Wind power self-interest and rural residential development - a conflict of objectives.

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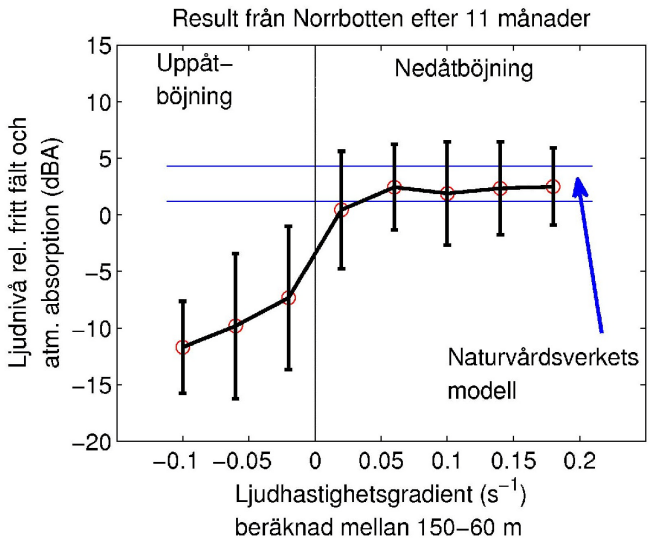
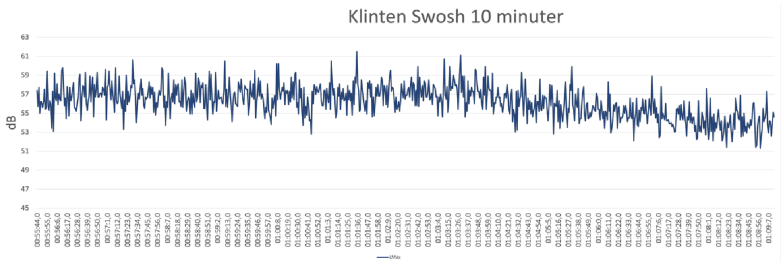
Background: I am a retired internal medicine physician who since 2009 has followed with concern the expansion of wind power in Sweden, where space is now being sought for ever larger farms and more powerful plants in order to satisfy increased electricity demand through the transition from oil gas and coal to the mix of solar, wind and hydro power. Wind power is now a national interest that takes precedence over other national interests, with the health of rural populations and biodiversity taking a back seat. The political decision is to accelerate the expansion of wind power with cost reductions in the form of electricity certificates in order to counteract further temperature rises above 1.5 degrees. And to expand electricity generation for fossil-free steel, electric cars and hydrogen production. Now, in addition, decisions on wind farm projects are to be speeded up by making the veto process as short as possible. This is because it has noticed the stiff municipal resistance to establishments to the extent that in 2021 78 project applications were rejected by municipal boards. Explanations for this hardening climate are illustrated in my article.
A recent change in the Environmental Code,has the purpose to speed up permit procedure before installing and also to further expand new wind mill parks. Thus, after an initial consultation, where local residents have been informed about the project and it has been examined and approved by the municipality and in the environmental assessment delegation, the permit owner to create more and larger plants in the same project, (see below!) no longer need to seek views of local residents and affected locals in a renewed consultation. In other words, the democratic need for transparency on the part of local residents is made more difficult.
Adjustments in SNV regulations on wind power noise: The Swedish Environmental Protection Agency's guidance on wind power noise 2020 does point out on page 7 that, depending on different meteorological conditions and amplitude modulation, sound levels around the turbines outdoors can increase by 10-20 decibels A up to 2 km away from the turbines. Which my practical cases illustrate.
However: in order to increase the area where wind power is considered to have suitable wind conditions according to wind mapping, guidelines for noise from wind turbines have been adjusted to allow turbines to be located 300 m closer than they were in 2002. Onshore wind turbines were 2-3 mega-watts in 2002, now they are 6-8 megawatts (,offshore, or coastal from a cost point of view), 10-15 MW each, more than 300m high. Compared to 2002, the 2020 version has removed the requirement to reduce the noise limit at night to a maximum of 35 decibels in quiet settlements, special consideration is no longer given to wind protected locations The tightening for wind protected locations was introduced in 2002 when it was considered that a very low background level could lead to a higher level of disturbance, but has in the SNV 2020 version been considered undemocratic and removed! WHO conclusion (Guidelines 2018) is that noise level above 38.5 dBA means "adverse health effects" Deutsche Immissionsschutz proposes 10 x tower height as distance from wind farm to dwellings, clearly rejects dBA as measurement standard and proposes development of new regulatory framework in collaboration with medical expertise. However, SNV2020 no longer takes into account the deflection of sound, which takes place in the evening when the air is cooled and is heaviest at ground level, now with a summer temperature of 15 degrees, not with paved frozen ground or hilly terrain without flat cereal fields. The significance of climate for noise levels from wind turbines on flat land (Gotland), flat forest terrain (Småland) and in hilly forest terrain (Norrbotten) was investigated in 2014 by Conny Larsson and Ulf Öhlund at the Department of Meteorology, Uppsala University, with measurements around 12 wind turbines over 11 months.

