From:	Simon Chapman
To:	
Subject:	Re: Environment and Communications Committee Questions on Notice
Date:	Wednesday, 21 November 2012 8:58:35 AM
Attachments:	image001.png

Here are my grants for last 5 years (this is public information). I will send the rapid review material through shortly.

CHIEF INVESTIGATOR B: The future of tobacco control 2006-2009. Hall W, Chapman S. NHMRC project grant #401558. (not administered through the University of Sydney)
$487,000

CHIEF INVESTIGATOR: Chapman S, Freeman B. **The use of Web 2.0 internet sites to undermine tobacco advertising bans and to mobilise tobacco control advocates.** NHMRC Project Grant 570869, 2009-2011
$351,000

CHIEF INVESTIGATOR: Chapman S, Hall W, Redman S, Leeder S, Gillespie J. **What characterises influential public health policy research in Australia?** NHMRC Project Grant 570870. 2009-2010.
$433,500

CO-INVESTIGATOR: Wakefield M, Hammond D, Goldberg M, Durkin S, Chapman S. Project grant. **Effects of current and plain cigarette package design on smokers' cigarette evaluation.** NHMRC project grant 623203. 2010 (not administered through the University of Sydney)
$646,800 ($345,900; 2011 $300,900)

CO-INVESTIGATOR: Blood W, Chapman S, Pirkis J. **Public and media understandings of A/H1N1 within a risk communication environment.** NHMRC 2009: (not administered through the University of Sydney)
$107,340

CHIEF INVESTIGATOR: Chapman S, Blood W, Pirkis J. **The Australian Health News Research Collaboration.** NHMRC Capacity Building Grant 571376, 2009-13.
$1,897,375

CHIEF INVESTIGATOR: Chapman S, Kerridge I, Jordens C, Bacon W, Bonfiglioli C, Sweet M. **Calling the tune? Investigating corporate influences on media reporting of health**. NHMRC 632840 2010:
$415,500(2010:$138,500; 2011: $138,500; 2012: $138,500.)

CHIEF INVESTIGATOR: Chapman S, Redman S, Rychetnik L, King L, Milat A. **Characteristics of intervention research that progresses to 'real world' Implementation.** NHMRC 2012: #1024291 $537,020

CO-INVESTIGATOR: Dunlop S, Chapman S, Freeman B, Carter S. **The natural history of unassisted smoking cessation in Australia.** NHMRC #1024459 3 years $318,510

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From: <Stewart>, "Carol (SEN)"
Date: Tuesday, 20 November 2012 11:43 AM
To: Simon Chapman <simon.chapman@sydney.edu.au>
Subject: Environment and Communications Committee Questions on Notice

Dear Professor Simon Chapman,

Thank you for your evidence given to the Environment and Communications committee at its hearing on 14 November. Following the hearing, the committee has asked if you could respond to the questions on notice below.

<!--[if !supportLists]-->1. <!--[endif]-->How much funding has been received from the NH&MRC for research projects with which you are affiliated over the last five years?

-

<!--[if !supportLists]-->2. <!--[endif]-->Will you please provide the Committee with a copy of the document of reference to the rapid review which was sent to you by the NHMRC and your comments related to the reviewing of the NHMRC Rapid Review.

The committee would appreciate answers being received by COB Friday 23 November 2012. If you will be unable to meet that deadline, please advise me at the first possible opportunity.

If you have any questions, please do not hesitate to contact me.

Regards

Dr Ian Holland
Secretary, Senate Community Affairs committee
Secretary, Senate Environment & Communications committee inquiry into the renewable energy (wind farm noise) bill
PO Box 6100
Parliament House
Canberra ACT 2600
Ph. 61 – 2 – 6277 3515
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We're on twitter …

From:	Simon Chapman
To:	
Subject:	FW: Peer review of NHMRC Public Statement Wind Turbines and Health [SEC=UNCLASSIFIED]
Date:	Wednesday, 21 November 2012 9:07:54 AM
Attachments:	DRAFT NHMRC Public Statement.doc Wind Turbines and Health.doc Wind turbine risk NHMRC.doc

This was the invitation I received. My reviewer's response is attached.

