime measurements were found to exceed 60 dBC. Noise levels exceeding 50 dBA or 60 dBC may cause annoyance and be detrimental to health; thus, these noise levels have the potential to impact health and noise levels and associated health effects warrant further investigation. © 2018 Nature America, Inc., part of Springer Nature
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85046712959&doi=10.1038%2fs41370-018-0039-8&partnerID=40&md5=8246f65a2b2ff1deee84e2a8e84d9035

61. Combined exposure to carbon disulfide and low-frequency noise reversibly affects vestibular function. Chalansonnet M, Carreres-Pons M, Venet T, Thomas A, Merlen L, Seidel C, et al. Neurotoxicology. 2018 Jun 19;67:270-8.

- ✓ NOT (niet relevant voor review)

Chronic occupational exposure to carbon disulfide (CS2) has debilitating motor and sensory effects in humans, which can increase the risk of falls. Although no mention of vestibulotoxic effects is contained in the literature, epidemiological and experimental data suggest that CS2 could cause low-frequency hearing loss when associated with noise exposure. Low-frequency noise might also perturb the peripheral balance receptor through an as-yet unclear mechanism. Here, we studied how exposure to a low-frequency noise combined with 250-ppm CS2 affected balance in rats. Vestibular function was tested based on post-rotary nystagmus recorded by a video-oculography system. These measurements were completed by behavioral tests and analysis of the cerebellum to measure expression levels for gene expression associated with neurotoxicity. Assays were performed prior to and following a 4-week exposure, and again after a 4-week recovery period. Functional measurements were completed by histological analyses of the peripheral organs.Nystagmus was unaltered by exposure to noise alone, while CS2 alone caused a moderate 19% decrease of the saccade number. In contrast, coexposure to 250-ppm CS2 and low-frequency noise decreased both saccade number and duration by 33% and 34%, respectively. After four weeks, recovery was only

partial but measures were not significantly different from pre-exposure values. Real-time quantitative polymerase chain reaction (RT-qPCR) analysis of cerebellar tissue revealed a slight but significant modification in expression levels for two genes linked to neurotoxicity in CS2-exposed animals. However, neither histopathological changes to the peripheral receptor nor behavioral differences were observed. Based on all these results, we propose that the effects of CS2 were due to reversible neurochemical disturbance of the efferent pathways managing post-rotatory nystagmus. Because the nervous structures involving the vestibular function appear particularly sensitive to CS2, post-rotary nystagmus could be used as an early, non-invasive measurement to diagnose CS2 intoxication as part of an occupational conservation program.
https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=29928918

62. Contesting facts about wind farms in Australia and the legitimacy of adverse health effects. Clark S, Botterill LC Health (London). 2018 Jul;22(4):337-55.

? SOCIAL (analyse argumentatie HE's met sociale factoren; men zoekt naar bij positie passende argumenten)

The development of wind energy in Australia has been subject to ongoing public debate and has been characterised by concerns over the health impacts of wind turbines. Using discursive psychology, we examine 'wind turbine syndrome' as a contested illness and analyse how people build and undermine divergent arguments about wind-farm health effects. This article explores two facets of the dispute. First, we consider how participants construct 'facts' about the health effects of wind farms. We examine rhetorical resources used to construct wind farms as harmful or benign. Second, we examine the local negotiation of the legitimacy of health complaints. In the research interviews examined, even though interviewees treat those who report experiencing symptoms from wind farms as having primary rights to narrate their own experience, this epistemic primacy does not extend to the ability to 'correctly' identify symptoms' cause. As a result, the legitimacy of health complaints is undermined. Wind turbine syndrome is an example of a contested illness that is politically controversial. We show how stake, interest and legitimacy are particularly relevant for participants' competing descriptions about the 'facts' of wind turbine health effects.
https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=28401817

63. Wind turbine sound limits: Current status and recommendations based on mitigating noise annoyance. Davy JL, Burgemeister K, Hillman D Applied Acoustics. 2018;140:288-95.

✓ EXPOSURE (vergelijking hindercurves; verschil buiten-binnen suggereert geveldemping van 5-7 dB, minder dan gebruikelijk 10-15 dB)

This paper describes existing wind turbine sound limits in Australian states and several other countries with similar constraints, how these were established and a method that could facilitate their harmonisation. Most existing limits appear to have been adopted to avoid sleep disturbance using data derived from sound sources other than wind turbines. This seems to have been a reasonable approach at the time of their adoption because of the paucity of other suitable data. More recently the concept of "annoyance" has been used to encapsulate negative reactions to wind turbine sound. Many studies have now demonstrated a significant relationship between annoyance and wind turbine sound level, whether or not sound was the major source of the annoyance. Thus there is a logical basis for now deriving a wind turbine sound limit based on limiting annoyance. This paper describes such an approach. The derived limit is compared to existing Australian and international limits. Its value lies within the range of these other limits. It provides a method for harmonisation of future limits based on direct assessments of human response to wind turbine sound. © 2018
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85048927018&doi=10.1016%2fj.apacoust.2018.06.009&partnerID=40&md5=c73493ef3bfaaf966a5e144b02a1e9e0

64. MCDM analysis of wind energy in Turkey: decision making based on environmental impact. Degirmenci S, Bingol F, Sofuoglu SC Environ Sci Pollut Res Int. 2018 Jul;25(20):19753-66.

? NOT (betreft geschiktheid gebied voor WTs)

Development of new wind energy projects require complex planning process involving many social, technical, economic, environmental, political concerns, and different agents such as investors, utilities, governmental agencies, or social groups. The aim of this study is to develop a tool combining Geographic Information System (GIS) and Multi-Criteria Decision-Making (MCDM) methodologies, and its application for Turkey as a case study. A variety of constraints and criteria were identified based on a literature review and regulations gathered from variety of agencies, use of which resulted in determination of infeasible sites. Then, pairwise comparisons were carried out using analytic hierarchy process as the MCDM method to estimate relative importance of the criteria, and to visualize a suitability map with three classes. As the final stage, decision making was carried out based on environmental impact where 45.5% of the Turkish territory was found as infeasible area. Sixty percent of the remaining area are covered by the moderate suitability class, followed by the highly suitable area (20.3%) and low suitable area (19.8%). The output of this study can be used by energy planners to estimate the extent that wind energy can be developed based on public perception, administrative, and environmental aspects.
https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=29736652

65. Wind in the sails or choppy seas?: People-place relations, aesthetics and public support for the United States' first offshore wind project. Firestone J, Bidwell D, Gardner M, Knapp L Energy Research and Social Science. 2018;40:232-43.

? OFFSHORE

The primary social challenge of offshore wind power development may be local community members' struggle to come to terms with the transformation of the ocean. In this study of local residents' perceptions of the first wind power project off the North American coast, we consider whether factors such as aesthetics and place attachment, dependency and identity might serve as barriers or gateways toward an offshore wind power future. Respondents are 420 coastal Rhode Island and Block Island residents who were randomly sampled by mail or internet prior to turbine installation and after project commissioning. Data were analysed using weighted descriptive statistics and multiple imputed regression analysis. 87% of respondents who live in census tracts bordering the coast support or lean toward supporting the project despite paying significantly above-market prices for the electricity generated. Regression models show that support for the project is influenced, at least in part, by general disposition toward wind power and whether a respondent likes the turbines' appearance, with place-related measures having less influence. Descriptions of the wind turbines that resonated with supporters and opponents include respectively, "Symbolic of progress towards clean energy" and "Cause the loss of something intangible, where all you see is the ocean". © 2018 Elsevier Ltd
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85042848736&doi=10.1016%2fj.erss.2018.02.017&partnerID=40&md5=3e688663bea0da4c29f19785e0ce8853

66. Health effects of wind turbines in working environments - a scoping review. Freiberg A, Schefter C, Girbig M, Murta VC, Seidler A Scand J Work Environ Health. 2018 Jul 1;44(4):351-69.

? NOT (betreft arbo)

Objectives The wind industry is a growing economic sector, yet there is no overview summarizing all exposures emanating from wind turbines throughout their life cycle that may pose a risk for workers` health. The aim of this scoping review was to survey and outline the body of evidence around the health effects of wind turbines in working environments in order to identify research gaps and to highlight the need for further research. Methods A scoping review with a transparent and systematic

procedure was conducted using a comprehensive search strategy. Two independent reviewers conducted most of the review steps. Results Twenty articles of varying methodical quality were included. Our findings of the included studies indicate that substances used in rotor blade manufacture (epoxy resin and styrene) cause skin disorders, and respectively, respiratory ailments and eye complaints; exposure to onshore wind turbine noise leads to annoyance, sleep disorders, and lowered general health; finally working in the wind industry is associated with a considerable accident rate, resulting in injuries or fatalities. Conclusions Due to the different work activities during the life cycle of a wind turbine and the distinction between on- and offshore work, there are no specific overall health effects of working in the wind sector. Previous research has primarily focused on evaluating the effects of working in the wind industry on skin disorders, accidents, and noise consequences. There is a need for further research, particularly in studying the effect of wind turbine work on psychological and musculoskeletal disorders, work-related injury and accident rates, and health outcomes in later life cycle phases.
https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=29360123

67. Explaining regional acceptance of the German energy transition by including trust in stakeholders and perception of fairness as socio-institutional factors. Gölz S, Wedderhoff O Energy Research and Social Science. 2018.

- ✓ SOCIAL

In this paper we pursue the hypothesis that acceptance of the energy transition is not merely determined by technology acceptance but also by the perception of socio-institutional stakeholders and the perception of fairness. We test an acceptance model which includes the following main predictors: attitudes towards the risks of the energy transition and attitudes towards the technology options such as wind power, photovoltaic systems or transmission lines. Additional influences are assumed to arise from the perception of regional added values and the trust in various socio-institutional stakeholders. Furthermore, we expect fairness to be a mediating variable for acceptance. In this paper we test the model empirically with a representative German sample (N = 2009) in a structural equation model (SEM) for the acceptance of onshore wind power. Moreover, we analyse whether differences in the factors are related to the German regions North, East, West and South since we assume regional landscapes, renewable energy sources and socio-political contexts to be important for acceptance. Results show evidence that perception of stakeholders and fairness is important for the regional acceptance. In addition, results show that, among the four regions, different factors are relevant for acceptance. Results are discussed and conclusions for governance are drawn. © 2018 Elsevier Ltd
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85047926450&doi=10.1016%2fj.erss.2018.05.026&partnerID=40&md5=6269325dcf8f15a7183c97643f356c3c

68. The acceptability of wind farms: the impact of public participation. Janhunen S, Hujala M, Pätäri S Journal of Environmental Policy and Planning. 2018;20(2):214-35.

- ✓ SOCIAL (ook participatie gewenst tijdens exploitative windpark)

The planning process for wind farm projects appears to be a complicated matter in many cases. Despite the positive attitude towards wind power in general, local wind farm projects often face strong opposition. The aim of this study is to shed more light on residents' perceptions of participation in the planning process of wind farms. This study is based on interview data (N = 22) and survey data (N = 291) collected from residents living near two Finnish large-scale onshore wind farms built about 1.5 years before the data were collected. The results indicate that residents' participation in the planning process was rather passive and the vast majority of the respondents perceived that they did not have an opportunity to participate. Quite interestingly, perceived participation in the planning process resulted in a decrease in acceptability in terms of perceived well-being. Furthermore, the results indicate that the need for participation does not expire after the

planning process for a wind farm has concluded. Thus, project developers should be prepared to continue communication with residents after the planning phase. © 2017 Informa UK Limited, trading as Taylor & Francis Group.
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85033716075&doi=10.1080%2f1523908X.2017.1398638&partnerID=40&md5=c44fd72789ec9d7a255a6c02065e697a

69. Wind, power, and the situatedness of community engagement. Kim H, Cho SH, Song S Public Underst Sci. 2018 Apr 1:963662518772508.

✓ SOCIAL

Jeju, an island in Korea, became a place to site wind turbines with an unusually high level of public acceptance. Based on interviews, media analyses, and policy research, we found that the collective memory of socio-economic deprivation enabled community engagement to matter to residents, the provincial government, and environmental activists. It was within socio-historically contextualized processes of articulating the vision of a "good" society that an actual form of community engagement, however inadequate it might appear to some, became relevant to stakeholders in a particular locality. We emphasize that community engagement in renewable energy governance does not have one but multiple and situated ways of mattering depending on local contexts.
https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=29683059

70. Wind energy and local communities: A manufacturer's efforts to gain acceptance. Landeta-Manzano B, Arana-Landín G, Calvo PM, Heras-Saizarbitoria I Energy Policy. 2018;121:314-24.

✓ SOCIAL

Community opposition is one of the key obstacles to the expansion of wind turbine developments. The scholarly literature has focused on public opinion on wind farms (WFs) and the level of community acceptance. The efforts of Original Equipment Manufacturers (OEMs), to gain community acceptance has been under-researched. To fill this gap, the present study analyzes the evolution of interventions by a leading OEM to secure the acceptance of local communities for wind energy projects and the outcomes of those efforts. The fieldwork consisted of a longitudinal case study carried out from 2014 to 2017 by a leading international OEM. In depth personal interviews were also conducted with six experts in the field. The main efforts of the OEM focused on the visual impact of the developments, health and safety issues, community involvement and social investment in the community. In selecting the location for developing a WF, economic criteria usually prevail over social criteria. Although the company makes social investments in the community, different groups point out that those local communities should be taken more seriously, as they can serve as facilitators in the development of projects. Implications for stakeholders such as developers and policy makers are discussed. © 2018 Elsevier Ltd
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85049452660&doi=10.1016%2fj.enpol.2018.05.034&partnerID=40&md5=7b9aeab775503f3ace6926d68b8b0462

71. Factors influencing citizens' acceptance and non-acceptance of wind energy in Germany. Langer K, Decker T, Roosen J, Menrad K Journal of Cleaner Production. 2018;175:133-44.

✓ SOCIAL (afstand weinig van belang in acceptatie, angst infrageluid wel)

Among renewable energy technologies, wind energy accounts for the highest share in gross electricity consumption in Germany. To keep this renewable share up, wind energy project have to combine technological aspects with environmental and societally aspects. The successful planning and implementation of a wind farm crucially depends on acceptance of citizens living in the vicinity of the site. Factors influencing acceptance of wind energy can be categorised into processrelated variables, personal characteristics, perceived side effects and technical and geographical issues. However, research is still missing on how and to what extend the identified factors have an influence

on the acceptance and non-acceptance. This article identifies the relevant factors within each of these four categories by investigating which of these factors have an impact upon acceptance or non-acceptance of a project. This identification enables policy makers and operators to implement wind energy projects with a certain acceptance level by the society. The study is based on a German wide online-survey with about 1,400 participants. Using a multinomial logistic regression analysis, the results show that factors in all categories are relevant in driving citizens' active acceptance, ambivalence or active non-acceptance of wind energy. The paper reveals that in particular the factors fear of infrasound and the opportunity for participation plays an essential role in the categories perceived side effects and process-related variables. The fear of infrasound has the most significant negative influence on the acceptance. Also the participation level, alibi participation, displays significant negative effects on the acceptance. Furthermore, the results suggest that some of the most recent changes in the legal framework regulating new wind energy projects in Germany counteract acceptance according the findings of this study. In particular, results show that the distance between the place of residence and wind turbines has no significant influence on the acceptance. © 2017 Elsevier Ltd
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85039838371&doi=10.1016%2fj.jclepro.2017.11.221&partnerID=40&md5=03a5baa2ee1937a2ae9fb0085d2d8410

72. Don't be grossly misled by astonishing wind turbine noise complaint figures. Lotinga M Acoustics Bulletin. 2018;42(2):61.

✓ NOT (betreft brief aan redactie)

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85042010024&partnerID=40&md5=72bfce50835ee0e54fa0065e15a27708

73. Perception and control of amplitude modulation in wind turbine noise. Lotinga M, Perkins R, Lewis T Acoustics Bulletin. 2018;42(2):41-6.

✓ EXPOSURE (uitleg hoe AM te meten)

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85029415676&partnerID=40&md5=6e21ddeade15659834ed51483ab870f1

74. A method to precisely measure wind turbine pressure disturbances, including noise. Metelka A Canadian Acoustics - Acoustique Canadienne. 2018;46(1):53-6.

✓ EXPOSURE

Complex noises sources are not easily measured when the conditions constantly change. Wind turbines are an example of these challenging sources. Some say it's like magic; now you hear them and now you don't. Sound comes and goes and changes with distance, temperature, humidity, wind speed, wind direction, wind shear, thermal inversion, sound absorption, etc. Its annoyance and detectability may also be masked by various forms of intermittent background noise. There is also unwanted noise inherent with the measurement system itself, such as wind screen noise that needs to be separated from the sources of interest. These need to be identified such that only clean records where artifacts are not present are chosen and the sources of interest are analyzed. Being variables, many may, at times, have a cumulative effect on the sources, increasing their presence. Different receptors (humans and animals) react differently with different types of noise. Receptors that live under these conditions tend to experience annoyance.
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85044973938&partnerID=40&md5=265055b029d45daa98c2fe7bbb271e17

75. Erratum: Effects of wind turbine noise on self-reported and objective measures of sleep (Sleep (2016) 39:1 (97-109) DOI: 10.5665/sleep.5326). Michaud DS, Feder K, Keith SE, Voicescu SA, Marro L, Than J, et al. Sleep. 2018;41(5).

✓ HE sleep (nagaan of dit effect heeft op onze eerdere conclusie)

In the Health Canada Community Noise and Health Study (CNHS) objective measures of sleep were based on activity counts collected using a wrist-worn sleep watch (Actiwatch2), with results presented as nightly averages. In preparing for a follow-up analysis based on activity counts in 10-min intervals time-synchronized to wind turbine operational data, it came to our attention that the data file used to analyse the objective sleep endpoints included data processing errors. It was discovered that the default "rest interval" was incorrectly assigned when participants did not wear their device continuously over the 7-d data collection period. As the rest interval is used to determine objective sleep outcomes, this impacted the calculation of "total sleep time", "sleep onset", "sleep efficiency", "wake after sleep onset" and "awakening bouts". The entire sleep data file (6307 sleep night actograms) has been reviewed with rest intervals manually corrected where necessary. The corrections were made under blinded conditions, with 100% agreement between two analysts regarding which sleep nights needed to be corrected. Following the corrections, a random selection of 244 sleep nights revealed an 88% inter-rater reliability (within +/- 5 minutes) on the precise start and stop time for each manually inserted rest interval. Statistics Canada has made the revised data file available to the public through their Research Data Centres. There is no impact on any of the self-reported outcomes and the overall conclusion of the original paper does not change, which stated: "Study results do not support an association between exposure to outdoor wind turbine noise (WTN) up to 46 dB(A) and an increase in the prevalence of disturbed sleep." Following the reanalysis the most notable secondary observations can be summarized as follows: 1) annoyance toward blinking lights on wind turbines (aircraft warning signals) was no longer found to be related to awakening bouts, however the association with reduced total sleep time remained; 2) annoyance toward vibrations/rattle perceived to be associated with wind turbine operations was found to be related to higher total sleep time in the reanalysis; 3) participants' history of exposure to WTN, assessed as "years hearing WTN" was inversely related to awakening bouts; 4) WTN was marginally related to sleep efficiency ($p = 0.0519$), however there was no consistent pattern revealed in the pairwise tests; 5) caffeine consumption was no longer found to be associated with any of the actigraphy measures; and 6) the correlations between actigraphy outcomes and self-reported sleep measured using the Pittsburgh Sleep Quality Index (PSQI) were more widespread and stronger than previously reported. The article and supplementary information have now been updated with the correct data. The corresponding author on this publication accepts full responsibility for the data file processing miscalculations that led to the publication errors and sincerely regrets any inconvenience this may have caused.

http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L622254160

76. Clarifications on the Design and Interpretation of Conclusions from Health Canada's Study on Wind Turbine Noise and Health. Michaud DS, Feder K, Voicescu SA, Marro L, Than J, Guay M, et al. Acoustics Australia. 2018;46(1):99-110.

