



## Driemaandelijks overzicht van relevante literatuur over windenergie en gezondheid Q3-2024

Periode: Juli t/m September 2024

Het Expertisepunt Windenergie en Gezondheid houdt voor haar kennisbasis de wetenschappelijke literatuur bij over windenergie en gezondheid. Elke drie maanden wordt een overzicht gemaakt van de nieuwgevonden wetenschappelijke en grijze literatuur.

In dit document vindt u het overzicht van de literatuur gevonden in de hierboven aangegeven periode.

### Literatuuropbrengst

Hieronder wordt eerst een overzicht gegeven van de wetenschappelijke artikelen gevonden in diverse literatuurdatabanken. Daarna volgt een (niet-uitputtende) opsomming van overige relevante bronnen, zoals (Nederlandse) onderzoeksrapporten en conferentieverlagen, ook wel grijze literatuur genoemd.

### Disclaimer

Deze selectie is tot stand gekomen met behulp van een zoekprofiel (zie bijlage Methode Zoekstrategie) en toepassing van inclusie en exclusiecriteria. Op deze documenten is geen dataextractie toegepast noch is er een algemeen kwaliteitsoordeel aan gegeven.

### Literatuur gepubliceerd in wetenschappelijke tijdschriften

Tabel 1 Overzicht van het aantal gevonden studies (fases)

	Juli- september 2024
Aantal artikelen gevonden met zoekstrategieën voordat selectie heeft plaatsgevonden	108
Aanvullende referenties gevonden via andere bronnen (dit betreft niet de grijze literatuur)	0
Aantal referenties na verwijdering van duplicaten	<b>89</b>
Verwijderde referenties omdat ze niet relevant zijn (voldoen niet aan inclusie en exclusie criteria)	80
Aantal relevante artikelen geselecteerd door reviewers	5
Aantal artikelen waarover reviewer 1 en reviewer 2 hebben afgestemd (grensgevallen)	4
<b>Totaal aantal relevante artikelen (na afstemmen)</b>	<b>6</b>

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## **Overzicht van de relevante studies**

### **1. Titel: *The Social Psychology of Framing: The Emotional Content of Finnish Anti-Wind Power Frames***

**Samenvatting (gekopieerd uit artikel):** Protests against wind power have become increasingly common in Western countries and in Finland. This article explores various anti-wind farm frames and their emotional dynamics and content. The framing approach highlights cognitive and constructive rather than emotional aspects. However, social-psychological understanding of emotions enables us to recognise those types of emotions that give content to a specific frame and are essential to understanding individual motivations for building frames and joining protests. This article points out three anti-wind farm frames: Nimby (love, feelings of security, fear of disruption, and anger); populist (experience of helplessness, fear, grief and anger); and environmentalist (concern and respect). The frames reveal how online activists oriented towards the same cause and goal arise from multiple emotional contents, indicating the actors' concerns over the effects of wind turbines on their own well-being and reflecting their own different positions. © The Author(s) 2023.

**Referentie:** Husu, H. M. (2024). The Social Psychology of Framing: The Emotional Content of Finnish Anti-Wind Power Frames. *Sociological Research Online*, 29(3), 712-728.

**Link naar bron:** <https://doi.org/10.1177/13607804231192328>

### **2. Titel: *Community-based wind energy development does not work? Empirical evidence from residents in Canada and Ireland***

**Samenvatting :** geen abstract van het artikel beschikbaar

**Referentie:** Baxter, J., Ellis, G., Wilson, S. & McAteer, B. (2024). Community-based wind energy development does not work? Empirical evidence from residents in Canada and Ireland. *Energy Policy*, 191.

**Link naar bron:** <https://doi.org/10.1016/j.enpol.2024.114199>

### **3. Titel: *Price or public participation? Community benefits for onshore wind in Ireland, Denmark, Germany and the United Kingdom***

