



## Driemaandelijks overzicht van relevante literatuur over windenergie en gezondheid Q1-2024

Periode: Januari t/m maart 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

| Fase   | Januari-<br>Maart<br>2024 |
|--|---------------------------|
| Aantal artikelen gevonden met zoekstrategieën voordat selectie heeft plaatsgevonden                  | 164                       |
| Aanvullende referenties gevonden via andere bronnen (dit betreft niet de grijze literatuur)          | 0                         |
| Aantal referenties na verwijdering van duplicaten  | <b>138</b>                |
| Verwijderde referenties omdat ze niet relevant zijn (voldoen niet aan inclusie en exclusie criteria) | 128                       |
| Aantal relevante artikelen geselecteerd door reviewers   | 10                        |
| Aantal artikelen waarover reviewer 1 en reviewer 2 hebben afgestemd (grensgevallen)                  | 4                         |
| <b>Totaal aantal relevante artikelen (na afstemmen)</b>  | <b>7</b>                  |

RIVM

A. van Leeuwenhoeklaan 9  
3721 MA Bilthoven  
Postbus 1  
3720 BA Bilthoven  
www.rivm.nl

T 088 689 9111

**Datum:**

26 april 2024

**Kenmerk:**

EP WE&G

**Contact:**

windenergie@rivm.nl

## **Overzicht van de relevante studies**

### **1. Titel: Nature is ours! – Psychological ownership and preferences for wind energy**

**Samenvatting (gekopieerd uit artikel):** Psychological ownership (PO) is a phenomenon whereby individuals feel ownership of goods they do not necessarily formally own. A substantial body of literature in marketing, consumer psychology, and organizational sciences conceptualizes PO as value-enhancing and an underlying factor of the endowment effect. Recent psychological research has documented that people can also experience PO of environmental public goods and suggested that PO could generate land use conflicts and territorial behavior, which is particularly relevant for renewable energy development. Renewable energy represents a critical social issue with competing interests and policy objectives, often faced with severe public opposition. More research is needed on the underlying mechanisms of opposition to mitigate conflicts and increase efficiency in policy implementation. In this paper, we assess how PO influences people's economic choices and valuation of environmental effects from wind energy, illuminating psychological processes underlying decision-making. First, we provide a novel theoretical framework suggesting that PO increases people's valuation of environmental public goods and leads to resistance against their transformation due to weak substitutability between environmental protection and money income. We test these predictions in two discrete choice experiments on preferences for wind energy, where one examination is conducted from a local perspective and the other from a national perspective. The national experiment permits the analysis of spatial dimensions of PO and willingness to pay to avoid wind energy externalities. Using a hybrid mixed logit approach, we find consistent support for hypothesized effects in both experiments. Our scientific findings suggest that the PO phenomenon should be given more attention in public management of renewable energy development to overcome land use conflicts and territorial behavior. © 2023 The Author(s)

**Referentie:** Dugstad, A., Brouwer, R., Grimsrud, K., Kipperberg, G., Lindhjem, H. & Navrud, S. (2024). Nature is ours! – Psychological ownership and preferences for wind energy. *Energy Economics*, 129.

**Link naar bron:** <https://doi.org/10.1016/j.eneco.2023.107239>

### **2. Titel: Noise-induced sleep disruption from wind turbines: scientific updates and acoustical standards**

**Samenvatting (gekopieerd uit artikel):** A step change is needed in the deployment of renewable energy if the triple challenge of ensuring climate change mitigation, energy security, and energy affordability is to be met. Yet, social acceptance of infrastructure projects and policies remains a key concern. While there has been decades of fruitful research on the social acceptance of wind energy and other renewables, much of the extant research is cross-sectional in nature, failing to capture the important dynamic processes that can make or break renewable energy projects. This paper introduces a Special Issue of *Energy Policy* which focusses on the neglected topic of the dynamics of social acceptance of renewable energy, drawing on contributions made at an international research conference held in St. Gallen (Switzerland) in June 2022. In addition to introducing these papers and drawing out common themes, we also seek to offer some conceptual clarity on the issue of dynamics in social acceptance, taking into account the influence of time, power, and scale in shaping decision-making processes. We conclude by highlighting a number of avenues of potential future research. © 2023 Elsevier Ltd

**Referentie:** Ellenbogen, J. M., Kellam, C. B. & Hankard, M. (2024). Noise-induced sleep disruption from wind turbines: scientific updates and acoustical standards. *Sleep*, 47(2).  
**Link naar bron:** <https://doi.org/10.1093/sleep/zsad286>