Result from Norrbotten over 11 months

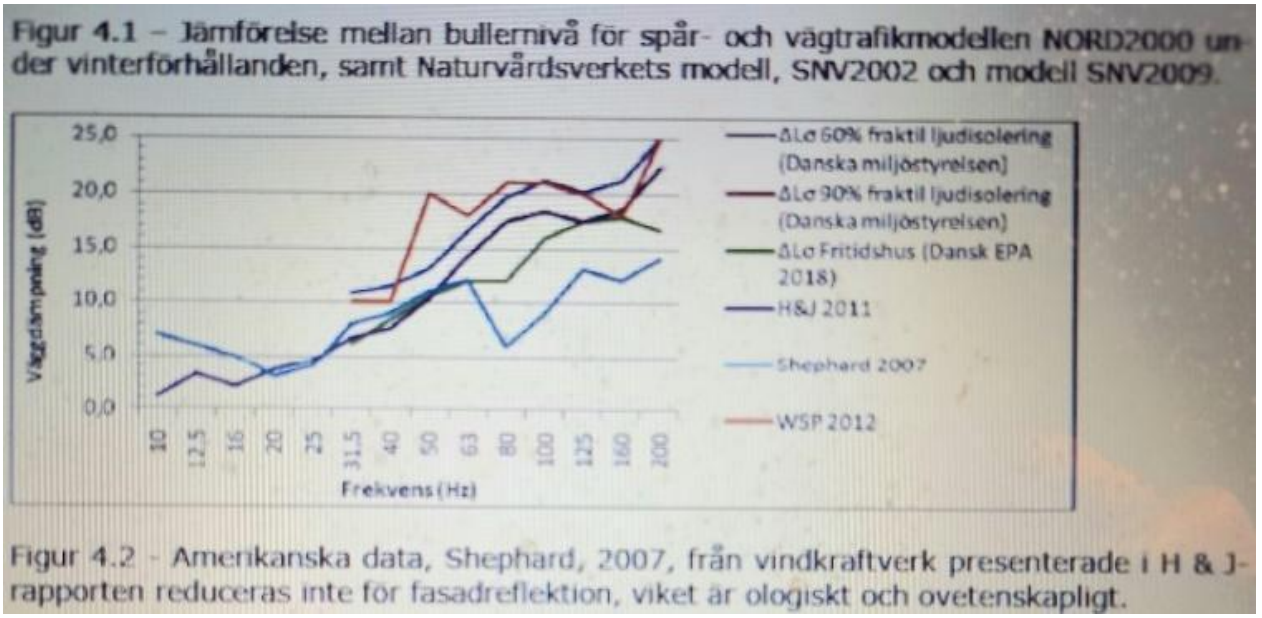




The measured sound levels, which especially in the evening are additionally amplified by amplitude modulation, the swoshlanget (which itself fluctuates up to +5-6 dB/ 10 minutes, see graph), clearly show that in quiet evenings, nights and mornings when the air is coldest and heaviest on the ground, the sound level due to the downward bending of the sound is 10-15 dBA higher then than in the daytime, see graph. This is not taken into account in SNV 2020, which reduces the consultants' reported measurements. The measurement model for calculating wall attenuation of indoor noise used by the consultants now engaged and developed by Hoffmeyer and Jacobsen is, according to Professors Kerstin Person Waye and Henrik Möller, so incorrect, exaggerating wall attenuation by up to 30 decibels, that they, because of methodological fallacies due to lack of available data to compare three different methods ,warned against its use. Nevertheless it was used in all permit applications in Sweden. Wooden villas in Sweden are built for thermal insulation, not for noise protection, and have a wall stiffness one tenth that of concrete walls. Infrasound and low frequencies dominate wind noise and wall attenuation is 10-20dB worse for wind noise than for traffic noise which predominates from 300 hz and upwards But they are calculated by the H&J method to be as sound attenuating as concrete walls! A measurement method according to Shephard 2007 in the USA, based on free-field measurements against wind turbines shows at 63-160 Herz in comparison with the H&J method up to 12 decibels les attenuation of indoor noise in Swedish wooden villas than the Danish model. Exactly the frequencies that cause edge

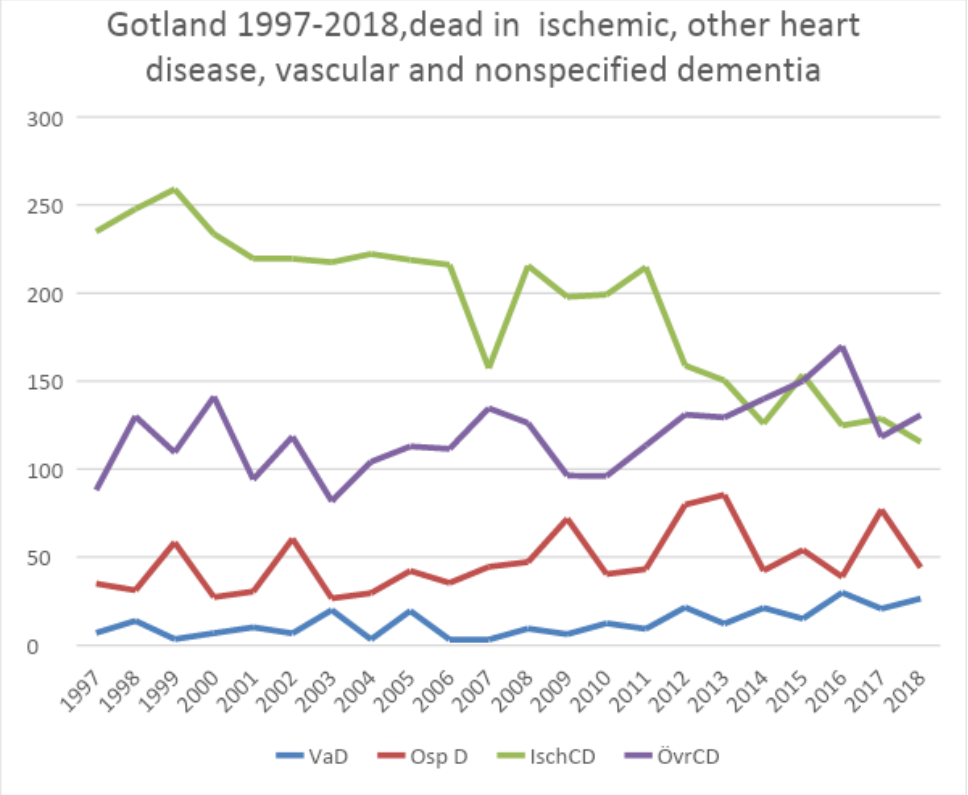
oscillation in the bedrooms of wooden villas, common dimensions 4x4 m. Measurement method differences at terns from 10-200 Herz between 3 types of walls according to Danish EPA, H&J 2011,WSP measurement of airport noise and Shephard's methods fig. 4 Difference largest at 80 Hz where FOHM indoor noise guidelines are exceeded by 12 decibels, see fig. 1

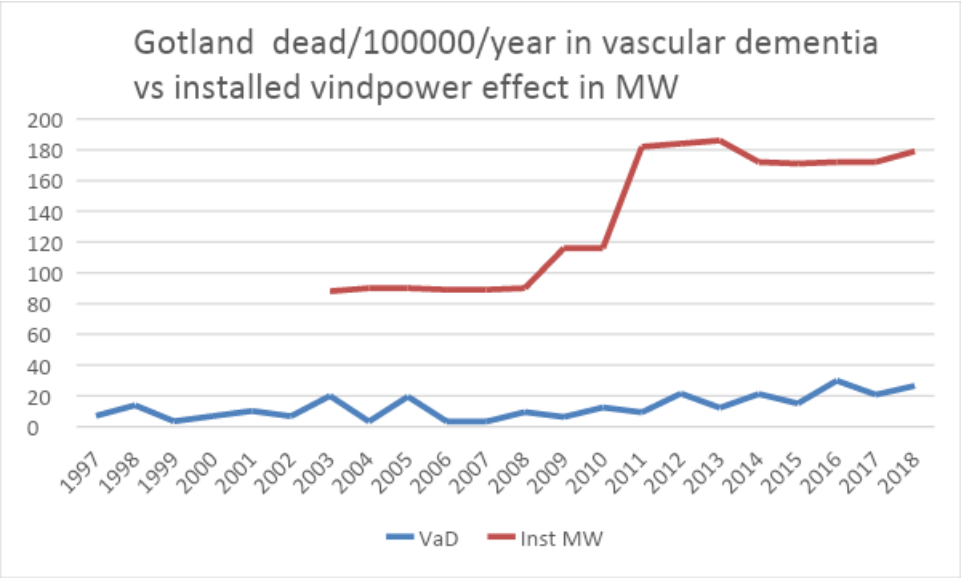
Fig 1 Differences in wall attenuation with methods according to Danish EPA, Hoffmeyer & Jacobsen, WSP and Shephard 2007 (original article 1991)



