

3 March 2011

Dr T Kendall A/g Committee Secretary Senate Community Affairs Committee Parliament House Canberra ACT 2600 Writers direct contact: 03 8621 6406 Email: arichards@pacifichydro.com.au

Dear Dr Kendall,

Re: Senate Inquiry into the Social and Economic Impacts of Rural Wind Farms

Pacific Hydro is pleased to be able to provide a supplementary submission to the above inquiry to address comments made in relation to the conduct of developers. We also submit additional comments in two supplementary aspects; namely, evidence on health impacts and; jobs growth and renewable energy.

Developer conduct

As noted in our earlier submission, regulation of wind farm developments is guided by strict state and federal planning and environmental laws that require environmental impact assessments including flora and fauna impacts, noise assessments and visual amenity. The assessment process commonly results in mitigation measures being embedded within the wind farm design or adopted during construction and operation.

A core component of wind farm design is proper community consultation. We take community liaison and the ongoing relationship we have with local communities extremely seriously from the early stages of proposal development through construction, commissioning and operation. In negotiations and ongoing liaison with landholders, too, we ensure that landholders are kept appraised of the project status and development prospects.

In relation to Pacific Hydro as such, we note that a number of submissions have specifically identified our projects, or ourselves, as exemplar developers in the way we manage land holder negotiations, community consultations and broader stakeholder management.

Evidence on health impacts

We note that in numerous media appearances – particularly on local and regional radio – Sarah Laurie and/or representatives from the Waubra Foundation or Landscape Guardians continue to refer to research and evidence of the 'health effects' from wind turbines.

With regard to this research (which has been cited directly and indirectly in a number of submissions to this Inquiry), we would like to request that the Committee seek the advice of experts such as Dr G A Wittert. Dr Wittert is a Professor of Medicine and Endocrinologist, Head, School of Medicine at Adelaide University and Consulting Endocrinologist at Royal Adelaide Hospital.

In testimony provided to the Environment, Resources and Development Court of South Australia hearing of an appeal against the approval of the Allendale windfarm, Dr Wittert agreed with the statement that "the data that's been collected, and the work that has been done so far, has not identified a risk which calls for further investigation".

ENCLOSURE: 1. Transcript of Dr Wittert's testimony to the ERD Court of South Australia's hearing of an appeal against the approval of the Allendale windfarm. 2. Climate Institute Clean Energy Jobs Snapshots for NSW. Victoria. Queensland. South Australia and Western Australia

Further, Dr Wittert said that "there's no fundamental epidemiological signal. In countries where there are dense concentrations of wind farms like... [in] Europe, the prevalence of hypertension [high blood pressure] is falling according to the most recent surveillance data...[from] the EU and the World Health Organisation".

For the purposes of the ERD Court hearing, Dr Wittert reviewed Sarah Laurie's research and conducted simple correlation analysis between the blood pressure recordings of the three individuals with elevated blood pressure and overnight wind turbine generation based on wind speed data. Dr Wittert's analysis of the data showed no consistency in the relationship between turbine operation and waking systolic (blood pressure) readings. Specifically, Dr Wittert's said that his analysis of the data showed "no consistent relationship between turbine audibility and blood pressure" and "no relationship between output and blood pressure". Commenting on his analysis, and the diarised information provided to Sarah Laurie, Dr Wittert noted that the highest blood pressure recordings "resulted from an altercation...indicating just how strongly...stress and interpersonal interaction can affect blood pressure".

When questioned on the relevance of case histories specifically with regard to proving cause and effect, Dr Wittert noted that while the case histories may be accurate, they "cannot be used to ascribe any assertion that these [symptoms] are necessarily due to the wind farm.

On the specific symptoms described in Sarah Laurie's evidence to the ERD Court hearing, Dr Wittert noted that sensations such as "a vibrating feeling...is commonly seen in people who are hyperventilating or anxious". With regard to sleep disturbance, Dr Wittert noted that "the issue of sleep disturbance is complex since it may be a consequence of stress and anxiety and of itself and/or noise perception".

On the basis of this testimony, and in relation to numerous documents submitted to the Inquiry to date, Pacific Hydro recommends that the Committee review the evidence from the ERD Court hearing¹.

We also recommend that the Committee consider calling Dr Wittert to provide his expert advice with regard to the quality of data collected to date and the question of the need for scientific research on the so-called "health impacts" which – Dr Wittert notes – cannot be seen 'based on the data...sufficient evidence to attribute cause and effect' which would form the rationale for such research to be undertaken.

Jobs growth and renewable energy

Pacific Hydro is pleased to provide further analysis of the likely economic benefits to regional areas from the expansion of renewable energy, including wind. Research released by the Climate Institute on 28 February – *Clean Energy Jobs: Regional Australia* – demonstrates the importance of a price on carbon and of ensuring the continued existence of a clear, workable Renewable Energy Target.

The report demonstrates the enormous opportunities that exist for regional Australia to benefit from climate change policy and underscores our experience in developing utility scale wind farms in regional Australia. Namely, that renewable energy projects provide an enormous jobs and economic boost to regional communities.

The last two projects that Pacific Hydro built, employed around 400 people each through construction with many of these jobs being filled by people from the local and surrounding areas.

The Climate Institute report shows that a clean energy transition can drive tens of billions of dollars of investment in the electricity sector creating close to 34,000 new jobs in regional Australia through policies including the Renewable Energy Target.

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¹ Transcripts of the testimony from Dr Wittert are provided as an attachment to this letter.

Employment figures in the report show that while all states will benefit, NSW and Victoria will stand to gain the most of these new opportunities, followed closely by Queensland. As shown in the attached Climate Institute Clean Energy Job snapshots, wind opportunities across 12 regions in just these three states could drive more 11,179 new jobs.

This report clearly demonstrates that policies to encourage the deployment of renewable energy, put a price on pollution, and encourage energy efficiency are all important in developing the new clean jobs economy that is critical to the long term sustainability of regional communities.

As noted in our earlier submission, and supported by the Climate Institute's latest report; the 2020 Renewable Energy Target plays a critical role in bringing on a range of clean energy resources and backing up a clear price on pollution that drives switching from coal to gas in terms of existing base-load. The Climate Institute research clearly shows that value of the the renewable energy legislation in doing the hard work to driving the renewable energy investment.

Pacific Hydro submits that the economic opportunities and benefits to regional communities from increasing renewable investment opportunities, including wind farms, are clearly demonstrated by this research. Our own experience strongly supports the conclusions and employment modelling.

Yours sincerely

Andrew Richards Executive Manager, Government and Corporate Affairs



CLEAN ENERGY JOBS IN REGIONAL NEW SOUTH WALES New South Wales



New South Wales has enough clean energy potential to

- power **3**,**000**,**000** homes
- remove pollution equivalent to 3,300,000 cars
- create 6,600 new jobs



INTRODUCTION

Australia is in the early stages of a clean energy boom, with tens of billions of dollars set to be invested in renewable energy in regional areas over the coming decades. The national 20% Renewable Energy Target alone is expected to drive investments of around \$19 billion out to 2030. The introduction of stronger policies to cut pollution and make clean energy cheaper will drive even greater levels of investment.

Clean energy investments create jobs in regional Australia, where the best renewable energy resources are located. Modelling for The Climate Institute shows that with strong and decisive pollution and climate policies - including a price-tag on pollution - close to 34,000 new jobs could be created in Australia by 2030.

Where this clean energy investment and job creation occurs is up for grabs. States and regions with the best clean energy resources and the strongest policy settings will attract the lion's share.

This briefing paper - part of a larger nation-wide study - assesses NSW's potential to benefit from the clean energy boom, with a particular focus on the employment opportunities this will create. Both state-wide and regional employment opportunities have been assessed.

The NSW component of this study was partly funded by the NSW Department of Climate Change and Water. With this funding six detailed regional roadmaps were produced to help regional stakeholders maximise clean energy jobs growth in their region. These roadmaps are available to download from The Climate Institute's website, along with shorter regional snapshots.

Some highlights of the NSW study include:

A large untapped resource: The modelling results show strong growth in NSW's electricity sector, with up to an additional 11,600 MW of generating capacity projected to be installed by 2030. This includes renewable energy, including wind, solar, bioenergy, and geothermal, as well as gas.

State-wide employment: Based on the modelling results it is estimated that over 6,900 new jobs will be created in NSW's electricity sector by 2030, including 1,304 permanent ongoing jobs, 4,463 construction jobs and over 1,200 manufacturing jobs. The vast majority of these jobs will be in renewable energy.

Regional clean energy jobs: Thousands of renewable energy jobs are up for grabs in regional NSW, including over 1,700 in the New England Tablelands; 866 in the Upper Hunter; 1,700 in the Central Tablelands; 560 in Snowy Monaro; 1,700 in the NSW/ACT Border Region and 390 in the South Coast. Details of the regional employment opportunities have been published separately to this briefing paper.



clean energy jobs in regional new south wales snapshot New South Wales

2 A BRIGHT FUTURE FOR NEW SOUTH WALES' ELECTRICITY SECTOR

NSW currently depends on black coal to supply the majority of its electricity needs, with around 65 million tonnes of carbon pollution released into the atmosphere from this source each year. Yet, NSW also has vast and largely untapped low pollution energy sources. This includes renewable energy options such as solar, wind, and bioenergy.

As part of this study, electricity sector modelling was undertaken by one of Australia's leading energy consultants, SKM-MMA. This modelling assessed how NSW's electricity generation mix might change over the coming two decades as Australia reduces its dependence on pollution. Specifically, the modelling assessed the combined effect of the 20% Renewable Energy Target and the introduction of a carbon price from 2012.

As part of the NSW component of this study, two separate carbon price scenarios were assessed. The first – Medium Carbon Price – assumes a carbon price is introduced consistent with the goal of reducing Australia's pollution by 15% below 2000 levels by 2020 and 60% by 2050. The second scenario – Strong Carbon Price – includes a carbon price consistent with a 25% cut in Australia's pollution below 2000 levels by 2020. Further details of the modelling have been published separately.¹

Note, the Medium Carbon Price scenario was included with financial support from the NSW Department of Climate Change and Water as part of a more detailed study into the regional opportunities in NSW. This scenario was not included for other states.

NSW'S FUTURE ENERGY MIX

As illustrated in Figure 1 and Figure 2, strong government policies to cut pollution and make clean

energy cheaper will drive significant changes in NSW's energy mix over the coming decades. By 2030, up to 33% of NSW's electricity could be produced from renewable energy sources, up from around 8% today. Regional analysis shows that greater proportions of renewable electricity are attainable with extra policies and focus. The modelling also illustrates that gas is likely to play a significant, transitionary role in NSW.