✓ HE (aanvullende info uit veldstudie, o.a. prevalenties HE in bevolking Canada)

It has been extensively communicated that Health Canada's Community Noise and Health Study (CNHS) did not find positive associations between wind turbine noise (WTN) levels and any of the evaluated health outcomes, beyond an increase in the prevalence of high annoyance toward several wind turbine features. The authors emphasize that this general conclusion remains bound by the study strengths and limitations. Following the publication of the CNHS findings, there has been interest among some individuals to present alternative interpretations of the results originally reported by Michaud et al. (J Acoust Soc Am 139(3):1443–1454, 2016. https://doi.org/10.1121/1.4942391). While recognizing the importance of independent scientific re-evaluation and/or reinterpretation, this commentary serves to clarify and, where necessary, correct some of the information put forward by others. One factor that has been re-evaluated by external stakeholders is the subsample of participants that comprise the lowest WTN category. In their reanalysis, they have eliminated this category, or introduced alternative comparative data. This paper identifies substantial issues associated with the re-evaluation put forth. To thoroughly address

these issues and to avoid further confusion or misinterpretation, the authors of the CNHS provide a comparison between the CNHS health condition prevalence data and nationally representative health-based surveys conducted in Canada during the same calendar year. In addition, this paper responds to comments received to date on the CNHS, including the study's age range, the generalization of findings, the provision of raw data, and conclusions on the association between WTN level and health. © 2018, The Author(s).
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85047839426&doi=10.1007%2fs40857-017-0125-4&partnerID=40&md5=b38772e14e4e348ad1b2f39b98705d82

77. The association between self-reported and objective measures of health and aggregate annoyance scores toward wind turbine installations. Michaud DS, Marro L, McNamee J Can J Public Health. 2018 Apr;109(2):252-60.

✓ HE total annoyance - HE's

OBJECTIVE: An aggregate annoyance construct has been developed to account for annoyance that ranges from not at all annoyed to extremely annoyed, toward multiple wind turbine features. The practical value associated with aggregate annoyance would be strengthened if it was related to health. The objective of the current paper was to assess the association between aggregate annoyance and multiple measures of health. METHODS: The analysis was based on data originally collected as part of Health Canada's Community Noise and Health Study (CNHS). One adult participant per dwelling (18-79 years), randomly selected from Ontario (ON) (n = 1011) and Prince Edward Island (PEI) (n = 227), completed an in-person questionnaire. RESULTS: The average aggregate annoyance score for participants who indicated they had a health condition (e.g., chronic pain, Pittsburgh Sleep Quality Index (PSQI) > 5, tinnitus, migraines/headaches, dizziness, highly sensitive to noise, and reported a high sleep disturbance) ranged from 2.53 to 3.72; the mean score for those who did not report these same conditions ranged between 0.96 and 1.41. Household complaints about wind turbine noise had the highest average aggregate annoyance (8.02), compared to an average of 1.39 among those who did not complain. CONCLUSION: A mean aggregate annoyance score that could reliably distinguish participants who self-report health effects (or noise complaints) from those who do not could be one of several factors considered by jurisdictions responsible for decisions regarding wind turbine developments. However, the threshold value for acceptable changes and/or levels in aggregate annoyance has not yet been established and could be the focus of future research efforts.
https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=29981034

78. Derivation and application of a composite annoyance reaction construct based on multiple wind turbine features. Michaud DS, Marro L, McNamee J Can J Public Health. 2018 Apr;109(2):242-51.

✓ HE annoyance (geluid, lichten, flikker, visueel allemaal belangrijk, trillingen minder)

OBJECTIVES: Noise emissions from wind turbines are one of multiple wind turbine features capable of generating annoyance that ranges in magnitude from not at all annoyed to extremely annoyed. No analysis to date can simultaneously reflect the change in all magnitudes of annoyance toward multiple wind turbine features. The primary objective in this study was to use principal component analysis (PCA) to provide a single construct for overall annoyance to wind turbines based on reactions to noise, blinking lights, shadow flicker, visual impacts, and vibrations evaluated as a function of proximity to wind turbines. METHODS: The analysis was based on data originally collected as part of Health Canada's cross-sectional Community Noise & Health Study (CNHS). One adult participant (18-79 years), randomly selected from dwellings in Ontario (ON) (n = 1011) and Prince Edward Island (PEI) (n = 227), completed an in-person questionnaire. Content relevant to the current analysis included the annoyance responses to wind turbines. RESULTS: The first construct tested in the PCA explained 58-69% of the variability in total annoyance. Reduced distance to turbines was associated with elevated aggregate annoyance scores among ON and PEI participants. In the ON sample, aggregate annoyance was effectively absent in areas beyond 5 km (mean 0.12; 95% CI 0.00,

1.19), increasing significantly between (2 and 5] km (mean 2.13; 95% CI 0.92, 3.33), remaining elevated, but with no further increase until (0.550-1] km (mean 3.37; 95% CI 3.02, 3.72). At </= 0.550 km, the average overall annoyance was 3.36 (95% CI 2.03, 4.69). In PEI, aggregate annoyance was essentially absent beyond 1 km; i.e., (1-2] km (mean 0.21; 95% CI 0.00, 0.88); (2-5] km (mean 0.00; 95% CI 0.00, 1.37); > 5 km (mean 0.00; 95% CI 0.00, 1.58). Annoyance significantly increased in areas between (0.550 and 1] km (mean 1.59; 95% CI 1.02, 2.15) and was highest within 550 m (mean 4.25; 95% CI 3.34, 5.16). CONCLUSION: The advantages and disadvantages to an aggregated annoyance analysis, including how it should not yet be considered a substitute for relationships based on changes in high annoyance, are discussed.
https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=29981033

79. Long-term exposure to wind turbine noise at night and risk for diabetes: A nationwide cohort study. Poulsen AH, Raaschou-Nielsen O, Pena A, Hahmann AN, Nordsborg RB, Ketzel M, et al. Environ Res. 2018 Aug;165:40-5.

- ✓ HE diabetes (geen verband)

Focus on renewable energy sources and reduced unit costs has led to increased number of wind turbines (WTs). WT noise (WTN) is reported to be highly annoying at levels from 30 to 35dB and up, whereas for traffic noise people report to be highly annoyed from 40 to 45dB and up. This has raised concerns as to whether WTN may increase risk for major diseases, as exposure to traffic noise has consistently been associated with increased risk of cardiovascular disease and diabetes. We identified all Danish dwellings within a radius of 20 WT heights and 25% of all dwellings within 20-40 WT heights from a WT. Using detailed data on WT type and hourly wind data at each WT position and height, we estimated hourly outdoor and low frequency indoor WTN for all dwellings, aggregated as nighttime 1- and 5-year running means. Using nationwide registries, we identified a study population of 614,731 persons living in these dwellings in the period from 1996 to 2012, of whom 25,148 developed diabetes. Data were analysed using Poisson regression with adjustment for individual and area-levels covariates. We found no associations between long-term exposure to WTN during night and diabetes risk, with incidence rate ratios (IRRs) of 0.90 (95% confidence intervals (CI): 0.79-1.02) and 0.92 (95% CI: 0.68-1.24) for 5-year mean nighttime outdoor WTN of 36-42 and >/=42dB, respectively, compared to <24dB. For 5-year mean nighttime indoor low frequency WTN of 10-15 and >/=15dB we found IRRs of 0.90 (0.78-1.04) and 0.74 (95% CI: 0.41-1.34), respectively, when compared to and <5dB. The lack of association was consistent across strata of sex, distance to major road, validity of noise estimate and WT height. The present study does not support an association between nighttime WTN and higher risk of diabetes. However, there were only few cases in the highest exposure groups and findings need reproduction.
https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=29665463

80. Short-term nighttime wind turbine noise and cardiovascular events: A nationwide case-crossover study from Denmark. Poulsen AH, Raaschou-Nielsen O, Pena A, Hahmann AN, Nordsborg RB, Ketzel M, et al. Environ Int. 2018 May;114:160-6.

- ✓ HE cardiovascular (verband niet significant)

AIMS: The number of people exposed to wind turbine noise (WTN) is increasing. WTN is reported as more annoying than traffic noise at similar levels. Long-term exposure to traffic noise has consistently been associated with cardiovascular disease, whereas effects of short-term exposure are much less investigated due to little day-to-day variation of e.g. road traffic noise. WTN varies considerably due to changing weather conditions allowing investigation of short-term effects of WTN on cardiovascular events. METHODS AND RESULTS: We identified all hospitalisations and deaths from stroke (16,913 cases) and myocardial infarction (MI) (17,559 cases) among Danes exposed to WTN between 1982 and 2013. We applied a time-stratified, case-crossover design. Using detailed data on wind turbine type and hourly wind data at each wind turbine, we simulated mean nighttime outdoor

(10-10,000Hz) and nighttime low frequency (LF) indoor WTN (10-160Hz) over the 4days preceding diagnosis and reference days. For indoor LF WTN between 10 and 15dB(A) and above 15dB(A), odds ratios (ORs) for MI were 1.27 (95% confidence interval (CI): 0.97-1.67; cases=198) and 1.62 (95% CI: 0.76-3.45; cases=21), respectively, when compared to indoor LF WTN below 5dB(A). For stroke, corresponding ORs were 1.17 (95% CI: 0.95-1.69; cases=166) and 2.30 (95% CI: 0.96-5.50; cases=15). The elevated ORs above 15dB(A) persisted across sensitivity analyses. When looking at specific lag times, noise exposure one day before MI events and three days before stroke events were associated with the highest ORs. For outdoor WTN at night, we observed both increased and decreased risk estimates. CONCLUSION: This study did not provide conclusive evidence of an association between WTN and MI or stroke. It does however suggest that indoor LF WTN at night may trigger cardiovascular events, whereas these events seemed largely unaffected by nighttime outdoor WTN. These findings need reproduction, as they were based on few cases and may be due to chance. https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=29505969

81. Turbulent times: tourists' attitudes towards wind turbines in the Southern Highlands in Iceland. Sæþórsdóttir AD, Ólafsdóttir R, Smith D International Journal of Sustainable Energy. 2018;37(9):886-901.

✓ NOT (betreft toeristische perceptie)

As a response to the threat of climate change, many nations are increasing their use of renewable energy, including wind energy. Large wind farms often conflict with other land uses, particularly tourism, which is a growing industry worldwide. In Iceland, tourism has recently become the largest export sector, with majority of tourists travelling to the country to experience its nature. This paper examines tourists' opinions and perceptions of wind power development in the Southern Highlands of Iceland and compares how number, size and proximity of wind turbines, and the landscape in which they are situated, influence tourists' perceptions. The study is based on an on-site questionnaire survey conducted in 2015. The results indicate that one-third of the travellers would be less likely to visit the Southern Highlands if a proposed wind farm were built, and two-thirds think that wind turbines would decrease the area's attractiveness. © 2017, © 2017 Informa UK Limited, trading as Taylor & Francis Group. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85032819892&doi=10.1080%2f14786451.2017.1388236&partnerID=40&md5=baf16d7bd8cbbb553daffe7896a29a1e

82. Health-aware model predictive control of wind turbines using fatigue prognosis. Sanchez HE, Escobet T, Puig V, Odgaard PF International Journal of Adaptive Control and Signal Processing. 2018;32(4):614-27.

✓ NOT (betreft technische staat WTs)

Wind turbine components are subject to considerable fatigue because of extreme environmental conditions to which they are exposed, especially those located offshore. Wind turbine blades are under significant gravitational, inertial, and aerodynamic loads, which cause their fatigue and degradation during the wind turbine operational life. A fatigue problem is often present at the blade root because of the considerable bending moments applied to this zone. Interest in the integration of control with fatigue load minimization has increased in recent years. This paper investigates the fatigue assessment using a rainflow counting algorithm and the blade root moment information coming from the sensor available in a high-fidelity simulator of a utility-scale wind turbine. Then, the integration of the fatigue-based system health management module with control is proposed. This provides a mechanism for the wind turbine to operate safely and optimize the trade-off between components' life and energy production. In particular, this paper explores the integration of model predictive control with the fatigue-based prognosis approach to minimize the damage of wind turbine components (the blades). A control-oriented model of the fatigue based on the rainflow counting algorithm is proposed to obtain online information of the blades' accumulated damage that

can be integrated with model predictive control. Then, the controller objective function is modified by adding an extra criterion that takes into account the accumulated damage. The scheme is implemented and tested in a well-known wind turbine benchmark. Copyright © 2017 John Wiley & Sons, Ltd.
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85019138637&doi=10.1002%2facs.2784&partnerID=40&md5=4d2908ecec074475f5d18b55b80ffd83

83. Effects of different spectral shapes and amplitude modulation of broadband noise on annoyance reactions in a controlled listening experiment. Schäffer B, Pieren R, Schlittmeier SJ, Brink M International Journal of Environmental Research and Public Health. 2018;15(5).

- ✓ HE annoyance (vooral AM blijkt hinder te verhogen; meer LF hinderlijker, maar praktisch niet van belang)

Environmental noise from transportation or industrial infrastructure typically has a broad frequency range. Different sources may have disparate acoustical characteristics, which may in turn affect noise annoyance. However, knowledge of the relative contribution of the different acoustical characteristics of broadband noise to annoyance is still scarce. In this study, the subjectively perceived short-term (acute) annoyance reactions to different broadband sounds (namely, realistic outdoor wind turbine and artificial, generic sounds) at 40 dBA were investigated in a controlled laboratory listening experiment. Combined with the factorial design of the experiment, the sounds allowed for separation of the effects of three acoustical characteristics on annoyance, namely, spectral shape, depth of periodic amplitude modulation (AM), and occurrence (or absence) of random AM. Fifty-two participants rated their annoyance with the sounds. Annoyance increased with increasing energy content in the low-frequency range as well as with depth of periodic AM, and was higher in situations with random AM than without. Similar annoyance changes would be evoked by sound pressure level changes of up to 8 dB. The results suggest that besides standard sound pressure level metrics, other acoustical characteristics of (broadband) noise should also be considered in environmental impact assessments, e.g., in the context of wind turbine installations.
http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L622185176

84. A participatory integrated assessment of the social acceptance of wind energy. Scherhaufer P, Höltinger S, Salak B, Schauppenlehner T, Schmidt J Energy Research and Social Science. 2018.

- ✓ SOCIAL

This research paper deals with problems of operationalisation or how to conduct research in the field of energy and climate change from a methodological point of view. Guided by a participatory integrated assessment the research project TransWind identified key issues relevant to the social acceptance of wind energy development in Austria. Based on a mixed-method design including modelling and visualisation efforts, workshops, interviews, focus groups and questionnaires researchers and stakeholders expressed their ideas and perceptions with regard to the three dimensions of social acceptance: community, market, and socio-political acceptance. The paper focuses on two main challenges in the assessment: i) the integration of various relevant stakeholders into the research process, ii) the integration of different research methods into one conceptional and methodological reliable assessment investigating the social acceptance of wind energy. The results highlight that there is a strong need for integrating in a systematic way the analytical perspectives of scientists and their approaches with preferences and perceptions of the persons concerned about the issue. © 2018 Elsevier Ltd
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85049474343&doi=10.1016%2fj.erss.2018.06.022&partnerID=40&md5=dac8f61638556ef6a9cae66d0f0318f8

85. Predicting the visual impact of onshore wind farms via landscape indices: A method for objectivizing planning and decision processes. Sklenicka P, Zouhar J Applied Energy. 2018;209:445-54.

- ✓ VISUAL

Visual impact is one of the main factors influencing the acceptance of wind farms by the public and by the authorities. It therefore often sets the environmental and social limits of energy policy and energy use. However, the assessment of visual impacts is subjective, as is often pointed out by critics of the evaluation process. The study presented here for the first time uses accurately and objectively measurable landscape indices to directly predict the visual impact of onshore wind turbines. The method also for the first time evaluates map-based landscape indices in a panoramic simulation, and this provides a better match of visual preferences with landscape indices than the cartographic projection used until now. 400 respondents from four Central European countries (Austria, Germany, Poland and Czechia) provided an evaluation of their scenic perception of 32 different landscapes, in each case with and without wind turbines. At the same time, we analysed 12 indices characterizing the principal landscape components (relief, land cover and landscape pattern) on the basis of the 32 landscape photographs. These were further tested as predictors of visual impact. The most prominent predictors of visual impact were the Percentage of Industrial Area (including Commercial, Logistic and Mining Areas), Percentage of Forest Cover, Density of Technical Infrastructure, Number of Elevation Landmarks, and Elevation Variation. None of the three landscape pattern indices was statistically significant. On the basis of a regression model that is able to predict the potential visual impact in large areas of four Central European countries (over 830,000 km2), we present the general principles of an objectivized method for predicting the visual impact of onshore wind farms. The method makes an automatic assessment of the visual impact in large areas of entire regions or countries via a GIS analysis of Sentinel data and DEM data. This forms a good basis for both preventive evaluation and causal evaluation, and provides significant support for objectivizing the planning and decision process in order to mitigate negative environmental and social impacts of the use of wind energy. © 2017 Elsevier Ltd
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85033377945&doi=10.1016%2fj.apenergy.2017.11.027&partnerID=40&md5=efa68328647f2971c1dc7007313aea24

86. Public estimates of support for offshore wind energy: False consensus, pluralistic ignorance, and partisan effects. Sokoloski R, Markowitz EM, Bidwell D Energy Policy. 2018;112:45-55.