**Samenvatting (gekopieerd uit artikel):** Efforts to promote community acceptance of wind energy include a range of 'financial participation' mechanisms focused on residents near to commercial wind farms, such as community benefit funding, citizen investment opportunities, incentives for households nearest to wind farms, as well as administrative supports to promote community ownership of wind farms. This review compares the adaptation of policies introduced by Germany, Denmark, the United Kingdom, and Ireland to investigate how the roles of community stakeholders interconnect with the European Union's commitment to accelerate onshore wind deployment. These mature markets view onshore wind energy as an essential contribution towards the net-zero electricity system, security of supply, and energy independence. The comparative case study highlights that the interaction between market-based and community-based approaches to wind energy development has seen the size, scale and formality of financial benefits increase while supports for small-scale community-led wind energy have been considerably reduced. The continued paradigm shift narrows the scope for community participation in wind farms and presents considerations and paradoxes regarding the role of communities in local energy transitions. Recommendations consider the need for flexibility regarding the geographic "proximity criteria" for citizen participation, approaches to include communities into the governance and disbursement of shared benefits, and the potential to encourage citizen investment into onshore wind energy. These contribute to the debate regarding the balance between objectives of the energy transition: to promote meaningful citizen participation and benefit at a local scale

while rapidly reducing the levelized cost of renewable energy for the wider benefit of society. © 2024 The Author

**Referentie:** le Maitre, J. (2024). Price or public participation? Community benefits for onshore wind in Ireland, Denmark, Germany and the United Kingdom. *Energy Research and Social Science*, 114.

**Link naar bron:** <https://doi.org/10.1016/j.erss.2024.103605>

#### **4. Titel: Global Review on Environmental Impacts of Onshore Wind Energy in the Field of Tension between Human Societies and Natural Systems**

**Samenvatting (gekopieerd uit artikel):** Deploying onshore wind energy as a cornerstone of future global energy systems challenges societies and decision-makers worldwide. Expanding wind energy should contribute to a more sustainable electricity generation without harnessing humans and their environment. Opponents often highlight the negative environmental impacts of wind energy to impede its expansion. This study reviews 152 studies to synthesize, summarize, and discuss critically the current knowledge, research gaps, and mitigation strategies on the environmental impacts of onshore wind energy. The investigated effects comprise impacts on the abiotic and biotic environment, with birds and bats in particular, noise and visual impacts. Effects are discussed in the context of social acceptance, other energy technologies, and wind energy expansion in forests. This review illustrates that many effects are highly case-specific and must be more generalizable. Studies are biased regarding the research focus and areas, needing more standardized research methods and long-term measurements. Most studies focus on the direct mortality of birds and bats at wind farms and are concentrated in Europe and North America. Knowledge gaps persist for many impact categories, and the efficacy of mitigation strategies has yet to be proven. More targeted, unbiased research is required that allows for an objective evaluation of the environmental impacts of wind energy and strategies to mitigate them. Impacts, such as those on biodiversity, need to be addressed in the context of other anthropogenic influences and the benefits of wind energy. This forms the basis for a socially acceptable, efficient, and sustainable expansion of wind energy. © 2024 by the authors.

**Referentie:** Sander, L., Jung, C. & Schindler, D. (2024). Global Review on Environmental Impacts of Onshore Wind Energy in the Field of Tension between Human Societies and Natural Systems. *Energies*, 17(13).

**Link naar bron:** <https://doi.org/10.3390/en17133098>

#### **5. Titel: Influence of Wind Turbines as Dominants in the Landscape on the Acceptance of the Development of Renewable Energy Sources in Poland**

**Samenvatting (gekopieerd uit artikel):** Where there are wind turbines, they become a dominant feature of the landscape. The landscape is one of the frequently identified types of impacts of these investments on the natural environment and people. Specially prepared methodologies are used to assess the impact of turbines on the landscape. No less important is the subjective feeling of residents because it can affect the social acceptance of these investments. The work answers questions about residents' opinions on the impact of energy installations on the landscape. The results of the study, using chi-square, indicate that there is a relationship between the presence of windmills in the municipality and support for their development, as well as the evaluation of both the positive as well as the negative. Residents of a municipality where wind turbines have been around for more than a dozen years considered the introduction of a very strong visual stimulus as the most important negative impact on the landscape. Residents of a municipality without wind power considered interference with ecosystems as the most important negative impact. © 2024 by the authors.

**Referentie:** Świdłyńska, N., Witkowska-Dąbrowska, M. & Jakubowska, D. (2024). Influence of Wind Turbines as Dominants in the Landscape on the Acceptance of the Development of Renewable Energy Sources in Poland. *Energies*, 17(13).