Figure 1: NSW's projected generation mix under Medium Carbon Price Scenario (commercial scale technologies only)

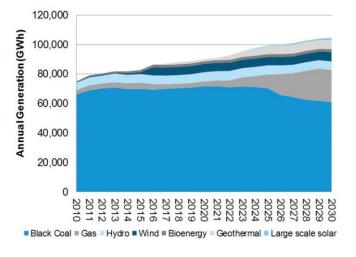
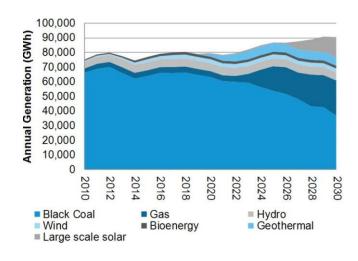


Figure 2: NSW's projected generation mix under Strong Carbon Price Scenario (commercial scale technologies only)



¹ The methodology can be downloaded from The Climate Institute's website.



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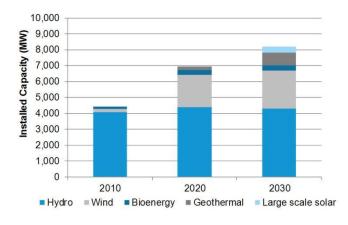
Table 1: Projected growth in small scale solar technologies in NSW

Technology	Unit	2010	2020	2030
PV	MW	200	380	511
Solar hot water	MW	500	961	2,408
Total	MW	700	1,341	2,919

Figure 3 and Figure 4 illustrate the projected growth in the amount of renewable energy installed in NSW out to 2030 under the two scenarios. Particularly strong growth is projected for wind and solar energy, with smaller, but still substantial growth projected for geothermal energy.

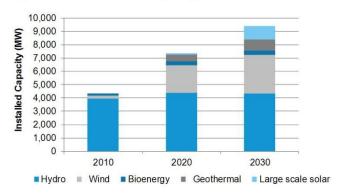
Consumer preferences and government policies have seen strong growth in small scale solar technologies over recent years, including rooftop PV and solar hot water. There are currently over 130,000 solar PV units and close to 180,000 solar hot water units installed in NSW, with a combined capacity equivalent to around 700 MW.² As illustrated in Table 1, between now and 2030, it is projected that demand for these technologies will continue to grow.3

Figure 3: Projected growth in renewable energy in NSW under the Medium Carbon Price Scenario (commercial scale capacity only)



² Clean Energy Council (2010), Clean Energy Australia 2010.

Figure 4: Projected growth in renewable energy in NSW under the Strong Carbon Price Scenario (commercial scale capacity only)



OUTLOOK FOR STATE-WIDE EMPLOYMENT

As part of this study The Climate commissioned the University of Technology, Sydney to assess the employment impacts across the power sector as a whole, including both conventional and renewable technologies, as well as the number of jobs created by renewables alone. The results are summarised below.

Three key job categories were assessed: (i) permanent workers employed to operate, maintain and supply fuel to electricity generators; (ii) construction and installation workers employed to build and install a new generation plant; and (iii) manufacturing workers employed in the manufacturing sectors that supply components for new

³ Projections for these small scale technologies were done separately to MMA's modeling. See methodology for full documentation.



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NERGY JOBS IN REGIONAL NEW SOUTH WALES New South Wales

electricity installations. Details of the methodology used have been published separately.4

SECTOR-WIDE EMPLOYMENT

As shown in Figure 5 and Figure 6, the total annual workforce - including all three employment categories for both conventional and renewable technologies - is projected to increase significantly between 2010 and 2030 under both of the modelling scenarios.

Figure 5: Projected total annual workforce in NSW's electricity sector under the Medium Carbon Price Scenario

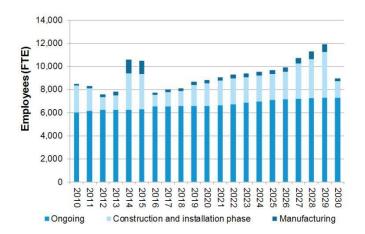


Figure 6: Projected total annual workforce in NSW's electricity sector under the Strong Carbon Price Scenario



⁴ The methodology can be downloaded from The Climate Institute's

Under the Medium Carbon Price scenario, over 6,400 new jobs could be created during this period. This includes close to 1,300 new permanent, ongoing jobs, a peak construction and installation workforce of over 3,900 people, and a peak manufacturing workforce over 1,170 people.

With a stronger carbon price over 6,900 new jobs are projected, including over 1,300 new permanent jobs, a construction workforce peaking at 4,460 and around 1,200 manufacturing jobs.

RENEWABLE ENERGY JOBS

Most of the new jobs projected for NSW over the coming decades are associated with the development of the state's renewable energy resources. Estimates of the number of new jobs associated with renewable energy technologies are presented in Table 2 and Table 3.

REGIONAL CASE STUDIES

The Climate Institute has prepared detailed regional roadmaps for six renewable energy precincts in NSW: New England Tablelands; Upper Hunter; Central Tablelands; NSW/ACT Border Region; Snowy-Monaro; and the South Coast. These roadmaps can be downloaded from The Climate Institute website.

In summary, the roadmaps demonstrate good potential for clean energy jobs growth in each of the precincts:

- New England Tablelands: up to 1,704 new jobs, including 598 ongoing jobs and 1,107 manufacturing jobs.
- Upper Hunter: up to 866 new jobs, including 273 ongoing jobs and a peak construction workforce of 593.
- Central Tablelands: up to 1,713 new jobs, 819 of which would be ongoing jobs and another 818 construction jobs.
- Snowy-Monaro: up to 561 new jobs, with 182 ongoing and 379 during construction.



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- NSW/ACT Border Region: up to a total of 1,734 new jobs including 414 ongoing jobs and a peak construction workforce of 1,320.
- South Coast: up to 391 new jobs, with 184 ongoing jobs and 207 construction jobs.

Table 2: Summary of renewable energy jobs estimates in NSW out to 2030 under the Medium Carbon Price Scenario

Renewable Technology	New ongoing jobs Total new jobs (FTE)	Construction and installation phase employment Peak workforce, 2010- 2030 (FTE)	Manufacturing jobs supported Peak workforce, 2010- 2030 (FTE)	Total New Jobs
Hydro	0	0	0	0
Wind	317	2,029	1,014	3,360
Bioenergy	131	94	0	225
Geothermal	482	321	34	837
Large-scale solar	83	860	57	1,000
Small-scale solar	85	1,450	45	1,580
Solar hot water	0	1,836	455	2,291
Total	1,111	3,353^	1,178^	5,642

^{*} These jobs are for new wind capacity which comes online post-2030, but for which construction begins in 2028.

Table 3: Summary of renewable energy jobs estimates in NSW out to 2030 under the Strong Carbon Price Scenario

Renewable Technology	New ongoing jobs Total new jobs (FTE)	Construction and installation phase employment Peak workforce, 2010- 2030 (FTE)	Manufacturing jobs supported Peak workforce, 2010- 2030 (FTE)	Total New Jobs
Hydro	0	0	0	0
Wind	387	2,060	1,030	3,477
Bioenergy	131	95	0	226
Geothermal	482	334	35	852
Large-scale solar	230	1,336	89	1,654
Small-scale solar	85	1,450	45	1,580
Solar hot water	0	1,836	455	2,291
Total	1,320	4,083^	1,200^	6,603

^{*} These jobs are for new wind capacity which comes online post-2030, but for which construction begins in 2028.

[^] This is the peak annual workforce for all technologies, not the sum of individual peaks for each technology

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clean energy jobs in regional new south wales snapshot New South Wales

5 POLICY IMPLICATIONS

Australia has a world-class and largely untapped potential to shift to clean energy sources and reduce the economy's dependence on pollution. Through the Federal Government's 20 percent Renewable Energy Target, this transition to clean energy sources can now begin in earnest.

While the Renewable Energy Target is a key interim driver of clean energy investments, it will not do the job of shifting Australia to a clean energy economy on its own

To unlock Australia's full clean energy potential additional policies are needed at federal, state and local levels. Key priorities are outlined below.

A LIMIT AND PRICE-TAG ON POLLUTION

The most important step Australia can take towards a low pollution economy is to introduce a limit and pricetag on carbon pollution. A credible pollution price that increases over time will level the playing field between renewable energy and conventional polluting sources, providing investors with greater long-term confidence to invest in clean energy sources.

Without long, loud and legal price signals businesses will lack the confidence to scale-up investments in clean energy from the research and development through to large-scale commercial deployment phases. As more investment flows, innovation in communities, businesses and technology will occur. This will accelerate the cost reductions and make clean energy cheaper.

The modelling undertaken for this study also demonstrates that a strong price-tag on pollution will create a net improvement in jobs across the electricity sector in Australia, particularly in regional Australia and stimulate billions of dollars of investment in those regional areas.

The Climate Institute welcomes the emerging multiparty commitments to have a price-tag on pollution in place in 2012. To maximise pollution savings and job creation, Parliament should ensure this carbon pricing mechanism, in conjunction with other policies, has the potential to reduce pollution by 25 percent or more below 2000 levels by 2020.

Australia has made an international commitment to reducing up to the 25% target and needs to demonstrate it has the national policies to deliver it.

A price-tag on pollution is a necessary, but not sufficient component of reforms needed.

SUPPORTING INNOVATION AND DEPLOYMENT

The 20 percent Renewable Energy Target and a carbon price are key to unlocking Australia's clean energy resources, but support for innovation will also be crucial.

A number of the technologies included in this study, particularly large-scale solar and geothermal, are at the early stages of commercialisation in Australia. Other emerging clean energy technologies, such as wave energy, hold great potential, but are in the research and development phase. A supportive policy and investment environment will be needed to facilitate and accelerate the deployment of these technologies.

Specifically, to drive early deployment of new emerging clean energy options, above the Renewable Energy Target, governments need to:

- Put in place targeted policies to support clean technology development in each phase of the commercialisation process (for example loan guarantees, tax credits and seed funds coinvestment or grant programs, such as the Solar Flagships, revenue subsidies and accelerated depreciation). These policies remove upfront and ongoing barriers to investments in emerging technologies, such as large scale solar, marine and geothermal and;
- Support the development of effective venture capital markets in Australia to attract private clean tech investment; and



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Support the deployment of clean energy technologies by removing infrastructure and regulatory barriers (for example, smart grids supporting distributed generation, streamlined state planning policies, National Energy Market regulatory reform, CCS pipelines and storage hubs, and additional electricity network infrastructure).