**3. Titel: Taking the carbon capture and storage, wind power, PV or other renewable technology path to fight climate change? Exploring the acceptance of climate change mitigation technologies – A Danish national representative study**

**Samenvatting (gekopieerd uit artikel):** Despite numerous prior studies regarding public acceptance of climate change mitigation technologies, most academic papers focus on individual technologies in their analyses. Little is known about the acceptance of multiple low-carbon energy technologies. This study bridges this research gap and explores the cross-technology acceptance of various energy solutions at different locations. Thus, we provide a comprehensive understanding of public acceptance patterns by analysing a broader range of technologies concurrently, focusing on: (a) nuclear power, (b) district heating, (c) energy-saving technologies, (d) onshore, nearshore, and offshore wind power (WP), (e) photovoltaics (PV) installed on agricultural land, industrial roofs, and private roofs, and (f) carbon capture and storage (CCS) in offshore, nearshore, rural onshore, and urban onshore locations. Based on Danish nationally representative survey data, our results give strong policy indications that PV on industrial rooftops is accepted at the highest level. In contrast, nuclear power, onshore rural and urban CCS, and nearshore CCS are the least accepted technologies to combat climate change among the Danish public. Additionally, we discover that the acceptance of a specific technology is contingent on locations. Specifically, the public acceptance of PV, WP, and CCS depends on the place of living and the potential location of technology placement. Finally, this study explores subgroup analyses to compare acceptance differences according to gender, age, education, income, and location of residence. © 2023 The Authors

**Referentie:** Ladenburg, J., Kim, J., Zuch, M. & Soytaş, U. (2024). Taking the carbon capture and storage, wind power, PV or other renewable technology path to fight climate change? Exploring the acceptance of climate change mitigation technologies – A Danish national representative study. *Renewable Energy*, 220. **Link naar bron:** <https://doi.org/10.1016/j.renene.2023.119582>

**4. Titel: Do concerns about wind farms blow over with time? Residents' acceptance over phases of project development and proximity**

**Samenvatting (gekopieerd uit artikel):** Social acceptance is a key issue for the continued expansion of onshore wind energy. Wind energy development targets increasingly rely on the assumption that residents' concerns related to new wind farms dissipate over time. The persistence of resistance to new wind farms has motivated efforts to investigate this effect. The 'U-curve' hypothesis proposes that acceptance is likely to decrease when residents are confronted with the planning of a wind farm in their neighbourhood, but that acceptance may later recover during construction and operation. In this study, relevant research is reviewed, discussed, and applied using a largescale experimental survey focused on residents living within 10 km of an existing wind farm in Ireland (n = 1109). It uses two indicators of how people experience wind farms to investigate willingness to accept further developments. The indicators include the proximity of existing wind farms and their development phase (i.e., planning, construction or operation). The findings show that experience is an important determinant of acceptance, as are an awareness of low-carbon energy initiatives and sense of community spirit. The study examines residents' expectations for participatory

fairness and local benefits. Expected adverse impacts on local tourism or potential for discord within the community influence the acceptance for further development. Acceptance is also determined by trust in sources of information, including a designated community liaison officer. The concerns of residents living within the nearest 2 km radius of a wind farm and at the earliest and most uncertain phases of project planning can be crucial issues for acceptance. © 2023 The Authors

**Referentie:** le Maitre, J., Ryan, G. & Power, B. (2024a). Do concerns about wind farms blow over with time? Residents' acceptance over phases of project development and proximity. *Renewable and Sustainable Energy Reviews*, 189.

**Link naar bron:** <https://doi.org/10.1016/j.rser.2023.113839>

### **5. Titel: Mechanisms to promote household investment in wind energy: A national experimental survey**

**Samenvatting (gekopieerd uit artikel):** Citizen investment into wind energy is conducive to public acceptance and can contribute to closing the renewable energy investment gap, while promoting corporate social responsibility. This study addresses this topic and conducts a novel choice experiment to determine the investment preferences of a representative sample of 1,009 Irish households. First, the paper investigates the attributes determining willingness to invest into wind farms. Second, it considers to what extent public attitudes and proximity to wind farms affect investment. Third, it assesses the suitability of five specific investment mechanisms. Through these activities the findings enhance current understanding of the opportunities and challenges concerning the design of citizen investments within a centralised system which is predominantly reliant on incumbent wind energy developers. The findings show that the risk of loss and the expected annual return on investment are the main attributes determining investment decisions, but secondary criteria, such as the project location and ownership characteristics, also affect willingness to invest. Respondents living within 10 km of a wind farm or expressing support for wind energy are significantly more likely to consider investing. Recommendations include interventions to encourage joint ventures between community organisations and specialised developers as a mechanism to promote investment in wind farms. © 2023 The Authors