From:

Sent: Wednesday, February 24, 2010 2:31 PM
To: Simon Chapman
Cc:
Subject: Peer review of NHMRC Public Statement Wind Turbines and Health [SEC=UNCLASSIFIED]

The Australian National Health and Medical Research Council (NHMRC) recently investigated the health effects of wind turbines with the aim of providing advice to the Australian public. The result is *Wind Turbines and Health – A Rapid Review of the Evidence* (Review) and *NHMRC Public Statement: Wind Turbines and Health* (Public Statement).

The Review set out to ascertain if the following statement could be supported by the evidence: "There are no obvious health effects from wind farms and any potential impact on humans can be minimised by following existing planning guidelines". The Public Statement aims to outline, for the general public, the evidence relating to health effects of wind turbines.

To ensure that the Review and Public Statement are accurate and that the most current and best available evidence has been used in their development, NHMRC is seeking peer review prior to publication. As a person with expertise on this subject, you are invited to undertake this task.

Please note that the attached Review and Public Statement have been provided to you in confidence and are not for further distribution. It is imperative that these documents remain confidential until such time as they are made public. Thank you for your discretion.

Please advise if you are willing to assist in this peer review process. Should you decide to undertake this task, please provide your review comments by no later than 30 April 2010. I can be contacted on or for further information.

Thank you for your consideration of this request.

Yours sincerely,

Professor John McCallum

John McCallum
Executive Director | Health Evidence & Advice
National Health & Medical Research Council

w : www.nhmrc.gov.au

NHMRC Public Statement: Wind Turbines and Health

January 2010

There is no evidence of adverse health effects from wind turbines. Any potential impact on humans can be minimised by following existing planning guidelines.

In Australia, since the legislation of the *Renewable Energy (Electricity) Act* in 2000, wind power has been gaining prominence as a viable sustainable alternative to more traditional forms of energy production. Studies have found that there is increasing population demand for 'green' energy[1,2]. Wind energy is associated with fewer health effects than other forms of traditional energy generation and will have positive health benefits[3].

Do wind turbines impact on health?

While a range of health effects such as annoyance, anxiety, hearing loss, interference with sleep, speech and learning have been reported there is no evidence to support adverse effects of wind turbine on health.

The World Health Organization states in its *Guidelines for community noise* that 'There is no reliable evidence that sounds below the hearing threshold produce physiological or psychological effects'[4]. A recent expert panel review found no evidence that audible or subaudible sounds emitted by wind turbines have any direct adverse physiological effect[5].

A study of three UK wind farms also supports this conclusion, finding that sound associated with modern wind turbines is not a source which will result in noise levels which may be injurious to the health of a wind farm neighbour[6].

How much sound do wind turbines produce?

Sound is composed of frequency expressed as hertz (Hz) and pressure expressed as decibels (dB). In terms of frequency sound can be categorised as audible and inaudible. Infrasound is commonly defined as sound which is inaudible to the human ear, however it can be audible[7]. There is often confusion regarding the boundary between infrasound and low frequency noise[8]. Human sensitivity to sound is variable and people will exhibit variable levels of tolerance to different frequencies[9].

Noise can be defined as any undesirable or unwanted sound. The perception of the noise is also influenced by the attitude of the hearer towards the sound source (AusWEA, 2004).

Table 1 below compares the noise produced by a ten turbine wind farm compared to noise levels from some selected activities.

Activity	**Sound pressure level (dBA*)**
Jet aircraft at 250m	105
Noise in a busy office	60
Car travelling at 64kph at 100m	55
Wind farm (10 turbines) at 350m	**35-45**
Quiet bedroom	35
Background noise in rural area at night	20-40

Table 1: Noise levels compared to ten turbine wind farm[10]**.**The "A" represents a weighting of measured sound to mimic that discernable by the human ear, which does not perceive sound at low and high frequencies to be as loud as mid range frequencies[11].

Based on these figures noise pollution generated by wind turbines is negligible[12]. Further, a survey of all known published results of infrasound from wind turbines found that wind turbines of contemporary design, where rotor blades are in front of the tower, produce very low levels of infrasound[13]. The principal human response to perceived infrasound is annoyance.

Are there other features of wind turbines that may have effects on health?

It has been suggested that phenomenon such as shadow flicker and blade glint could have effects on health. Shadow flicker describes the flicking on and off of the wind turbine's shadow as the blades rotate. The evidence on shadow flicker does not support a health concern as the chance of conventional horizontal axis wind turbines causing an epileptic seizure for an individual experiencing shadow flicker is less than 1 in 10 million.