ENERGY EFFICIENCY

To help households and businesses manage energy bills and to stimulate broader technical and skills development additional policies and programs are needed to overcome barriers that have ensured Australia's poor performance in energy efficiency. Key recommendations in the Prime Ministers Energy Efficiency Task Group such as the Energy Savings Initiative should be adopted.

REGIONAL TRANSITIONS, SKILLS AND INDUSTRY DEVELOPMENT

Broader experience and Ernst and Young studies prepared for NSW renewable energy precincts in this research have highlighted the need for a number of other regional and local initiatives necessary to convert the clean energy technical potential to investment and employment reality. These include:

- Raise awareness, understanding and buy-in in the local business and wider community - with local demonstrations, industry focus groups, community engagement.
- Skilling up and engaging local work forces identifying training paths, providing workshops and on-line training opportunities, education and training programs and reaching out to part time or semi-retired trainers and tradespeople.
- Skills attraction programs to attract people with extra skills not available in the region, including assessments of social infrastructure and communications strategies.
- Further understanding of clean energy opportunities - further analysis and comparison of different technologies, greater analysis of local manufacturing potential.
- National/regional industry development broader analysis of potential for, and barriers to, existing industries expansion to cleaner employment and investment opportunities and linkages to training opportunities in training programs such as the Productivity Places Program.



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EAN ENERGY JOBS IN REGIONAL AUSTRALIA f Victoria



Victoria has enough clean

• power **1,500,000** homes

energy potential to

- remove pollution equivalent to 1,600,000 cars
- create 6,500 new jobs



The Climate Institute is a

INTRODUCTION

Australia is in the early stages of a clean energy boom, with tens of billions of dollars set to be invested in renewable energy in regional areas over the coming decades. The national 20% Renewable Energy Target alone is expected to drive investments of around \$19 billion out to 2030. The introduction of stronger policies to cut pollution and make clean energy cheaper will drive even greater levels of investment.

Clean energy investments create jobs in regional Australia, where the best renewable energy resources are located. Modelling for The Climate Institute shows that with strong and decisive pollution and climate policies - including a price-tag on pollution - close to 34,000 new jobs could be created in Australia by 2030.

Where this clean energy investment and job creation occurs is up for grabs. States and regions with the best clean energy resources and the strongest policy settings will attract the lion's share.

This briefing paper - part of a larger nation-wide study - assesses Victoria's potential to benefit from the clean energy boom, with a particular focus on the employment opportunities this will create. Both state-wide and regional employment opportunities have been assessed.

Some highlights of the Victoria study include:

A large untapped resource: The modelling results show strong growth in Victoria's electricity sector, with an additional 10,000 MW of generating capacity projected to be installed by 2030. This includes renewable energy, including wind, solar, bioenergy, and geothermal, as well as gas.

State-wide employment: Based on the modelling results it is estimated that over 7,800 new jobs will be created in Victoria's electricity sector by 2030, including over 2,000 permanent ongoing jobs, close to 4,600 construction jobs and over 1,200 manufacturing jobs. The vast majority of these jobs will be in renewable energy.

Regional clean energy jobs: Thousands of renewable energy jobs are up for grabs in regional Victoria, including over 3,300 in the Western District, over 1,300 in the Central Highlands and over 2,600 in the Mallee.



CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot Victoria

2 A BRIGHT FUTURE FOR VICTORIA'S ELECTRICITY SECTOR

Victoria currently depends on brown coal to supply the majority of its electricity needs, with around 60 million tonnes of carbon pollution released into the atmosphere from this source each year. Yet, Victoria has vast and largely untapped low pollution energy sources. This includes renewable energy options such as geothermal, solar, wind, hydro and bioenergy. Victoria also has large reserves of gas, which can play an important role in the transition to a clean energy economy, particularly for the rapid replacement of more pollution coal assets.

As part of this study, electricity sector modelling was undertaken by one of Australia's leading energy consultants, SKM-MMA. This modelling assessed how Victoria's electricity generation mix might change over the coming two decades as Australia reduces its dependence on pollution. Specifically, the modelling assessed the combined effect of the 20% Renewable Energy Target and the introduction of a strong carbon price from 2012, consistent with the goal of reducing Australia's pollution by 25% below 2000 levels by 2020. Further details of the modelling have been published separately.¹

VICTORIA'S FUTURE ENERGY MIX

As illustrated in Figure 1, strong government policies to cut pollution and make clean energy cheaper will drive significant changes in Victoria's energy mix over the coming decades. By 2030, up to 40% of Victoria's electricity could be produced from renewable energy sources, up from around 5% today. Regional analysis shows that greater proportions of renewable electricity are attainable with extra policies and focus. The modelling also illustrates that gas is likely to play a significant, transitionary role in Victoria.

Figure 2 illustrates the projected growth in the amount of renewable energy installed in Victoria out to 2030. Particularly strong growth is projected for wind and

solar energy, with smaller, but still substantial growth projected for geothermal energy.

Figure 1: Victoria's projected generation mix with strong pollution reduction policies (commercial scale technologies only)

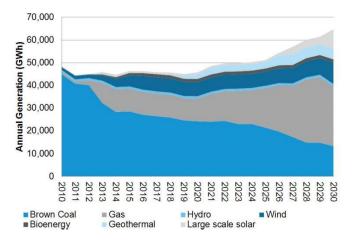
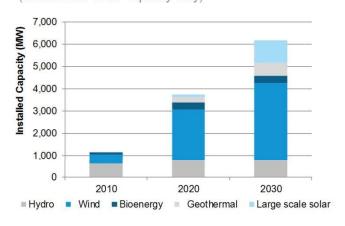


Figure 2: Projected growth in renewable energy in Victoria with strong pollution reduction polices (commercial scale capacity only)



¹ The methodology can be downloaded from The Climate Institute's website.



CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot Victoria

Table 1: Projected growth in small scale solar technologies in Victoria

Technology	Unit	2010	2020	2030
PV	MW	47	400	662
Solar hot water	MW	273	513	849
TOTAL	MW	320	913	1,510

A combination of consumer preferences and government policies have seen strong growth in small scale solar technologies over recent years, including rooftop solar PV and solar hot water units. It is estimated that there are currently 32,000 solar PV units and 98,000 solar hot water units installed in Victoria, with a combined capacity equivalent to around 320 MW.² As illustrated in Table 1, between now and 2030, it is projected that demand for these technologies will continue to grow.³

3 OUTLOOK FOR STATE-WIDE EMPLOYMENT

As part of this study, The Climate Institute commissioned University of Technology, Sydney to assess the employment impacts across the sector as a whole, including both conventional and renewable technologies, as well as the number of jobs created by renewables alone. The results are summarised below.

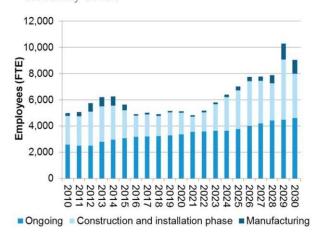
Three key job categories were assessed: (i) permanent workers employed to operate, maintain and supply fuel to electricity generators; (ii) construction and installation workers employed to build and install a new generation plant; and (iii) manufacturing workers employed in the manufacturing sectors that supply components for new

electricity installations. Details of the methodology used have been published separately.⁴

SECTOR-WIDE EMPLOYMENT

As shown in Figure 3, the total annual workforce – including all three employment categories for both conventional and renewable technologies – is projected to increase significantly between 2010 and 2030, with an estimated 7,846 new jobs created during this period. This includes 2,039 new permanent and a peak construction and installation workforce of close to 4,600 people. At its peak, the number of manufacturing jobs across the state is expected to exceed 1,200 people.

Figure 3: Projected total annual workforce in Victoria's electricity sector



² Clean Energy Council (2010), Clean Energy Australia 2010.

³ Projections for these small scale technologies were done separately to SKM-MMA's modeling. See methodology for full documentation.

⁴ The methodology can be downloaded from The Climate Institute's website



CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot Victoria

Table 2: Summary of renewable energy jobs estimates in Victoria out to 2030

Renewable Technology	New ongoing jobs Total new jobs (FTE)	Construction and installation phase employment Peak workforce, 2010- 2030 (FTE)	Manufacturing jobs supported Peak workforce, 2010- 2030 (FTE)	Total New Jobs
Hydro	32	0	0	32
Wind	435	2,166	1,083	3,684
Bioenergy	160	99	0	260
Geothermal	362	214	23	599
Large-scale solar	230	1,336	89	1,654
Small-scale solar	196	1,024	32	1,252
Solar hot water	0	519	129	647
TOTAL	1,414	3,896^	1,206^	6,516

^{*} These jobs are for new wind capacity which comes online post-2030, but for which construction begins in 2028.

RENEWABLE ENERGY JOBS

Estimates of the number of new jobs associated with renewable energy technologies are presented in Table 2. In total, it is estimated that close over 6,500 new jobs could be created as a result of a shift to renewable energy in Victoria. This includes over 1,400 new permanent, ongoing jobs, a peak construction phase workforce of over 3,890 people and a peak manufacturing workforce of around 1,200 people.

REGIONAL CASE STUDY: WESTERN DISTRICT

The Western District covers an area of over 22,000 square kilometres in Victoria's south-west, including the coastline from the South Australian border almost to Cape Otway. The region has a population of some 100,000 people, with the main population centres being Warrnambool, Portland and Hamilton.

REGIONAL CLEAN ENERGY POTENTIAL

As outlined in Table 3, the Western District has significant renewable energy resources, which to date remain largely untapped. While around 200 MW of renewable energy is currently installed, there is approximately 520 MW of additional capacity proposed for development. On top of this, it is estimated that another 4,100 MW could be developed in the region.

Note, the true potential of the region's bioenergy and geothermal resources may be significantly higher than listed in Table 3, but a comprehensive assessment was beyond the scope of this study.

HOW MUCH OF THE REGION'S CLEAN ENERGY RESOURCE WILL BE DEVELOPED?

The Western District has a significant renewable energy resource, which to date has yet to be fully developed. The extent to which this resource will be developed over the coming decades will depend on how attractive the region is to investors, relative to other regions

[^] This is the peak annual workforce for all technologies, not the sum of individual peaks for each technology



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Table 3: Commercial-scale renewable energy potential in the Western District

Resource type		Additional Potenti	al Capacity (MW)	
	Existing Capacity (MW)	Committed & Proposed Projects	Additional Inferred Potential	Total (MW)
Wind	150	487	2,000	2,637
Biomass	57	35	165	257
Geothermal	-	-	2,000	2,000
TOTAL	207	522	4,165	4,894

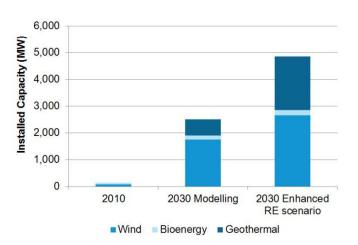
across Victoria and Australia as a whole. Indeed, given the competitive dynamics of Australia's electricity market, not all of the renewable energy opportunities identified in the Western District will necessarily be developed over the next two decades. Other project opportunities in other regions or states may work out to be more cost effective, factoring in regional policy support and other commercial drivers.