Ljungbyholm, in Småland, is one example of many wind farms. There, permission was granted in 2013 for the start-up of 8 4-megawatt turbines of the Siemen type, and this was done with a consultation procedure and by obtaining the views of local community members. With the authorisation from the Environmental Approval Delegation, which did not lead to the start until 2021, the wind company could, without the requirement for new consultation, exchange these for 8 4 MW Nordex turbines and were allowed 4 more in the far west, in fact, according to closer examination, now 4.5 MW Nordex turbines, at 200 m total height, source noise 108.1 from 12 m/sec. Instead of Gothia AB, which went bankrupt, OX2 took over and now owns the project.
Public health and environmental aspects: For me and medical colleagues I know, there is growing concern about the impact of wind power expansion in rural areas with noise, lantern lights and shadows from rotor blades and other inputs on the health of humans and other living creatures, biodiversity, a living countryside and our self-sufficiency. Within a few months of the start of work, I have received the following stories from Ljungbyholm, each illustrating how their health and habitat have been affected by various departures from previous stricter noise restrictions, departures from which were only 2-3 MW in strength anyway! Much emphasis has so far been placed on studies of the adverse effects of community noise from road, air, rail and other industrial noise sources on human health in the form of clearly demonstrated excess cardiovascular disease, and impaired learning in children (Babisch, Stansfeld, Bluhm, Jansen et al.) at long-term exposure levels above 55 dBA Leq e.g. in Denmark > 58dBALeq. Limit around wind power where 45 dBALeq, Poulsen's long term prevalence study on 711000 Danes around 7800 works from 1983-2013 gives small but significant increased risk of heart attack, doubtful (small number of people) outcome regarding stroke. However, hub height of studied turbines

suggests significantly lower megawatt power than current turbines. WHO guidelines 2018 mention that epidemiological studies have not yet provided the same evidence regarding noise from wind power, although it is known that the rate of very disturbed at 40 decibels A is higher from wind power (Jansen 2011,Bluhm 2011) than other noise, and this occurs at night and irregularly in quiet rural areas, the others mainly during the day. In a study from ETH in Zurich 2018 (Schäffer, Pieren et al), disturbance levels according to ICBEN (new,11degree scale) and sleep patterns of 52 subjects with normal hearing were measured by white noise recorded at 40 dBaLeq, wind power sounds with or without periodic or irregular amplitude modulation and separate LFNsounds with increasing amplitudes. The least disturbing was white noise, more wind noise and most LFN noise. Sleep less than 6 hours from age 50 vs more than 7 hours increases risk of dementia by 30% . Interestingly and an observandum on Gotland is that deaths from vascular dementia increase significantly from 2009-2018 while installed wind power in megawatts increases significantly. This in contrast to other kinds of CVD





Sources: SCB and Vindbrukskollen
The other noise sources have from 0-20000 Herz unfiltered sound amplitudes essentially equal and 70-100 decibels in the whole frequency spectrum while for wind power the amplitudes at 0-10 Herz are above 110-130 decibels to decrease with increasing frequencies The lowest 0-10 Herz of these have the highest penetration capability in biological tissues, into the cellular level in all organs they can as yet demonstrated at the cell and animal experimental level in t.e. e.g. alter cell membrane structure, genes, impair our protection against free oxygen radicals, change the structure of vascular walls and connective tissue while frequencies above 4000 Herz are already absorbed in superficial body tissues.
Practical case: 1) A family, father 37, mother 38, daughter 6 and son 3 years old, previously healthy residents with 800 m distance from a semicircle of 4 works SE-SW about them, all get within a few months after the start, all hypersensitivity to noise. At 220 and 1760 Herz. The son no longer tolerates the children's screams at the free time or the father rustling a paper bag, all sleep worse and are easily awakened, inside the bedroom is measured with dBA/dBC meter 32 decibel A (FOHM upper limit 30 decibel),in a corner is measured up to 49.8 decibel C, that is, the difference with decibel A is 18 dB ,well above the difference 15 dB where WHO guidelines require tersband measurement. Outside the house 45-48 decibels A have been measured outside the house in winds of 5-6 m/s where forest noise is however included but also when there were only winds of 4-5 m/s, 42-44 dBA were measured. If the father in the house walks in the direction of a work in the SW, No. 4, away towards a house 300 m further away in the NE, there is more noise there than outside his house, i.e. the noise is bent down. Their previously calm horses now become anxious and frustrated when there is wind from the SW and noise from the works , not when there is no wind. Elk seen in the fields south of the house are no longer seen when the turbines are running. Wind didn't make a difference to the horses before!
2) A couple in their 60s live 1000 m SW of the westernmost works partly hidden by an irregular gravel pit. The woman had menstrual related severe migraine with vomiting until menopause 13 years ago, After the start of the work the migraine has returned. Since the works started she has had difficulty sleeping 2 - 4 nights/week due to noise from the works, waking for 30 minutes several times a night and sleeping 2 hours at a time, 5 1/2 hours in total as opposed to the normal 7 1/2. every sleep disturbed night she has had headaches. In addition to the headaches, she gets uncomfortable pressure sensations in

her body, Her husband, a carpenter with tinnitus, got rid of the tinnitus when he moved to the area 20 years ago. After starting work, the tinnitus has returned. The worst noise disturbances occur when the wind blows from the NE in November 2021 when the whole house vibrated, but also at VNV or OSO wind direction, i.e. with the rotor plane directed towards the house ! That is to say the noise also in the rotor plane. Bedroom 4x4 meters. Between the house and turbine 1 is a gravel pit 100-400 m from turbine 1. Which is not taken into account in the input data used by the consultant. Of interest is that they had chickens for 10 years, 700 m from plant 1 in a cage with dimensions 1.5x5 m, After the start of the plants, the hens no longer incubate for 21 days but stop after 10 days and the chicks are dead, unhatched in the eggs.
3) Another person in the area lives with his partner in a wooden house 2200-2300m NNV from 2 turbines, (it is intended to allow turbines closer than 800 meters from homes!) who according to the consultant is exposed to 34.1 dBA, According to calculation using SNV2002 with ground attenuation of noise, Wind Pro with noise database from 1100 tools and statistical software, this resident is exposed to 44.5 dBA in place of the home (wooden villa). The consultant has not measured at this house!! 2 -3 nights per week he has been exposed to noise (like airplanes) in the bedroom, (dimensions 4x 5m), the bed at the wall. He received noise injury in grenade rifle squad during military service and had several ear infections as a child. The ensuing hissing disappeared within a year when they moved there 13 years ago but has returned after work started in March 2021. He feels general discomfort, especially at bedtime around 10 p.m., it kind of pumps in his body he feels pressure in his head and nausea. He then sleeps 1-2 hours at a time 6-8 hours a night. The worst problems are experienced with southeast winds from works 1 and 2 and fog. Lateral reflection of noise from an elongated gravel pit in SSW-NNW direction at this wind direction is added! Even the partner experiences the same discomfort when trying to sleep. The house is an old log house, but has been renovated in stages. Ear plugs against the noise rather amplify the noise discomfort. This is logical, as the plugs only attenuate sounds in the frequency range from 200 -3000 Herz, not in the
and low-frequency (0-200 Hz) range and the human ear can perceive to the threshold 83 dB filter-adjusted sound down to 25 Herz (Landström et al 1985). None of these 4 concerned was prepared for the onset of migraine, tinnitus and insomnia problems!

4) A property owner living 1240 m directly west of plant 1, receives according to the consultant 34 dBA, according to SNV 2002 with ground attenuation 36.6, according to SNV2002 without ground attenuation (sea model) 46.5. He has both a wooded area and part of a gravel pit between him and plant 1. If there is no wind at all in front of the house, and a cigarette lighter flame is not flickering outside, there is noise inside the cage window upstairs, i.e. there is wind shadow, sound deflection, sound reflections from the paved surface and self-resonance inside the house.