✓ OFFSHORE

Meeting future energy demands will require large-scale implementation of renewable energy projects. If one of these energy sources—offshore wind—becomes a common sight off coastlines, consideration of local public opinion and action will be critical. Previous research from the social sciences has lacked depth in examining the underlying factors that shape public opinion towards offshore wind development. The current research brings a new perspective to the literature by showing that how members of the public perceive support among others relates to their own opinions of offshore wind energy. We report results from two surveys. The first focused on opinion formation relating to offshore wind in general among New England residents, while the second focused on a specific offshore wind project in Rhode Island. We find evidence that both supporters and opponents of offshore wind underestimate levels of support among others, indicating a pluralistic ignorance effect and false consensus effect, respectively. We also find distinct patterns of perceived support among self-identified Republicans and Democrats. The findings hold important implications for policymakers and developers in understanding the nature of public support and opposition for offshore wind energy, particularly with respect to individuals' willingness to publicly engage with offshore wind projects. © 2017 Elsevier Ltd
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85042145109&doi=10.1016%2fj.enpol.2017.10.005&partnerID=40&md5=7880dc563b82afec2ade129c676c413f

87. Wind turbine health state monitoring based on a Bayesian data-driven approach. Song Z, Zhang Z, Jiang Y, Zhu J Renewable Energy. 2018;125:172-81.

✓ NOT (betreft technische staat WTs)

The efficient wind turbine monitoring and the identification of abnormal turbine states are crucial to advance the wind farm operations and management. This paper presents a pioneer study of identifying wind turbine health states based on their SCADA data. A Bayesian framework is introduced to explore the feasibility and potential of identifying abnormal turbine states based on SCADA data only. Three methods, the bin method, the multivariate normal distribution based method, and the Copula method, are applied and compared in the Bayesian framework development based on SCADA data of two commercial wind turbines. A comprehensive study is conducted to analyze the pros and cons of three methods. Computational results demonstrate the effectiveness of the proposed methods and the Copula method outperforms other two after a careful model calibration. Extending the Bayesian Copula model to produce the one-step ahead prediction of turbine health states is also explored. In addition, the advantage of the proposed framework is further validated by comparing with the classical power curve based monitoring methods. Generated results show the feasibility of identifying turbine health states with SCADA data and the great potential of further enhancing the health monitoring function. © 2018 Elsevier Ltd
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85042703970&doi=10.1016%2fj.renene.2018.02.096&partnerID=40&md5=72b65530842091aa99ffff592cba4d55

88. Perceptions and attitudes of residents living near a wind turbine compared with those living near a coal power plant. Thomson H, Kempton W Renewable Energy. 2018;123:301-11.

✓ SOCIAL (WTs meer acceptabel dan kolencentrale)

This study addresses resident attitudes and visual and auditory impacts from nearby electricity generation. Unlike most prior studies, questions allowing bidirectional answers are used, allowing positive or negative responses, and matched questions are applied in paired communities, one community proximate to utility-scale wind generation and the second proximate to fossil generation. At least a few individuals had negative attitudes and reported negative visual and auditory impact regardless of which type of generation-but residents near the wind turbine predominately had positive attitudes toward the facility, and reported more positive than negative visual and auditory impacts. Conversely, residents near coal generation reported substantially more negative attitudes, visual impacts, and auditory impacts from the coal plant. When asked about willingness-to-pay to keep or remove the nearby facility, residents near the wind turbine would, on average, say they would pay $2.56 a month to keep it in place, whereas residents near the coal plant were, on average, willing to pay $1.82 a month to remove that facility. Demographics did not have significant effect on the results. © 2017 The Authors
https://www.scopus.com/inward/record.uri?eid=2-s2.0-85042224369&doi=10.1016%2fj.renene.2017.10.036&partnerID=40&md5=d5a49eb4a01c6fe5adf501fcbb9e2987

89. A Review of Wind Turbine-Generated Infrasound: Source, Measurement and Effect on Health. Tonin R Acoustics Australia. 2018;46(1):69-86.

✓ LFN

Some people who reside in proximity to wind turbines complain of a range of adverse health impacts. These include tinnitus, raised blood pressure, heart palpitations, tachycardia, stress, anxiety, vertigo, dizziness, nausea, blurred vision, fatigue, cognitive dysfunction, headaches, ear pressure, exacerbated migraine disorders, motion sensitivity, inner ear damage and sleep deprivation. This article begins with a historical review of prognoses such as Vibroacoustic Disease and Wind Turbine Syndrome which were proposed to explain the reported health symptoms and the hypothesised link to the emission of infrasound from wind turbines. A review of noise measurements at wind turbine sites conducted by various investigators shows that the level of infrasound is below the threshold of hearing. Notwithstanding, others postulate that stimulation by infrasound of the otolith organs causes nauseogenic symptoms or that stimulation of the outer hair cells, which are said to be particularly sensitive to infrasound frequencies, explains the symptoms. A review of social surveys is

undertaken of self-reported health effects attributable to wind turbine noise, including the effects of sleep disturbance. A description is finally provided of physical exploration studies which subject participants to infrasound and measure their response. © 2017, Australian Acoustical Society. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85047832318&doi=10.1007%2fs40857-017-0098-3&partnerID=40&md5=4cdfc931f9aeeb16abba33bbbfa8318c

90. Are there harmful effects caused by the silent noise of infrasound produced by windparks? An experimental approach. Vahl CF, Ghazy A, Chaban R Thoracic and Cardiovascular Surgeon. 2018;66.

✓ LFN

Introduction: The increased number of wind parks raised the question, whether infrasound waves produced by wind turbines are harmful on human-beings, or not. Infrasound is a low frequency sound (< 20 Hz), undetectable with human ears. However, some people live near windparks describe unspecific symptoms i.e., palpitations, dizziness, headache, etc. This study analyses the infrasound effects on isolated atrial human myocardium and measures the contractile performance in human trabeculae using different frequencies and amplitudes of infrasound generated by a loudspeaker. Methods: Human atrial trabeculae were resected from 8 patients undergoing aorto coronary bypass surgery, then demembranized using Triton X 100 and small fibers were generated with diameter < 0.3 mm and length 4-6 mm. The fibers were attached between force transducer and loudspeaker while activated at optimal length and room temperature in an organ bath using supramaximal calcium concentrations. Then infrasound was imposed using frequencies of 10 Hz or 20 Hz. Sound amplitudes (SA) were either 5% or 10% of tissue length (TL). Sound was applied for 1 minute. Force was measured before and after 1 minute of infrasound. Results: Imposed infrasound on isolated human myocardium caused a direct force inhibition of the completely activated myocardial preparation. At 10 Hz and 5% TL (SA) force inhibition was 18.8+2% while at 10% TL (SA) up to 23.3+2% ($p < 0.05$). At 20 Hz; force inhibition was 23+2% at 5% TL and 32+4% at 10% TL ($p < 0.01$). After stopping infrasound; force was recovered but not to the initial value. No sound was heard during the experiments. Passive resting force was minimally affected (n.s.). Conclusion: Infrasound can induce direct effects on human myocardium in the given experimental setting. Although mono-frequency sounds are not present in nature, our experimental data indicates, that direct effects on myocardial tissue are present. The infrasound influence on human tissue requires further investigation because the increasing number of a) wind turbines and b) human beings exposed by the neighborhood of windparks. Humans have no chance to protect themselves from the silent noise of infrasound, as long as no scientific data presents.
http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L620926032

91. Health Effects Related to Wind Turbine Sound, Including Low-Frequency Sound and Infrasound. van Kamp I, van den Berg F Acoustics Australia. 2018;46(1):31-57.

Tsja, waar delen we dit in? ☺

A narrative review of observational and experimental studies was conducted to assess the association between exposure to wind turbine sound and its components and health effects in the general population. Literature databases Scopus, Medline and Embase and additional bibliographic sources such as reference sections of key publications and journal databases were systematically searched for peer-reviewed studies published from 2009 to 2017. For the period until early 2015 only reviews were included, while for the period between January 2015 and January 2017 all relevant publications were screened. Ten reviews and 22 studies met the inclusion criteria. Most studies examined subjective annoyance as the primary outcome, indicating an association between exposure levels and the percentage highly annoyed. Sound from wind turbines leads to a higher percentage of highly annoyed when compared to other sound sources. Annoyance due to aspects, like shadow flicker, the visual (in) appropriateness in the landscape and blinking lights, can add to the noise annoyance. There is no evidence of a specific effect of the low-frequency component nor of infrasound. There are indications that the rhythmic pressure pulses on a building can lead to additional annoyance indoors. Personal characteristics such as noise sensitivity, privacy issues and

social acceptance, benefits and attitudes, the local situation and the conditions of planning a wind farm also play a role in reported annoyance. Less data are available to evaluate the effects of wind turbines on sleep and long-term health effects. Sleep disturbance as well as other health effects in the vicinity of wind turbines was found to be related to annoyance, rather than directly to exposure.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85047947270&doi=10.1007%2fs40857-017-0115-6&partnerID=40&md5=77019ed1a460b2850d6006e37be9c166

92. WHO environmental noise guidelines for the European region: A systematic review on environmental noise and cardiovascular and metabolic effects: A summary. van Kempen E, Casas M, Pershagen G, Foraster M International Journal of Environmental Research and Public Health. 2018;15(2).

✓ REVIEW cardiovascular

To update the current state of evidence and assess its quality, we conducted a systematic review on the effects of environmental noise exposure on the cardio-metabolic systems as input for the new WHO environmental noise guidelines for the European Region. We identified 600 references relating to studies on effects of noise from road, rail and air traffic, and wind turbines on the cardio-metabolic system, published between January 2000 and August 2015. Only 61 studies, investigating different end points, included information enabling estimation of exposure response relationships. These studies were used for meta-analyses, and assessments of the quality of evidence using the Grading of Recommendations Assessment, Development and Evaluation (GRADE). A majority of the studies concerned traffic noise and hypertension, but most were cross-sectional and suffering from a high risk of bias. The most comprehensive evidence was available for road traffic noise and Ischeamic Heart Diseases (IHD). Combining the results of 7 longitudinal studies revealed a Relative Risk (RR) of 1.08 (95% CI: 1.01–1.15) per 10 dB (LDEN) for the association between road traffic noise and the incidence of IHD. We rated the quality of this evidence as high. Only a few studies reported on the association between transportation noise and stroke, diabetes, and/or obesity. The quality of evidence for these associations was rated from moderate to very low, depending on transportation noise source and outcome. For a comprehensive assessment of the impact of noise exposure on the cardiovascular and metabolic system, we need more and better quality evidence, primarily based on longitudinal studies.
http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L620774799

93. Valuing the visual impact of wind farms: A calculus method for synthesizing choice experiments studies. Wen C, Dallimer M, Carver S, Ziv G Sci Total Environ. 2018 Oct 1;637-638:58-68.

✓ VISUAL

Despite the great potential of mitigating carbon emission, development of wind farms is often opposed by local communities due to the visual impact on landscape. A growing number of studies have applied nonmarket valuation methods like Choice Experiments (CE) to value the visual impact by eliciting respondents' willingness to pay (WTP) or willingness to accept (WTA) for hypothetical wind farms through survey questions. Several meta-analyses have been found in the literature to synthesize results from different valuation studies, but they have various limitations related to the use of the prevailing multivariate meta-regression analysis. In this paper, we propose a new meta-analysis method to establish general functions for the relationships between the estimated WTP or WTA and three wind farm attributes, namely the distance to residential/coastal areas, the number of turbines and turbine height. This method involves establishing WTA or WTP functions for individual studies, fitting the average derivative functions and deriving the general integral functions of WTP or WTA against wind farm attributes. Results indicate that respondents in different studies consistently showed increasing WTP for moving wind farms to greater distances, which can be fitted by non-linear (natural logarithm) functions. However, divergent preferences for the number of turbines and turbine height were found in different studies. We argue that the new analysis method proposed in this paper is an alternative to the mainstream multivariate meta-regression analysis for synthesizing

CE studies and the general integral functions of WTP or WTA against wind farm attributes are useful for future spatial modelling and benefit transfer studies. We also suggest that future multivariate meta-analyses should include non-linear components in the regression functions.
https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=29742475

EMBASE + SCOPUS 2018 tot 27-2-2020

Toelichting:
- doorgestreept : dubbel met update 2018-2019
- vinkje : indeling conform table Irene
- vraagteken : indeling niet conform table Irene
- achter REVIEW of HE is eventueel het health effect van het artikel genoteerd

1) b(2019). "Retraction: Adaptive neuro-fuzzy methodology for noise assessment of wind turbine (PLoS ONE (2014) 9:7 (e103414) DOI: 10.1371/journal.pone.0103414)." PLoS ONE 14(4).
   ✓ NOT (teruggetrokken artikel)
   Following publication, concerns have been raised regarding overlap of text between this article [1] and a number of other previously published works. Segments of text in the Abstract, Introduction, Materials and Methods, and Conclusion sections are similar or identical to excerpts from other previously published works, some of which are cited, but it is not made clear that text has been re-used verbatim from these sources. There is text overlap with papers from other author groups, specifically, in the Abstract [2,3], in the Introduction [4–7], in the Materials and Methods [8], and in the Conclusion [9]. The Introduction, Materials and Methods, and Conclusion sections also contain duplicate text from a 2014 article by some of the same authors [10], which has since been retracted. In view of the extent of the overlapping text, the PLOS ONE Editors retract this article. SS did not agree with retraction. DB, RH, SM did not respond. The corresponding author stands by the article as an independent contribution.

2) Ali, S., et al. (2018). "Performance optimization of linear active disturbance rejection control approach by modified bat inspired algorithm for single area load frequency control concerning high wind power penetration." ISA transactions 81: 163-176.
   ✓ NOT (techniek WTs)
   The linear active disturbance approach is employed to deal with the load frequency control issue of a single area wind power system based on doubly fed induction generator, and the performance of the control law is optimized by using the bat-inspired algorithm. The load frequency control issue has become more challenging in a complex power system based on wind energy conversion system due to the varying feature of the wind penetration, and sustaining the balance between the power generation and demand by rejecting the internal uncertainties in the process model and the external disturbances simultaneously. In the framework of the presented linear active disturbance rejection control approach, by constructing an extended state observer, the total disturbance, including all the unmodelled dynamics in the process model and the external disturbances, can be estimated in real time and then compensated by a simple linear PD control law. The controller parameters tuning is then simplified into the optimization of the two bandwidths: observer bandwidth, and the controller bandwidth. Then, this issue can be achieved by employing the heuristic modified bat inspired algorithm based on the optimization of the proposed performance index. The effectiveness of the proposed approach is validated by the extensive simulation examples of the load frequency control issue involved in the single area power system, taking into account different wind penetration, as well as the external disturbances. The performance robustness of the proposed approach against the parameters perturbation in the process model is also demonstrated via the Monte-Carlo method. The performance superiority of the proposed approach over the conventional Proportional Integral and Fuzzy-Proportional Integral based controller even in the presence of external disturbances and uncertainty in power system parameters under different cases of high wind penetration is also validated from the simulation results.

3) Barry, R., et al. (2018). "Using residential proximity to wind turbines as an alternative exposure measure to investigate the association between wind turbines and human health." The Journal of the Acoustical Society of America 143(6): 3278.
   ✓ HE (aanvulling op, maar bestreden door Michaud et al –zie 32)

This analysis uses data from the Community Noise and Health Study developed by Statistics Canada to investigate the association between residential proximity to wind turbines and health-related outcomes in a dataset that also provides objective measures of wind turbine noise. The findings indicate that residential proximity to wind turbines is correlated with annoyance and health-related quality of life measures. These associations differ in some respects from associations with noise measurements. Results can be used to support discussions between communities and wind-turbine developers regarding potential health effects of wind turbines.

4) Basner, M. and S. McGuire (2018). "WHO environmental noise guidelines for the european region: A systematic review on environmental noise and effects on sleep." International Journal of Environmental Research and Public Health 15(3).

✓ REVIEW sleep

To evaluate the quality of available evidence on the effects of environmental noise exposure on sleep a systematic review was conducted. The databases PSYCINFO, PubMed, Science Direct, Scopus, Web of Science and the TNO Repository were searched for non-laboratory studies on the effects of environmental noise on sleep with measured or predicted noise levels and published in or after the year 2000. The quality of the evidence was assessed using GRADE criteria. Seventy four studies predominately conducted between 2000 and 2015 were included in the review. A meta-analysis of surveys linking road, rail, and aircraft noise exposure to self-reports of sleep disturbance was conducted. The odds ratio for the percent highly sleep disturbed for a 10 dB increase in Lnight was significant for aircraft (1.94; 95% CI 1.61–2.3), road (2.13; 95% CI 1.82–2.48), and rail (3.06; 95% CI 2.38–3.93) noise when the question referred to noise, but non-significant for aircraft (1.17; 95% CI 0.54–2.53), road (1.09; 95% CI 0.94–1.27), and rail (1.27; 95% CI 0.89–1.81) noise when the question did not refer to noise. A pooled analysis of polysomnographic studies on the acute effects of transportation noise on sleep was also conducted and the unadjusted odds ratio for the probability of awakening for a 10 dBA increase in the indoor Lmax was significant for aircraft (1.35; 95% CI 1.22–1.50), road (1.36; 95% CI 1.19–1.55), and rail (1.35; 95% CI 1.21–1.52) noise. Due to a limited number of studies and the use of different outcome measures, a narrative review only was conducted for motility, cardiac and blood pressure outcomes, and for children's sleep. The effect of wind turbine and hospital noise on sleep was also assessed. Based on the available evidence, transportation noise affects objectively measured sleep physiology and subjectively assessed sleep disturbance in adults. For other outcome measures and noise sources the examined evidence was conflicting or only emerging. According to GRADE criteria, the quality of the evidence was moderate for cortical awakenings and self-reported sleep disturbance (for questions that referred to noise) induced by traffic noise, low for motility measures of traffic noise induced sleep disturbance, and very low for all other noise sources and investigated sleep outcomes.

5) Bräuner, E. V., et al. (2018). "Long-term wind turbine noise exposure and incidence of myocardial infarction in the Danish nurse cohort." Environment International 121: 794-802.

✓ HE myocardial

Background: Growing evidence supports the concept that traffic noise exposure leads to long-term health complications other than annoyance, including cardiovascular disease. Similar effects may be expected from wind turbine noise exposure, but evidence is sparse. Here, we examined the association between long-term exposure to wind turbine noise and incidence of myocardial infarction (MI). Methods: We used the Danish Nurse Cohort with 28,731 female nurses and obtained data on incidence of MI in the Danish National Patient and Causes of Death Registries until ultimo 2013. Wind turbine noise levels at residential addresses between 1982 and 2013 were estimated using the Nord2000 noise propagation model, as the annual means of a weighted 24-hour average (Lden) at the most exposed façade. Time-varying Cox proportional hazard regression was used to examine the association between the 11-, 5- and 1-year rolling means prior to MI diagnosis of wind turbine noise levels and MI incidence. Results: Of 23,994 nurses free of MI at cohort baseline, 686 developed MI by end of follow-up in 2013. At the cohort baseline (1993 or

1999), 10.4% nurses were exposed to wind turbine noise (≥1 turbine within a 6000-m radius of the residence) and 13.3% in 2013. Mean baseline residential noise levels among exposed nurses were 26.3 dB, higher in those who developed MI (26.6 dB) than among those who didn't develop MI (26.3 dB). We found no association between wind turbine noise and MI incidence: adjusted hazard ratios (HRs) and 95% confidence intervals (CIs) comparing nurses with 11-years mean residential noise levels of <21.5 dB, 21.5–25.4 dB, 25.4–29.9 dB, and >29.9 dB, to non-exposed nurses were 0.89 (0.64–1.25), 1.20 (0.82–1.77), 1.38 (0.95–2.01), and 0.88 (0.53–1.28), respectively. Corresponding HR (95% CI) for the linear association between 11-year mean levels of wind turbine noise (per 10 dB increase) with MI incidence was 0.99 (0.77–1.28). Similar associations were observed when considering the 5- and 1-year running means, and with no evidence of dose-response. Conclusions: The results of this comprehensive cohort study lend little support to a causal association between outdoor long-term wind-turbine noise exposure and MI. However, there were only few cases in the highest exposure groups and our findings need reproduction.