**Link naar bron:** <https://doi.org/10.3390/en17133268>

**6. Titel: Urban energy transition and quality of life: A comprehensive statistical study on the nexus of wind clean energy adoption, job creation, and livability**

**Samenvatting (gekopieerd uit artikel):** This study investigates the intricate relationship between wind farm clean energy adoption and urban quality of life through three key contributions. Firstly, an Integrated Hybrid Deep Q-Networks (DQN) and Long Short-Term Memory (LSTM) model is introduced for wind farm power prediction. This novel approach synergistically leverages DQN's decision-making capabilities and LSTM's sequential learning to enhance accuracy by capturing temporal dependencies in wind conditions. Secondly, a Comprehensive Statistical Study on the Urban Energy Transition Nexus goes beyond traditional analyses, exploring the links between clean energy adoption, job creation, and urban livability. Advanced statistical methods quantify wind farm impacts on job creation and overall quality of life, providing a nuanced understanding of the urban energy transition. Thirdly, the Harmony Search (HS) algorithm, with modified parameters, optimizes the hybrid DQN-LSTM model. This nature-inspired algorithm addresses hyperparameter tuning challenges, contributing a unique dimension to model optimization for better convergence and exploration of the solution space. Finally, the study delves into job creation and livability in the context of urban energy transition, examining how the adoption of wind farm clean energy contributes to employment opportunities and enhances overall urban quality of life. Together, these contributions offer a comprehensive framework for integrating wind farm clean energy into urban environments, providing innovative solutions for accurate power predictions and facilitating sustainable urban energy transitions. © 2024 Elsevier Ltd

**Referentie:** Wang, X., Ali, D. A. & Zhao, W. (2024). Urban energy transition and quality of life: A comprehensive statistical study on the nexus of wind clean energy adoption, job creation, and livability. *Sustainable Cities and Society*, 108.

**Link naar bron:** <https://doi.org/10.1016/j.scs.2024.105436>

Tabel 2 Indeling van de wetenschappelijke literatuur naar type en onderwerp (Soort onderzoek)

	<b>Hinder</b>	<b>Slaap</b>	<b>Gezondheid divers</b>	<b>Anders (bijv. co- determinanten)</b>
<b>Tekstmining (bijv. sentiment analyse van (sociale) media artikelen)</b>				Husu (2024)
<b>Case study</b>				Le Maitre (2024)
<b>Observationeel (bijv. Cross- sectionele, cohort, of case control studies)</b>				Baxter (2024); Świdyńsk (2024)
<b>Experimenteel</b>				
<b>Review</b>				Sander (2024)
<b>Anders (bijv. theoretisch model, opinie,...)</b>				Wang (2024)

## **Relevante Nederlandse onderzoeksrapporten en overige relevante grijze literatuur**

### **Overzicht van relevante grijze literatuur**

#### **1. Titel: Acceptatie van windturbines**

**Beschrijving (gekopieerd):** De perceptie van burgers is een niet te verwaarlozen factor tijdens de planning en constructie van windprojecten. Negatieve percepties, in de vorm van collectief of officieel bezwaar, hebben er in het verleden al toe geleid dat projecten vertraging oplopen of in sommige gevallen zelfs stopgezet worden. Het doel van deze vragenlijststudie is om inzicht te verwerven in de voorspellers van enerzijds de intentie van burgers om windprojecten te steunen of er bezwaar tegen in te dienen, anderzijds wat ertoe leidt dat burgers windprojecten al dan niet accepteren. In het algemeen vinden we dat sociodemografische variabelen zo goed als geen effect hebben op de algemene acceptatie van windturbines. Een uitzondering hierop is dat stedelingen meer geneigd zijn om bezwaar aan te tekenen.

Er werden 4 profielen gedefinieerd afhankelijk van of er al dan niet windturbines in de buurt zijn en/of gepland zijn. Mensen zonder windturbines in de buurt en waar geen plannen zijn voor een windturbine in de toekomst, zullen een windturbineproject meer accepteren dan het profiel waar er wel al windturbines in de buurt terug te vinden zijn, maar waarvoor er geen plannen zijn in de toekomst. Het effect hiervan is echter zeer minimaal en zeker niet groot genoeg als belangrijke voorspeller.