The Climate Institute commissioned modelling by leading energy sector consultants, SKM-MMA to provide an indication of how much of the Western District's renewable energy resource might be developed over the next two decades, based on the results of the state-wide modelling described above. In addition to the modelling results, The Climate Institute developed a hypothetical 'enhanced renewables' scenario, in which a much greater proportion of the region's renewable energy potential is developed over the next two decades.

The amount of renewable energy developed under each of these scenarios is shown in Figure 4. Based on the modelling results, it is projected that more than 2,500 MW will be developed, including around 1,700 MW of wind, over 150 MW of bioenergy and around 600 MW of geothermal. Under the enhanced renewables scenario, significantly more of the region's wind and geothermal resources are developed, with over 4,800 MW of renewable energy developed in total.

In addition to commercial scale renewable energy, significant demand for small scale solar technologies is also projected. By 2030, it is estimated that approximately 26 MW of small scale solar PV will be installed in the Western District, along with the equivalent of 34 MW of solar hot water.

Figure 4: Renewable energy development in Western District under the modelling and enhanced renewables scenarios.





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LEAN ENERGY JOBS IN REGIONAL AUSTRALIA apshot Victoria

Table 4: Estimate of new renewable energy jobs in the Western District (2010-2030)

	Lower estimate (Based on Modelling)	Upper estimate (Enhanced Scenario)
New ongoing jobs (FTE)	667	1,680
Construction phase (FTE, peak workforce)	692	1,356
Manufacturing jobs (FTE, peak workforce)	187	354
TOTAL	1,545	3,389

REGIONAL EMPLOYMENT IMPACTS

The expansion of renewable energy in the Western District will create new employment opportunities for local residents, including permanent operations and maintenance jobs, as well as supporting jobs during the construction and installation phase. The Western District already has an established manufacturing base. supplying wind towers to the Victorian and South Australian market. The potential to expand this base is assessed here.

Using the same approach as for the state-wide employment estimates described above, The Climate Institute has estimated the approximate number of jobs that could be created in the Western District between now and 2030. The results are presented in Table 4.

If the region's renewable energy resource is developed in line with the modelling results, it is predicted that more than 1,500 new jobs will be created in the region. This includes 667 permanent, ongoing jobs, a peak construction phase workforce of 692 people and a peak manufacturing workforce of 187 people.

If the region's renewable energy resources are developed in line with the enhanced scenario, over 3,389 new jobs could be created. This includes 1,680 ongoing jobs and a peak annual construction workforce of 1,356. Under this scenario, there is potential to support up to 354 manufacturing jobs in the region, building on the existing manufacturing base.

It's important to note that the manufacturing workforce estimates in Table 4 are based on the assumption that the region's existing manufacturers supply the region's wind industry only. In fact, they are likely to supply wind towers to other parts of Victoria and interstate. This may result in an even larger workforce than predicted, below.

5 REGIONAL CASE STUDY: CENTRAL HIGHLANDS

With a population of over 330,000 people, the Central Highlands region covers an area of over 26,000 square kilometres to the north-west of Melbourne and includes the regional centres of Ballarat and Bendigo.

REGIONAL CLEAN ENERGY POTENTIAL

Central Highlands has significant untapped renewable energy resources - see Table 5. While around 247 MW of renewable energy is currently installed, there is approximately 1,400 MW of additional wind energy capacity currently proposed for development. On top of this, it is estimated that another 1,200 MW of wind energy could be developed in the region.



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NERGY JOBS IN REGIONAL AUSTRALIA **Nictoria**

Table 5: Commercial-scale renewable energy potential in Central Highlands

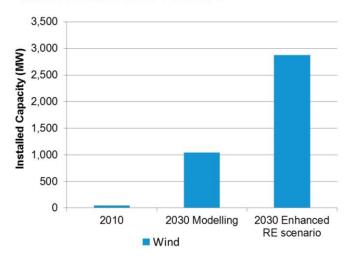
		Additional Potenti	al Capacity (MW)	
Resource type	Existing Capacity (MW)	Committed & Proposed Projects	Additional Inferred Potential	Total (MW)
Wind	245	1427	1,202	2,874
Hydro	2	•		2
Solar	1			1
TOTAL	247	1,427	1,202	2,877

HOW MUCH OF THE REGION'S CLEAN ENERGY RESOURCE WILL BE DEVELOPED?

The extent to which Central Highlands's renewable energy resources will be developed over the coming decades will depend on how attractive the region is to investors, relative to other regions in Victoria and Australia.

The amount of renewable energy developed under two scenarios - one based on the state-wide modelling undertaken for this project and the other based on a more extensive development of the resource – is shown in Figure 5.

Figure 5: Renewable energy development in Central Highlands under the modelling and enhanced renewables scenarios.



Based on the modelling results, it is projected that approximately 1,000 MW of wind is to be developed in the region. Under the enhanced renewables scenario this increases to over 2,800 MW of wind energy.

In addition to commercial scale renewable energy, significant demand for small scale solar technologies is also projected. By 2030, it is estimated that approximately 46 MW of small scale solar PV will be installed in the Central Highlands, along with the equivalent of 59 MW of solar hot water.

EMPLOYMENT IMPACTS

The Climate Institute's estimates of the number of new clean energy jobs that could be created in Central Highlands are summarised in Table 6. If the region's renewable energy resource is developed in line with the modelling results, it is predicted that close to 592 new jobs could be created in the region. This includes around 144 ongoing jobs and a peak construction workforce of 448 people.

It is estimated that even more jobs could be created if the region's renewable energy resources are developed in line with the enhanced scenario, with over 1,321 new jobs that could be created by 2030. This includes 409 new permanent jobs and 912 construction phase jobs.



CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot Victoria

Table 6: Estimate of new renewable energy jobs in Central Highlands (2010-2030)

	Lower estimate (Based on Modelling)	Upper estimate (Enhanced Scenario)
Permanent employment (FTE)	144	409
Construction phase (FTE, peak workforce)	448	912
TOTAL	592	1,321

6 REGIONAL CASE STUDY:

The Mallee covers an area of over 16,000 square kilometres in Victoria's north-west, bordering on NSW and South Australia. The region has a population of some 95,000 people, with the main population centres being Mildura and Swan Hill.

REGIONAL CLEAN ENERGY POTENTIAL

The Mallee has a very large, untapped solar energy resource – see Table 7. To date, a number projects have been proposed for the Mallee, with a combined capacity of over 330 MW. It is estimated that at least another 3,200 MW could be developed in the region, but in reality this figure may be much larger.

HOW MUCH OF THE REGION'S CLEAN ENERGY RESOURCE WILL BE DEVELOPED?

The extent to which the Mallee's solar resource will be developed over the coming decades will depend on how attractive the region is to investors, relative to other regions across Victoria and Australia as a whole.

Indeed, given the competitive dynamics of Australia's electricity market, not all of the renewable energy opportunities identified in the Mallee will necessarily be developed over the next two decades. Other project opportunities in other regions or states may work out to be more cost effective, factoring in regional policy support and other commercial drivers.

The Climate Institute commissioned modelling by leading energy sector consultants, SKM-MMA to provide an indication of how much of the Mallee's solar energy resource might be developed over the next two decades, based on the results of the state-wide modelling described above. In addition to the modelling results, The Climate Institute developed a hypothetical 'enhanced renewables' scenario, in which a much greater proportion of the region's solar energy potential is developed over the next two decades.

It is important to note that the modelling was undertaken prior to the release of the Victorian Climate Change White Paper, which flagged significant incentives for large-scale solar development, including in the Mallee. If these incentives are introduced it is likely that the Mallee's solar resource will be developed more in line with the enhanced renewables scenario.

Table 7: Commercial-scale renewable energy potential in the Mallee

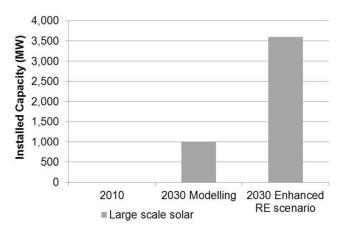
		Additional Potenti		
Resource type	Existing Capacity (MW)	Committed & Proposed Projects	Additional Inferred Potential	Total (MW)
Solar		334	3,266	3,600
TOTAL	0	334	3,266	3,600



CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot Victoria

The amount of solar energy developed under each of the two scenarios developed for this project is shown in Figure 6. Based on the modelling results, it is projected that 1,000 MW will be developed, while over 3,500 MW is developed under the enhanced renewables scenario.

Figure 6: Renewable energy development in the Mallee under the modelling and enhanced renewables scenarios.



In addition, by 2030 it is estimated that approximately 36 MW of small scale solar PV will be installed in the Mallee, along with the equivalent of 46 MW of solar hot water.

REGIONAL EMPLOYMENT IMPACTS

Using the same approach as for the state-wide employment estimates described above, The Climate Institute has estimated the number of jobs that could be

created in the Mallee between now and 2030. The results are presented in Table 8.

If the region's renewable energy resource is developed in line with the modelling results, it is predicted that 1,182 new jobs could be created in the region. This includes 240 permanent, ongoing jobs and a peak construction phase workforce of 942 people.

If the region's renewable energy resources are developed in line with the enhanced scenario, over 2,631 new jobs could be created. This includes 837 ongoing jobs and a peak annual construction workforce of 1,794 people.

7 POLICY IMPLICATIONS

Australia has a world-class and largely untapped potential to shift to clean energy sources and reduce the economy's dependence on pollution. Through the Federal Government's 20 percent Renewable Energy Target, this transition to clean energy sources can now begin in earnest.

While the Renewable Energy Target is a key interim driver of clean energy investments, it will not do the job of shifting Australia to a clean energy economy on its own.

To unlock Australia's full clean energy potential additional policies are needed at federal, state and local levels. Key priorities are outlined below.

Table 8: Estimate of new renewable energy jobs in the Mallee (2010-2030)

	Lower estimate (Based on Modelling)	Upper estimate (Enhanced Scenario)
New ongoing jobs (FTE)	240	837
Construction phase (FTE, peak workforce)	942	1,794
TOTAL	1,182	2,631



CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot Victoria

WHAT ABOUT GIPPSLAND AND THE LATROBE VALLEY?