Blade glint happens when the surface of wind turbine blades reflects the sun's light. All major wind turbine blade manufacturers coat their blades with a low reflectivity treatment which prevents reflective glint from the surface of the blade. The risk of blade glint from modern wind turbines is considered to be very low.

There has been some concern about electromagnetic radiation from wind turbines. However, electrical cabling between wind turbines is typically buried in the ground, effectively eliminating any electromagnetic field.

Concerns regarding the adverse health impacts of wind turbines focus on infrasound noise, electromagnetic interference, shadow flicker and blade glint produced by wind turbines as discussed above. There is no evidence of wind turbines causing health effects resulting from any of these identified issues. Complying with standards relating to wind turbine design, manufacture, and site evaluation will minimise any potential impacts of wind turbines on surrounding areas[14].

References

[1]Chatham-Kent Public Health Unit. (2008). *The Health Impact of Wind Turbines: A Review of the Current White, Grey, and Published Literature*

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[3] World Health Organisation (WHO). (2004). *Energy, sustainable development and health.* GenevaBackground document for the Fourth Ministerial Conference on Environment and Health, 23-25 June 2004.

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[5] Colby DW, Doby R, Leventhall G, Lipscomb DM, McCunney RJ, Seilo MT, Søndergaard B. (2009). *Wind Turbine Sound and Health Effects - An Expert Panel Review.* Prepared for the American Wind Energy Association and the Canadian Wind Energy Association.

[6] Department of Trade and Industry UK (DTI) (2006). The measurement of low frequency noise at three UK wind farms: URN No: 06/1412" issued by the DTI in July 2006.

[7] Environment Protection and Heritage Council (EPHC). (2009). *National Wind Farm Development Guidelines - Public Consultation Draft.*

[8] Leventhal G. (2006). Infrasound from Wind Turbines – Fact, Fiction or Deception. *Canadian Acoustics*, 24(2): 29-36.

[9] Minnesota Department of Health. (2009). *Public Health Impacts of Wind Turbines.*

[10] Sustainable Development Commission (United Kingdom) (SDC). (2005). *Wind Power in the UK: A guide to the key issues surrounding onshore wind power development in the UK*, Government of the United Kingdom, England.

[11] Australian Wind Energy Association (AusWEA). (nd.a) *Wind Farms and Noise*, Fact Sheet No. 6.

[12] Macintosh A & Downie C. (2006). *Wind Farms: the facts and the fallacies.* The Australia Institute: Discussion Paper No. 91.

[13] Jakobsen J. 2005. Infrasound Emission from Wind Turbines. *Journal of Low Frequency Noise, Vibration and Active Control*, 24(3): 145-155.
[14] Sustainable Energy Authority Victoria (2003). *Policy and planning guidelines for development of wind energy facilities in Victoria.* Sustainable Energy Authority Victoria, Melbourne.

Wind Turbines and Health – A Rapid Review of the Evidence

The purpose of this paper is to present findings from a rapid review of the evidence from current literature on the issue of wind turbines and potential impacts on human health. In particular the paper seeks to ascertain if the following statement can be supported by the evidence: *There are no obvious health effects from wind farms and that any potential impact on humans can be minimised by following existing planning guidelines.*

Context

In Australia since the legislation of the *Renewable Energy (Electricity) Act* in 2000, wind power has been gaining prominence as a viable sustainable alternative to more traditional forms of energy production. Studies have found that there is increasing population demand for 'green' energy and that people are willing to pay a premium for renewable energy (Chatham-Kent Public Health Unit, 2008; Pedersen & Persson Waye, 2007). However as with any shift in technology, the emergence of wind farms is not without controversy.

There are two opposing viewpoints regarding wind turbines and their potential effect on human health. It is important to note that these views are usually presented by groups or people with vested interests. For example, wind energy associations purport that there is no evidence linking wind turbines to human health concerns. Conversely, individuals or groups who oppose the development of wind farms contend that wind turbines can adversely impact the health of individuals living in proximity to wind turbines.

Concerns regarding the adverse health impacts of wind turbines focus on infrasound noise, electromagnetic interference, shadow flicker and blade glint produced by wind turbines. Does the evidence support these concerns?