Het al dan niet zichtbaar zijn van een windturbine heeft daarentegen een consistent effect op bezwaar/steun en acceptatie van een windturbine: zichtbaarheid is geassocieerd met een hogere intentie tot bezwaar en een lagere acceptatie. We vinden ook dat sociale normen, bestaande attitudes tegenover windturbines en ingeschatte beheersing om windturbines te steunen een belangrijke rol spelen bij de intentie om bezwaar in te dienen tegen windturbines of ze te steunen.

Een positieve impact op de energieprijzen en meer energieonafhankelijkheid zijn facilitatoren die leiden tot minder bezwaar. Daartegenover draagt de mogelijkheid om

bezorgdheid te uiten en financieel te investeren bij tot meer bezwaar tegen windturbines. De mogelijkheid om financieel te investeren heeft ook een impact op het steunen van windturbines. Tenslotte zorgen de mogelijkheid om financieel te investeren en meer energieonafhankelijkheid voor een hogere acceptatiegraad bij de burger. Vertrouwen in de gemeente zorgt voor minder bezwaar en meer acceptatie. Er werd daarentegen geen impact gevonden van vertrouwen in de industrie.

Biosferisch geloof (de gepercipieerde impact van moderne ontwikkelingen op de lokale fauna en flora en het klimaat) zorgt voor minder acceptatie, terwijl bezorgdheid over het milieu (noodzaak van inspanningen ter bescherming van het milieu) geen impact heeft op intentie op bezwaar of acceptatie.

Wat betreft gepercipieerde overlast vinden we vooral een effect voor bezorgdheid om geluid en visuele hinder, wat in beide gevallen zorgt voor minder acceptatie en meer bezwaar. De impact van slagschaduw is zeer beperkt. Tot slot zien we dat subjectieve kennis en praktische ervaring met een windturbine significant geassocieerd zijn met een hogere acceptatie.

**Referentie:** Conradie, P., Hove, S. V. & Martens, E. (2023). *Acceptatie van windturbines*. Universiteit van Gent.

**Datum van publicatie:** 22-05-2023

**Link naar bron:** : <https://vwea.be/wp-content/uploads/2024/06/052023-Rapport-Acceptatie-van-windturbines-Imec-UGent-FINAAL.pdf>

## **2. Titel: Health problems in the proximity of wind turbines in the Netherlands: findings from a nationwide epidemiological study based on primary health care data**

**Samenvatting (gekopieerd):** Despite a growing body of evidence, there is still limited epidemiological research on the association between wind turbines (WT) and health. The present study integrated electronic patient records from general practitioners participating in the Nivel Primary Care Database, with publicly available geospatial data (Environmental Health Atlas) on the locations of all active WT and accompanying noise levels (estimated on the basis of the STAMINA model). Spanning a decade (2012-2021) and a yearly sample of 350,000 to 560,000 individuals within 5 kilometers of WT, this study investigated a broad range of health symptoms and chronic conditions presented and diagnosed in general practice. Medication prescriptions, social problems and total health care utilization were also included as secondary outcomes. Multilevel regression analyses generally indicated a lack of consistent and significant associations between residential proximity (within 500, 1000 and 2000 meters) to WT and prevalence of health problems diagnosed by general practitioners. While the prevalence of certain symptoms such as tension headache and depressive feelings increased within 500 meters from WT in later years, results were not statistically significant. Additionally, higher average sound levels (Lden) (above 42 decibels) in later years were associated with a higher risk of prescribed painkillers. However, such associations were absent in earlier years and lacked consistent patterns. Only a small number of people in the sample lived within 500m from WT and was exposed to higher noise levels. In light of the expanding deployment of WT and current methodological limitations of epidemiological research in this field, more comprehensive research is necessary. Recommendations for future studies include using the largest feasible samples in the direct vicinity of WT, refining exposure assessment with precise geospatial data at the individual level, incorporating low-frequency noise components, and thorough control over relevant confounding and moderating variables.

**Referentie:** Baliatsas, C., Yzermans, J., Hooiveld, M., Kenens, R. & Dückers, M. (2024). *Health problems in the proximity of wind turbines in the Netherlands: findings from a*

*nationalwide epidemiological study based on primary health care data* [Paper presentation]. ICSV, Amsterdam, The Netherlands.