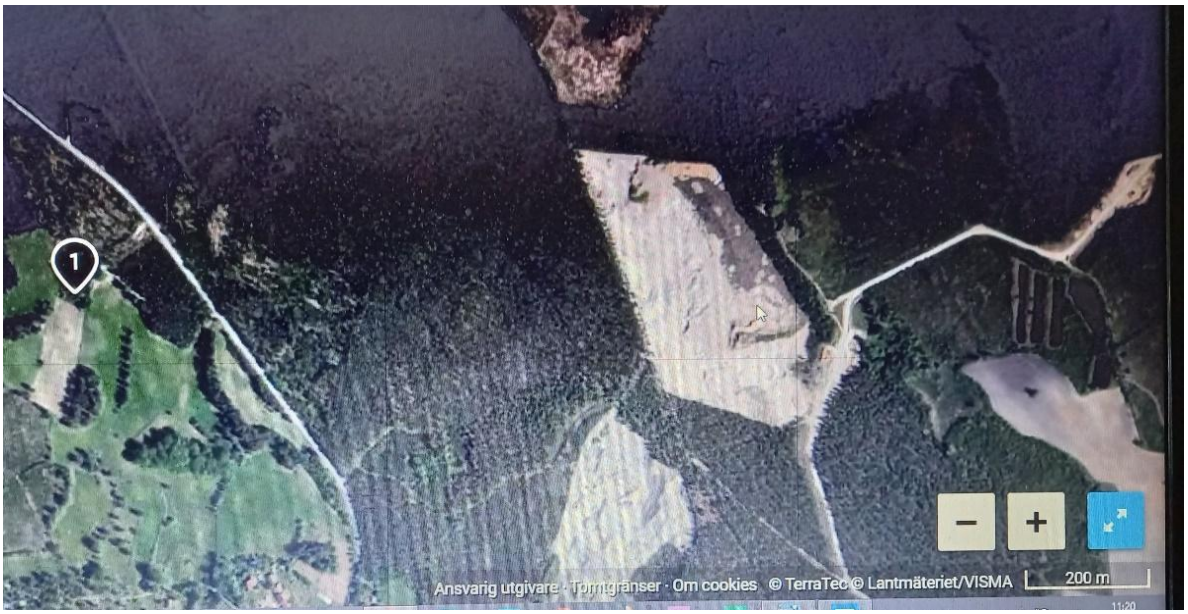


Fig. 2: Aerial photo showing the gravel pit and the forest booth between work 1 and the house 1240 m W of the work.

5) A family of 3 persons lives in a wooden villa from 1909 942 m north of the nearest work No. 8. 4 works (7-10) distance from the house is 942-1420 m. Decibel level outside according to the consultant 38, according to SNV 2002 with ground attenuation 42,3, according to SNV 2002 sea without ground attenuation which does not matter at 115 m hub height 50,8 decibel A!!. They can no longer stay outside in front of the house and in summertime now not sleep with the window open. Forest in front of the house in the direction of the turbines, well in line with the fact that the sound in the evening is bent down due to positive inversion, as well as summation noise from 4 turbines

These practical cases illustrate that the tall turbines should not be noise calculated as if ground attenuation would matter as they are 200 m tall to the tip of the rotor blade. The sound bends down. It is worse in bedrooms in the evening/night time. The frequencies in the range 63-100 Herz produce edge oscillation, which is amplified by so-called amplitude modulation that further increases the noise level by 10 - 20 decibels + 20 dB = 100 times higher energy content. The ear is capable of detecting the strong amplitude variations of 10 - 12 decibels lasting only 10 milliseconds, which are visible during short recordings of 10 minutes, but these are not visibly recorded and are smoothed out during noise measurement of equivalent noise for e.g. 8 hours. Frequencies 10 - 63 Herz are only absorbed 0.02 - 0.5 decibels per kilometre compared to the audible range which is attenuated 6 decibels at spherical, 3 decibels/kilometre at cylindrical propagation, even more at high humidity relative to the low frequencies. The complaints of the above-mentioned residents more than 2000 m away show this. Noise discomfort is consistent with different parts of the body being brought into self-resonance. For example, the rotor blades most commonly have a blade passage frequency past the base of the tower of 1.3 Hz, equivalent to the heart rate, the chest self-resonates at 4-5 Hz, the spine 10-12 HZ and the head 20-30 HZ. Three of the cases highlight that a number of diseases contribute to noise sensitivity. It has not been considered necessary to measure noise in houses further than 2000 m from the plants. Nevertheless, one property owner more than 2000 m away from the turbines experiences severe sleep problems, worst in foggy conditions. The consultant should have calculated 99% instead of 71% humidity. Add to this the noise from 3 turbines at a comparable distance from the home at the OS wind! A

number of scientific papers from professors of acoustics in the USA, Canada Australia and New Zealand, are not included in the 2020 SNV noise guidelines (Thomas Lagö, Colin Hansen, Wade Bray, Stephen Ambrose, Robert Rand, Bob Thorne et al) They show how e.g. measuring plates are wrongly placed, wrong wind protection of measuring plates, that amplitude modulation disturbs people in houses more than 3.5 km from wind farm, that the noise at 45 and 135 Herz is 10-15 dBA stronger 60 degrees sideways than in the wind direction! Instruments recording wind noise without adjusting filters show temporal correlation between sleep disturbance and frequencies in the low frequency range and acute symptoms in noise analyzing acousticians (Ambrose and Rand 2011), but no temporal correlation, when the same noise is recorded with decibel A filters, which remove 70 decibels out of 120 at 1 Herz. Indoor recording of indoor noise with 10 min recordings captures 10 millisecond-long amplitude variations of up to 15 decibels (Wade Bray) Already Neil Kelley criticized in 1985 the use of A-filters, which do not reflect the full noise exposure. See A-filter effect in table! References are not included in SNV noise guidelines until 2020. Lagö surveyed a wooden villa in Hestra in Småland Oct 2021. From increasingly powerful works, IFN and LFN increasingly dominate. From 14 3.6 MW plants in the north, at west wind 8-10 m/s 15.10 at 40 HZ 74 dBlin is reached indoors! (FOHM limit 49), lateral noise and rock reflections!! In addition, a study with measurement of dBA and dBZ 2021 in a wooden villa in Hestra, shows that an addition with wooden wall does not meet attenuation criteria for at least 50 dBlin ie not have standard design according to Cstandard STC-52. A loudspeaker emitted 100 decibels from inside the upstairs wall, and terrestrial measurements with a microphone on the outside recorded sound levels in terrestrial bands. The outer wall itself amplifies indoor noise at 32 HZ by 10 dB due to self-resonance.