**Referentie:** le Maitre, J., Ryan, G., Power, B. & Sirm, G. (2024b). Mechanisms to promote household investment in wind energy: A national experimental survey. *Renewable Energy*, 220.

**Link naar bron:** <https://doi.org/10.1016/j.renene.2023.119557>

### **6. Titel: A capability approach to analyse well-being impacts of wind energy infrastructure**

**Samenvatting (gekopieerd uit artikel):** This paper operationalises the capability approach to analyse the tensions and trade-offs in assessing well-being outcomes generated by the production of wind energy, and how these reflect social acceptance at the local level. Specifically, the paper addresses the difficulties in understanding the voice of Indigenous people living near wind energy infrastructure in Southern Mexico and how their conceptions of well-being can be used to estimate the impact of wind energy development on three different communities. The methodology involved a three-stage process that integrated semi-structured interviews, focus groups, a survey, and participatory workshops, involving 450 participants. The findings conclude that community acceptability of energy infrastructure such as wind farms will only be achieved through inclusive community engagement that considers valued ways of being and doing of the local population. These include increasing the opportunities for people to

live in good health, skilled employment in the industry, engaging and integrating local culture, values, worldviews and needs, and having a collective approach to the distribution of economic benefits that may strengthen social networks. By focusing on the recognition of valuable human capabilities from a participatory mixed-methods perspective, this paper contributes to a more compelling body of theory on social wind energy impacts that focuses on locally defined priorities and perspectives. Furthermore, this study also shows how the inclusion of community members as co-researchers is crucial to validate and locate local knowledge at the forefront while allowing local stakeholders to exercise greater voice and agency in how the research is conducted and designed. We hope that this methodology can offer useful insights for the design and implementation of future renewable energy projects that have environmental and social sustainability in mind. © 2024 The Author(s). Published by IOP Publishing Ltd.

**Referentie:** Velasco-Herrejón, P., López, T., Romo, L., J, A., Antonio, E., T, K., Carrasco, M., Hernández, R., Ignacio, H., L, Y., Gutiérrez, F., G, A., Jiménez, L., L, S., Rueda Rasgado, N. I., Martínez, S. & Martínez, A. (2024). A capability approach to analyse well-being impacts of wind energy infrastructure. *Environmental Research: Infrastructure and Sustainability*, 4(1).

**Link naar bron:** <https://doi.org/10.1088/2634-4505/ad269c>

### **7. Titel: Multi-objective calibration of vertical-axis wind turbine controllers: balancing aero-servo-elastic performance and noise**

**Samenvatting (gekopieerd uit artikel):** Vertical-axis wind turbines (VAWTs) are considered promising solutions for urban wind energy generation due to their design, low maintenance costs, and reduced noise and visual impact compared to horizontal-axis wind turbines (HAWTs). However, deploying these turbines close to densely populated urban areas often triggers considerable local opposition to wind energy projects. Among the primary concerns raised by communities is the issue of noise emissions. Noise annoyance should be considered in the design and decision-making process to foster the social acceptance of VAWTs in urban environments. At the same time, maximising the operational efficiency of VAWTs in terms of power generation and actuation effort is equally important. This paper balances noise and aero-servo-elastic performance by formulating and solving a multi-objective optimisation problem from a controller calibration perspective. Psychoacoustic annoyance is taken as a novel indicator for the noise objective by providing a more reliable estimate of the human perception of wind turbine noise than conventional sound metrics. The computation of the psychoacoustic annoyance metric is made feasible by integrating it with an accurate and computationally efficient low-fidelity noise prediction model. For optimisation, an advanced partial-load control scheme – often used in industrial turbines – is considered, with the  $K\omega^2$  controller as a baseline for comparison. Optimal solutions balancing the defined objectives are identified using a multi-criteria decision-making method (MCDM) and are subsequently assessed using a frequency-domain controller analysis framework and mid-fidelity time-domain aero-servo-elastic simulations. The MCDM results indicate the potential application of this controller in small-scale urban VAWTs to attain power gains of up to 39 % on one side and to trade off a reduction in actuation effort of up to 25 % at the cost of only a 2 % power decrease and a 6 % increase in psychoacoustic annoyance on the other side compared to the baseline. These findings confirm the flexible structure of the optimally calibrated wind speed estimator and tip-speed ratio (WSE-TSR) tracking controller, effectively balancing aero-servo-elastic performance with noise emissions and marking the first instance of integrating residential concerns into the decision-making process. © Author(s) 2024. This work is distributed under the Creative Commons Attribution 4.0 License.