**Datum van publicatie:** 08-07-2024

**Opmerkingen:** Congres paper

### **3. Titel: Psychoacoustic evaluation of modelled wind turbine noise**

**Samenvatting (gekopieerd):** Current validation of wind turbine noise models primarily focuses on sound levels averaged over time, typically expressed in metrics such as the equivalent A-weighted sound pressure level (LA,eq). Whereas valid for regulatory purposes, these methods are not sufficient for psychoacoustic research, as time-averaged levels alone do not fully explain the measured noise annoyance. Therefore, this research aims to establish whether psychoacoustic sound quality metrics (SQMs) provide additional value when analysing wind turbine noise models. This work employs the Horizontal Axis Wind turbine simulation Code 2 (HAWC2) to generate noise source spectrograms, which are propagated through the atmosphere with a Gaussian beam-tracing approach. The final sound signals are retrieved through an inverse Short-Time Fourier Transform (iSTFT). This methodology is applied to a case study featuring a stall-controlled, horizontal-axis, Nordtank NTK 500/41 wind turbine. The results are evaluated against measurements by considering LA,eq, SQMs, and a comparative listening experiment. The LA,eq metric shows a consistent underprediction of the simulations with respect to measurements, which is partly explained by a ground reflection modelling error. In the high-frequency range, stall noise is known to be significantly underpredicted by the aero-acoustic simulation model. This usually translates in increasing discrepancies between measurements and models as the wind speed increases. The comparative listening experiment confirms that participants experience the simulations and the measurements as significantly different. The difference ratings show a good agreement with the differences in the psychoacoustic annoyance and loudness metrics. It is more difficult to relate the results from the listening experiment to LA,eq. These findings confirm that an evaluation with psychoacoustic metrics next to conventional methods provides additional value in validating wind turbine noise models for human perception research.

**Referentie:** Josephine Siebert Pockelé & Merino-Martínez, R. (2024). *Psychoacoustic evaluation of modelled wind turbine noise* [Paper presentation]. ICSV, Amsterdam, The Netherlands

**Datum van publicatie:** 08-07-2024

**Opmerkingen:** Congres paper

### **4. Titel: A study on low-frequency noise of wind turbines**

**Beschrijving (gekopieerd):** In 2021 in The Netherlands the legal noise limits for new wind parks were inactivated by a court decision. Since then, the government conducted an environmental impact assessment to substantiate the admissibility of limit values. The standard limits are year averaged A-weighted sound pressure levels (Lden and Lnight). For the new wind turbine regulations, the question arised which norm adequately protect residents from the environmental effects including the low-frequency contribution of the noise of wind turbines. Therefore, research has been conducted specifically on low-frequency noise produced by wind turbines. The research addresses several questions. A typical noise emission spectrum is determined for a large\_scale future model windturbine of 5 and 8 MW. A comparison is made between the low-frequency noise spectrum of wind turbines and other common noise sources. Furthermore, the distance is determined at which low-frequency noise from wind turbines becomes significant, and the sound pressure levels inside dwellings are calculated. For the determination of the sound pressure levels inside dwellings also measurements of the low-frequency isolation of

several Dutch facades of dwellings are included in the survey. This paper gives an overview of the used methodology and results of research into low-frequency noise due to wind turbines. The results are compared with a standard curve for the low-frequency hearing threshold and a typical curve confirming annoyance.

**Referentie:** Maarl, W. v. d. & Beer, E. d. (2024). *A study on low-frequency noise of wind turbines* [Paper presentation]. ICSV, Amsterdam, The Netherlands..

**Datum van publicatie:** 08-07-2024

**Opmerkingen:** Congres paper

### **5. Titel: *The "effects of wind turbine sound on working memory" (A pre-registration plan)***

**Beschrijving (gekopieerd):** Although research on the effects of wind turbine sound (WTS) over mental health factors is increasing, very little attention has been given to the potential effects of WTS over subtle cognitive processes, such as concentration or memory. The "brainwave entrainment hypothesis" is rooted in neuropsychological research demonstrating that brain oscillations are modulated by external rhythms. In addition, perceived annoyance to wind turbines seems to be a phenomenon in which both visual and psychological variables interact with acoustic stimulation. However, annoyance is a concept rarely operationalised in the literature. Our study aims to experimentally assess the effects of WTS on working memory. Working memory is recognised as a basic process, playing a crucial role in unconscious everyday processes (e.g., perceiving an object's trajectory despite input interruptions when blinking), as well as deliberate processes (e.g., carrying out arithmetic operations). By exploring variations in performance during a memory task, while being exposed to WTS samples, we could highlight acoustic characteristics of the WTS stimuli that interfere—or not—with cognitive processes. These data, combined with within-block ratings of annoyance, can provide us with index of annoyance directly related to the acoustic properties present in WTS recordings.