Sound and Noise from Wind Turbines

Sound is composed of frequency expressed as hertz (Hz) and pressure expressed as decibels (dB). In terms of frequency sound can be categorised as audible and inaudible sound. Infrasound is commonly defined as sound which is inaudible to the human ear (below 16 Hz). Despite this commonly used definition, infrasound can be audible (EPHC, 2009). There is often confusion regarding the boundary between infrasound and low frequency noise (Leventhall, 2006). Human sensitivity to sound, especially to low frequency sound, is variable and people will exhibit variable levels of tolerance to different frequencies (Minnesota Department of Health, 2009).

Noise can be defined as any undesirable or unwanted sound. The perception of the noise is also influenced by the attitude of the hearer towards the sound source (AusWEA, 2004).

Wind turbines produce noise that can be classified into the following categories:

1. Mechanical noise which is produced from the motor or gearbox. If functioning correctly, mechanical noise from modern wind turbines should not be an issue.

2. Aerodynamic noise which is produced by wind passing over the blade of the wind turbine (Minnesota Department of Health, 2009).

As well as the general audible range of sound emissions, wind turbines also produce noise that includes a range of Special Audible Characteristics (SACs) such as amplitude modulation, impulsivity, infrasound, low frequency noise and tonality (EPHC, 2009).

Table 1 compares the noise produced by a ten turbine wind farm compared to noise levels from some selected activities.

Activity	**Sound pressure level (dBA)**[1]
Wind farm (10 turbines) at 350m	35-45
Jet aircraft at 250m	105
Noise in a busy office	60
Car travelling at 64kph at 100m	55
Quiet bedroom	35
Background noise in rural area at night	20-40

Table 1: Noise levels compared to ten turbine wind farm (SDC, 2005).

Macintosh and Downie (2006) conclude that based on these figures noise pollution generated by wind turbines is negligible.

One of the most common assertions regarding potential adverse noise impacts of wind turbines is concerned with low frequency noise and infrasound. It should be noted that infrasound is constantly present in the environment and is caused by various sources such as ambient air turbulence, ventilation units, ocean waves, distant explosions, volcanic eruptions, traffic, aircraft and other machinery (Rogers, Manwell & Wright, 2006). In relation to wind turbines, Leventhall (2006) concludes that there is insignificant infrasound generated by wind turbines and that there is normally little low frequency noise. A survey of all known published results of infrasound from wind turbines found that wind turbines of contemporary design, where rotor blades are in front of the tower, produce very low levels of infrasound (Jakobsen, 2005). Another recent report concludes that wind farm noise does not have significant low-frequency or infrasound components (Ministry of the Environment, 2007). As discussed in further detail below the principal human response to perceived infrasound is annoyance.

Effects of Noise from Wind Turbines on Human Health

The health and well-being effects of noise on people can be classified into three broad categories:

1. subjective effects including annoyance, nuisance and dissatisfaction;
2. interference with activities such as speech, sleep and learning; and
3. physiological effects such as anxiety, tinnitus or hearing loss (Rogers, Manwell & Wright, 2006).

[1] The "A" represents a weighting of measured sound to mimic that discernable by the human ear, which does not perceive sound at low and high frequencies to be as loud as mid range frequencies (AusWEA, nd. a).

Several commentators argue that noise from wind turbines only produces effects in the first two categories (Rogers, 2006; Pedersen & Persson Waye, 2007).

Various studies of wind turbine effects on people have concentrated on the self-reported perception of annoyance. According to the World Health Organisation (WHO) (1999) annoyance is an adverse health effect. However there are difficulties with measuring and quantifying subjective effects of noise such as annoyance. One study of wind turbine noise and annoyance found that no adverse health effects other than annoyance could be directly correlated with noise from wind turbines. The authors concluded that reported sleep difficulties, as well as feelings of uneasiness, associated with noise annoyance could be an effect of the exposure to noise, although it could just as well be that respondents with sleeping difficulties more easily appraised the noise as annoying (Pedersen & Persson Waye, 2007).