6) Bräuner, E. V., et al. (2019). "Association Between Long-Term Exposure to Wind Turbine Noise and the Risk of Stroke: Data From the Danish Nurse Cohort." Journal of the American Heart Association 8(14).
   ✓ HE stroke
   Background: Epidemiological studies suggest that road traffic noise increases the risk of stroke. Similar effects may be expected from wind turbine noise (WTN) exposure, but epidemiological evidence is lacking. The present study investigated the association between long-term exposure to WTN and the risk for stroke. Methods and Results: First-ever stroke in 28 731 female nurses in the Danish Nurse Cohort was identified in the Danish National Patient register until the end of 2013. WTN, traffic noise, and air pollution exposures were estimated for all historic and present residential addresses between 1982 and 2013. Time-varying Cox proportional hazard regression was used to examine the associations between the 11-, 5-, and 1-year rolling means of WTN levels and stroke incidence. Of 23 912 nurses free of stroke at the cohort baseline, 1097 nurses developed stroke by the end of follow-up. At the cohort baseline, 10.3% of nurses were exposed to WTN (≥1 turbine within a 6000-meter radius of the residence) and 13.3% in 2013. Mean baseline residential noise levels among exposed nurses were 26.3 dB(A). No association between long-term WTN exposure and stroke incidence was found. The adjusted hazard ratios and 95% CIs for the 11-, 5-, and 1-year running mean residential WTN exposures preceding stroke diagnosis, comparing nurses with residential WTN levels above and below 20 dB(A) were 1.09 (0.90–1.31), 1.08 (0.89–1.31) and 1.08 (0.89–1.32), respectively. Conclusions: This comprehensive cohort study lends no support to an association between long-term WTN exposure and stroke risk.

7) Bräuner, E. V., et al. (2019). "Long-term wind turbine noise exposure and the risk of incident atrial fibrillation in the Danish Nurse cohort." Environment International 130.
   ✓ HE fibrillation
   Background: The potential health effects related to wind turbine noise (WTN) have received increased focus during the past decades, but evidence is sparse. We examined the association between long-term exposure to wind turbine noise and incidence of atrial fibrillation (AF). Methods: First ever hospital admission of AF amongst 28,731 female nurses in the Danish Nurse Cohort were identified in the Danish National Patient register until ultimo 2013. WTN levels at residential addresses between 1982 and 2013 were estimated using the Nord2000 noise propagation model, as the annual means of Lden, Lday, Levening and Lnight at the most exposed façade. Time-varying Cox proportional hazard regression models were used to examine the association between the 11-, 5- and 1-year rolling means of WTN levels and AF incidence. Results: 1430 nurses developed AF by end of follow-up in 2013. Mean (standard deviation) baseline residential noise levels amongst exposed nurses were 26.3 (6.7) dB and slightly higher in those who developed AF (27.3 (7.31) dB), than those who didn't (26.2 (6.6)). We observed a 30% statistically significant increased risk (95% CI: 1.05–1.61) of AF amongst nurses exposed to long-term

(11-year running mean) WTN levels ≥20 dB(A) at night compared to nurses exposed to levels <20 dB(A). Similar effects were observed with day (HR 1.25; 95% CI: 1.01–1.54), and evening (HR 1.25; 95% CI: 1.01–1.54) noise levels. Conclusions: We found suggestive evidence of an association between long-term exposure to WTN and AF amongst female nurses. However, interpretation should be cautious as exposure levels were low.

8) Carlile, S., et al. (2018). "A Review of the Possible Perceptual and Physiological Effects of Wind Turbine Noise." Trends in hearing 22: 2331216518789551.
? LFN
This review considers the nature of the sound generated by wind turbines focusing on the low-frequency sound (LF) and infrasound (IS) to understand the usefulness of the sound measures where people work and sleep. A second focus concerns the evidence for mechanisms of physiological transduction of LF/IS or the evidence for somatic effects of LF/IS. While the current evidence does not conclusively demonstrate transduction, it does present a strong prima facia case. There are substantial outstanding questions relating to the measurement and propagation of LF and IS and its encoding by the central nervous system relevant to possible perceptual and physiological effects. A range of possible research areas are identified.

9) Clark, C. and K. Paunovic (2018). "Who environmental noise guidelines for the European region: A systematic review on environmental noise and quality of life, wellbeing and mental health." International Journal of Environmental Research and Public Health 15(11).
✓ REVIEW QoL, mental health
This systematic review assesses the quality of the evidence across studies on the effect of environmental noise (road traffic noise, aircraft noise, railway noise, wind-turbine noise) on quality of life, wellbeing and mental health. Quantitative studies of noise effects on children and adults published from January 2005 up to October 2015 were reviewed. A total of 29 papers were identified. 90% of the papers were of cross-sectional design, with fewer studies of longitudinal or intervention design. Outcomes included depression and anxiety, medication use and childhood emotional problems. The quality of the evidence across the studies for each individual noise source was assessed using an adaptation of the GRADE methodology. Overall, given the predominance of cross-sectional studies, most evidence was rated as very low quality, with evidence of effects only being observed for some noise sources and outcomes. These ratings reflect inconsistent findings across studies, the small number of studies and a lack of methodological robustness within some domains. Overall, there are few studies of clinically significant mental health outcomes; few studies of railway noise exposure; and studies of large samples are needed. The lack of evidence for noise effects across studies for many of the quality of life, wellbeing and mental health domains examined does not necessarily mean that there are no effects: rather, that they have not yet been studied robustly for different noise sources.

~~10) Clark, S. and L. C. Botterill (2018). "Contesting facts about wind farms in Australia and the legitimacy of adverse health effects." Health (London, England : 1997) 22(4): 337-355.
The development of wind energy in Australia has been subject to ongoing public debate and has been characterised by concerns over the health impacts of wind turbines. Using discursive psychology, we examine 'wind turbine syndrome' as a contested illness and analyse how people build and undermine divergent arguments about wind-farm health effects. This article explores two facets of the dispute. First, we consider how participants construct 'facts' about the health effects of wind farms. We examine rhetorical resources used to construct wind farms as harmful or benign. Second, we examine the local negotiation of the legitimacy of health complaints. In the research interviews examined, even though interviewees treat those who report experiencing symptoms from wind farms as having primary rights to narrate their own experience, this epistemic primacy does not extend to the ability to 'correctly' identify symptoms' cause. As a result, the legitimacy of health complaints is undermined. Wind turbine syndrome is an example of a contested illness that is politically controversial. We show how stake, interest and legitimacy are~~

~~particularly relevant for participants' competing descriptions about the 'facts' of wind turbine health effects.~~

11) Davy, J. L., et al. (2018). "Wind turbine sound limits: Current status and recommendations based on mitigating noise annoyance." Applied Acoustics 140: 288-295.
✓ EXPOSURE (maar limiet gebaseerd op hinder)
This paper describes existing wind turbine sound limits in Australian states and several other countries with similar constraints, how these were established and a method that could facilitate their harmonisation. Most existing limits appear to have been adopted to avoid sleep disturbance using data derived from sound sources other than wind turbines. This seems to have been a reasonable approach at the time of their adoption because of the paucity of other suitable data. More recently the concept of "annoyance" has been used to encapsulate negative reactions to wind turbine sound. Many studies have now demonstrated a significant relationship between annoyance and wind turbine sound level, whether or not sound was the major source of the annoyance. Thus there is a logical basis for now deriving a wind turbine sound limit based on limiting annoyance. This paper describes such an approach. The derived limit is compared to existing Australian and international limits. Its value lies within the range of these other limits. It provides a method for harmonisation of future limits based on direct assessments of human response to wind turbine sound. © 2018

12) Dhar, A., et al. (2019). "Perspectives on environmental impacts and a land reclamation strategy for solar and wind energy systems." Science of the Total Environment.
✓ NOT (betreft vooral milieuplanning)
Global energy demands and environmental concerns are a driving force for use of alternative, sustainable and clean energy sources. Solar and wind are among the most promising sources and have been developing steadily in recent years. However, these energy developments are not free of adverse environmental consequences, which require appropriate reclamation procedures. The environmental issues caused by solar and wind plants were reviewed in this paper by summarizing existing studies and synthesizing the principles that could underlie development of reclamation practices. The major environmental drawback of solar and wind energy plants are bird mortality, biodiversity, and habitat loss; noise; visual impact; and hazardous chemicals used in solar panels. Available mitigation measures to minimize these adverse environmental impacts, and appropriate reclamation protocol for the disturbed ecosystems, including key research needs are discussed. We include socio-economic perspectives of solar and wind energy, such as policy related to re-powering initiatives, decommissioning, and reclamation liability. The intent of this paper is to provide current perspectives on environmental issues associated with solar and wind energy development, strategies to mitigate environmental impacts, and potential reclamation practices to solar and wind energy planners and developers.

13) Elzinga, J., et al. (2019). Manuscript title: Installing offshore wind turbine foundations quieter: A performance overview of the first full-scale demonstration of the ADBM underwater noise abatement system C3 - Proceedings of the Annual Offshore Technology Conference, Offshore Technology Conference.
✓ OFFSHORE
Offshore wind is a quickly-emerging market resulting from the worldwide transition towards renewable energies. Whilst this transition has countless environmental benefits, the negative aspects pertaining to underwater noise generated during wind park construction are coming under increased public scrutiny. A number of countries have responded to this environmental and social concern by establishing underwater noise regulations. Construction using current piling techniques often requires the use of underwater noise mitigation systems to meet these legislative requirements. These systems can be applied at the piling source, near pile or far from pile. Under the Underwater Noise Abatement System (UNAS) program, partially sponsored by the Dutch government's 'Rijksdienst voor Ondernemend Nederland' (RVO), a new noise mitigation system has been tested. The UNAS consortium consists of three partners: Van Oord Offshore Wind Projects, AdBm

Technologies, and TNO (Netherlands Organization for Applied Scientific Research). The noise mitigation system, here after referred to as NMS, consists of a slatted system containing Helmholtz resonators which is deployed around a monopile in a similar method to venetian blinds. Scaled tests of the NMS at Butendiek and Luchterduinen Offshore Wind Parks showed potential for full-scale deployment. The full-scale test of the NMS was executed in the fall of 2018. A configuration where the vertical spacing of the slats was 0.67 m yielded a 7 to 8 dB SEL re 1 µPa2s reduction compared to the unmitigated scenario, while combining the NMS with a big bubble curtain (BBC) resulted in a 14 to 15 dB SEL reduction compared to the unmitigated situation. This reduction range, as well as a smooth offshore operational performance, puts the NMS in line with other near pile mitigation systems. Deployment of the NMS appears a feasible option to ensure underwater noise compliance in various nation's legislation. © 2019, Offshore Technology Conference

14) Fredianelli, L., et al. (2019). "A procedure for deriving wind turbine noise limits by taking into account annoyance." Science of the Total Environment 648: 728-736.
✓ EXPOSURE (maar verband gebaseerd met hinder)
With the increasing installation of wind farms, the attention of citizens towards wind turbine noise (WTN) has grown. Differently from some national legislations, the scientific community has promptly responded, increasing the studies and the social surveys in order to better understand the cause of disturbance and the indicators that relate to it. At first, the paper underlines the importance of low WTN levels for indirect health effects such as sleep disturbance and annoyance. The importance to consider noise annoyance in legislation is also discussed, as WTN is more disturbing than other most common noise sources. Then, conversion curves for equally highly annoyed are introduced considering the annoyance perceived by population in relation with the type of source. Finally, a specific limit value of 43 dB(A) for WTN is derived and suggested, comparable with British and Danish standards.

15) Freiberg, A., et al. (2018). "Health effects of wind turbines in working environments – A scoping review." Scandinavian Journal of Work, Environment and Health 44(4): 351-369.
✓ NOT (arbo, niet relevant voor belasting bewoners)
Objectives The wind industry is a growing economic sector, yet there is no overview summarizing all exposures emanating from wind turbines throughout their life cycle that may pose a risk for workers' health. The aim of this scoping review was to survey and outline the body of evidence around the health effects of wind turbines in working environments in order to identify research gaps and to highlight the need for further research. Methods A scoping review with a transparent and systematic procedure was conducted using a comprehensive search strategy. Two independent reviewers conducted most of the review steps. Results Twenty articles of varying methodical quality were included. Our findings of the included studies indicate that substances used in rotor blade manufacture (epoxy resin and styrene) cause skin disorders, and respectively, respiratory ailments and eye complaints; exposure to onshore wind turbine noise leads to annoyance, sleep disorders, and lowered general health; finally working in the wind industry is associated with a considerable accident rate, resulting in injuries or fatalities. Conclusions Due to the different work activities during the life cycle of a wind turbine and the distinction between on-and offshore work, there are no specific overall health effects of working in the wind sector. Previous research has primarily focused on evaluating the effects of working in the wind industry on skin disorders, accidents, and noise consequences. There is a need for further research, particularly in studying the effect of wind turbine work on psychological and musculoskeletal disorders, work-related injury and accident rates, and health outcomes in later life cycle phases.

16) Freiberg, A., et al. (2019). "Health effects of wind turbines on humans in residential settings: Results of a scoping review." Environmental Research 169: 446-463.
✓ REVIEW HE (goed review! Interessant conclusies alle reviews vergelijken)
Introduction: As the global number of wind turbines has increased steadily in recent years, as has the number of studies about putative health effects in residential settings, it is the review purpose to give an overview of the characteristics and methodologies of the

scientific literature around the topic in order to identify research gaps and to derive implications for research and practice. Additionally, study findings from higher-quality observational studies as well as results that seem to be of interest for the scientific and political debate are presented. Methods: The scoping review was conducted following systematic review methods. Comprehensive literature searches were carried out in several databases, and with extensive hand searches. All review steps were carried out in parallel by two reviewers or by one reviewer and in duplicate checked by another reviewer. The following important methodological criteria were investigated: Reporting, ethical aspects, generalization, selection bias, information bias, confounder bias. Findings from observational studies without a selection bias, information bias, and confounder bias are presented. Results: 84 articles, that varied significantly in methods and outcomes assessed, met the inclusion criteria. Multiple cross-sectional studies reported that wind turbine noise is associated with noise annoyance, which is moderated by several variables such as noise sensitivity, attitude towards wind turbines, or economic benefit. Wind turbine noise is not associated with stress effects and biophysiological variables of sleep. Results on the impact of wind turbine noise on sleep disburbance, quality of life, and mental health problems differed among cross-sectional studies. There were few studies that addressed the potential impact of turbine noise on clinically apparent health outcomes. There were also few studies on visual risk factors or infrasound exposure. No literature was identified regarding low-frequency noise, electromagnetic radiation, and ice throw. Conclusions: There is an extensive and diverse body of evidence around health impacts of wind turbines in residential settings, that increased sharply since 2010, showing particularly noise consequences concerning increased noise annoyance with its complex pathways; no relationship between wind turbine noise and stress effects and biophysiological variables of sleep; and heterogeneous findings concerning sleep disturbance, quality of life, as well as mental health problems. Research gaps concern the complex pathways of annoyance, the examination of clinically apparent health outcomes in comparison with non-exposed residents, an objective investigation of visual wind turbine features, the interaction between all wind turbine exposures, and epidemiological observational studies on field low-frequency and infrasound from wind turbines. Future research needs thorough high-quality and prospective study designs.

17) Haac, T. R., et al. (2019). "Wind turbine audibility and noise annoyance in a national U.S. survey: Individual perception and influencing factors." Journal of the Acoustical Society of America 146(2): 1124-1141.
✓ HE annoyance (samenhang hinder-visuele afkeuring sterker dan hinder-geluidniveau)
With results from a nationwide survey sponsored by the U.S. Department of Energy, factors that affect outdoor audibility and noise annoyance of wind turbines were evaluated. Wind turbine and summer daytime median background sound levels were estimated for 1043 respondents. Wind turbine sound level was the most robust predictor of audibility yet only a weak, albeit significant, predictor of noise annoyance. For each 1 dB increase in wind turbine sound level (L1h-max), the odds of hearing a wind turbine on one's property increased by 31% [odds ratio (OR): 1.31; 95% CI (confidence interval): 1.25-1.38] and the odds of moving to the next level of annoyance increased by 9% (OR: 1.09; 95% CI: 1.02-1.16). While audibility was overwhelmingly dependent on turbine sound level, noise annoyance was best explained by visual disapproval (OR: 11.0; 95% CI: 4.8-25.4). The final models correctly predict audibility and annoyance level for 80% and 62% of individuals, respectively. The results demonstrate that among community members not receiving personal benefits from wind projects, the Community Tolerance Level of wind turbine noise for the U.S. aligns with the international average, further supporting observations that communities are less tolerant of wind turbine noise than other common environmental noise sources at equivalent A-weighted sound levels. © 2019 Acoustical Society of America.

18) Hübner, G., et al. (2019). "Monitoring annoyance and stress effects of wind turbines on nearby residents: A comparison of U.S. and European samples." Environment International 132.

✓ HE annoyance, stress (verschillen USA en Europa)

As wind turbines and the number of wind projects scale throughout the world, a growing number of individuals might be affected by these structures. For some people, wind turbine sounds and their effects on the landscape can be annoying and could even prompt stress reactions. This comparative study analyzed a combined sample of survey respondents from the U.S., Germany and Switzerland. It utilized a newly developed assessment scale (AS-Scale) to reliably characterize these stress-impacted individuals living within populations near turbines. Findings indicate low prevalence of annoyance, stress symptoms and coping strategies. Noise annoyance stress (NAS-Scale) was negatively correlated with the perceptions of a lack of fairness of the wind project's planning and development process, among other subjective variables. Objective indicators, such as the distance from the nearest turbine and sound pressure level modeled for each respondent, were not found to be correlated to noise annoyance. Similar result patterns were found across the European and U.S. samples.

19) Ishitake, T. (2018). "Wind Turbine Noise and Health Effects." Nihon eiseigaku zasshi. Japanese journal of hygiene 73(3): 298-304.