**Referentie:** Garcia-Guerrero, S., O'Hora, D., King, E. & Manohare, M. (2024). *The "effects of wind turbine sound on working memory" (A pre-registration plan)* [Paper presentation]. InterNoise, Nantes, France.

**Datum van publicatie:** 25-08-2024

**Opmerkingen:** Congres paper

### **6. Titel: *Characterization of wind turbine noise using psychoacoustical indicators*** **Beschrijving (gekopieerd):**

Noise annoyance caused by wind turbines is a significant issue for people living in the vicinity of wind farms, leading to difficulty in its societal acceptance. Annoyance due to Wind Turbine Noise (WTN) has been regulated using conventional environmental indices, which often fail to account fully the human perception of noise exposure. This study examines the use of psychoacoustical indicators to assess the character of WTN in Ireland. Fourteen noise measurement locations were selected near wind farms in County Wexford (Ireland) with audio recordings made at each location, when WTN was the dominant source. These recordings are analyzed to extract different psychoacoustic indicators and Zwicker's psychoacoustical annoyance. Further clustering of these

sound samples was performed to understand the overall character of WTN and its associated annoyance. This characterization provides an understanding of how the variation in sychoacoustical indicators might lead to changes in the perception of wind farm noise. These results can be employed to develop sound quality maps and further develop noise annoyance models complemented by conducting listening experiments



**Referentie:** Manohare, M., King, E. & Keown, E. M. (2024). *Characterization of wind turbine noise using psychoacoustical indicators* [Paper presentation]. InterNoise, Nantes, France.

**Datum van publicatie:** 25-08-2024

**Opmerkingen:** Congres paper

### **7. Titel: Perceptual Evaluation of Sound Synthesis of Wind Turbine Noise**

**Beschrijving (gekopieerd):** This study brings together several laboratories with the aim of assessing the health effects of "audible" noise (> 20 Hz) and infrasound (< 20 Hz) emitted by wind turbines. To study loudness and annoyance due to this noise, perceptual tests are planned at the LMA, where a restitution cabin has been developed, specifically designed to diffuse very low frequencies and infrasound. As recording wind turbine noise is only possible at low wind speeds for a good quality sound reproduction, it would be interesting to be able to use sound synthesis of wind turbine noise. From sounds recorded in a wind farm for different meteorological conditions, the corresponding sounds have been synthesized. A physical model synthesis was performed, based on an extended-source aeroacoustic model taking into account propagation over flat ground. Dissimilarity tests including recorded and synthesized sounds enabled a 2D perceptual space to be built. Synthesized and the corresponding recorded sounds are closed together in the perceptual space, but some differences can be perceived, mainly due to difference in amplitude of fluctuation and spectral balance. The analysis of the perceptual space opens up interesting prospects for improving the sound synthesis and its use for future perceptual tests.

**Referentie:** Meunier, S., Sawaf, O. E., Marquis-Favre, C., Couzon, G., Strauss, N., Cotte, B., Mascarenhas, D. & Cathron, J. (2024). *Perceptual Evaluation of Sound Synthesis of Wind Turbine Noise* [Paper presentation]. InterNoise, Nantes, France.

**Datum van publicatie:** 25-08-2024

**Opmerkingen:** Congres paper

### **8. Titel: A preliminary analysis of long-term self-reported sleep disturbance attributed to wind turbines and modelled outdoor nightly average wind turbine sound pressure level**