Many factors can influence the way noise from wind turbines is perceived. The aforementioned study also found that being able to see wind turbines from one's residence increased not just the odds of perceiving the sound, but also the odds of being annoyed, suggesting a multimodal effect of the audible and visual exposure from the same source leading to an enhancement of the negative appraisal of the noise by the visual stimuli (Pedersen & Persson Waye, 2007). Another study of residents living in the vicinity of wind farms in the Netherlands found that annoyance was strongly correlated with a negative attitude toward the visual impact of wind turbines on the landscape. The study also concluded that people who benefit economically from wind turbines were less likely to report noise annoyance, despite exposure to similar sound levels as those people who were not economically benefiting (Pedersen et al, 2009).

In addition to audible noise, concerns have been raised about infrasound from wind farms and health effects. It has been noted that the effects of low frequency (infrasound) vibration (less than 20Hz) on humans are not well understood (NRC, 2007). However, as discussed above, several authors have suggested that low level frequency noise or infrasound emitted by wind turbines is minimal and of no consequence (Leventhall, 2006; Jakobsen, 2005). Further, numerous reports have concluded that there is no evidence of health effects arising from infrasound or low frequency noise generated by wind turbines (DTI, 2006; CanWEA, 2009; Chatham-Kent Public Health Unit, 2008; WHO, 2004; WHO, 1999; EPHC, 2009; HGC Engineering, 2007). In summary:

- 'There is no reliable evidence that infrasounds below the hearing threshold produce physiological or psychological effects' (WHO, 1999).

- Infrasound associated with modern wind turbines is not a source which will result in noise levels which may be injurious to the health of a wind farm neighbour (DTI, 2006).

- Findings clearly show that there is no peer-reviewed scientific evidence indicating that wind turbines have an adverse impact on human health (CanWEA, 2009).

- Sound from wind turbines does not pose a risk of hearing loss or any other adverse health effects in humans. Subaudible, low frequency sounds and infrasound from wind turbines do not present a risk to human health (Colby, et al 2009).

- The Chatham-Kent Public Health Unit (Ontario, Canada) reviewed the current literature regarding the known health impacts of wind turbines in order to make an evidence-based decision. Their report concluded that current evidence failed to demonstrate a health concern associated with wind turbines. 'In summary, as long as the Ministry of Environment Guidelines for location criteria of wind farms are followed … there will be negligible adverse health impacts on Chatham-Kent citizens. Although opposition to wind farms on aesthetic grounds is a legitimate point of view, opposition to wind farms on the basis of potential adverse health consequences is not justified by the evidence' (Chatham-Kent Public Health Unit, 2008).

- Wind energy is associated with fewer health effects than other forms of traditional energy generation and in fact will have positive health benefits (WHO, 2004).

- 'There are, at present, very few published and scientifically-validated cases of an SACs of wind farm noise emission being problematic … the extent of reliable published material does not, at this stage, warrant inclusion of SACs … into the noise impact assessment planning stage (EPHC, 2009).

- While a great deal of discussion about infrasound in connection with wind turbine generators exists in the media there is no verifiable evidence for infrasound and production by modern turbines (HGC Engineering, 2007).

The opposing view is that noise from wind turbines produces a cluster of symptoms which can has been termed Wind Turbine Syndrome (WTS). The main proponent of WTS is Dr Peirpoint whose assertions are yet to be published in a peer-reviewed journal.

Shadow Flicker and Blade Glint

'Shadow flicker occurs when the sun is located behind a wind turbine casting a shadow that appears to flick on and off as the wind turbine blades rotate (Chatham-Kent Public health Unit, 2008, 13). It is possible to use specialist modelling software to model shadow flicker before the finalisation of a wind farm layout and siting.

Blade glint happens when the surface of wind turbine blades reflects the sun's light and has the potential to annoy people (EPHC, 2009).

Effects of Shadow Flicker and Blade Glint on Human Health

Shadow flicker from wind turbines that interrupts sunlight at flash frequencies greater than 3Hz has the potential to provoke photosensitive seizures (Harding, Harding & Wilkins, 2008). As such it is recommended that to circumvent potential health affects

of shadow flicker wind turbines should only be installed if flicker frequency remains below 2.5 Hz under all conditions (Harding, Harding & Wilkins, 2008).