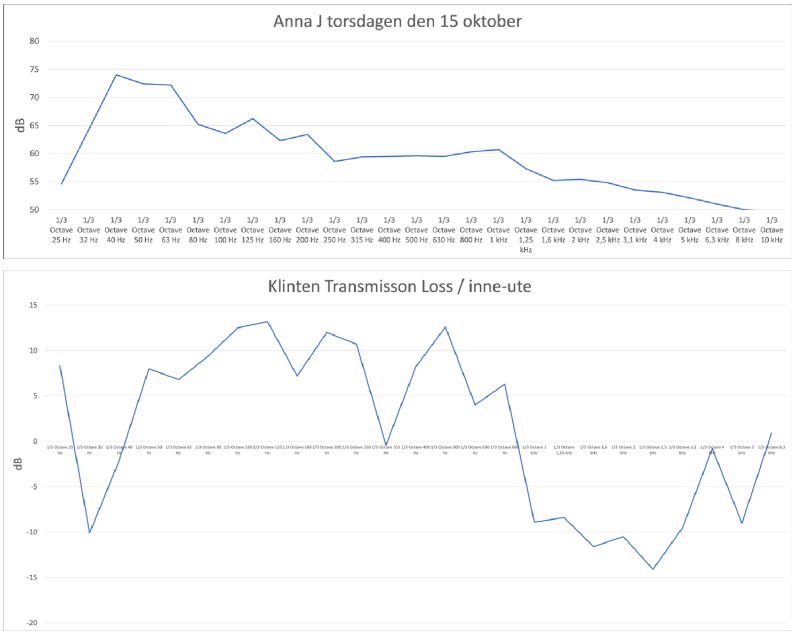


Fig.3 Indoor noise maximum at 40 Hz 74 dBlin (FOHM limit 49!!)in wooden villa in Hestra.
Fig 4 10 dBlin amplification of indoor noise at 32Hz due to self-resonance in the wooden wall!!

Long-term exposure for 7 years to infrasound from e.g. coal mining and textile factory work has been shown to sensitize a few nearby residents these in Australia. This for completely unanticipated, digitally recorded cardiac arrhythmia and respiratory distress, when they went to a toilet. These physiological responses were recorded simultaneously with audio recorded infrasound frequencies with maxima and harmonic harmonics from 1.3-41 Herz

originating in a 134 works wind farm, hidden by forest 3300-7300 m away (See Pereira et al 2017). Which rules out the nocebo effect! There are a large number of reports on infrasound exposure of animals, most Chinese on effects on all cellular systems including brain cells (e.g. activation of glial cells, in turn astrocytes type 1 destroying neurons in the hippocampus), but also the muscle power of human heart muscle is affected by infrasound (Chaban, Vahl) The short exposure time due to experimental animal costs and hence high power 120 decibels unadjusted at 5-16 Herz makes the data doubtful to be transferable to long-term effects of lower infrasound amplitudes for longer time on human tissue. On the other hand, low-frequency noise for 1 month at 70 decibels at 100 Herz, i.e. lower power but longer exposure, caused in white mice disturbed balance during gait tests and microscopically visible damage to the outer hair cells of the membrane labyrinth, which regulate our balance. Whereas 16 KHz, absorbed in the outer skin, did not damage the mice's balance. These infrared and low-frequency ambient noise levels to which residents are exposed will be achieved in terms of exposure around increasingly megawatt wind farms.Amply illustrated by indoor measurements of 74 dBlin at 40 Hz in Hestra as referred above! Interestingly then, the 4 above related subjects also report dizziness (balance impairment!) in conjunction with the other symptoms when there is noise in the bedrooms.A long term follow up in 10 year of 1,6 million Swedish pregnancies in women working in noisy industries(Selander et al), exposed at work for <75, 75-85 and >85 dBA LEQ, shows a clear correlation in newborn babies between noise levels and increased hearing impairment signs. What frequencies then do this harm intra utero? This study cannot give the full answer. It is however tempting to suggest, that had this study focussed at recording unweighted dBlin, the results would have been well in accordance with the mice experiments as cited above

Ljungbyholm 2022: Noise data 12 windmills Nordex 4,5 MW source emission 106,1 dB

		Noise measurement method dBA outdoors					
Bost	Dist VK min	N2000H&M(**1**)	N2000 F/HwintBP(**2**)	SNv2002landMD (**3**)	SNV2002Sea(**4**)	Hz	dBAred dBCred(5)
AM	761-1151	40	43,9	43,9	51,1	100	19 0
S	800	40	44,2	44,5	52	85	21 0
R	830	40	43,9 (Cf AJ 42-44!)	44,2	51,2	63	25 0,5
AH	1000	35	38,3	38,1	47,3	50	30 7
AP	1240	34	36,3	36,6	46,5	20	45 13
CH	2028-2527	ND	34,1	33,5	45	10	70 15

BG	942-1125	38	42,1	42,2	50,7	1	150 55

1) Consultant's calculation according to Nord2000 and wall damping according to Hoffmeyer & Jacobsen: Input data: temp 15gr, air humidity 71%. I. e. summer conditions!
2) Nord2000, calculation according to Bertil Persson: Input: Temp 0,1 degr C, 99% relative humidity, frozen ground, cloudy sky and inversion.Winter conditions!
3) SNV 2002 land calculates with ground attenuation, good agreement with method 2
4) SNV 2002 sea: No absorption in reflective surfaces. Power plant with total height to blade tip in this case is 200 m
5) A and C filters reduction of sound intensity at 1-100 Herz

If the consultancy had used input data according to alternative method 2, they would have been in line also with what the homeowner of R (AJ) himself measured outdoors one meter in front in light wind from SV with certified dBA/dBC meter from Clas Ohlsson. Well in line with method 2!! But then permission would not have been granted. The dwellings where 40 dBA was recorded are in many cases those where the value of 40.4 dBA was rounded to 40 in order to obtain permission to start operation! In order to comply with the noise limit of 40 dBA in relation to the current actual exposure of up to 44.5 dBA, a reduction of 5 dBA around the clock is urgently required. However, for each decibel, wind energy capture is reduced by 5%. A 25% reduction in profitability! Moreover, deregulation does not reduce noise levels in the IFN/LFN areas!

On co-morbidity between noise sensitivity/sound intolerance/hyperacusis and predisposing diseases

What determines a person's noise sensitivity or hyperacusis or sound intolerance has been the subject of a number of papers from different countries with prevalence ranging from 8.6 to 22.6%. In a 2021 UK meta-analysis on hyperacusis prevalence, 42 works were selected that met criteria, studied a total of 34,796 people, including the general public (28,425pc), occupational workers (2,746pc), and patients with concurrent disease (5,093pc). The prevalence was 0.2-17.2% in the general population, 3.8-67% in professional workers, and 4.7-95% in patients with concurrent disease. A recent 2020 thesis from Umeå University on 3407 randomly selected individuals (Johan Paulin) showed that 313 self-reported and 66 doctorally diagnosed individuals with varying degrees of noise intolerance represented a prevalence of 9% in the Swedish population. The doctor-diagnosed are older than the self-reported and have longer duration of symptoms. The majority are women. A number of medical conditions show covariation with sound intolerance: anxiety, depression, fatigue syndrome, post-traumatic stress disorder, ADHD, hearing loss, tinnitus, whiplash injury (signs of ongoing impact are sound hypersensitivity) back pain, chronic fatigue syndrome, fibromyalgia, irritable bowel syndrome and migraine. 30% of women have experienced migraine at some time. 14% report tinnitus = 1 million Swedes. Of the latter, 50% have hyperacusis. Exposure to white noise at levels up to 60 decibels showed a difference between three groups, the non, moderately and markedly noise-sensitive according to Weinstein and Borg's rating scales (NSS-SF scale with 11 variables, respectively Grade 0-10) in that the first two groups showed stress-type counter-reactions in the form of heart rhythm variation, while the most noise-sensitive were not able to respond with changes in heart rhythm. Bolin, Nilsson and Bluhm 2013 argued in polemic against Håkan Enbom in LKT, that there was no evidence that wind noise levels affect human health. However, it is documented that although hearing with the inner hair cells, the classical hearing 200-4000 Hz decreases after the