Most of Victoria's electricity is currently generated by brown coal in the Latrobe Valley, in Gippsland, providing permanent employment to around 2,000 workers.

These brown coal assets will need to be replaced over the coming decades if Australia is to make deep cuts in carbon pollution. The rate at which these assets are replaced will depend on the strength of the carbon price and the introduction of other policies.

There are a number of options for replacing conventional brown coal generators, including gas, renewable energy and the use of carbon capture and storage technologies. Gippsland has the potential to use all three of these options to transition away from brown coal.

The modelling undertaken for this study found that over 4,000 MW of conventional brown coal generating capacity will need to be replaced over the next two decades. However, the Gippsland region is likely to remain one of Victoria's most important energy suppliers for decades to come.

Over the same period, it is projected that approximately 3,000 MW of gas fired generation capacity will be built in the Gippsland region, along with an additional 855 MW of wind and bioenergy. Approximately another 1,260 MW of wind may also be available for development. Studies are also underway to assess the potential to develop Gippsland's geothermal resources.

Work is also underway to demonstrate carbon capture and storage technologies, which would have good potential in Gippsland given the region's geological structure. Work by the Victorian Government has shown that if carbon capture and storage technologies are deployed, it would be possible to continue to produce around half of Victoria's electricity from brown coal in 2030 (Earth Resources Development Council, 2010).

What all of this means for employment in the Gippsland region is uncertain. Based on the modelling results described above the region will continue to provide permanent employment for over 1,500 people in the electricity sector, as well as supporting a peak construction workforce of over 720 people. The size of the workforce will be even larger if the region's full renewable energy resource is developed, and/or if carbon capture and storage technologies can be deployed.

A LIMIT AND PRICE-TAG ON POLLUTION

The most important step Australia can take towards a low pollution economy is to introduce a limit and pricetag on carbon pollution. A credible pollution price that increases over time will level the playing field between renewable energy and conventional polluting sources, providing investors with greater long-term confidence to invest in clean energy sources.

Without long, loud and legal price signals businesses will lack the confidence to scale-up investments in clean energy from the research and development through to large-scale commercial deployment phases. As more investment flows, innovation in communities, businesses and technology will occur. This will accelerate the cost reductions and make clean energy cheaper.

The modelling undertaken for this study also demonstrates that a strong price-tag on pollution will create a net improvement in jobs across the electricity sector in Australia, particularly in regional Australia and stimulate billions of dollars of investment in those regional areas.

The Climate Institute welcomes the emerging multiparty commitments to have a price-tag on pollution in place in 2012. To maximise pollution savings and job creation, Parliament should ensure this carbon pricing mechanism, in conjunction with other policies, has the potential to reduce pollution by 25 percent or more below 2000 levels by 2020.

Australia has made an international commitment to reducing up to the 25% target and needs to demonstrate it has the national policies to deliver it.

A price-tag on pollution is a necessary, but not sufficient component of reforms needed.

SUPPORTING INNOVATION AND DEPLOYMENT

The 20 percent Renewable Energy Target and a carbon price are key to unlocking Australia's clean energy resources, but support for innovation will also be crucial.



CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot Victoria

A number of the technologies included in this study, particularly large-scale solar and geothermal, are at the early stages of commercialisation in Australia. Other emerging clean energy technologies, such as wave energy, hold great potential, but are in the research and development phase. A supportive policy and investment environment will be needed to facilitate and accelerate the deployment of these technologies.

Specifically, to drive early deployment of new emerging clean energy options, above the Renewable Energy Target, governments need to:

- Put in place targeted policies to support clean technology development in each phase of the commercialisation process (for example loan guarantees, tax credits and seed funds coinvestment or grant programs, such as the Solar Flagships, revenue subsidies and accelerated depreciation). These policies remove upfront and ongoing barriers to investments in emerging technologies, such as large scale solar, marine and geothermal and;
- Support the development of effective venture capital markets in Australia to attract private clean tech investment; and
- Support the deployment of clean energy technologies by removing infrastructure and regulatory barriers (for example, smart grids supporting distributed generation, streamlined state planning policies, National Energy Market regulatory reform, CCS pipelines and storage hubs, and additional electricity network infrastructure).

ENERGY EFFICIENCY

To help households and businesses manage energy bills and to stimulate broader technical and skills development additional policies and programs are needed to overcome barriers that have ensured Australia's poor performance in energy efficiency. Key recommendations in the Prime Ministers Energy Efficiency Task Group such as the Energy Savings Initiative should be adopted.

REGIONAL TRANSITIONS, SKILLS AND INDUSTRY DEVELOPMENT

Broader experience and Ernst and Young studies prepared for NSW renewable energy precincts in this research have highlighted the need for a number of other regional and local initiatives necessary to convert the clean energy technical potential to investment and employment reality. These include:

- Raise awareness, understanding and buy-in in the local business and wider community – with local demonstrations, industry focus groups, community engagement.
- Skilling up and engaging local work forces —
 identifying training paths, providing workshops and
 on-line training opportunities, education and
 training programs and reaching out to part time or
 semi-retired trainers and tradespeople.
- Skills attraction programs to attract people with extra skills not available in the region, including assessments of social infrastructure and communications strategies.
- Further understanding of clean energy opportunities – further analysis and comparison of different technologies, greater analysis of local manufacturing potential.
- National/regional industry development broader analysis of potential for, and barriers to, existing industries expansion to cleaner employment and investment opportunities and linkages to training opportunities in training programs such as the Productivity Places Program.



ERGY JOBS IN REGIONAL AUSTRALIA Queensland



Queensland has enough clean energy potential to

- power **4**,000,000 homes
- remove pollution equivalent to 3,400,000 cars
- create 6.580 new jobs



The Climate Institute is a

INTRODUCTION

Australia is in the early stages of a clean energy boom, with tens of billions of dollars set to be invested in renewable energy in regional areas over the coming decades. The national 20% Renewable Energy Target alone is expected to drive investments of around \$19 billion out to 2030. The introduction of stronger policies to cut pollution and make clean energy cheaper will drive even greater levels of investment.

Clean energy investments create jobs in regional Australia, where the best renewable energy resources are located. Modelling for The Climate Institute shows that with strong and decisive pollution and climate policies - including a price-tag on pollution - close to 34,000 new jobs could be created in Australia by 2030.

Where this clean energy investment and job creation occurs is up for grabs. States and regions with the best clean energy resources and the strongest policy settings will attract the lion's share.

This briefing paper - part of a larger nation-wide study - assesses Queensland's potential to benefit from the clean energy boom, with a particular focus on the employment opportunities this will create. Both state-wide and regional employment opportunities have been assessed.

Some highlights of the Queensland study include:

A large untapped resource: The modelling results show strong growth in Queensland's electricity sector, with an additional 11,000 MW of generating capacity projected to be installed by 2030. This includes renewable energy, including bioenergy, geothermal and solar, as well as gas.

State-wide employment: Based on the modelling results it is estimated that over 7,100 new jobs will be created in Queensland's electricity sector by 2030, including over 2,400 permanent ongoing jobs, more than 3,800 construction jobs and over 840 manufacturing jobs. The vast majority of these jobs will be in renewable energy.

Regional clean energy jobs: Thousands of jobs are up for grabs in regional Queensland, including over 2,000 for North Queensland and over 3,100 for South-East Queensland.



CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot Queensland

2 A BRIGHT FUTURE FOR QUEENSLAND'S ELECTRICITY SECTOR

Like other Australian states Queensland currently depends on coal to supply the majority of its electricity needs, with around 43 million tonnes of carbon pollution released into the atmosphere from this source each year. Yet, Queensland has vast and largely untapped low pollution energy sources. This includes renewable energy options such as geothermal, solar, wind, hydro and bioenergy, as well as large reserves of gas, which can play an important role in the transition to a clean energy economy.

As part of this study, electricity sector modelling was undertaken by one of Australia's leading energy consultants, SKM-MMA. This modelling assessed how Queensland's electricity generation mix might change over the coming two decades as Australia reduces its dependence on pollution. Specifically, the modelling assessed the combined effect of the 20% Renewable Energy Target and the introduction of a strong carbon price from 2012, consistent with the goal of reducing Australia's pollution by 25% below 2000 levels by 2020. Further details of the modelling have been published separately.¹

QUEENSLAND'S FUTURE ENERGY MIX

As illustrated in Figure 1, strong government policies to cut pollution and make clean energy cheaper will drive significant changes in Queensland's energy mix over the coming decades. By 2030, close to 35% of Queensland's electricity could be produced from renewable energy sources, up from around 3% today. Regional analysis shows that greater proportions of renewable electricity are attainable with extra policies and focus. The modelling also illustrates that gas is likely to play a significant, transitionary role in Queensland.

Figure 2 illustrates the projected growth in the amount of renewable energy installed in Queensland out to 2030. Particularly strong growth is projected for geothermal and solar energy, with smaller, but still substantial growth projected for bioenergy sources, particularly from material left behind after the sugarcane harvest (bagasse).

Figure 1: Queensland's projected generation mix with strong pollution reduction policies (commercial scale technologies only)

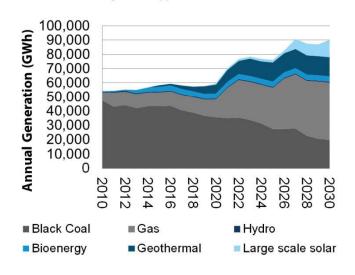
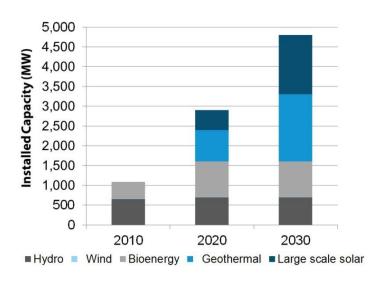


Figure 2: Projected growth in renewable energy in Queensland with strong pollution reduction polices (commercial scale capacity only)



¹ The methodology can be downloaded from The Climate Institute's website.



CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot Queensland

Table 1: Projected growth in small scale solar technologies in Queensland

Technology	Unit	2010	2020	2030
PV	MW	74	220	565
Solar hot water	MW	420	926	1,919
TOTAL	MW	495	1,145	2,484

A combination of consumer preferences and government policies have seen strong growth in small scale solar technologies over recent years, including rooftop solar PV and solar hot water units. It is estimated that there are currently approximately 50,000 solar PV units and 150,000 solar hot water units installed in Queensland, with a combined capacity equivalent to around 500 MW.² As illustrated in Table 1, between now and 2030, it is projected that demand for these technologies will continue to grow.³

3 OUTLOOK FOR STATE-WIDE EMPLOYMENT

As part of this study The Climate Institute commissioned University of Technology, Sydney to assess the employment impacts across the sector as a whole, including both conventional and renewable technologies, as well as the number of jobs created by renewables alone. The results are summarised below.