According to the EPHC (2009) there is negligible risk of seizures being caused by modern wind turbines for the following reasons:

- less than 0.5% of the population are subject to epilepsy at any one time, and of these, approximately 5% are susceptible to strobing light;
- Most commonly (96% of the time), those that are susceptible to strobe lighting are affected by frequencies in excess of 8 Hz and the remainder are affected by frequencies in excess of 2.5 Hz. Conventional horizontal axis wind turbines cause shadow flicker at frequencies of around 1 Hz or less;
- alignment of three or more conventional horizontal axis wind turbines could cause shadow flicker frequencies in excess of 2.5 Hz; however, this would require a particularly unlikely turbine configuration.

In summary, the evidence on shadow flicker does not support a health concern (Chatham-Kent Public Health Unit, 2008) as the chance of conventional horizontal axis wind turbines causing an epileptic seizure for an individual experiencing shadow flicker is less than 1 in 10 million (EPHC, 2009). As with noise, the main impact associated with shadow flicker from wind turbines is annoyance.

In regards to blade glint, manufacturers of all major wind turbine blades coat their blades with a low reflectivity treatment which prevents reflective glint from the surface of the blade. According to the Environment Protection and Heritage Council (EPHC) the risk of blade glint from modern wind turbines is considered to be very low (EPHC, 2009).

Electromagnetic Radiation and Interference

Electromagnetic radiation (EMR) is a wavelike pattern of electric and magnetic energy moving together. Types of EMR include X-rays, ultraviolet, visible light, infrared and radio waves (AusWEA, nd. b). From a wind resource perspective, high and exposed sites are attractive. So it is not unusual for any of a range of telecommunications installations, radio and television masts, mobile phone base stations or emergency service radio masts to be located nearby. Care must be taken to ensure that wind turbines do not passively interfere with these facilities by directly obstructing, reflecting or refracting the radio frequency EMR signals from these facilities.

Electromagnetic interference (EMI) from wind turbines may affect electromagnetic or radiocommunication signals including broadcast radio and television, mobile phones and radar (EPHC, 2009).

Effects of Electromagnetic Radiation and Interference from Wind Turbines on Human Health

Electromagnetic Fields (EMF) emanate from any wire carrying electricity and Australians are routinely exposed to these fields in their everyday lives. The electromagnetic fields produced by the generation and export of electricity

from a wind farm do not pose a threat to public health. Typically, electrical cabling between wind turbines is buried in the ground, effectively eliminating any EMF (AusWEA, nd. b).

Measures to Mitigate Potential Impacts of Wind Turbines

One review of wind turbines and noise recommends that best practice guidelines such as identifying potential receptors of turbine noise, following established setbacks and dispelling rumours regarding infrasound which have not been supported by research, are followed in order to mitigate any potential noise issues associated with wind turbines (Howe, 2007).

Sustainable Energy Authority Victoria (2003) also recommend that complying with standards relating to turbine design and manufacturing, site evaluation and final siting of wind turbines will minimise any potential impacts of wind turbines on the surrounding area.

The recently released Draft National Wind Farm Development Guidelines (EPHC, 2009) include detailed methodologies at different stages of the planning and development process to assess such issues as noise and shadow flicker to mitigate any potential impact. Such processes include a range of measures such as high-level risk assessment, data collection, impact assessment, detailed technical studies and public consultation.

Conclusion

The health effects of many forms of renewable energy generation, such as wind farms, have not been assessed to the same extent as those from traditional sources. However forms of renewable energy generation are associated with few adverse health effects compared with the well documented health burdens of polluting forms of electricity generation (Markandya & Wilkinson, 2007).

A review of the available evidence, including journal articles, surveys, literature reviews and government reports, supports the statement that: *There are no obvious health effects from wind farms and that any potential impact on humans can be minimised by following existing planning guidelines.*

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27 April 2010

***Wind Turbines and Health – A Rapid Review of the Evidence* (Review) and *NHMRC Public Statement: Wind Turbines and Health* (Public Statement).**

Dear Professor McCallum,

Thank you for the opportunity to consider the draft text of the statement about the health risks posed by wind turbines. I am a sociologist with a 35 year research career in public health. One of my research interests is in psycho-social factors that contribute to public anxiety about alleged risks to health, particularly when these involve new technologies.

I believe the draft statement currently is unbalanced in that it says too little about the sociological dimensions of the current debate about the alleged risks of wind turbines.