age of 50, the perception of infrasound frequencies 0.1-20 Herz in the elderly has a threshold that is only 4-5 dBSPL higher than in the young, which may explain why complaints about wind noise are more common in the elderly. In the range 4-25 Herz, the completely deaf have exactly the same perception thresholds as the hearing in terms of vibrotactile, proprioceptive perception (Landström,Lundström,Byström).As early as 1985, Ulf Landström and colleagues in Umeå showed that if healthy volunteers were exposed to infrasound 5-16 Herz at 95-105 dBSPL for 30 minutes, systolic and diastolic blood pressure increased significantly. A sign of peripheral vascular constriction by adrenaline secretion (Acta Medica Scandinavica 1985) Otoneurology professors Alec Salt and T Hullar have pointed out that the conjunctiva and the archwires, responsible for balance sensory reception, convey sensory input from outer hair cells via type II nerve fibres and are sensitive to 50Hz and lower frequencies which cause the conjunctiva to vibrate and can damage the conjunctival sac which swells, (See Alec Salt Timothy Hullar 2010) The hippocampal region in particular, responsible for memory storage and emotional control over the amygdala, is sensitive to reduced blood flow and high cortisone levels which in itself damages neurons. Clear reduction of this nucleus in magnetic resonance imaging (fMRI) is seen in dementia. Since 2013, wind power densities in rural areas have increased significantly and at the same time these now have source noise levels up to 108.1 dBA, compared to 103-104 dBA in 2013! At the same time, the proportion of infra- and low-frequency in these is increasing further! Different interpretations have been given for the group difference between noise sensitive and insensitive. but one explanation would be a reduced inhibition of incoming unpleasant nerve stimuli in response to noise stress. One factor may be reduced mobilization of cortisone and adrenaline, as seen in fatigue syndrome Some studies support a reduced activity in fast type I fibers in inner hair cells with compensatory activation of incoming nerves closer to central auditory nerve nuclei, others for a reduced inhibition of the upward nerve impulses in slow type II nerve fibers. Elevated levels in the brain of the transmitter substances GABA and serotonin have been observed and discussed, as in fibromyalgia. The vasodilatation in migraine attacks occurs when serotonin activates ion channels above and can be attenuated by serotonin receptor antagonists (triptans) A common denominator is that the protein that facilitates the transport of calcium ions into neurons and equalizes the membrane potential so that nerve impulses are more easily triggered, in e.g. migraine, is a genetically particularly efficient ion transporter. The non-classical sense of hearing, like the receptors for smell, sensation, vibration, pain and temperature, is transduced to the nerve nuclei of the medulla oblongata, limbic system, amygdala and frontal cortex via slow type II fibres. This is in contrast to the classical fast type I fibres which go directly to the auditory nerve nuclei. The type II nervous system, which is well developed in healthy children, and teaches us to distinguish between harmless and dangerous nerve impulses, is reduced in activity in older children, but persists in noise-sensitive children with ADHD and Asperger's, who remain broadly impulse-insensitive. My above practice cases support previous observations of the importance of co-morbidity in noise intolerance. In 2011, Bolin, Nilsson and Bluhm investigated the sound experience of 10 field subjects bothered by wind turbine noise in southern Sweden and 20 test subjects with recorded noise from their homes, partly in their home environment but also in the test lab alongside the test subjects. dBA and dBC filtered sound were used, white noise and loudness and 6 psychoacoustic variables. The worst correlation was with psychoacoustic variables except sharpness, best with dBA level R2=0.95 in both test groups. Interestingly, the field subjects perceived the same dBA loudness as 4 dB louder than the control subjects did, indicating increased sensitivity to sound.

Consistent with the presence in the group of both whiplash injury and tinnitus as a sensitizing condition. How well people sleep in noise has also been mapped by Dang Vu et al in a Belgian-American study in which sleepers were exposed to 4 common types of noise at sound levels progressively increasing to 60 decibels. They studied EEG during sleep and found a clear difference between the unawakened and the slightly awakened. This concerns the frequency of protective so-called sleep spindles in the central thalamic nucleus, waves with a frequency of 11-16 Herz, which were clearly more prevalent in those with good sleep. This may be one of several protective factors that determine how much we are disturbed in our sleep by night-time noise. These EEG strips could also have been studied in the so-called WITNES study from 2020, which shows that amplitude-modulated wind noise delays onset of REM sleep by an average of 16 minutes, (K Persson Waye et al) but sleep spindle data are not processed in the study. We have no clear idea how long we can tolerate exposure to night-time wind noise towards bedrooms in wooden villas. It may take a shorter time to symptoms for those with lower inhibitory capacity in the nervous system, either genetically, age- or co-morbidly related. It has been argued by various researchers (van den Berg, Crichton, Chapman) that cognitive conditioning mechanisms and so-called nocebo effects i.e. suggestion mechanisms and especially in people with affective disposition are most susceptible, that there is an overlap between people with idiopathic chemical hypersensitivity, so-called electrical allergy, olfactory hypersensitivity and what is called infrasound hypersensitivity, and that these phenomena are subject to influence mechanisms (NIMBY) and are not wind energy related. In a Finnish exposure study (P Maijala et al JASA April 2021) it was found that in a comparison of bothered and non-bothered people living around wind farms exposed to recorded wind noise and white noise in the laboratory the groups did not differ and had equal difficulty distinguishing white noise from wind noise . However, exposure times were only 10 minutes! According to Thomas Lagös own case studies too short to elicit significant differences. For LF sound at 25-40 Hz at 70-80 dBSPL, it takes at least half an hour for women to develop symptoms such as nausea, headache, dizziness, etc. For men with similar symptoms, it takes a couple of hours (T Lagö, US Professor of Acoustics, member of the ICE Noise Standardization Commission, personal message in e-mail). It is also forgotten that people's genetic background and co-morbidities make the peripheral and central nervous systems more easily irritable. A NIMBY explanation does not remove the fact that people like here, who were long without migraines and tinnitus prior to the start of wind turbines, have regained long-standing absent symptoms, covarying with wind strength and directions at startup. Quite surprising for them! What they have in common is that they react more easily to different kinds of impulses, which healthy people are not bothered by, sounds, smells, touch, heat, cold, pain, even without having been indoctrinated! Nor can we ignore the observations of the Pereira group that many years of exposure to industrial infrasound have been shown to cause general thickening of the connective tissue around blood vessels and the pericardium, and destruction of hearing cells and lung alveolus cells. detectable by electron microscopy. Or that children get nosebleeds, sleep problems and become aggressive after the wind farm starts and improve when they are far away from the turbines. Years of exposure to coal mine and textile mill noise in a couple in their 60s, followed by infra-sound and low-frequency instruments with FFT recordings, and digital recording of pulse, systolic, diastolic blood pressure and respiration rate, were quite surprisingly useful during a car journey t o r home and a community a few miles away. During a pee break on the road at a hotel toilet, both spouses experienced violent heart palpitations and subjective shortness of breath in a public toilet. Acoustic measuring equipment brought along for recording IFN and LFN frequencies showed that this was in response to simultaneous infrasound exposure to a wind farm unfamiliar to all of them at

100 works 3300-7200 m away, concealed by forest. A 2014 updated version with inclusion and exclusion criteria for symptom patterns strictly related to wind noise exposure was published in 2016 by Robert Mc Murtry and Carmen Krogh. It lists all the above predisposing conditions! A British study of 8000 individuals, followed from 1985 from age 50 published in 2021, has shown that the risk of dementia is increased by 30% in those with 6 hours of sleep or less. Residents should keep a diary for a longer period of time during windy months, regarding wind direction, wind strength, temperature, precipitation and the perceived degree of disturbance daytime and nighttime, from 0 disturbance, to unbearable in e.g. 5 degree scale according to ICBEN Rohrmann 1998 linked with meteorological observations to report this to the municipal environmental officer and health service.