? NOT (alleen abstract verder Japanse tekst)

We investigated whether long-term exposure to low-frequency noise generated by wind power facilities is a risk factor for sleep disorders. We performed an epidemiological study of the living environment and health effects of such noise by surveying 9,000 residents (≥20 years of age) living in areas with operational wind power facilities. Sleep disorders were assessed using the Athens Insomnia Scale. To assess environmental noise in residential areas near wind turbines, infrasound and low-frequency sound exposure levels were measured at 50 community centers of a town. The prevalence of sleep disorders was significantly higher among residents who reported subjectively hearing noise (by approximately twofold) than among those who did not. Moreover, the reported prevalence of sleep disorders was significantly higher (by approximately twofold) among residents living at a distance of ≤1,500 m from the nearest wind turbine than among residents living at a distance of ≥2,000 m, suggesting a dose-response relationship. The attitudes of residents towards wind power facilities strongly affected their responses regarding sleep disorder prevalence. It is highly likely that audible noise generated by wind power facilities is a risk factor for sleep disorders. Obtaining a satisfactory consensus from local residents before installing wind power facilities is important as for more amenable their attitudes towards such facilities.

20) Ishitake, T. and K. Hara (2018). "Current Situation around Wind Power Generation and Health Effects of Wind Turbine Noise." Nihon eiseigaku zasshi. Japanese journal of hygiene 73(3): 277.

✓ NOT (abstract + tekst in Japans)

21) Johansson, A., et al. (2019). "Annoyance and partial masking of wind turbine noise from ambient sources." Acta Acustica united with Acustica 105(6): 1035-1041.

✓ HE annnoyance

This paper investigates noise annoyance from wind turbines of different sizes and in different acoustic surroundings. A listening test was conducted where wind turbine noises were rated alone and together with background sounds from a deciduous forest, a busy city and road traffic. A magnitude production procedure was implemented which showed high correlation between repeated measurements and the results were analysed using A-weighted sound levels, signal-to-noise ratios and time varying loudness and partial loudness. Ratings for wind turbine sound heard alone showed no coherent statistically significant differences between wind turbine types, neither for A-weighted sound levels nor loudness. The masking test indicate that road traffic noise is a superior masker compared to forest sound. However, these effects where only statistically significant at low sound levels, below the range 35–45 dB(A), where noise guidelines for wind turbine noise usually are stipulated.

22) Kayser, B., et al. (2019). "Sensitivity analysis of a parabolic equation model to ground impedance and surface roughness for wind turbine noise." The Journal of the Acoustical Society of America 146(5): 3222.

✓ NOT (modellering geluidsvoortplanting)

Input parameters of outdoor sound prediction models are related to environmental phenomena, such as atmospheric conditions and ground properties, which are variable in both time and space. In order to obtain reliable predictions, it is essential to get information on uncertainties by quantifying the sensitivity of numerical or analytical models to their input parameters, and thus determine the inputs that will be the main source of uncertainties. This paper focuses on ground parameters impact on sound propagation considering wind turbine noise. First, the implementation of ground roughness in a parabolic equation model validated against scale model measurements and analytical solution is proposed. Then, the sensitivity of the model to its ground parameters is performed with the Morris' screening method in order to access their relative influences. Three parameters are considered: the ground absorption through the airflow resistivity, the ground roughness through the roughness height, and correlation length. Results clearly show that the variations of ground roughness induce non-negligible differences in sound pressure levels regarding the ground absorption, even for high height sound source, i.e., nongrazing incidence.

23) Keith, S. E., et al. (2018). "Wind turbine low frequency and infrasound propagation and sound pressure level calculations at dwellings." The Journal of the Acoustical Society of America 144(2): 981.

✓ EXPOSURE

This study was developed to estimate wind turbine low frequency and infrasound levels at 1238 dwellings in Health Canada's Community Noise and Health Study. In field measurements, spectral peaks were identifiable for distances up to 10 km away from wind turbines at frequencies from 0.5 to 70 Hz. These measurements, combined with onsite meteorology, were in agreement with calculations using Parabolic Equation (PE) and Fast Field Program (FFP). Since onsite meteorology was not available for the Health Canada study, PE and FFP calculations used Harmonoise weather classes and field measurements of wind turbine infrasound to estimate yearly averaged sound pressure levels. For comparison, infrasound propagation was also estimated using ISO 9613-2 (1996) calculations for 63 Hz. In the Health Canada study, to a distance of 4.5 km, long term average FFP calculations were highly correlated with the ISO based calculations. This suggests that ISO 9613-2 (1996) could be an effective screening method. Both measurements and FFP calculations showed that beyond 1 km, ISO based calculations could underestimate sound pressure levels. FFP calculations would be recommended for large distances, when there are large numbers of wind turbines, or when investigating specific meteorological classes.

24) Krogh, C. M. and M. E. B. Harrington (2019). "Wind Turbine Electromagnetic Energy: Exploring Risk of Harm to Human Health." Alternative therapies in health and medicine 25(3): 32-38.

✓ EXPOSURE EM radiation riskant?

The risk of harm to human health associated with radio/electromagnetic energy exposure is debated globally. Physicians and health practitioners may be presented with increasing numbers of patients with multisystem complaints, which may be initially confusing. Some residents living in proximity to wind energy facilities report harm they associate with exposure to radio/electromagnetic energy. Although authorities, physicians, and researchers express concerns regarding exposure to radio/electromagnetic energy in general, research specific to wind turbines is limited. Current regulations may be limited in scope and not include all devices that emit and/or utilize radio/electromagnetic energy. We recommend that government regulators advise the public of potential risks of exposure and establish limits that incorporate all sources of radio/electromagnetic energy, including wind turbines. Until these limits are established, governments should take precautionary and proactive measures to protect public health, with additional attention given to vulnerable population groups such as children and the older adults.

25) Lenzen-Schulte, M. and M. Schenk (2019). "Wind turbines and infrasound: The sound which one does not hear
Der Schall, den man nicht hört." Deutsches Arzteblatt International 116(6): A264-A268+A264.
✓ NOT (geen wetenschappelijk maar eerder journalistiek overzicht)

26) Lotinga, M., et al. (2018). "Perception and control of amplitude modulation in wind turbine noise." Acoustics Bulletin 42(2): 41-46.
✓ EXPOSURE (betreft mate van AM meten)
Wind turbine noise (WTN) has presented some of the greatest chal-lenges to environmental noise specialists in recent times. One of the most controversial acoustic issues has been the reports and perception of the modulation in the amplitude (AM) of the noise emitted by turbines. In response to growing concern, the Department of Energy and Climate Change (DECC) commissioned a review of AM research in 2015. The results of the DECC review have been used to recommend a control for AM. Various factors have been considered, and a recom-mendation made that balances the need for protection with the weight of the available evidence. The authors hope that the IOA and its members will continue to play a significant role in establishing best practice for UK acoustics professionals, and that this will lead to better decision-making and development planning in the wind energy sector. The DECC report confirms that the penalty should be applied to each individual 10-minute period assessed, and the rated levels separated into wind speed integer bins, for the purposes of comparison with the condition limits. One drawback of this approach is that, where some periods have AM, and some do not, this averaging could reduce the overall rated impact. One view that could be taken of this is that this average is a natural representation of the overall impact.

27) Ma, B., et al. (2020). "Three-Dimensional Wind Measurement Based on Ultrasonic Sensor Array and Multiple Signal Classification." Sensors (Basel, Switzerland) 20(2).
✓ NOT (betreft goed meten van wind, niet wat invloed op geluid is)
The wind power industry continues to experience rapid growth worldwide. However, the fluctuations in wind speed and direction complicate the wind turbine control process and hinder the integration of wind power into the electrical grid. To maximize wind utilization, we propose to precisely measure the wind in a three-dimensional (3D) space, thus facilitating the process of wind turbine control. Natural wind is regarded as a 3D vector, whose direction and magnitude correspond to the wind's direction and speed. A semi-conical ultrasonic sensor array is proposed to simultaneously measure the wind speed and direction in a 3D space. As the ultrasonic signal transmitted between the sensors is influenced by the wind and environment noise, a Multiple Signal Classification algorithm is adopted to estimate the wind information from the received signal. The estimate's accuracy is evaluated in terms of root mean square error and mean absolute error. The robustness of the proposed method is evaluated by the type A evaluation of standard uncertainty under a varying signal-to-noise ratio. Simulation results validate the accuracy and anti-noise performance of the proposed method, whose estimated wind speed and direction errors converge to zero when the SNR is over 15 dB.

28) Mearns, A. J., et al. (2019). "Effects of pollution on marine organisms." Water Environment Research 91(10): 1229-1252.
✓ OFFSHORE (verre betrekking tot offshore WTs)
This review covers selected 2018 articles on the biological effects of pollutants, including human physical disturbances, on marine and estuarine plants, animals, ecosystems, and habitats. The review, based largely on journal articles, covers field and laboratory measurement activities (bioaccumulation of contaminants, field assessment surveys, toxicity testing, and biomarkers) as well as pollution issues of current interest including endocrine disrupters, emerging contaminants, wastewater discharges, marine debris, dredging, and disposal. Special emphasis is placed on effects of oil spills and marine debris due largely to the 2010 Deepwater Horizon oil blowout in the Gulf of Mexico and

proliferation of data on the assimilation and effects of marine debris. Several topical areas reviewed in the past (e.g., mass mortalities ocean acidification) were dropped this year. The focus of this review is on effects, not on pollutant sources, chemistry, fate, or transport. There is considerable overlap across subject areas (e.g., some bioaccumulation data may be appear in other topical categories such as effects of wastewater discharges, or biomarker studies appearing in oil toxicity literature). Therefore, we strongly urge readers to use keyword searching of the text and references to locate related but distributed information. Although nearly 400 papers are cited, these now represent a fraction of the literature on these subjects. Use this review mainly as a starting point. And please consult the original papers before citing them.

29) Merchant, N. D. (2019). "Underwater noise abatement: Economic factors and policy options." Environmental Science and Policy 92: 116-123.
✓ OFFSHORE
Underwater noise pollution is becoming globally recognised as a significant threat to aquatic ecosystems and the resources they provide. The effects of noise pollution extend from blue whales to zooplankton, impacting threatened species and affecting key industries including fisheries and ecotourism. In response, policymakers in some jurisdictions have made substantive high-level commitments to address noise pollution, however the implementation of noise reduction measures (noise abatement) remains limited. To support the development of effective noise management policies, this paper explores the economic and policy context to noise abatement in three major noise-generating industries: shipping, offshore windfarm construction, and seismic surveying for oil and gas. In each case, tractable policy options are identified which make considered use of command-and-control and incentive-based measures in light of the available noise abatement methods. Drawing on instructive examples from terrestrial noise management and other sectors, it is concluded that such measures offer the most promising long-term solution to deliver existing and future policy commitments to manage cumulative levels of underwater noise pollution.

30) Merchant, N. D., et al. (2020). "Impulsive noise pollution in the Northeast Atlantic: Reported activity during 2015–2017." Marine Pollution Bulletin 152.
✓ OFFSHORE (en dieren)
Underwater noise pollution from impulsive sources (e.g. explosions, seismic airguns, percussive pile driving) can affect marine fauna through mortality, physical injury, auditory damage, physiological stress, acoustic masking, and behavioural responses. Given the potential for large-scale impact on marine ecosystems, some countries are now monitoring impulsive noise activity, coordinated internationally through Regional Seas Conventions. Here, we assess impulsive noise activity in the Northeast Atlantic reported during 2015–2017 to the first international impulsive noise register (INR), established in 2016 under the OSPAR Convention. Seismic airgun surveys were the dominant noise source (38%–56% of annual activity) and declined by 23% during 2015–2017. Reported pile driving activity increased 72%. Explosions and sonar/acoustic deterrent devices both had year-on-year increases in reported activity. Some increases were attributable to more comprehensive reporting in later years. We discuss utilising the INR for risk assessment, target setting, and forward planning, and the implementation of similar systems in other regions.

~~31) Michaud, D. S., et al. (2018). "Erratum: Effects of wind turbine noise on self-reported and objective measures of sleep (Sleep (2016) 39:1 (97-109) DOI: 10.5665/sleep.5326)." Sleep 41(5).~~
~~In the Health Canada Community Noise and Health Study (CNHS) objective measures of sleep were based on activity counts collected using a wrist-worn sleep watch (Actiwatch2), with results presented as nightly averages. In preparing for a follow-up analysis based on activity counts in 10-min intervals time-synchronized to wind turbine operational data, it came to our attention that the data file used to analyse the objective sleep endpoints included data processing errors. It was discovered that the default "rest interval" was incorrectly assigned when participants did not wear their device continuously over the 7-d~~

data collection period. As the rest interval is used to determine objective sleep outcomes, this impacted the calculation of "total sleep time", "sleep onset", "sleep efficiency", "wake after sleep onset" and "awakening bouts". The entire sleep data file (6307 sleep night actograms) has been reviewed with rest intervals manually corrected where necessary. The corrections were made under blinded conditions, with 100% agreement between two analysts regarding which sleep nights needed to be corrected. Following the corrections, a random selection of 244 sleep nights revealed an 88% inter-rater reliability (within +/- 5 minutes) on the precise start and stop time for each manually inserted rest interval. Statistics Canada has made the revised data file available to the public through their Research Data Centres. There is no impact on any of the self-reported outcomes and the overall conclusion of the original paper does not change, which stated: "Study results do not support an association between exposure to outdoor wind turbine noise (WTN) up to 46 dB(A) and an increase in the prevalence of disturbed sleep." Following the reanalysis the most notable secondary observations can be summarized as follows: 1) annoyance toward blinking lights on wind turbines (aircraft warning signals) was no longer found to be related to awakening bouts, however the association with reduced total sleep time remained; 2) annoyance toward vibrations/rattle perceived to be associated with wind turbine operations was found to be related to higher total sleep time in the reanalysis; 3) participants' history of exposure to WTN, assessed as "years hearing WTN" was inversely related to awakening bouts; 4) WTN was marginally related to sleep efficiency ($p = 0.0519$), however there was no consistent pattern revealed in the pairwise tests; 5) caffeine consumption was no longer found to be associated with any of the actigraphy measures; and 6) the correlations between actigraphy outcomes and self-reported sleep measured using the Pittsburgh Sleep Quality Index (PSQI) were more widespread and stronger than previously reported. The article and supplementary information have now been updated with the correct data. The corresponding author on this publication accepts full responsibility for the data file processing miscalculations that led to the publication errors and sincerely regrets any inconvenience this may have caused.

32) Michaud, D. S., et al. (2018). "Response to: "Using residential proximity to wind turbines as an alternative exposure measure to investigate the association between wind turbines and human health," by Barry, Sulsky, Kreiger (2018) J. Acoust. Soc. Am. 143(6), 3278-3282." The Journal of the Acoustical Society of America 144(1): 330.
✓ HE (kritiek op methode Barry et al)

33) Michaud, D. S., et al. (2018). "The association between self-reported and objective measures of health and aggregate annoyance scores toward wind turbine installations." Canadian journal of public health = Revue canadienne de sante publique 109(2): 252-260. OBJECTIVE: An aggregate annoyance construct has been developed to account for annoyance that ranges from not at all annoyed to extremely annoyed, toward multiple wind turbine features. The practical value associated with aggregate annoyance would be strengthened if it was related to health. The objective of the current paper was to assess the association between aggregate annoyance and multiple measures of health. METHODS: The analysis was based on data originally collected as part of Health Canada's Community Noise and Health Study (CNHS). One adult participant per dwelling (18-79 years), randomly selected from Ontario (ON) (n = 1011) and Prince Edward Island (PEI) (n = 227), completed an in-person questionnaire. RESULTS: The average aggregate annoyance score for participants who indicated they had a health condition (e.g., chronic pain, Pittsburgh Sleep Quality Index (PSQI) > 5, tinnitus, migraines/headaches, dizziness, highly sensitive to noise, and reported a high sleep disturbance) ranged from 2.53 to 3.72; the mean score for those who did not report these same conditions ranged between 0.96 and 1.41. Household complaints about wind turbine noise had the highest average aggregate annoyance (8.02), compared to an average of 1.39 among those who did not complain. CONCLUSION: A mean aggregate annoyance score that could reliably distinguish participants who self-report health effects (or noise complaints) from those who do not could be one of several factors considered by jurisdictions responsible for decisions regarding wind turbine developments. However, the threshold value for acceptable changes

and/or levels in aggregate annoyance has not yet been established and could be the focus of future research efforts.

34) Michaud, D. S., et al. (2018). "Derivation and application of a composite annoyance reaction construct based on multiple wind turbine features." Canadian journal of public health = Revue canadienne de sante publique 109(2): 242-251.
OBJECTIVES: Noise emissions from wind turbines are one of multiple wind turbine features capable of generating annoyance that ranges in magnitude from not at all annoyed to extremely annoyed. No analysis to date can simultaneously reflect the change in all magnitudes of annoyance toward multiple wind turbine features. The primary objective in this study was to use principal component analysis (PCA) to provide a single construct for overall annoyance to wind turbines based on reactions to noise, blinking lights, shadow flicker, visual impacts, and vibrations evaluated as a function of proximity to wind turbines. METHODS: The analysis was based on data originally collected as part of Health Canada's cross-sectional Community Noise & Health Study (CNHS). One adult participant (18-79 years), randomly selected from dwellings in Ontario (ON) (n = 1011) and Prince Edward Island (PEI) (n = 227), completed an in-person questionnaire. Content relevant to the current analysis included the annoyance responses to wind turbines. RESULTS: The first construct tested in the PCA explained 58-69% of the variability in total annoyance. Reduced distance to turbines was associated with elevated aggregate annoyance scores among ON and PEI participants. In the ON sample, aggregate annoyance was effectively absent in areas beyond 5 km (mean 0.12; 95% CI 0.00, 1.19), increasing significantly between (2 and 5] km (mean 2.13; 95% CI 0.92, 3.33), remaining elevated, but with no further increase until (0.550-1] km (mean 3.37; 95% CI 3.02, 3.72). At ≤ 0.550 km, the average overall annoyance was 3.36 (95% CI 2.03, 4.69). In PEI, aggregate annoyance was essentially absent beyond 1 km; i.e., (1-2] km (mean 0.21; 95% CI 0.00, 0.88); (2-5] km (mean 0.00; 95% CI 0.00, 1.37); > 5 km (mean 0.00; 95% CI 0.00, 1.58). Annoyance significantly increased in areas between (0.550 and 1] km (mean 1.59; 95% CI 1.02, 2.15) and was highest within 550 m (mean 4.25; 95% CI 3.34, 5.16). CONCLUSION: The advantages and disadvantages to an aggregated annoyance analysis, including how it should not yet be considered a substitute for relationships based on changes in high annoyance, are discussed.

35) Micic, G., et al. (2018). "A Review of the Potential Impacts of Wind Farm Noise on Sleep." Acoustics Australia 46(1): 87-97.