As I read the available literature on the putative hazards posed by turbines, I am strongly inclined to the view that much of the concern being expressed by opponents of wind farms is largely explicable in terms of factors extrinsic to the actual effects of wind turbine noise and or/vibration. These factors have been identified repeatedly in research on predictors of community outrage about alleged environmental hazards arising from new and particularly "imposed" technology. The draft statement does not seem to pay sufficient attention to these factors, and particularly to the impact of the variable "living with wind turbine on one's land" on the presence or absence of symptoms.

There has been a long history of sometimes protracted episodes of community concern about environmental health risks including those said to be caused by new technologies. Some examples include the telephone [1], television sets, computer screens, microwave ovens, electric blankets and other household electrical appliances [2], mobile telephones and base stations [3, 4], fluoridation and vaccination [5]. Wind turbines present a classic case study in a relatively new technology which has generated claims about symptoms and illness said to be caused by exposure to the turbines.

Risk communication and perception researchers such as Sandman have produced matrices of

factors which have been often found to be associated with increased levels of community "outrage" about putative environmental threats to health [6-8]. Sandman, drawing on Covello and others [9] distinguishes primary from additional factors, with primary factors being those which have been shown to be more strongly associated with increased levels of community concern. The table below indicates the likely applicability of these factors to the case of predicting community concern about wind farms.

Table: Primary and additional components predicting community outrage about putative environmental risks to health: the case of wind turbines.

A: Primary factors			
INCREASES OUTRAGE IF ...		**REDUCES OUTRAGE IF ...**	
exposure coerced (among those not electing to house turbines on their land)	✓✓	exposure voluntary (among those electing to house turbines on their land)	✓✓
agent industrial	✓✓	agent natural	
agent exotic	✓✓	agent familiar	
agent memorable	✓✓	agent forgettable	
consequences dreaded (eg: cancer, birth defects)		consequences not dreaded	✓
consequences catastrophic (ie: many people suddenly and badly affected)		consequences chronic	✓
true hazard unknowable (ie: science largely "open")	✓	true hazard knowable (ie: broad scientific consensus about effects)	
hazard controlled by others	✓✓	hazard individually controlled	
exposure unfair (ie: not all citizens exposed equally)	✓✓	exposure fair	
sources untrustworthy (ie: scientists, officials associated with source)	✓	sources trustworthy	
process unresponsive (ie: demands for action not quickly met)	✓✓	process responsive	
B: Additional factors			
affects vulnerable population (eg: children, retirees)	✓	affects general population	

health effects delayed		effects immediate	✓
substantial risk to future populations		no threat to future populations	✓
victims identifiable (ie: named complainants)	✓✓	victims statistical	
not preventable		preventable	✓
few benefits		many benefits	✓✓
substantial media attention	✓✓	little media attention	
opportunity for collective action	✓✓	no opportunity for collective action	

(✓✓ = applies strongly to wind turbines; ✓ = likely to apply less strongly)

Is payment for hosting a turbine a "protective" factor against claims of adverse health impact?

One factor that may have an important mediating effect on with claims about adverse health and psychological effects from wind turbines is whether those claiming such effects are persons who are in some way resentful about not receiving monetary reward for having turbines on their land. Land-owners owning land with topography favourable to the installation of turbines and who are chosen by power companies to have turbines on their land can receive substantial annual payments. Because of their topographical advantage, one land owner may receive such payments each year while neighbours without land with the appropriate topography or who do not wish to have turbines do not.

This practice may cause resentment, and anxiety about the impact of not having wind turbines on relative land values within rural neighbourhoods. The turbines thus become a symbol of perceived "unfairness" and features of the turbines such as the "swoosh" sound that might otherwise be unremarkable, become anxiety generating preoccupations.

Anecdotally, Australian company officials within the wind farm industry claim that landowners with turbines who receive payment rarely if ever complain of symptoms said to be caused by the turbines.

One recent Dutch study found that "people who benefit economically from wind turbines have a significantly decreased risk of annoyance, despite exposure to similar sound levels." and that "High turbine visibility enhances negative response, and having wind turbines visible from the dwelling significantly increased the risk of annoyance. Annoyance was strongly correlated with a negative attitude toward the visual impact of wind turbines on the landscape." [10]

Australian researchers should be encouraged to investigate the association between economic benefit and risk of annoyance and reported health symptoms.

Yours sincerely

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