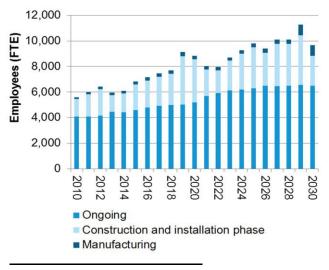
Three key job categories were assessed: (i) permanent workers employed to operate, maintain and supply fuel to electricity generators; (ii) construction and installation workers employed to build and install a new generation plant; and (iii) manufacturing workers employed in the manufacturing sectors that supply components for new

electricity installations. Details of the methodology used have been published separately.⁴

SECTOR-WIDE EMPLOYMENT

As shown in Figure 3, the total annual workforce – including all three employment categories for both conventional and renewable technologies – is projected to increase strongly between 2010 and 2030. In total an estimated 7,102 new jobs will be created over this period, including 2,408 new permanent, ongoing jobs and a peak construction and installation workforce of 3,852 people. At its peak, the number of manufacturing jobs across the state is expected to exceed 840 people.

Figure 3: Projected total annual workforce in Queensland's electricity sector



⁴ Methodology can be downloaded from The Climate Institute's website

documentation.

Clean Energy Council (2010), Clean Energy Australia 2010.
 Projections for these smaller scale technologies were done separately to SKM-MMA's modeling. See methodology for full



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ERGY JOBS IN REGIONAL AUST ot Queensland

Table 2: Summary of renewable energy jobs estimates in Queensland out to 2030

Renewable Technology	Ongoing jobs	Construction and Installation Phase employment	Manufacturing jobs supported	Total	
recimology	Total new jobs (FTE)	Peak workforce, 2010- 2030 (FTE)	Peak workforce, 2010- 2030 (FTE)		
Hydro	4	0	0	4	
Wind	0	1,080*	540*	1,620	
Bioenergy	369	362	3	733	
Geothermal	1,025	621	66	1,712	
Large-scale solar	344	901	60	1,306	
Small-scale solar	150	1,216	38	1,404	
Solar hotwater	0	1,192	295	1,487	
TOTAL	1,892	3,852^	842^	6,587	

[^] This is the peak annual workforce for all technologies, not the sum of individual peaks for each technology

RENEWABLE ENERGY JOBS

Estimates of the number of new jobs associated with renewable energy technologies are presented in Table 2. In total, it is estimated that 6,584 new renewable energy jobs could be created in Queensland. This includes over 1,880 new permanent ongoing jobs, a peak construction phase workforce of over 3,850 people and a peak manufacturing workforce of 840 people.

REGIONAL CASE STUDY: NORTH

For the purpose of this study the North Queensland region covers an area of more than 350,000 square kilometres and a population of around 440,000 people,

stretching from Townsville in the south to Cape York in the north, along Queensland's north east coast.

REGIONAL CLEAN ENERGY POTENTIAL

As outlined in Table 3, North Queensland has significant renewable energy resources, which to date remain largely untapped. While around 815 MW of renewable energy is currently installed, there is approximately 1,130 MW of additional capacity proposed for development. On top of this, it is estimated that another 3,774 MW could be developed in the region. Note, the true potential of the region's bioenergy and solar resources may be significantly higher than listed in Table 3, but a comprehensive assessment was beyond the scope of this study.

^{*}This is for wind capacity that comes online post 2030, but for which construction begins prior to 2030



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EAN ENERGY JOBS IN REGIONAL AUSTRALIA apshot Queensland

Table 3: Commercial-scale renewable energy potential in North Queensland

Resource type		Additional Potential Capacity (MW)		
	Existing Capacity (MW)	Proposed Projects	Additional Inferred Potential	Total (MW)
Bioenergy	145	87	175	407
Hydro	658	40	99	797
Wind	12	1,003	1,500	2,515
Large-scale solar	-	-	2,000	2,000
TOTAL	815	1,130	3,774	5,719

HOW MUCH OF THE REGION'S CLEAN ENERGY RESOURCE WILL BE DEVELOPED?

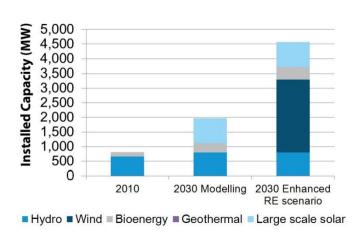
North Queensland has a significant renewable energy resource, which to date has yet to be fully developed. The extent to which this resource will be developed over the coming decades will depend on how attractive the region is to investors, relative to other regions across Queensland and Australia as a whole. Indeed, given the competitive dynamics of Australia's electricity market, not all of the renewable energy opportunities identified in North Queensland will necessarily be developed over the next two decades. Other project opportunities in other regions or states may work out to be more cost effective, factoring in regional policy support and other commercial drivers.

The Climate Institute commissioned modelling by leading energy sector consultants, SKM-MMA to provide an indication of how much of the North Queensland renewable energy resource might be developed over the next two decades, based on the results of the state-wide modelling described above. In addition to the modelling results, The Climate Institute developed a hypothetical 'enhanced renewables' scenario, in which a much greater proportion of the region's renewable energy potential is developed over the next two decades.

The amount of renewable energy developed under each of these scenarios is shown in Figure 4. Based on the modelling results, it is projected that more than 2,000 MW will be developed, including around 850 MW of large-scale solar, over 300 MW of bioenergy and around 170 MW of small scale solar technologies. The main difference under the enhanced renewables scenario is that the region's entire known wind resource is developed (2,200 MW), none of which is projected to be developed under the modelling scenario.

By 2030, it is estimated that approximately 70 MW of small scale solar PV will be installed in the North Queensland region, along with the equivalent of 110 MW of solar hot water.

Figure 4: Renewable energy development in North Queensland under the modelling and enhanced renewables scenarios.





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EAN ENERGY JOBS IN REGIONAL AUSTRALIA apshot Queensland

Table 4: Estimate of new renewable energy jobs in North Queensland (2030)

	Lower estimate	Upper estimate
	(Based on Modelling)	(Enhanced Scenario)
New ongoing jobs (FTE)	369	813
Construction phase	692	1 224
(FTE, peak workforce)	683	1,234
TOTAL	1,052	2,047

REGIONAL EMPLOYMENT IMPACTS

The expansion of renewable energy in North Queensland will create new employment opportunities for local residents, including permanent operations and maintenance jobs, and supporting jobs during the construction and installation phase. There may also be potential for the region to support new manufacturing jobs in the clean energy sectors, but it is very difficult to predict the regional distribution of these jobs.

Using the same approach as for the state-wide employment estimates described above, The Climate Institute has estimated the approximate number of jobs that could be created in North Queensland between now and 2030. The results are presented in Table 4.

If the region's renewable energy resource is developed in line with the modelling results, it is predicted that more than 1,000 new jobs will be created in the region. This includes around 369 permanent, ongoing jobs and a peak construction phase workforce of 683 people.

If the region's renewable energy resources are developed in line with the enhanced scenario, over 2,040 new jobs could be created. This includes 813 ongoing jobs and over 1,234 construction phase jobs.

REGIONAL CASE STUDY: SOUTH-EAST QUEENSLAND

For the purposes of this study, South East Queensland region includes Brisbane, the Gold Coast, Sunshine Coast and Darling Downs statistical divisions.

REGIONAL CLEAN ENERGY POTENTIAL

South-East Queensland has significant untapped renewable energy resources - see Table 5. While around 820 MW of renewable energy is currently installed, there is approximately 1,100 MW of additional capacity currently proposed for development. On top of this, it is estimated that a 2,200 MW could be developed in the region.

Note, the true potential of the region's bioenergy and solar resources may be significantly higher than listed in Table 5, but a comprehensive assessment was beyond the scope of this study.

HOW MUCH OF THE REGION'S CLEAN ENERGY RESOURCE WILL BE DEVELOPED?

As with the North Queensland case study, the extent to which South-East Queensland's renewable energy resources will be developed over the coming decades will depend on how attractive the region is to investors, relative to other regions is Queensland and Australia.



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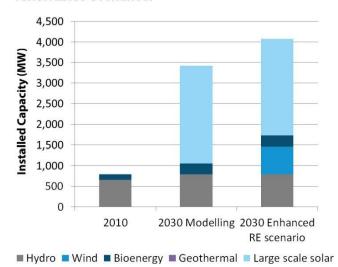
Table 5: Commercial-scale renewable energy potential in South East Queensland

Resource type	Existing	Additional Potential Capacity (MW)			
	Capacity (MW)	Committed Projects*	Proposed Projects	Additional Inferred Potential	Total (MW)
Bioenergy	134		14	115	263
Hydro	685		-	112	797
Wind			664	-	664
Large-scale solar			423	2,000	2,423
TOTAL	819	0	1,101	2,227	4,147

The amount of renewable energy developed under two scenarios - one based on the state-wide modelling undertaken for this project and the other based on a more extensive development of the resource – is shown in Figure 5.

Based on the modelling results, it is projected that approximately 3,400 MW of renewable energy will be developed in the region by 2030, including more than

Figure 5: Renewable energy development in South East Queensland under the modelling and enhanced renewables scenarios.



2,300 MW of large-scale solar. The main difference under the enhanced renewables scenario is that the region's entire known wind resource is developed (around 660 MW), none of which is projected to be developed under the modelling scenario.

A very large uptake of small scale technologies - solar PV and solar hot water - is also projected, with an equivalent combined capacity of around 1,350 MW.

EMPLOYMENT IMPACTS

The Climate Institute's estimates of the number of new clean energy jobs that could be created in South-East Queensland are summarised in Table 6. If the region's renewable energy resource is developed in line with the modelling results, it is predicted that close to 2,800 new jobs could be created in the region. This includes around 750 ongoing jobs and a peak construction workforce of over 2,000 people.

It is estimated that even more jobs could be created if the region's renewable energy resources are developed in line with the enhanced scenario, with over 3,100 new jobs that could be created by 2030. This includes more than 850 new permanent jobs and over 2,200 construction phase jobs.



CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot Queensland

Table 6: Estimate of new renewable energy jobs in South East Queensland (2030)

	Lower estimate	Upper estimate
	(Based on Modelling)	(Enhanced Scenario)
Permanent employment (FTE)	754	854
Construction phase	2.042	2.202
(FTE, peak workforce)	2,043	2,283
TOTAL	2,797	3,137

POLICY IMPLICATIONS

Australia has a world-class and largely untapped potential to shift to clean energy sources and reduce the economy's dependence on pollution. Through the Federal Government's 20 percent Renewable Energy Target, this transition to clean energy sources can now begin in earnest.