✓ REVIEW sleep (relatie WTN-sleep niet aangetoond, maar plausibel)

Adequate sleep is important for good health and well-being, and inadequate sleep leads to impaired attention and performance. Persistent poor sleep is also associated with cognitive and metabolic impairment, cardiovascular problems and diminished psychological well-being. Recent growth in wind farm developments has been associated with community complaints regarding sleep disturbance, annoyance and a range of health issues that some attribute to wind farms. Wind turbines create aerodynamic and mechanical noise that, if sufficiently loud, has the potential to disturb residents' sleep, particularly for those living in close proximity. According to the World Health Organisation (WHO), noise effects on sleep are expected to occur with outside noise levels > 40 dB (A). On the other hand, the WHO guidelines also state that "when prominent low-frequency components are present, measures based on A-weighting are inappropriate", so uncertainty remains regarding which alternative noise measures and noise limits are most appropriate to mitigate community impacts of wind farm noise on sleep. In Australia, dwellings are typically located > 1 km from the nearest wind turbine where wind farm noise becomes more biased towards lower frequencies (≤ 200 Hz) at low sound pressure levels (< ~ 40 dB (A) outside) that may or may not be audible inside a dwelling. Nevertheless, as with any environmental noise, wind farm noise has the potential to disturb sleep, via frequent physiological activation responses and arousals affecting the micro-structure of sleep, and the overall macro-structure of sleep, including total sleep time potentially reduced by difficulty falling asleep and returning to sleep following awakenings for whatever reason. Over time, chronic insomnia could potentially develop in individuals with greater sensory acuity and/or those prone to

annoyance from environmental noise. However, it is unclear if and how much sleep is disturbed by the relatively low sound pressure levels relevant to wind turbine noise. Good empirical evidence to investigate these plausible mechanisms is sparse. In this paper, we describe the psychophysiological mechanisms that underlie sleep disturbance in response to noise, review current evidence regarding the effects of wind farm noise on sleep, evaluate the quality of existing evidence and identify evolving research in this area. © 2018, Australian Acoustical Society.

36) Monazzam, M. R., et al. (2019). "Investigation of occupational noise annoyance in a wind turbine power plant." Journal of Low Frequency Noise Vibration and Active Control 38(2): 798-807.
✓ NOT (arbo)
Noise, emitted by wind turbines, is one of the main health risk factors which has been recently considered in many researches. Noise annoyance is among the most important human responses to noise. The aim of this work was to modeling of annoyance due to noise at workplace coming from wind turbines in workers. All workers of a wind power plant consisted the study sample. The equivalent noise level was measured using a task-based method. Moreover, data related to noise annoyance and noise sensitivity were acquired by standardized methods. Based on the results, noise exposure, noise sensitivity, visibility, age, and experience affected noise annoyance. According to path analysis, the most indirect and direct effect on noise annoyance were attributed to noise exposure. Age, sensitivity, and noise exposure were positively associated to annoyance. It can be concluded that there is a significant relationship between age, experience, sensitivity to noise, and exposure to the wind turbine noise with noise annoyance. © The Author(s) 2018.

37) Morsing, J. A., et al. (2018). "Wind turbine noise and sleep: Pilot studies on the influence of noise characteristics." International Journal of Environmental Research and Public Health 15(11).
✓ HE sleep
The number of onshore wind turbines in Europe has greatly increased over recent years, a trend which can be expected to continue. However, the effects of wind turbine noise on long-term health outcomes for residents living near wind farms is largely unknown, although sleep disturbance may be a cause for particular concern. Presented here are two pilot studies with the aim of examining the acoustical properties of wind turbine noise that might be of special relevance regarding effects on sleep. In both pilots, six participants spent five consecutive nights in a sound environment laboratory. During three of the nights, participants were exposed to wind turbine noise with variations in sound pressure level, amplitude modulation strength and frequency, spectral content, turbine rotational frequency and beating behaviour. The impact of noise on sleep was measured using polysomnography and questionnaires. During nights with wind turbine noise there was more frequent awakening, less deep sleep, less continuous N2 sleep and increased subjective disturbance compared to control nights. The findings indicated that amplitude modulation strength, spectral frequency and the presence of strong beats might be of particular importance for adverse sleep effects. The findings will be used in the development of experimental exposures for use in future, larger studies.

38) Nazir, M. S., et al. (2019). "Environmental impact and pollution-related challenges of renewable wind energy paradigm – A review." Science of the Total Environment 683: 436-444.
✓ NOT (betreft impact op milieu, niet bewoners)
With ever increasing environmental and socio-economic awareness, government and legislative authorities, around the globe, are concerned and considering the pollution-related challenges and parameters that influence the energy paradigm. Therefore, renewable energy resources, for instance, wind, solar, and hydro- are used to generate electricity to reduce fossil-fuel-related environmental concerns. The world needs swift, equitable, significant, and effective climate action on this stage. The scientific evidence has been mounting for decades to employ renewable energy resources. One of these shared

resources is wind energy, which currently appears as an emerging source of energy around the world. Electricity production using wind power schemes could be an essential replacement for conventional fossil-based fuel resources by using different modalities. Although the initial cost of installing a photovoltaic system is relatively high, however, the running cost is very low. Herein, we reviewed the environmental impact and considerable challenges of the technological paradigm for the development of wind energy technology with particular reference to Pakistan's future perspective. It is anticipated that the discussion provided can stimulate a negotiation between decision makers and raise attentiveness of environmental characteristics and a set of challenges related to the wind power industry development of Pakistan.

39) Oh, H. T., et al. (2018). "A study of noise stress and electromagnetic wave impact assessment for offshore wind farms project." Toxicology and Environmental Health Sciences 10(4): S59.
✓ OFFSHORE (en dieren)
In this study, we research the status of noise of water and electromagnetic wave impact assessment for offshore wind farms project for 2008-2017. For the finding the proper mitigation method and management in case of wind farm project, we have been considered the impact of water quality and sediment ecosystem caused by the increasement of small solid particles during construction, and the impact of marine geology and physiology. The recent study revealed the change of mitigation routes and activities to fisheries by the effect of artificial stress of offshore wind farm. This study focuses on the impact of noise of water and vibration during construction process and operation period, and also the harmful impact of electromagnetic wave on marine ecosystem and fisheries. In this study, we use the case of developmental project based on the marine environmental impact consultation program of Ministry of ocean. Through the assessment of current status of consultation, we wish support the decision making process between a development party and conservation group, including the fishermen and local community.

40) Park, J., et al. (2020). "Tree-Wrapped Triboelectric Generator for Harvesting Wind Energy." Journal of nanoscience and nanotechnology 20(1): 239-244.
✓ NOT (betreft techniek WTs)
Wind and solar energy are recognized as environmentally friendly energies. Wind energy is generated from the surface of the earth by solar energy. While wind energy can be regarded as "free" energy, generating it entails high installation cost as well as a large land footprint and noise, which is deemed to be a nuisance. In addition, maintenance costs are high. In this study, we propose a novel tree-wrapped wind energy harvester, which is inexpensive and easy to manufacture. Triboelectric generators follow simple principles and can be of various generator types. Triboelectric generators running on wind energy have been studied by many researchers. Our design comprises light and flexible tree-wrapped triboelectric generator modules. Multiple generator modules can be connected in parallel to harvest electrical energy. We show that the proposed generator can potentially harvest sufficient wind energy and can even be used in an urban environment by mounting them on trees in cities.

41) Pawlaczyk-Łuszczyńska, M., et al. (2018). "Response to noise emitted by wind farms in people living in nearby areas." International Journal of Environmental Research and Public Health 15(8).
✓ HE annoyance (andere HE's relatie met hinder, niet met WT SPL)
The aim of this study was to evaluate the perception and annoyance of noise from wind turbines in populated areas of Poland. A questionnaire inquiry was carried out among 517 subjects, aged 18–88, living within 204–1726 m from the nearest wind turbine. For areas where respondents lived, A-weighted sound pressure levels (SPLs) were calculated as the sum of the contributions from the wind power plants in the specific area. It has been shown that the wind turbine noise at the calculated A-weighted SPL of 33–50 dB was perceived as annoying or highly annoying by 46% and 28% of respondents, respectively. Moreover, 34% and 18% of them said that they were annoyed or highly annoyed indoors, respectively. The

perception of high annoyance was associated with the A-weighted sound pressure level or the distance from the nearest wind turbine, general attitude to wind farms, noise sensitivity and terrain shape (annoyance outdoors) or road-traffic intensity (annoyance indoors). About 48–66% of variance in noise annoyance rating might be explained by the aforesaid factors. It was estimated that at the distance of 1000 m the wind turbine noise might be perceived as highly annoying outdoors by 43% and 2% of people with negative and positive attitude towards wind turbines, respectively. There was no significant association between noise level (or distance) and various health and well-being aspects. However, all variables measuring health and well-being aspects, including stress symptoms, were positively associated with annoyance related to wind turbine noise.

42) Pohl, J., et al. (2018). "Understanding stress effects of wind turbine noise – The integrated approach." Energy Policy 112: 119-128.
✓ HE stress (longitudinale studie!, met de tijd nemen klachten af, attitude positiever; hinder van proces nadien gebleven; AM 's nachts belangrijkste geluidklacht)
To better understand causes and effects of wind turbine (WT) noise, this study combined the methodology of stress psychology with noise measurement to an integrated approach. In this longitudinal study, residents of a wind farm in Lower Saxony were interviewed on two occasions (2012, 2014) and given the opportunity to use audio equipment to record annoying noise. On average, both the wind farm and road traffic were somewhat annoying. More residents complained about physical and psychological symptoms due to traffic noise (16%) than to WT noise (10%, two years later 7%). Noise annoyance was minimally correlated with distance to the closest WT and sound pressure level, but moderately correlated with fair planning. The acoustic analysis identified amplitude-modulated noise as a major cause of the complaints. The planning and construction process has proven to be central – it is recommended to make this process as positive as possible. It is promising to develop the research approach in order to study the psychological and acoustic causes of WT noise annoyance even more closely. To further analysis of amplitude modulation we recommend longitudinal measurements in several wind farms to increase the data base — in the sense of "Homo sapiens monitoring".

43) Popper, A. N. and A. D. Hawkins (2019). "An overview of fish bioacoustics and the impacts of anthropogenic sounds on fishes." Journal of fish biology 94(5): 692-713.
✓ OFFSHORE (en dieren)
Fishes use a variety of sensory systems to learn about their environments and to communicate. Of the various senses, hearing plays a particularly important role for fishes in providing information, often from great distances, from all around these animals. This information is in all three spatial dimensions, often overcoming the limitations of other senses such as vision, touch, taste and smell. Sound is used for communication between fishes, mating behaviour, the detection of prey and predators, orientation and migration and habitat selection. Thus, anything that interferes with the ability of a fish to detect and respond to biologically relevant sounds can decrease survival and fitness of individuals and populations. Since the onset of the Industrial Revolution, there has been a growing increase in the noise that humans put into the water. These anthropogenic sounds are from a wide range of sources that include shipping, sonars, construction activities (e.g., wind farms, harbours), trawling, dredging and exploration for oil and gas. Anthropogenic sounds may be sufficiently intense to result in death or mortal injury. However, anthropogenic sounds at lower levels may result in temporary hearing impairment, physiological changes including stress effects, changes in behaviour or the masking of biologically important sounds. The intent of this paper is to review the potential effects of anthropogenic sounds upon fishes, the potential consequences for populations and ecosystems and the need to develop sound exposure criteria and relevant regulations. However, assuming that many readers may not have a background in fish bioacoustics, the paper first provides information on underwater acoustics, with a focus on introducing the very important concept of particle motion, the primary acoustic stimulus for all fishes, including elasmobranchs. The paper then provides background material on fish hearing, sound production and acoustic behaviour. This is followed by an overview of what is known about effects of anthropogenic

sounds on fishes and considers the current guidelines and criteria being used world-wide to assess potential effects on fishes. Most importantly, the paper provides the most complete summary of the effects of anthropogenic noise on fishes to date. It is also made clear that there are currently so many information gaps that it is almost impossible to reach clear conclusions on the nature and levels of anthropogenic sounds that have potential to cause changes in animal behaviour, or even result in physical harm. Further research is required on the responses of a range of fish species to different sound sources, under different conditions. There is a need both to examine the immediate effects of sound exposure and the longer-term effects, in terms of fitness and likely impacts upon populations.

44) Poulsen, A. H., et al. (2018). "Long-term exposure to wind turbine noise and redemption of antihypertensive medication: A nationwide cohort study." Environment International 121: 207-215.

✓ HE hypertension

Noise from wind turbines (WTs) has been reported more annoying than traffic noise at similar levels, and concerns have been raised about whether WT noise (WTN) can increase risk for cardiovascular disease. We aimed to investigate if long-term exposure to WTN increases risk for hypertension, estimated as redemption of prescriptions for antihypertensive drugs. We identified all Danish dwellings within a radius of 20 WT heights from a WT and 25% randomly selected dwellings within 20–40 WT heights radius. Using data on WT type and hourly wind conditions at each WT, we estimated hourly outdoor (10–10,000 Hz) and low frequency (LF: 10–160 Hz) indoor WTN for all dwellings, and aggregated it as long-term nighttime running means. From nationwide registries, we identified 535,675 persons age 25–85 years living in these dwellings for >1 year from 1996 to 2013, of whom 83,729 fulfilled our case definition of redeeming ≥2 prescriptions and ≥180 defined daily doses of antihypertensive drugs within a year. Data were analyzed using Poisson regression according to categories of WTN exposure and adjustment for individual and area-level covariates. We found no associations between 5-year mean exposure to WTN during night and redemption of antihypertensives, with hazard ratios (HR) of 0.91 (95% confidence intervals (CI): 0.78–1.06) for outdoor WTN ≥ 42 dB(A) and of 1.06 (CI: 0.83–1.35) for indoor LF WTN ≥ 15 dB(A) when compared to the reference WTN levels (<24 dB(A) and <5 dB(A), respectively). The lack of association was consistent across sub-populations of people living on farms, far from major roads and with high validity of the noise estimate. For people younger than 65 years we found HRs of 0.81 (95% CI: 0.67–0.98) and 0.94 (95% CI: 0.68–1.30) for outdoor WTN ≥ 42 dB(A) and indoor WTN ≥ 15 dB(A), respectively, whereas for people above 65 years the corresponding HRs were 1.17 (95% CI: 0.90–1.52) and 1.28 (95% CI: 0.87–1.88). In conclusion, the present study does not support an association between WTN and redemption of antihypertensive medication.

~~45) Poulsen, A. H., et al. (2018). "Long-term exposure to wind turbine noise at night and risk for diabetes: A nationwide cohort study." Environmental Research 165: 40-45.~~

~~Focus on renewable energy sources and reduced unit costs has led to increased number of wind turbines (WTs). WT noise (WTN) is reported to be highly annoying at levels from 30 to 35 dB and up, whereas for traffic noise people report to be highly annoyed from 40 to 45 dB and up. This has raised concerns as to whether WTN may increase risk for major diseases, as exposure to traffic noise has consistently been associated with increased risk of cardiovascular disease and diabetes. We identified all Danish dwellings within a radius of 20 WT heights and 25% of all dwellings within 20–40 WT heights from a WT. Using detailed data on WT type and hourly wind data at each WT position and height, we estimated hourly outdoor and low frequency indoor WTN for all dwellings, aggregated as nighttime 1- and 5-year running means. Using nationwide registries, we identified a study population of 614,731 persons living in these dwellings in the period from 1996 to 2012, of whom 25,148 developed diabetes. Data were analysed using Poisson regression with adjustment for individual and area-levels covariates. We found no associations between long-term exposure to WTN during night and diabetes risk, with incidence rate ratios (IRRs) of 0.90 (95% confidence intervals (CI): 0.79–1.02) and 0.92 (95% CI: 0.68–1.24) for 5-year mean nighttime outdoor WTN of 36–42 and ≥ 42 dB, respectively, compared to < 24 dB. For 5-~~

~~year mean nighttime indoor low frequency WTN of 10–15 and ≥ 15 dB we found IRRs of 0.90 (0.78–1.04) and 0.74 (95% CI: 0.41–1.34), respectively, when compared to and < 5 dB. The lack of association was consistent across strata of sex, distance to major road, validity of noise estimate and WT height. The present study does not support an association between nighttime WTN and higher risk of diabetes. However, there were only few cases in the highest exposure groups and findings need reproduction.~~

46) Poulsen, A. H., et al. (2018). "Pregnancy exposure to wind turbine noise and adverse birth outcomes: a nationwide cohort study." Environmental Research 167: 770-775.
✓ HE birth problems
Noise from wind turbines (WTs) is reported as more annoying than traffic noise at similar levels, raising concerns as to whether WT noise (WTN) may negatively affect health, as reported for traffic noise. We aimed to investigate whether residential WTN is associated with adverse birth outcomes. Based on national registries, we identified all Danish dwellings situated within ≤ 20 wt heights radius and a random selection of 25% of dwellings situated within 20–40 wt heights radius of a WT. We identified 135,795 pregnant women living in the dwellings from 1982 to 2013, and collected information on gestational age and birth weight from a national birth registry. Using data on WT type and simulated hourly wind at each WT, we estimated hourly outdoor and low frequency (LF) indoor WTN at the dwellings of the pregnant women and aggregated as mean nighttime WTN during pregnancy. We used logistic regression with adjustment for individual and area-level covariates for the analyses. We did not find evidence suggesting that mean pregnancy or trimester-specific exposure to outdoor or indoor LF WTN were associated with any of the three adverse birth outcomes investigated: preterm birth (n = 13,003), term small for gestational age (n = 12,220) or term low birth weight (n = 1127). However, the number of cases in the highest exposure categories of ≥ 42 dB outdoor WTN or ≥ 15 dB indoor LF WTN were low for all outcomes (n between 0 and 31). The present study does not support an association between nighttime WTN and adverse birth outcomes. However, there were few cases in the high exposure groups and the results call for reproduction.