Tabell 1 : Kortfattad beskrivning av störningsgrad för buller.

Störningsgrad	*ICBEN*	*Rohrmann*
0	–	Ej hörbart
1	Uppfattar, störs inte	Hörbart icke störande
2	Hör tydligt, kan störa kvalificerat skrivarbete men inte intellektuellt okvalificerat arbete	Lätt störande
3	Kan störa telefonsamtal, avkoppling utomhus	Måttligt störande
4	Påtagligt störande, kan tvingas gå in, kan störa insomning	Påtagligt störande
5	Outhärdligt ute, svårt somna in, vaknar nattetid ,står ej ut hemma dagtid	Ytterst störande/outhärdligt

Fig 5. Estimation of noise annoyance/disturbance degree according to Rohrmann.

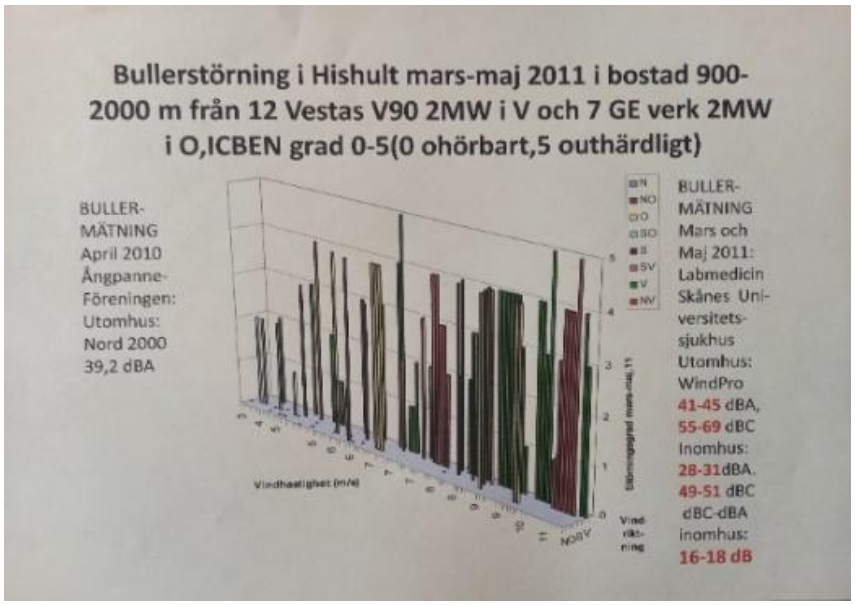


Fig.6. XYZ-diagram (B Persson 2011) over Windpower, wind direction and disturbance degree in Hishult, S of Knäred march-may 2011, with turbines 1-19 Vestas V90 2 MW

operative, Oxhult 12 westt, Kåphult 7 st east of cottage. Disturbance level highest, 4-5 at wind direction W, SW, some times East, least with N, E and S winds, once level 4-5 at dominating NW wind due to noise interference between 2 turbines 400 m apart Lowest disturbance from N and S where there are no turbines. Female (45 y) in the house is noise hypersensitive at 1760 Herz (piano 20220501) after a whiplash injury 1995. Since 2019 she has tinnitus! In 2011: Systolic and diastolic BP increase from 120/80 to 160/90 outdoors during lamb midwifery within 2 -4 hours in windy weather wih WM operating. Blood pressure normal outdoors and indoors without medication 120/80 when there is no wind during 2 weeks in february.In the sleeping room downstairs looking W are recorded 25.5.2011 kl. 1530 (vind V 12-14m/s): Weighed dBA =31,3 dBA. Weighed dBC= 51,5 dBC, clearly exceeding 15 dB difference. To say far exceeding FOHM over limit at 80 Hz indoors = 40 dBLeq! Repeatedly sleep interruption when SW winds prevail up to 4 nights/month. One night with NW-winds it sounded as if the washing machine jumped around in the cellar, but it stood still not operating! Resonance in the room!!! Ångpanneföreningens(ÅF) records 2010 outdoors with Nord 2000, summer variables= 39,2 dBA, (12 2 MW WM west of their house operating.). May 2011 (12 WM to the west, 9 WM to the east operating) Acoustic engineer from the clinic for occupational health care at the Skåne Universitets Sjukhus(SUS)makes recordings acccording to SNV2002 and WindPro outdoors 41-45 dBA,55-69 dBC, indoors 28-31dBA, 45-51 dBC, diffe-rence16-18 dBC!!! All installations had previous permit for start to operate!

If this is not recorded, we do not know what we are exposing the rural population to in the long run with ever more powerful turbines and larger wind farms, with SNV now modified guidelines ever closer to homes. Stress management with elimination of triggering conflicts, physical training, habituation with CBT treatment, medication, etc., can affect sound intolerance, in migraine also amine-reduced diet. But it cannot be a way out for society to get rural residents to accept the (with the promise of compensation in the form of rent or municipal subsidies) forced increasingly loud nightly wind noise into their bedrooms, the difficulty of staying outdoors and the stress in the form of loss of value!! And make them stay in the countryside! The cost of care and the loss of Swedish autonomy in food supply from Swedish agriculture that this increasing noise exposure may cause is not yet considered! Those affected so far represent a minority of voters! Tersband measurements in wooden villas around wind turbines, in the absence of the residents, taking into account FOHM rules for indoor noise should be the rule in case of complaints about indoor noise after start of operation. Consultancies that now measure noise, produce readings that do not reflect the actual noise exposure of nearby residents. See table and figure 3 above! It has long been known that both aircraft noise and, according to a recent study of 2,680 school children aged 7-12 in Barcelona, road noise negatively affect their cognitive development. Growing up in a farming family surrounded by wind farm noise can affect the individual already in sensitive childhood years, see practical case with the 3 year old above!

Effects on animals and nature:
Rural residents with many years of knowledge of nature have observed, for example, like a homeowner in Pajala, that moose flee from winter hay feeding areas and do not return after the wind farm north of Pajala has been started. Nor has he noted the return of swimming birds in the area. Since the wind farm Storrotliden in Västerbotten 40 Vestas 2 MW turbines, 2.5 km NW of an 80 year old landowner, was started in 2010, he has no longer seen fish in streams flowing down from the flat mountain where the turbines are located. 5 years after the start, he himself has suffered from tinnitus which has been

further aggravated when the 34 4 MW turbines of Fäbodberget 1000 m east of his home have come into operation! Moose, which before the start of the plants in 2010 were often seen in the fields to the north of his house, are now only seen there after 1 week of no wind. Observations of horses and chickens in Ljungbyholm should be followed up and seen as warning signs. A Polish research report in 2013 has shown that geese growth is inhibited, females most, and they get higher blood cortisol the closer they are placed to wind turbines with 99-103 dBA exposure. With decreasing impact from 50 - 500 m away! UK study shows that badgers in burrows 1 km from wind farms have 2.6 times higher blood and hair cortisol compared to those in burrows 10 km away. Danish mink farmer Kaj bank Olesen reports in June to AOH in Hörning in an online article 23 June 2014 that since 4 Vestas turbines 145 m high a 3 MW started in September 2013, mink miscarriages quintupled from 6% normal to 30%, 1600 and several stillborn had deformed limbs. After the requested temporary shutdown, miscarriage rates returned to normal. In May 2014, when the wind was blowing from the south-west, females attacked their young so that 4

On the impact of wind power proximity on property values.