**Beschrijving (gekopieerd):** The World Health Organization (WHO) Environmental Noise Guidelines provide source\_based nighttime sound level ( $L_{night}$ ) recommendations. For non-aircraft sources, the recommended  $L_{night}$  is where the absolute prevalence of high sleep disturbance (HSD) equals 3%. The Guideline Development Group (GDG) did not provide an  $L_{night}$  for wind turbines due to inadequate data. In the current study, calculated outdoor wind turbine  $L_{night}$  ranged from <20.5 dB(A) to 41.5 dB(A). Questionnaires were completed between May and September 2013 by 606 males and 632 females, 18-79y, randomly selected from households 0.25 to 11.22 kilometers from operational wind turbines. When the source of sleep disturbance was unspecified, the mean prevalence of HSD was 13.3% overall and unrelated to  $L_{night}$  ( $p = 0.53$ ). As  $L_{night}$  increased, identifying wind turbines as one of the causes of HSD increased from 0% below 20.5 dB(A) to 3.8% between 35.5-41.5 dB(A) ( $p = 0.01$ ). The WHO's 3% HSD benchmark was observed at  $L_{night}$  33.5 dB(A) (95% CI 31.1 to 36.1 dB(A)). Results affirm findings from Health Canada's Community Noise and Health Study of minimal impacts of wind turbines on sleep, yet noted uncertainties and limitations are discussed, including the suggestion that the HSD prevalence benchmark for wind turbines may be too low.

**Referentie:** Michaud, D. S., Denning, A. & McNamee, J. (2024). *A preliminary analysis of long-term self-reported sleep disturbance attributed to wind turbines and modelled*

*outdoor nightly average wind turbine sound pressure level* [Paper presentation].  
InterNoise, Nantes, France.

**Datum van publicatie:** 25-08-2024

**Opmerkingen:** Congres paper

**9. Titel: Health effects related to wind turbine sound – a rapid evidence review covering 2020-2024**

**Beschrijving (gekopieerd):** Wind energy plays an important role in the delivery of net zero and energy security commitments, and globally wind additions are forecast to more than double by 2028 compared with 2022. Permitting frameworks have been identified as a key barrier to growth of onshore wind, and the health effects of wind turbine sound emissions remain a primary concern to local communities. Evidence reviews published in 2017 and 2020-21 concluded that the health effects literature is increasing, but there are still gaps, especially for health endpoints other than annoyance, and how non-acoustic factors can moderate and/or mediate self-reported health outcomes. We carried out a rapid evidence review covering the period July 2020 to February 2024 to determine if newer evidence is addressing these gaps. Of the 22 studies about health effects, most focused on self-reported health, annoyance, and sleep disturbance. Studies about other health effects remains limited. Studies on "social acceptance" (n=10) continue to show the importance of non-acoustic factors, such as attitudes and personal characteristics are in impacting outcomes. No intervention studies were identified. Due to variations in study design, exposure and outcome measures, and how non-acoustic factors are characterised, it remains challenging to make generalised recommendations to mitigate health impacts.

**Referentie:** Woodland, L., Minkin, M. & Fenech, B. (2024). *Health effects related to wind turbine sound – a rapid evidence review covering 2020-2024* [Paper presentation].  
InterNoise, Nantes, France.

**Datum van publicatie:** 25-08-2024

**Opmerkingen:** Congres paper

**10. Titel: Participatie in de praktijk - Een kwalitatief onderzoek naar inwonerparticipatie en de beleving hiervan bij zonne- en windparken**

**Beschrijving (gekopieerd):** Zonneparken en windparken kunnen een belangrijke bijdrage leveren aan de verduurzaming van de energieopwek. Ze hebben echter effecten op de leefomgeving. Via inwonerparticipatie wordt getracht om omwonenden te betrekken in deze veranderingen. In dit kwalitatieve onderzoek is bij acht verschillende projecten gekeken naar inwonerparticipatie in de praktijk en hoe inwoners dit ervaren. Welke kenmerken van inwonerparticipatie zorgen voor een positieve beleving van het participatieproces? En waar is ruimte voor verbetering?

**Referentie:** Peuchen, R., Klösters, M., Grift, E. v. d., Gitte Mulder & Paradies, G. (2024). *Participatie in de praktijk - Een kwalitatief onderzoek naar inwonerparticipatie en de beleving hiervan bij zonne- en windparken* (TNO 2024 R10767).

**Datum van publicatie:** 1 juli 2024

**Link naar bron:** <https://energy.nl/publications/participatie-in-de-praktijk/>

**Opmerkingen:** Dit project is gefinancierd als onderdeel van het onderzoeksprogramma Energietransitie Studies onder regie van de directie Klimaat van het DG Energie en Klimaat van het ministerie van EZK met als doel het leveren van kennis voor energiebeleid.