47) ~~Poulsen, A. H., et al. (2018). "Short-term nighttime wind turbine noise and cardiovascular events: A nationwide case-crossover study from Denmark." Environment International 114: 160-166.~~
~~Aims: The number of people exposed to wind turbine noise (WTN) is increasing. WTN is reported as more annoying than traffic noise at similar levels. Long-term exposure to traffic noise has consistently been associated with cardiovascular disease, whereas effects of short-term exposure are much less investigated due to little day-to-day variation of e.g. road traffic noise. WTN varies considerably due to changing weather conditions allowing investigation of short-term effects of WTN on cardiovascular events. Methods and results: We identified all hospitalisations and deaths from stroke (16,913 cases) and myocardial infarction (MI) (17,559 cases) among Danes exposed to WTN between 1982 and 2013. We applied a time-stratified, case-crossover design. Using detailed data on wind turbine type and hourly wind data at each wind turbine, we simulated mean nighttime outdoor (10–10,000 Hz) and nighttime low frequency (LF) indoor WTN (10–160 Hz) over the 4 days preceding diagnosis and reference days. For indoor LF WTN between 10 and 15 dB(A) and above 15 dB(A), odds ratios (ORs) for MI were 1.27 (95% confidence interval (CI): 0.97–1.67; cases = 198) and 1.62 (95% CI: 0.76–3.45; cases = 21), respectively, when compared to indoor LF WTN below 5 dB(A). For stroke, corresponding ORs were 1.17 (95% CI: 0.95–1.69; cases = 166) and 2.30 (95% CI: 0.96–5.50; cases = 15). The elevated ORs above 15 dB(A) persisted across sensitivity analyses. When looking at specific lag times, noise exposure one day before MI events and three days before stroke events were associated with the highest ORs. For outdoor WTN at night, we observed both increased and decreased risk estimates. Conclusion: This study did not provide conclusive evidence of an association between WTN and MI or stroke. It does however suggest that indoor LF WTN at night may trigger cardiovascular events, whereas these events seemed largely unaffected by nighttime outdoor WTN. These findings need reproduction, as they were based on few cases and may be due to chance.~~

48) Poulsen, A. H., et al. (2019). "Impact of long-term exposure to wind turbine noise on redemption of sleep medication and antidepressants: A nationwide cohort study." Environmental Health Perspectives 127(3).
✓ HE sleep, depression
BACKGROUND: Noise from wind turbines (WTs) is associated with annoyance and, potentially, sleep disturbances. OBJECTIVES: Our objective was to investigate whether long-term WT noise (WTN) exposure is associated with the redemption of prescriptions for sleep medication and antidepressants. METHODS: For all Danish dwellings within a radius of 20-WT heights and for 25% of randomly selected dwellings within a radius of 20-to 40-WT heights, we estimated nighttime outdoor and low-frequency (LF) indoor WTN, using information on WT type and simulated hourly wind. During follow-up from 1996 to 2013, 68,696 adults redeemed sleep medication and 82,373 redeemed antidepressants, from eligible populations of 583,968 and 584,891, respectively. We used Poisson regression with adjustment for individual and area-level covariates. RESULTS: Five-year mean outdoor nighttime WTN of ≥42 dB was associated with a hazard ratio (HR) = 1.14 [95% confidence interval (CI]: 0.98, 1.33) for sleep medication and HR = 1.17 (95% CI: 1.01, 1.35) for antidepressants (compared with exposure to WTN of <24 dB). We found no overall association with indoor nighttime LF WTN. In age-stratified analyses, the association with outdoor nighttime WTN was strongest among persons ≥65 y of age, with HRs (95% CIs) for the highest exposure group (≥42 dB) of 1.68 (1.27, 2.21) for sleep medication and 1.23 (0.90, 1.69) for antidepressants. For indoor nighttime LF WTN, the HRs (95% CIs) among persons ≥65 y of age exposed to ≥15 dB were 1.37 (0.81, 2.31) for sleep medication and 1.34 (0.80, 2.22) for antidepressants. CONCLUSIONS: We observed high levels of outdoor WTN to be associated with redemption of sleep medication and antidepressants among the el-derly, suggesting that WTN may potentially be associated with sleep and mental health.

49) Poulsen, A. H., et al. (2019). "Long-term exposure to wind turbine noise and risk for myocardial infarction and stroke: A nationwide cohort study." Environmental Health Perspectives 127(3).
✓ HE stroke
BACKGROUND: Noise from wind turbines (WTs) is reported as more annoying than traffic noise at similar levels, raising concerns as to whether WT noise (WTN) increases risk for cardiovascular disease, as observed for traffic noise. OBJECTIVES: We aimed to investigate whether long-term exposure to WTN increases risk of myocardial infarction (MI) and stroke. METHODS: We identified all Danish dwellings within a radius 20 times the height of the closest WT and 25% of the dwellings within 20–40 times the height of the closest WT. Using data on WT type and simulated hourly wind at each WT, we estimated hourly outdoor and low frequency (LF) indoor WTN for each dwelling and derived 1-y and 5-y running nighttime averages. We used hospital and mortality registries to identify all incident cases of MI (n = 19,145) and stroke (n = 18,064) among all adults age 25–85 y (n = 717,453), who lived in one of these dwellings for ≥one year over the period 1982–2013. We used Poisson regression to estimate incidence rate ratios (IRRs) adjusted for individual-and area-level covariates. RESULTS: IRRs for MI in association with 5-y nighttime outdoor WTN >42 (vs. <24) dB(A) and indoor LF WTN >15 (vs. <5) dB(A) were 1.21 [95% confidence interval (CI): 0.91, 1.62; 47 exposed cases] and 1.29 (95% CI: 0.73, 2.28; 12 exposed cases), respectively. IRRs for intermediate categories of outdoor WTN [24–30, 30–36, and 36–42 dB(A) vs. <24 dB(A)] were slightly above the null and of similar size: 1.08 (95% CI: 1.04, 1.12), 1.07 (95% CI: 1.00, 1.12), and 1.06 (95% CI: 0.93, 1.22), respectively. For stroke, IRRs for the second and third outdoor exposure groups were similar to those for MI, but near or below the null for higher exposures. CONCLUSIONS: We did not find convincing evidence of associations between WTN and MI or stroke.

50) Radun, J., et al. (2019). "Variables associated with wind turbine noise annoyance and sleep disturbance." Building and Environment 150: 339-348.
✓ HE annoyance, sleep, other HE's

Wind turbine noise (WTN) increases the risk of WTN annoyance and self-reported sleep disturbance, which in turn can influence people's well-being. However, the sound level explains only a small fraction of WTN annoyance. The purpose of our study was to determine how acoustic and various non-acoustic variables are associated with WTN annoyance indoors, WTN annoyance outdoors, and sleep disturbance due to WTN. 318 permanent residents living within 2 km of the nearest wind turbine in three different areas of Finland responded to the questionnaire. The turbines were relatively large, within 3 and 5 megawatts. The explanatory models were developed using binary logistic regression. The models predicting WTN annoyance had the predictive strengths of 67% for indoor and 71% for outdoor WTN annoyance. The concern for health effects was the most important factor related to both WTN annoyance and sleep disturbance due to WTN. Other factors explaining WTN annoyance were area, noise sensitivity, and general attitude towards wind power as a form of energy production. Sound level explained also outdoor annoyance and sleep disturbance related to WTN. Furthermore, women were more annoyed indoors and reported more sleep disturbance due to WTN than men. We believe that the health concerns and WTN annoyance could be reduced by providing the residents with more fact-based information about wind power and more interactive and transparent communication concerning the planning and building processes. © 2018 Elsevier Ltd

51) Rafiee, A., et al. (2018). "Interactive 3D geodesign tool for multidisciplinary wind turbine planning." Journal of Environmental Management 205: 107-124.

✓ NOT (ruimtelijke planning)

Wind turbine site planning is a multidisciplinary task comprising of several stakeholder groups from different domains and with different priorities. An information system capable of integrating the knowledge on the multiple aspects of a wind turbine plays a crucial role on providing a common picture to the involved groups. In this study, we have developed an interactive and intuitive 3D system (Falcon) for planning wind turbine locations. This system supports iterative design loops (wind turbine configurations), based on the emerging field of geodesign. The integration of GIS, game engine and the analytical models has resulted in an interactive platform with real-time feedback on the multiple wind turbine aspects which performs efficiently for different use cases and different environmental settings. The implementation of tiling techniques and open standard web services support flexible and on-the-fly loading and querying of different (massive) geospatial elements from different resources. This boosts data accessibility and interoperability that are of high importance in a multidisciplinary process. The incorporation of the analytical models in Falcon makes this system independent from external tools for different environmental impacts estimations and results in a unified platform for performing different environmental analysis in every stage of the scenario design. Game engine techniques, such as collision detection, are applied in Falcon for the real-time implementation of different environmental models (e.g. noise and visibility). The interactivity and real-time performance of Falcon in any location in the whole country assist the stakeholders in the seamless exploration of various scenarios and their resulting environmental effects and provides a scope for an interwoven discussion process. The flexible architecture of the system enables the effortless application of Falcon in other countries, conditional to input data availability. The embedded open web standards in Falcon results in a smooth integration of different input data which are increasingly available online and through standardized access mechanisms.

~~52) Schäffer, B., et al. (2018). "Effects of different spectral shapes and amplitude modulation of broadband noise on annoyance reactions in a controlled listening experiment." International Journal of Environmental Research and Public Health 15(5).~~

~~Environmental noise from transportation or industrial infrastructure typically has a broad frequency range. Different sources may have disparate acoustical characteristics, which may in turn affect noise annoyance. However, knowledge of the relative contribution of the different acoustical characteristics of broadband noise to annoyance is still scarce. In this study, the subjectively perceived short-term (acute) annoyance reactions to different broadband sounds (namely, realistic outdoor wind turbine and artificial, generic sounds) at 40 dBA were investigated in a controlled laboratory listening experiment. Combined with~~

~~the factorial design of the experiment, the sounds allowed for separation of the effects of three acoustical characteristics on annoyance, namely, spectral shape, depth of periodic amplitude modulation (AM), and occurrence (or absence) of random AM. Fifty-two participants rated their annoyance with the sounds. Annoyance increased with increasing energy content in the low-frequency range as well as with depth of periodic AM, and was higher in situations with random AM than without. Similar annoyance changes would be evoked by sound pressure level changes of up to 8 dB. The results suggest that besides standard sound pressure level metrics, other acoustical characteristics of (broadband) noise should also be considered in environmental impact assessments, e.g., in the context of wind turbine installations.~~

53) Schäffer, B., et al. (2019). "Influence of visibility of wind farms on noise annoyance – A laboratory experiment with audio-visual simulations." Landscape and Urban Planning 186: 67-78.
   ✓ VISUAL (ook geluidhinder en effect AM onderzocht, maar methodologie bleek gebrekkig)

   Noise annoyance reactions in the population due to wind farms are related to visual as well as noise-related impacts of the farms. Improved understanding of these effects may support the planning of better accepted wind farms. Recently, tools for visualization and auralization of wind farms have been developed that allow mutually studying audio-visual effects on annoyance. The objective of this study was to investigate the audio-visual effects of different wind turbine noise situations on short-term noise annoyance in a psychophysical laboratory experiment, considering serial position effects (simple order and differential carryover effects). A set of 24 audio-visual situations covering a range of acoustical characteristics (sound pressure level, periodic amplitude modulation) and visual settings (landscape with visible wind turbine, landscape only, grey background) was created. The factorial design of the experiment allowed separating audio-visual effects from serial position effects on noise annoyance. Both visual and acoustical characteristics were found to affect noise annoyance, besides the participants' attitude towards wind farms. Sound pressure level and amplitude modulation increased annoyance, the presence of a visualized landscape decreased annoyance, and the visibility of a wind turbine increased annoyance. While simple order effects could be eliminated by counterbalancing, the initial visual setting strongly affected the annoyance ratings of the subsequent settings. Due to this differential carryover effect, visual effects could be assessed reliably only as long as the participants saw the initial visual setting. Therefore, the presentation order of audio-visual stimuli sho uld be carefully considered in experimental studies and in participatory landscape planning. © 2019 Elsevier B.V.

54) Seltenrich, N. (2019). "Assessing potential health impacts of wind turbine noise: A longitudinal look at multiple end points." Environmental Health Perspectives 127(9).
   ✓ NOT (journalistiek, geen wetenschappelijk overzicht)

55) Simos, J., et al. (2019). "Wind turbines and health: A review with suggested recommendations." Environnement, Risques et Sante 18(2): 149-159.
   ✓ REVIEW HE

   Wind energy has considerable potential worldwide; however, several health concerns are associated with its development. Based on a structured search of the international scientific literature, this review investigates the main health concerns, grouped into the following categories: noise, infrasound and low-frequency sounds, wind turbine syndrome, stroboscopic effect and shadow flicker, safety, landscape impacts, and real estate prices. There is a geographical mismatch between the globally positive aspects of wind farm development and the possible health effects on the neighbourhood, which are the focus of this review. Health complaints are often difficult to link firmly to the activity of adjacent wind farms, with the exception of annoyance caused by noise pollution. Part of the negative health effects reported by local populations may be influenced by the so-called nocebo effect. However, discomfort and suffering should always be addressed and taken seriously into account by decision-makers and public health officials. The distribution of economic

and health-related advantages and inconveniences should be perceived as being fair. This article concludes with a 9-point list of recommendations for the development of wind power in a context favourable to health.

56) Thorsson, P., et al. (2018). "Low-frequency outdoor-indoor noise level difference for wind turbine assessment." The Journal of the Acoustical Society of America 143(3): EL206.
✓ LFN
To increase the understanding of wind turbine noise on sleep, human physiological reactions need to be studied in a controlled laboratory setting. The paper presents an outdoor-indoor noise level difference as a function of frequency, applicable to creating wind turbine indoor sounds with the outdoor sounds as input. For this, a combination of measurement data and modeling results has been used. The suggested data are provided in a table.

57) Vahl, C. F., et al. (2018). "Are there harmful effects caused by the silent noise of infrasound produced by windparks? An experimental approach." Thoracic and Cardiovascular Surgeon 66.
✓ LFN
Introduction: The increased number of wind parks raised the question, whether infrasound waves produced by wind turbines are harmful on human-beings, or not. Infrasound is a low frequency sound (< 20 Hz), undetectable with human ears. However, some people live near windparks describe unspecific symptoms i.e., palpitations, dizziness, headache, etc. This study analyses the infrasound effects on isolated atrial human myocardium and measures the contractile performance in human trabeculae using different frequencies and amplitudes of infrasound generated by a loudspeaker. Methods: Human atrial trabeculae were resected from 8 patients undergoing aorto coronary bypass surgery, then demembranized using Triton X 100 and small fibers were generated with diameter < 0.3 mm and length 4-6 mm. The fibers were attached between force transducer and loudspeaker while activated at optimal length and room temperature in an organ bath using supramaximal calcium concentrations. Then infrasound was imposed using frequencies of 10 Hz or 20 Hz. Sound amplitudes (SA) were either 5% or 10% of tissue length (TL). Sound was applied for 1 minute. Force was measured before and after 1 minute of infrasound. Results: Imposed infrasound on isolated human myocardium caused a direct force inhibition of the completely activated myocardial preparation. At 10 Hz and 5% TL (SA) force inhibition was 18.8+2% while at 10% TL (SA) up to 23.3+2% ($p < 0.05$). At 20 Hz; force inhibition was 23+2% at 5% TL and 32+4% at 10% TL ($p < 0.01$). After stopping infrasound; force was recovered but not to the initial value. No sound was heard during the experiments. Passive resting force was minimally affected (n.s.). Conclusion: Infrasound can induce direct effects on human myocardium in the given experimental setting. Although mono-frequency sounds are not present in nature, our experimental data indicates, that direct effects on myocardial tissue are present. The infrasound influence on human tissue requires further investigation because the increasing number of a) wind turbines and b) human beings exposed by the neighborhood of windparks. Humans have no chance to protect themselves from the silent noise of infrasound, as long as no scientific data presents.

58) van Kamp, I. and F. van den Berg (2018). "Health Effects Related to Wind Turbine Sound, Including Low-Frequency Sound and Infrasound." Acoustics Australia 46(1): 31-57.
Ons eigen review
A narrative review of observational and experimental studies was conducted to assess the association between exposure to wind turbine sound and its components and health effects in the general population. Literature databases Scopus, Medline and Embase and additional bibliographic sources such as reference sections of key publications and journal databases were systematically searched for peer-reviewed studies published from 2009 to 2017. For the period until early 2015 only reviews were included, while for the period between January 2015 and January 2017 all relevant publications were screened. Ten reviews and 22 studies met the inclusion criteria. Most studies examined subjective annoyance as the primary outcome, indicating an association between exposure levels and

the percentage highly annoyed. Sound from wind turbines leads to a higher percentage of highly annoyed when compared to other sound sources. Annoyance due to aspects, like shadow flicker, the visual (in) appropriateness in the landscape and blinking lights, can add to the noise annoyance. There is no evidence of a specific effect of the low-frequency component nor of infrasound. There are indications that the rhythmic pressure pulses on a building can lead to additional annoyance indoors. Personal characteristics such as noise sensitivity, privacy issues and social acceptance, benefits and attitudes, the local situation and the conditions of planning a wind farm also play a role in reported annoyance. Less data are available to evaluate the effects of wind turbines on sleep and long-term health effects. Sleep disturbance as well as other health effects in the vicinity of wind turbines was found to be related to annoyance, rather than directly to exposure.

59) van Kempen, E., et al. (2018). "WHO environmental noise guidelines for the European region: A systematic review on environmental noise and cardiovascular and metabolic effects: A summary." International Journal of Environmental Research and Public Health 15(2).

? REVIEW cardiovascular

To update the current state of evidence and assess its quality, we conducted a systematic review on the effects of environmental noise exposure on the cardio-metabolic systems as input for the new WHO environmental noise guidelines for the European Region. We identified 600 references relating to studies on effects of noise from road, rail and air traffic, and wind turbines on the cardio-metabolic system, published between January 2000 and August 2015. Only 61 studies, investigating different end points, included information enabling estimation of exposure response relationships. These studies were used for meta-analyses, and assessments of the quality of evidence using the Grading of Recommendations Assessment, Development and Evaluation (GRADE). A majority of the studies concerned traffic noise and hypertension, but most were cross-sectional and suffering from a high risk of bias. The most comprehensive evidence was available for road traffic noise and Ischeamic Heart Diseases (IHD). Combining the results of 7 longitudinal studies revealed a Relative Risk (RR) of 1.08 (95% CI: 1.01–1.15) per 10 dB (LDEN) for the association between road traffic noise and the incidence of IHD. We rated the quality of this evidence as high. Only a few studies reported on the association between transportation noise and stroke, diabetes, and/or obesity. The quality of evidence for these associations was rated from moderate to very low, depending on transportation noise source and outcome. For a comprehensive assessment of the impact of noise exposure on the cardiovascular and metabolic system, we need more and better quality evidence, primarily based on longitudinal studies.

60) Velasco Garrido, M., et al. (2018). "A cross-sectional survey of physical strains among offshore wind farm workers in the German exclusive economic zone." BMJ Open 8(3).