**Referentie:** Brandetti, L., Mulders, S. P., Merino-Martinez, R., Watson, S. & van Wingerden, J. W. (2024). Multi-objective calibration of vertical-axis wind turbine controllers: balancing aero-servo-elastic performance and noise. *Wind Energy Science*, 9(2), 471-493.

**Link naar bron:** <https://doi.org/10.5194/wes-9-471-2024>

Tabel 2 Indeling van de wetenschappelijke literatuur naar type en onderwerp.

|   | Hinder           | Slaap             | Gezondheid divers       | Anders (bijv. co-determinanten)                        |
|---|------------------|-------------------|-------------------------|--|
| <b>Tekstmining (bijv. sentiment analyse van (sociale) media artikelen)</b>      |                  |                   |                         |  |
| <b>Case study</b>   |                  |                   |                         |  |
| <b>Observationeel (bijv. Cross-sectionele, cohort, of case control studies)</b> |                  |                   | Velasco-Herrejón (2024) | le Maitre (2024a); le Maitre (2024b); Ladenburg (2024) |
| <b>Experimenteel</b>  |                  |                   |                         |  |
| <b>Review</b>   |                  | Ellenbogen (2024) |                         |  |
| <b>Anders (bijv. theoretisch model, opinie,...)</b>                             | Brandetti (2024) |                   |                         | Dugstad (2024)   |

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

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

##### **1. Titel: Windpark De Drentse Monden en Oostermoer. Metingen geluidemissie Beschrijving (gekopieerd uit rapport)**

In opdracht van gemeente Aa en Hunze en van gemeente Borger-Odoorn hebben wij controle-metingen verricht van de geluidemissie van de windturbines van het windpark De Drentse Monden en Oostermoer (DMO). Doel van de metingen is te controleren of de geluidemissie overeenkomt met de specificaties. Aanleiding van de metingen is het eerder verricht onderzoek waarbij gedurende langere tijd metingen in de omgeving van het windpark zijn verricht. Bij dat onderzoek is in beperkte mate een hogere geluidimmissie gemeten dan verwacht bij de tertsbanden van 100 en 125 Hz (zie rapport R068502aa.22CH7TH van 30 januari 2023).

Met deze metingen zal ook de geluidbelasting Lden worden beoordeeld en de eventuele tonaliteit van het windpark.

**Referentie:** Dijkstra, M. (2024). *Windpark De Drentse Monden en Oostermoer Metingen geluidemissie* (R001\_05\_068502aa). LBP Sight.

**Datum van publicatie:** 25-01-2024

**2. Titel: Nationale windturbinebepalingen leefomgeving. Voorlopig toetsingsadvies over het milieueffectrapport**

**Samenvatting (gekopieerd):** De regering wil nieuwe nationale milieunormen voor windturbines vaststellen. Sinds juli 2021 gelden geen nationale normen meer vanwege een uitspraak van de hoogste Nederlandse bestuursrechter, de Afdeling Bestuursrechtspraak van de Raad van State. Die oordeelde dat een milieueffectrapport (MER) nodig was voor de nationale normen die toen golden. Voordat een besluit genomen wordt over de nieuwe normen, de nationale windturbinebepalingen leefomgeving, is een MER opgesteld. De staatssecretaris van Infrastructuur en Waterstaat heeft de Commissie voor de milieueffectrapportage (de Commissie) gevraagd te adviseren over dit MER. In dit advies spreekt de Commissie zich uit over de juistheid en de volledigheid van het MER.

**Referentie:** Commissie voor de milieueffectrapportage. (2024). *Nationale windturbinebepalingen leefomgeving, Voorlopig toetsingsadvies over het milieueffectrapport*.

**Datum van publicatie:** 24-01-2024

**Link naar bron:** <https://commissiemer.nl/docs/mer/p36/p3615/a3615vts.pdf>