

# Wind turbine noise affects dream sleep and perceived sleep restoration

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Wind turbine noise (WTN) influences people's perception of the restorative effects of sleep, and also has a small but significant effect on dream sleep, otherwise known as REM (rapid eye movement) sleep, a

study at the University of Gothenburg shows. A night of WTN resulted in delayed and shortened REM sleep.

Knowledge of how sleep is affected by WTN has been limited to date. Research involving physiological study of its impact using polysomnography, the top-ranking method of sleep recording, is lacking.

Studies carried out in the Sound Environment Laboratory at the Department of Occupational and Environmental Medicine in Gothenburg, Sweden, are adding new knowledge in the field. Polysomnography involves using electrodes attached to the head and chest to record brain activity, eye movement, heart rate, etc. during sleep.

Of the 50 participants in the new study, 24 had been living within one kilometer of one or more [wind turbines](#) for at least one year. The other 26, the reference group, did not live near wind turbines.

Kerstin Persson Waye, Professor of Environmental Medicine at Sahlgrenska Academy, University of Gothenburg, is the corresponding author in the study, published in the journal *Sleep*.

"We wanted to find out whether people exposed to noise from wind turbines over time become more sensitive or more habituated to WTN, so that their sleep may be affected differently than someone who doesn't live near any turbines," she says.

## **Fewer minutes of dream sleep**

The participants spent three nights in the Sound Environment Laboratory, one for acclimatization and then, in a random order, one quiet night and one with four separate periods of WTN. The sounds that were used were modeled based on outdoor measurements from several

wind turbines, and was filtered to correspond with the sound insulation of a typical Swedish wooden house. Exposure was further modeled, to correspond to sleeping with a closed window and window ajar respectively.

The sounds were chosen to represent relatively unfavorable conditions, with a slightly higher average outdoor noise level than is currently permitted in Sweden. This level corresponded, however, with a low indoor noise level—below the levels at which sleep had previously been found to be affected by, for example, traffic noise.

During the night with WTN, according to the physiological measures, the participants spent an average of 11.1 minutes less in REM sleep, which they entered 16.8 minutes later than during the quiet night. The proportion of time they spent in REM sleep was 18.8% for the night with WTN, compared with 20.6% for the quiet night—a small but statistically [significant difference](#) that, moreover, was independent from habituation to WTN.

There were no statistically significant differences in other sleep parameters, such as number of awakenings, total sleep time, time in deeper (non-REM) sleep stages or fragmentation of deep sleep, and heart rate. However, rhythmic sound variations appeared to disturb sleep, especially with closed windows.

## **Less well rested in both groups**

Besides the physiologically based measurements, participants filled out a questionnaire on their sleep quality and how tired or rested they felt. Both groups reported that they slept worse during nights with WTN.

The study gave no indication of the habituation effect or increased sensitivity in the participants exposed to wind turbines in their home

environment. However, the group that lived close to [wind](#) turbines reported worse sleep overall, even during the quiet night.

"Sleep disturbance, a negative health effect according to the World Health Organization (WHO), can in itself contribute to chronic diseases. However, we can't draw conclusions from this study on long-term health impact. Further studies should, if possible, investigate sleep in people's home environments and include longer exposure time," Kerstin Persson Waye concludes.

**More information:** Michael G Smith et al. A laboratory study on the effects of wind turbine noise on sleep: results of the polysomnographic WiTNES study, *Sleep* (2020). [DOI: 10.1093/sleep/zsaa046](https://doi.org/10.1093/sleep/zsaa046)

Provided by University of Gothenburg

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