✓ NOT (offshore en arbo)

Objectives To assess the physical strains of employees in the German offshore wind industry, according to job type and phase of the wind farm (under construction or operation). Design Web-based cross-sectional survey. Setting Offshore wind farm companies operating within the German exclusive economic zone. Participants Male workers with regular offshore commitments and at least 28 days spent offshore in the past year (n=268). Outcome measures Physical strains (eg, climbing, noise, working overhead, with twisted upper body or in confined spaces, vibration, heavy lifting, humidity, odours). Results The most frequently mentioned physical strain was 'climbing' with 63.8% of the respondents reporting to be always or frequently confronted with climbing and ascending stairs during offshore work. Work as a technician was associated with a greater exposition to noise, vibrations, humidity, cold, heat, chemical substances, lifting/carrying heavy loads, transport of equipment, working in non-ergonomic positions and in cramped spaces, as well as climbing. Indeed, statistical analyses showed that, after adjusting for phase of the wind farm, age, nationality, offshore experience, work schedule and type of shift, compared with non-technicians, working as a technician was associated with more frequently

lifting/carrying of heavy loads (OR 2.58, 95% CI 1.58 to 4.23), transport of equipment (OR 2.06 95% CI 1.27 to 3.33), working with a twisted upper body (OR 2.85 95% CI 1.74 to 4.69), working overhead (OR 2.77 95% CI 1.67 to 4.58) and climbing (OR 2.30 95% CI 1.40 to 3.77). Working in wind farms under construction was strongly associated with increased and decreased exposure to humidity (OR 2.32 95% CI 1.38 to 3.92) and poor air quality (OR 0.58 95% CI 0.35 to 0.95), respectively. Conclusions Workers on offshore wind farms constitute a heterogeneous group, including a wide variety of occupations. The degree of exposure to detrimental physical strains varies depending on the type of job. Technicians are more exposed to ergonomic challenges than other offshore workers.

61) Velasco Garrido, M., et al. (2018). "Sleep quality of offshore wind farm workers in the German exclusive economic zone: A cross-sectional study." BMJ Open 8(11).
✓ OFFSHORE (en arbo)
Objectives To assess the quality of sleep of employees in the German offshore wind industry and to explore factors associated with poor sleep quality. Design Web-based cross-sectional survey. Setting Offshore companies operating in wind farms within the German exclusive economic zone. Participants Workers with regular offshore commitments and at least 28 days spent offshore in the past year (n=268). Outcome measures Sleep quality in the past 4 weeks, troubles falling asleep or sleeping through in the past 4 weeks, differences in sleep quality between offshore deployments and onshore leaves. Results Having problems with sleep onset was reported by 9.5% of the respondents. 16.5% reported troubles with maintaining sleep three or more times per week. The overall quality of sleep was rated as very bad by only 1.7% of the participants. 47.9% of the workers reported their quality of sleep to be worse during offshore commitments than when being onshore. Higher levels of exposition to noise, vibrations and poor air quality were associated with sleeping troubles and poorer sleep quality. Sharing the sleep cabin with colleagues was associated with troubles sleeping through. No association was found for working in rotating shifts and for regularity of the offshore commitments. Conclusions Workers in our study showed frequent sleep problems and poorer sleep quality offshore than onshore. Our results indicate that higher degrees of exposure to noise, vibrations and artificial ventilation are associated with poor sleep quality rather than organisational factors such as shift-work and type of working schedule. In view of the high demands of the offshore workplace and the workers' particular recovery needs, addressing sleep disorders should be part of any health and safety management strategy for this workplace.

62) Wang, Z. T., et al. (2019). "Soundscape of an Indo-Pacific humpback dolphin (Sousa chinensis) hotspot before windfarm construction in the Pearl River Estuary, China: Do dolphin engage in noise avoidance and passive eavesdropping behavior?" Marine Pollution Bulletin 140: 509-522.
✓ OFFSHORE (en dieren)
Soundscapes are vital to acoustically specialized animals. Using passive acoustic monitoring data, the temporal and spectral variations in the soundscape of a Chinese white dolphin hotspot were analyzed. By cluster analysis, the 1/3 octave band power spectrum can be grouped into three bands with median overall contribution rates of 35.24, 14.14 and 30.61%. Significant diel and tidal soundscape variations were observed with a generalized linear model. Temporal patterns and frequency ranges of middle frequency band sound matched well with those of fish vocalization, indicating that fish might serve as a signal source. Dolphin sounds were mainly detected in periods involving low levels of ambient sound and without fish vocalization, which could reflect noise avoidance and passive eavesdropping behaviors engaged in by the predator. Pre-construction data can be used to assess the effects of offshore windfarms on acoustic environments and aquatic animals by comparing them with the soundscape of postconstruction and/or postmitigation.

63) Yang, C. M., et al. (2018). "Observation and comparison of tower vibration and underwater noise from offshore operational wind turbines in the East China Sea Bridge of Shanghai." The Journal of the Acoustical Society of America 144(6): EL522.
✓ OFFSHORE

Underwater operational turbine noise emitted by China's first offshore wind farm in the East China Sea Bridge of Shanghai was measured and analyzed in this study. Two sensors were used in the measurement: a hydrophone recording the underwater sound and an accelerometer placed in the turbine tower detecting the tower vibrations. Measurements were performed at two different types of wind turbines: a Sinovel 3 MW SL3000 turbine and a Shanghai Electric 3.6 MW W3600 turbine. The two turbines show similar tower vibration characteristics, characterized by a number of tonal components, mainly in the low-frequency domain (30-500 Hz). The peak vibration frequencies changed with the wind speed until the turbine approached its nominal power rating. Spectral analysis of the underwater acoustic data showed that the amplitude spectra had a strong correlation with the spectra of the turbine vibration intensity level, indicating that the measured underwater noise was generated by the tower mechanical vibration.

Daarnaast:
The influence of audio-visual interactions on the annoyance ratings for wind turbines
Applied Acoustics, Volume 129, 2018, pp. 190-203
Malina Szychowska, Honorata Hafke-Dys, Anna Preis, Jędrzej Kociński, Paweł Kleka

The impact of wind turbine noise on health (alleen abstract van oral presentation)
J Almeida, M Alves-Pereira, P Nossa
European Journal of Public Health, Volume 29, Issue Supplement_1, April 2019, ckz034.060, https://doi-org.proxy-ub.rug.nl/10.1093/eurpub/ckz034.060
Published: 27 April 2019

Hansen, C.; Hansen, K. Recent Advances in Wind Turbine Noise Research. Acoustics 2020, 2, 172-207.

Niet in 2017 review:
Characterisation of wind farm infrasound and low-frequency noise
Journal of Sound and Vibration, Volume 370, 2016, pp. 176-190
Branko Zajamšek, Kristy L. Hansen, Con J. Doolan, Colin H. Hansen

Excluded: non-human effects (e.g. ecosystem effects, animals), technical aspects of wind turbines health effects of sound not related to wind turbines.
Included: publicaties in de volgende categorieën:

1: categorie	2: toelichting	3: Scopus + Medline + Embase 2017-2018	Tot.	5: Embase 2018-2020	Tot.
EXPOSURE	betreft blootstelling (geen effecten), incl. modellering	4, 6, 9, 11, 20, 53, 73. 74 9 20 53 55 56 57 63 83	7	11, 22, 23, 26 3,11, 14, 23, 27, 52	4
HE	onderzoek naar een of meer Health Effects tgv geluid (in brede zin, ook perceptie en hinder)	10, 11, 30, 38(+42+48), 54, 57, 62, 63, 75-80, 83, 7 21 25 28, 31 42 43 44 75, 76, 77, 78, 79, 80, 82	17	3, 5-7, 17, 18, 24, 32, 36, 37, 41, 42, 44, 46, 48, 50, 53 3, 5, 6, 7, 16,17, 18,19,21, 31-34, 37, 41, 42, 44, 45, 46, 47, 48, 49, 54 health(lang) , 59,	17
SOCIAL	als het vooral om sociale/community aspecten gaat, inclusief gehele proces	2, 39, , 59, 72, 84, 86, 3, 13. 14.16 18, 29 32 34 36 37 38 40 45 46 49 50 64 67 68 69 70 71 81 88 2 10 44	21	14, 38 10, 24,	2
VISUAL	visuele aspecten inclusief landschap; kan van belang zijn, maar hoeft niet (artikel zelf lezen)	19, 22, 24, 85, 93 19 22 24 54 85 , 93	5	53	
LFN	Low Frequency Noise; kan van belang zijn, maar hoeft niet (artikel zelf lezen)	1, 5, 28, 47, 51, 52, 55, 89, 5,23,25,33,47,51,52, 90	9	25, 56, 57 26, 56,57	3
WHO	Artikelen ivm WHO guidelines	25, 58, 92	3	4, 9, 59	3

REVIEW	een overzicht van (resultaten van) meerdere onderzoeken	91 (=ons review) dubbel (58) 89 (moved to LFN)		8, 16, 35, 55, 58 (=ons review) 4, 8,9,(20JAP), 26 (LFG) 55,58	4
CASE	case study	45, 49,	2		
NOT	(met reden zoals onderaan vermeld)	7, 8, 12, 16, 17, 21, 23, 26, 27+60, 29, 31, 32, 33, 35, 43, 44, 56, 61, 64, 66, 81, 82, 87, 90 1 4 8 12 17 26 27 29 30 41 47 52 55 56 58 59 60 61 62 65 72 73 74 83 87 91 92	25	2, 10, 12, 15, 19, 20, 27, 31, 33, 34, 36, 40, 51, 52, 54, 60, 61 22, 28,, 35, 36occ, 38, 43animal,	15
OFFSHORE	niet van belang voor ons	3, 41, 65,	3	13, 28, 29, 30, 39, 43, 62, 63 15, 29, 39, 60, 61, 62 62, 63	8
??	onduidelijk	15 11 15 35 83	1	12,13, 51	
	Totaal	93		63	

Kolom 3: 7 (+31+43) (dubbelt eerdere artikelen van Jalali et al; (+discussie daarover)), 8 (impulsgeluid), 12 (compressoren), 16 + 17 + 90 (alleen abstract), 21 (te algemeen), 23 (hoog niveau LFN), 26+82+87 (bewaking WTs), 27+60 (olie/gaswinning), 29, 32, 33 (rapport uit 1987), 35, 44 (conf.paper: nu wet.art. (52 in kolom 5), 56+81 (geen omwonenden), 61+66 (arbo), 64
Kolom 5: 2+27+40: technisch), 12 (geen gezondheid), 15, 19+20 (Japanse tekst), 36 (arbo), 51 (planning instrument), 54 (journalistiek), 60, 61 (arbo); 10+31+33+34+45+47+52 zijn dubbel met eerdere uodate (resp. 62, 75, 77, 78, 79, 80, 83 in kolom 3)

Doc. 8

2017-2018	Match	MISMATCH Frits wel	MISMATCH Irene wel
EXPOSURE			
HE	42 75, 76, 77, 78, 79, 80,	10, 11, 30, 38(+42+48), 54, 57, 62, 63, 75-80, 83,	7 21 25 28, 31 43 44 82
SOCIAL	2 13. 14. 18, 34 36 37 40 46 5067 68 69 70 71 88	2, 39, , 59, 72, 84, 86,	3, 10 16 29 32 38 44 45 49 64 81
VISUAL			
LFN			
REVIEWS	Zie 2017-2018	Ok see selected	
LEG			
Exclude	8 12 17 26 27 29 41 56 60 61 87 91 65	7, 16, 21, 23, 31, 32, 33, 35, 43, 44, 64, 66, 81, 82, 90	1 4 30 47 52 55 58 59 62 72 73 74 83 92
Unclear			

2018-2020	Idem	Frits wel	Irene wel
EXPOSURE			
HE	3, 5, 6, 7, 18, 37, 41, 42, 44, 46, 48,	24, 36, 50, 53	16,17,19,21, 31-34, 45, 47, 49, 54 , 59,
SOCIAL	Geen	14, 38	10, 24
VISUAL			
LFN			
REVIEWS	4, 8, 9, 16, 35, 55, 58, 59	nvt	nvt
LEG			
Exclude (samengevoegd met offshore)	15, 28 29, 36 39, 60, 61, 62, 63	2, 10, 12, 19, 20, 27, 31, 33, 34, 36, 40, 51, 52, 54,	22, 35, 38, 43
Unclear			

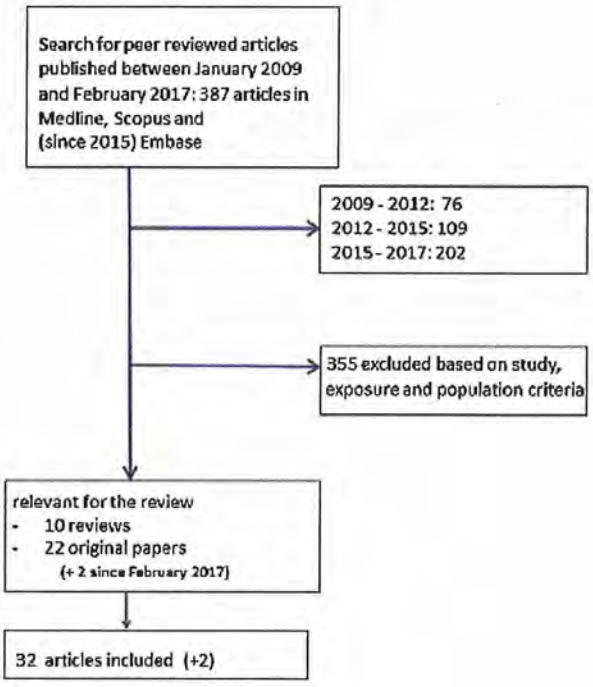


Fig. 1 Flowchart of selection process

Search resultaat: zie Gros-lit_Swissreview

Inclusie en exclusie criteria;

Alleen studies warden meegenomen die in de titel of abstract aangaven dat de relatie tussen wind turbine geluid en een reactie, gezondheidseffect of effect op welbevinden. Ook onderzoek werd meegenomen dat zich richt op het participatieproces tijdens de bouw van het windpark. Dit houdt in dat de relatie tussen (laagfrequent) geluid en hinder, gezondheid, welbevinden, verstoring van activiteiten werd bestudeerd. Zowel observationeel als experimenteel onderzoek werd meegenomen. Taal was beperkt tot Duits, Engels, Frans, en Nederlands.

Alleen studies warden geselecteerd die gepubliceerd warden in peer reviewed tijdschiften, congres proceedings en wetenschappelijke rapporten. Zowel kwalitatief als kwantitatief onderzoek werd geselecteerd en er waren geen restricties voor wat betreft onderzoeksdesign.

Uitsluiting: effecten anders dan op de mens, effecten anders dan op omwonenden, beroepsmatige blootstelling, offshore, en opiniestukken, *editorials*, brief aan de editor, errata of discussiepapers .

Inclusie: (Voor wat betreft niet akoestische effecten): visuele aspecten, landschap, licht effecten, slagschaduw, trillingen, elektromagnetische velende, context en persoonlijke factoren zoals geluidgevoeligheid, houding, eigenaarschap, participatie etc.

*selectie werd uitgevoerd door de twee auteurs in parallel en in nauwe samenwerking met een bibliothecaris van het RIVM. De kernstappen van de zgn "Preferred Reporting Items for Systematic Reviews and Meta-Analyses" (PRISMA) werden hierbij zoveel mogelijk gevolgd.

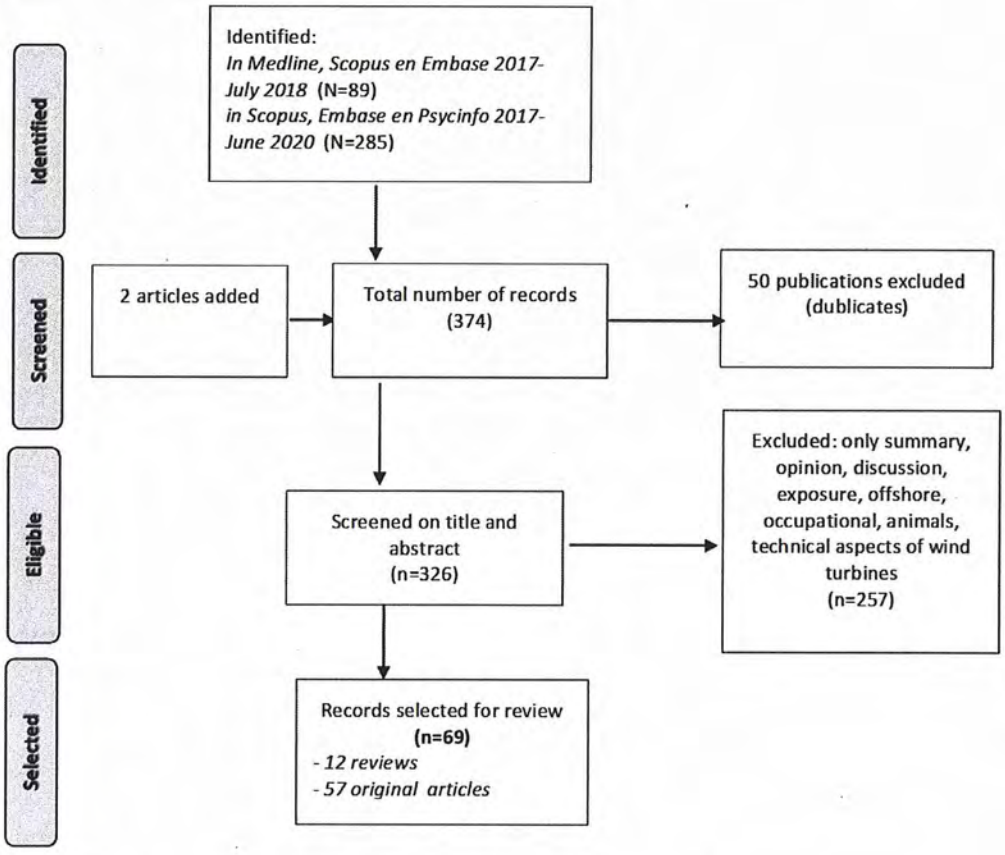
Procedure

De artikelen werden gegroepeerd in 7 categorieën: reviews, gezondheidseffecten, offshore, bloostelling, laagfrequent geluid, visuele aspecten, sociale aspecten, niet relevant. Alle reviews en originele studies werden gelezen die op grond van een eerste selectie op titel en abstract aan de

genoemde criteria voldeden, Offshore en beroepsmatige bloostellingspapers werden a-priori uitgesloten. Exclusie werd vervolgens alsnog gedaan als de paper toch niet relevant bleek, of dubbel was etc. Na volledige bestudering door de twee auteurs werd een finale beslissing genomen. Met oog op de beperkte tijd en budget is een meta-analyse niet uitgevoerd. .

Voor Informatie over selectie: zie verschillende bestanden:

1. **Medline, Embase, Scopus shortlist (-2017)**
2. **Categorisering (zie onder procedure)**
3. **Tabellen geselecteerde artikelen in:** *van Kamp, I., & van den Berg, F. (2018). Health effects related to wind turbine sound, including low-frequency sound and infrasound. Acoustics Australia, 46(1), 31-57.*



Search Resultaten: zie: BIB-windturbine-lowfrequency_complete. pdf

Inclusie en exclusie criteria (zie boven).

Procedure (zie boven)

Voor informatie over selectie in verschillende bestanden:

1. **Shortlist_2017-2018; 2018-2020**
2. **Categorisering (zie uitleg onder procedure)**
3. **Tabellen van geselecteerde artikelen nog niet beschikbaar (onder review)**