0/60 healthy newborns had to be culled.

According to a survey by professors Hans Westlund and Mats Wilhelmsson at KTH 2021 on the sales price of 100,000 homes 2008 - 2013, property values are 20% lower within 2 km of a planned wind farm and 30% lower if there are more than 10 turbines in the farm. A gradual further reduction in value seems to have taken place between 2013 and 2018 Residents in Smedjebacken, for example, have recently been denied loans for extensions for this reason, here 50% halving of the market value, due to reduced bank security. What about Sweden's self-sufficiency, like beef cows, grain when farmers are displaced from homes they can no longer sleep in? Children do not want to take over, possible buyer needs to rebuild house etc. How will the animals be? People move, if they can even afford a new home. An immeasurable psychological trauma. An epidemiological study in the US (Erik Zou 2017), shows a clear correlation between proximity to wind power in the direction of the wind and suicide rates within 2.5 km of the turbines.

In Näsbyholm in Skurup, after the 4 turbines 800-1000 m west of the community of Lindsmölla were commissioned in 2010, 3 homeowners sold their houses due to noise disturbance. Individuals, estate agents or companies buying them up can then raise prices for their rentals in the summer when there is no wind, on the other hand the houses are empty during the windy months of spring and late autumn. What then happens to nature conservation when observant farmers with a knowledge of nature no longer live there? We are now seeing a deliberate political disregard for property rights in areas that have been identified as suitable for wind farms. This is motivated by the ambition to counteract the current rise in temperature with a massive, almost unilateral investment in wind power with its irregular electricity supply. Sweden does not have a law on damages for minor property damage or illness similar to that in Denmark. In Denmark, damages are paid in relation to dwellings less than 6 tower heights from a wind farm. The application of the law should be based on the applicant proving that the activity is not harmful, and not, as is the case now, on the victim proving that the activity caused the damage. The municipality should be informed in detail by the applicant of the possible risks of the activity and have this as a basis before making a decision, after informing the members of the municipality and obtaining their views in consultation. If damage to property or illness of residents occurs with a demonstrable link to the start of the wind farm, the applicant is legally liable for damages. How do we know that the expansion of wind power will not increase noise sensitivity? As observed in the Umeå study, different types of psychiatric illness and other disease burden covary with noise intolerance. Compared to the current Swedish

prevalence study, other studies show prevalence of noise hypersensitivity up to 23% in different populations. Significantly higher than the acceptance limit of 10% highly disturbed by wind power currently applied. Not being able to control one's noise environment with sleep disturbance due to irregular night-time noise is a clear stress factor, already recognised but more pronounced than for other noises. Which should be applied to wind noise as well. Environmental courts that have authorised the start of operations cannot award damages to those affected by the permits that these authorities themselves have agreed to!!

On wind power, difficulty due to sleep deprivation to stay in rural areas to farm and the impact on Sweden's self-sufficiency

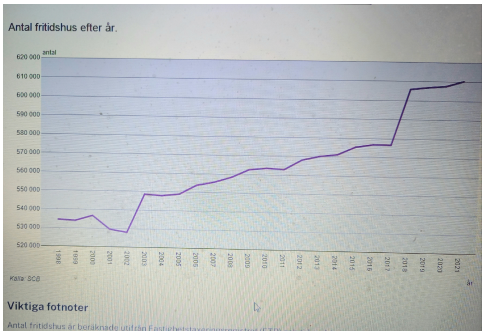


Fig. 7 and 8: Of 75,000 new single-family homes built from 1998 to 2020, an average of 70 % were built of wood. With 1/10 of wall stiffness relative to brick and concrete walls

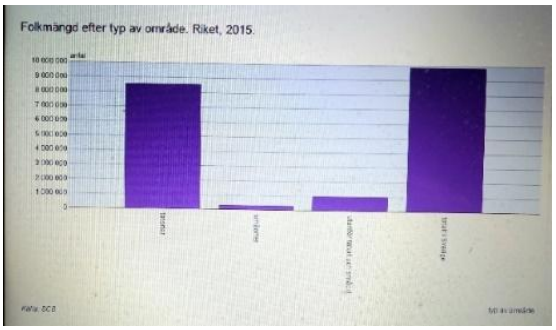


Fig 9 SCB2015. Out of 10 million Swedes, 300,000 live in rural areas with the largest urban centre having less than 200 inhabitants,
i.e. the areas of interest to the wind power industry. And at the same time where our agriculture is mainly located. Agriculture now employs some 150,000 men and women full or part time, with a downward trend from a peak in 2005. How will they manage to digitally manage 100 dairy cows, for example, if they are not allowed to sleep because of amplitude modulated noise in a 4x4 bedroom with self-resonance at 85 Herz? Because of the establishment of more and more powerful and increasingly distant wind farms? Those who will be responsible for our self-sufficiency in insulation?

Conclusion:
What will affect the economy and health of rural citizens and the rural environment? Yes: Wind companies' self-interest, foreign ownership of wind power, political directives from authorities such as the government's regulation letters to county councils, gradual

relaxation of noise regulations, directives on which input data is now recommended for noise mapping to expand land areas suitable for wind power. If SNV2002 rules are applied, wind power areas cannot be expanded to the extent that is now happening, but stricter rules can protect human health and biodiversity. Or is it now the case that if map and terrain do not match, the map applies? Instead of being bound, when there is too little wind anyway, to supply 45% of our balance power (hydro power) to the continent with consequent power shortages in southern Sweden. The grid should be expanded. Restrictive de-certification of hydroelectric plants in southern and central Sweden. Increased investment in small modular 10 MW nuclear power with removal of regulatory barriers making them unviable. With concrete consumption/TWh 1000 tonnes instead of 9000 tonnes per TWh of wind power! Return to noise regulations SNV2002 land. More rooftop solar power, taking into account fire and electrical safety.and not occupying fertile soil with solar plants Replant 2 trees / 1 felled tree. Green plantings on high-rise exterior walls. Thermal power plant via water reservoirs. The government, county councils, courts, the Energy Agency, the Nature Conservation Agency, the Nature Protection Association and others should take into account that increasingly powerful wind turbines mean increasing ambient exposure at night to low frequency but also infrasound, shadows, solar flares, lantern LED lights at night etc for all living creatures. Everyone should save electricity!! Precautionary principle! Better instead of worse possibilities for transparency about the application process and the granting of permits.The operator must declare that the wind farm does not cause health effects and if such effects can be documented by a medical examination, the operator is liable for damages. The noise victims are currently at a clear legal disadvantage.

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