While the Renewable Energy Target is a key interim driver of clean energy investments, it will not do the job of shifting Australia to a clean energy economy on its own.

To unlock Australia's full clean energy potential additional policies are needed at federal, state and local levels. Key priorities are outlined below.

A LIMIT AND PRICE-TAG ON POLLUTION

The most important step Australia can take towards a low pollution economy is to introduce a limit and pricetag on carbon pollution. A credible pollution price that increases over time will level the playing field between renewable energy and conventional polluting sources, providing investors with greater long-term confidence to invest in clean energy sources.

Without long, loud and legal price signals businesses will lack the confidence to scale-up investments in clean energy from the research and development through to large-scale commercial deployment phases. As more investment flows, innovation in communities, businesses and technology will occur. This will

accelerate the cost reductions and make clean energy cheaper.

The modelling undertaken for this study also demonstrates that a strong price-tag on pollution will create a net improvement in jobs across the electricity sector in Australia, particularly in regional Australia and stimulate billions of dollars of investment in those regional areas.

The Climate Institute welcomes the emerging multiparty commitments to have a price-tag on pollution in place in 2012. To maximise pollution savings and job creation, Parliament should ensure this carbon pricing mechanism, in conjunction with other policies, has the potential to reduce pollution by 25 percent or more below 2000 levels by 2020.

Australia has made an international commitment to reducing up to the 25% target and needs to demonstrate it has the national policies to deliver it.

A price-tag on pollution is a necessary, but not sufficient component of reforms needed.

SUPPORTING INNOVATION AND DEPLOYMENT

The 20 percent Renewable Energy Target and a carbon price are key to unlocking Australia's clean energy resources, but support for innovation will also be crucial.

A number of the technologies included in this study, particularly large-scale solar and geothermal, are at the early stages of commercialisation in Australia. Other emerging clean energy technologies, such as wave



EAN ENERGY JOBS IN REGIONAL AUSTRALIA **Oli Queensland**

energy, hold great potential, but are in the research and development phase. A supportive policy and investment environment will be needed to facilitate and accelerate the deployment of these technologies.

Specifically, to drive early deployment of new emerging clean energy options, above the Renewable Energy Target, governments need to:

- Put in place targeted policies to support clean technology development in each phase of the commercialisation process (for example loan guarantees, tax credits and seed funds coinvestment or grant programs, such as the Solar Flagships, revenue subsidies and accelerated depreciation). These policies remove upfront and ongoing barriers to investments in emerging technologies, such as large scale solar, marine and geothermal and;
- Support the development of effective venture capital markets in Australia to attract private clean tech investment; and
- Support the deployment of clean energy technologies by removing infrastructure and regulatory barriers (for example, smart grids supporting distributed generation, streamlined state planning policies, National Energy Market regulatory reform, CCS pipelines and storage hubs, and additional electricity network infrastructure).

ENERGY EFFICIENCY

To help households and businesses manage energy bills and to stimulate broader technical and skills development additional policies and programs are needed to overcome barriers that have ensured Australia's poor performance in energy efficiency. Key recommendations in the Prime Ministers Energy Efficiency Task Group such as the Energy Savings Initiative should be adopted.

REGIONAL TRANSITIONS, SKILLS AND INDUSTRY DEVELOPMENT

Broader experience and Ernst and Young studies prepared for NSW renewable energy precincts in this research have highlighted the need for a number of other regional and local initiatives necessary to convert the clean energy technical potential to investment and employment reality. These include:

- Raise awareness, understanding and buy-in in the local business and wider community - with local demonstrations, industry focus groups, community engagement.
- Skilling up and engaging local work forces identifying training paths, providing workshops and on-line training opportunities, education and training programs and reaching out to part time or semi-retired trainers and tradespeople.
- Skills attraction programs to attract people with extra skills not available in the region, including assessments of social infrastructure and communications strategies.
- Further understanding of clean energy opportunities - further analysis and comparison of different technologies, greater analysis of local manufacturing potential.
- National/regional industry development broader analysis of potential for, and barriers to, existing industries expansion to cleaner employment and investment opportunities and linkages to training opportunities in training programs such as the Productivity Places Program.



EAN ENERGY JOBS IN REGIONAL AUSTRALIA South Australia



South Australia has enough clean energy potential to

- power **3,000,000** homes
- remove pollution equivalent to **450**,000 cars
- create 5.000 new jobs



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INTRODUCTION

Australia is in the early stages of a clean energy boom, with tens of billions of dollars set to be invested in renewable energy in regional areas over the coming decades. The national 20% Renewable Energy Target alone is expected to drive investments of around \$19 billion out to 2030. The introduction of stronger policies to cut pollution and make clean energy cheaper will drive even greater levels of investment.

Clean energy investments create jobs in regional Australia, where the best renewable energy resources are located. Modelling for The Climate Institute shows that with strong and decisive pollution and climate policies - including a price-tag on pollution - close to 34,000 new jobs could be created in Australia by 2030.

Where this clean energy investment and job creation occurs is up for grabs. States and regions with the best clean energy resources and the strongest policy settings will attract the lion's share.

This briefing paper - part of a larger nation-wide study - assesses South Australia's potential to benefit from the clean energy boom, with a particular focus on the employment opportunities this will create. Both state-wide and regional employment opportunities have been assessed.

Some highlights of the South Australia study include:

A large untapped resource: The modelling results show strong growth in South Australia's electricity sector, with an additional 5,400 MW of generating capacity projected to be installed by 2030. This includes renewable energy, including wind, solar and geothermal, as well as gas.

State-wide employment: Based on the modelling results it is estimated that close to 5,000 new jobs will be created in South Australia's electricity sector by 2030, including 1,089 permanent ongoing jobs, 2,688 construction jobs and 1,189 manufacturing jobs. The vast majority of these jobs will be in renewable energy.

Regional clean energy jobs: Thousands of jobs are up for grabs in regional South Australia, including over 1,200 on the Eyre Peninsula and over 1,300 in the York and Lower North region.



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CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot South Australia

2 A BRIGHT FUTURE FOR SOUTH AUSTRALIA'S ELECTRICITY SECTOR

South Australia currently depends on coal and natural gas to supply the majority of its electricity, with around seven million tonnes of carbon pollution released into the atmosphere from this source each year. Yet, South Australia also has vast and still largely untapped renewable energy resources, including geothermal, solar, wind, and bioenergy.

As part of this study, electricity sector modelling was undertaken by one of Australia's leading energy consultants, SKM-MMA. This modelling assessed how South Australia's electricity generation mix might change over the coming two decades as Australia reduces its dependence on pollution and shifts to clean energy sources. Specifically, the modelling assessed the combined effect of the 20% Renewable Energy Target and the introduction of a strong carbon price from 2012, consistent with the goal of reducing Australia's pollution by 25% below 2000 levels by 2020. Further details of the modelling have been published separately.¹

SOUTH AUSTRALIA'S FUTURE ENERGY MIX

As illustrated in Figure 1, strong government policies to cut pollution and make clean energy cheaper have the potential to drive significant renewable energy investments in South Australia over the coming decades. The modelling undertaken for this study shows that by 2030, close to 87% of South Australia's electricity could be produced from renewable energy sources, up from around 13% today. Regional analysis shows that greater proportions of renewable electricity are attainable with extra policies and focus

Figure 2 illustrates the projected growth in the amount of renewable energy installed in South Australia out to 2030 under the modelling scenario. Particularly strong growth is projected for geothermal and solar energy.

Figure 1: South Australia's Electricity Generation by technology 2010 to 2030

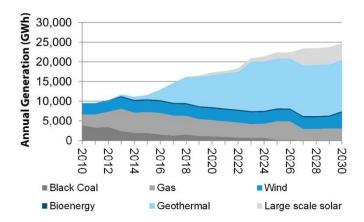
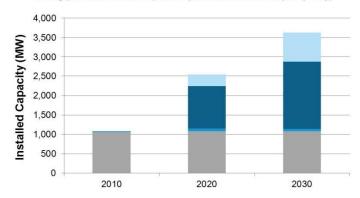


Figure 2: Projected growth in renewable energy in South Australia with strong pollution reduction polices (commercial scale capacity only)



Consumer preferences and government policies have seen strong growth in small scale solar technologies over recent years. An estimated 24,000 solar PV units and 35,000 solar hot water units are currently installed in South Australia, with a combined capacity of 130 MW.² Strong growth is expected out to 2030 - Table 1.³

¹ The methodology can be downloaded from The Climate Institute's website

² Clean Energy Council (2010), *Clean Energy Australia 2010*.

³ Projections for these smaller scale technologies were done separately to SKM-MMA's modeling. See methodology for full documentation.



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CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot South Australia

Table 1: Projected growth in small scale solar technologies in South Australia

Technology	Unit	2010	2020	2030
PV	MW	40	91	220
Solar hot water	MW	100	218	475
Total	MW	140	309	695

3 OUTLOOK FOR STATE-WIDE EMPLOYMENT

As part of this study The Climate Institute commissioned the University of Technology, Sydney to assess the employment impacts across the sector as a whole, including both conventional and renewable technologies, as well as the number of jobs created by renewables alone. The results are summarised below.

Three key job categories were assessed: (i) permanent workers employed to operate, maintain and supply fuel to electricity generators; (ii) construction and installation workers employed to build and install a new generation plant; and (iii) manufacturing workers employed in the manufacturing sectors that supply components for new electricity installations. Details of the methodology used have been published separately.⁴

SECTOR-WIDE EMPLOYMENT

As shown in Figure 3, the total annual workforce – including all three employment categories for both conventional and renewable technologies – is projected to increase strongly between 2010 and 2030. In total an estimated 4,966 new jobs will be created over this period, including 1,089 new permanent, ongoing jobs and a peak construction and installation workforce of 2,688 people. At its peak, the number of manufacturing jobs across the state is expected to exceed 1,180 people.

RENEWABLE ENERGY JOBS

Estimates of the number of new jobs associated with renewable energy technologies are presented in Table 2. In total, it is estimated that 5,178 new jobs could be created as a result of a shift to renewable energy in South Australia. This includes 1,300 new permanent ongoing jobs, a peak construction phase workforce of 2,688 people and a peak manufacturing workforce of over 1,189 people.

Figure 3: Projected total annual workforce in South Australia's electricity sector



⁴ The methodology can be downloaded from The Climate Institute's website

CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot South Australia

Table 2: Summary of renewable energy jobs estimates in South Australia out to 2030

Renewable Technology	Ongoing jobs	Construction and Installation Phase employment	Manufacturing jobs supported	Total
	Total new jobs (FTE)	Peak workforce, 2010- 2030 (FTE)	Peak workforce, 2010- 2030 (FTE)	
Wind	0	2,250*	1,125*	3,375
Bioenergy	35	42	0	77
Geothermal	1,045	559	59	1,664
Large-scale solar	172	491	33	696
Small-scale solar	48	353	11	412
Solar hotwater	0	259	64	323
Total	1,300	2,688^	1,189^	5,178

[^] This is the peak annual workforce for all technologies, not the sum of individual peaks for each technology

REGIONAL CASE STUDY: EYRE PENINSULA

South Australia's Eyre Peninsula is located to the south-west of Port Augusta and covers an area of more than 37,000 square kilometres and has a population of around 29,000 people. As outlined below, there is good potential for clean energy jobs growth in the region.

REGIONAL CLEAN ENERGY POTENTIAL

As outlined in Table 3, the Eyre Peninsula has significant renewable energy resources, which to date remain largely untapped. While around 400 MW of renewable energy is currently installed, there is over 1,400 MW of additional capacity currently proposed for development. On top of this, it is estimated that another 1,300 MW could be developed in the region. The

Table 3: Commercial-scale renewable energy potential on the Eyre Peninsula

Resource type	Existing Capacity	Additional Poter		
	(MW)	Committed and Proposed Projects	Additional Inferred Potential	Total (MW)
Wind	400	1,425	1,059	2,884
Large-scale solar	0	41	na	41
TOTAL	400	1,466	1,059	2,925

^{*}This is for wind capacity that comes online post 2030, but for which construction begins prior to 2030



CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot South Australia

region's most significant resource is wind energy, but there may also be potential to develop large scale solar (note, the true potential of the region's solar resources may be significantly higher than listed in Table 2, but a comprehensive assessment was beyond the scope of this study).

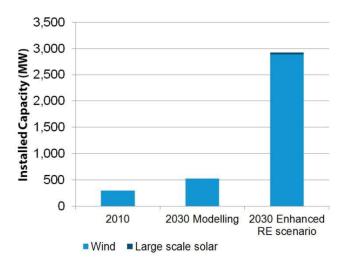
HOW MUCH OF THE REGION'S CLEAN ENERGY RESOURCE WILL BE DEVELOPED?

The Eyre Peninsula has a significant renewable energy resource, which to date has yet to be fully developed. The extent to which this resource will be developed over the coming decades will depend on how attractive the region is to investors, relative to other regions. Indeed, given the competitive dynamics of Australia's electricity market, not all of the renewable energy opportunities identified in the Eyre Peninsula will necessarily be developed over the next two decades. Other project opportunities in other regions or states may work out to be more cost effective, factoring in regional policy support and other commercial drivers.

The Climate Institute commissioned modelling by leading energy sector consultants, SKM-MMA to provide an indication of how much of the Eyre Peninsula's renewable energy resource might be developed over the next two decades, based on the results of the state-wide modelling described above. In addition to the modelling results, The Climate Institute developed a hypothetical 'enhanced renewables' scenario, in which a much greater proportion of the region's renewable energy potential is developed over the next two decades.

The amount of renewable energy developed under each of these scenarios is shown in Figure 4. Based on the modelling results, it is projected that close to 525 MW of wind will be developed in the region by 2030. However, under the enhanced renewables scenario the region's full wind resource is developed (over 2,880 MW), plus a relatively small amount of commercial scale solar (40 MW).

Figure 4: Renewable energy development on the Eyre Peninsula under the modelling and enhanced renewables scenarios



In addition to commercial scale renewable energy, significant demand for small scale solar technologies is also projected. By 2030, it is estimated that approximately 6 MW of small scale solar PV will be installed on the Eyre Peninsula, along with the equivalent of 9 MW of solar hot water.

EMPLOYMENT IMPACTS

The development of the Eyre Peninsula's renewable energy resources will create new employment opportunities in the precinct, including permanent operations and maintenance jobs, and supporting jobs during the construction and installation phase. There may also be potential for the region to support new manufacturing jobs in the clean energy sectors, but it is very difficult to predict the regional distribution of these jobs.

Using the same approach as for the state-wide employment estimates described above, The Climate Institute has estimated the approximate number of jobs that could be created in the Eyre Peninsula region between now and 2030. The results are presented in Table 4.



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CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot South Australia

Table 4: Estimate of new renewable energy jobs on the Eyre Peninsula

	Lower estimate (Based on Modelling)	Upper estimate (Enhanced Scenario)
New ongoing jobs (FTE)	13	364
Construction phase (FTE, peak workforce)	157	921
TOTAL	170	1,285

If the region's renewable energy resource is developed in line with the modelling results, it is estimated that 170 new clean energy jobs will be created in the region between now and 2030. However, if the region's renewable energy resources are developed in line with the enhanced scenario, over 1,280 new jobs could be created. This includes more than 360 permanent jobs and a peak construction and installation workforce of 920 employees.

5 REGIONAL CASE STUDY: YORK AND LOWER NORTH

The York and Lower North region of South Australia covers over 20,300 square kilometres, including the York Peninsula, and has a population of around 47,000 people. The region has a very large and to date mostly untapped wind energy resource.

REGIONAL CLEAN ENERGY POTENTIAL

The York and Lower North region has significant untapped wind energy resources – see Table 5. While around 300 MW of wind energy is currently installed,

there is approximately 1,700 MW of additional capacity currently proposed for development. On top of this, it is estimated that approximately another 880 MW could be developed in the region.

HOW MUCH OF THE REGION'S CLEAN ENERGY RESOURCE WILL BE DEVELOPED?

As with the Eyre Peninsula case study, the extent to which the York and Lower North region's renewable energy resources will be developed over the coming decades will depend on how attractive the region is to investors, relative to other regions in South Australia and in other parts of the country.

The amount of renewable energy developed under two scenarios — one based on the state-wide modelling undertaken for this project and the other based on a more extensive development of the resource — is shown in Figure 5.

Based on the modelling results, it is projected that slightly over 500 MW of wind energy will be developed in the region by 2030. Under the enhanced renewables

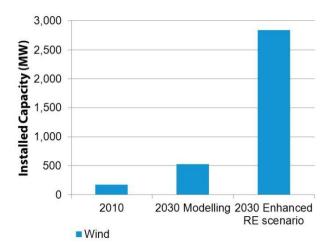
Table 5: Commercial-scale renewable energy potential in the York and Lower North Region

Resource type	Poleston	Additional Potential Capacity (MW)			
	Existing Capacity (MW)	Committed and Proposed Projects	Additional Inferred Potential	Total (MW)	
Wind	300	1,699	886	2,884	
TOTAL	300	1,699	886	2,884	



CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot South Australia

Figure 5: Renewable energy development in the York and Lower North region under the modelling and enhanced renewables scenarios.



scenario the region's full wind resource is developed (over 2,800 MW).

In addition to commercial scale renewable energy, significant demand for small scale solar technologies is also projected. By 2030, it is estimated that approximately 5 MW of small scale solar PV will be installed in the York and Lower North region, along with the equivalent of 13 MW of solar hot water.

EMPLOYMENT IMPACTS

The Climate Institute's estimates of the number of new clean energy jobs that could be created in the York and Lower North region are summarised in Table 6. If the region's renewable energy resource is developed in line with the modelling results, it is predicted that over 300 new clean energy jobs could be created in the region. However, it is estimated that even more jobs could be created if the region's renewable energy resources are developed in line with the enhanced scenario, with over 1,300 new jobs that could be created by 2030. This includes more than 360 new peak construction jobs and an installation workforce of over 1,300 people.

Table 6: Estimate of new renewable energy jobs in York and Lower North

	Lower estimate (Based on Modelling)	Upper estimate (Enhanced Scenario)
New ongoing jobs (FTE)	29	363
Construction phase (FTE, peak workforce)	284	945
TOTAL	313	1,308



CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot South Australia

6 POLICY IMPLICATIONS

Australia has a world-class and largely untapped potential to shift to clean energy sources and reduce the economy's dependence on pollution. Through the Federal Government's 20 percent Renewable Energy Target, this transition to clean energy sources can now begin in earnest.

While the Renewable Energy Target is a key interim driver of clean energy investments, it will not do the job of shifting Australia to a clean energy economy on its own.

To unlock Australia's full clean energy potential additional policies are needed at federal, state and local levels. Key priorities are outlined below.

A LIMIT AND PRICE-TAG ON POLLUTION

The most important step Australia can take towards a low pollution economy is to introduce a limit and pricetag on carbon pollution. A credible pollution price that increases over time will level the playing field between renewable energy and conventional polluting sources, providing investors with greater long-term confidence to invest in clean energy sources.

Without long, loud and legal price signals businesses will lack the confidence to scale-up investments in clean energy from the research and development through to large-scale commercial deployment phases. As more investment flows, innovation in communities, businesses and technology will occur. This will accelerate the cost reductions and make clean energy cheaper.

The modelling undertaken for this study also demonstrates that a strong price-tag on pollution will create a net improvement in jobs across the electricity sector in Australia, particularly in regional Australia and stimulate billions of dollars of investment in those regional areas.

The Climate Institute welcomes the emerging multiparty commitments to have a price-tag on pollution in place in 2012. To maximise pollution savings and job creation, Parliament should ensure this carbon pricing mechanism, in conjunction with other policies, has the potential to reduce pollution by 25 percent or more below 2000 levels by 2020.

Australia has made an international commitment to reducing up to the 25% target and needs to demonstrate it has the national policies to deliver it.

A price-tag on pollution is a necessary, but not sufficient component of reforms needed.

SUPPORTING INNOVATION AND DEPLOYMENT

The 20 percent Renewable Energy Target and a carbon price are key to unlocking Australia's clean energy resources, but support for innovation will also be crucial.

A number of the technologies included in this study, particularly large-scale solar and geothermal, are at the early stages of commercialisation in Australia. Other emerging clean energy technologies, such as wave energy, hold great potential, but are in the research and development phase. A supportive policy and investment environment will be needed to facilitate and accelerate the deployment of these technologies.

Specifically, to drive early deployment of new emerging clean energy options, above the Renewable Energy Target, governments need to:

- Put in place targeted policies to support clean technology development in each phase of the commercialisation process (for example loan guarantees, tax credits and seed funds coinvestment or grant programs, such as the Solar Flagships, revenue subsidies and accelerated depreciation). These policies remove upfront and ongoing barriers to investments in emerging technologies, such as large scale solar, marine and geothermal and;
- Support the development of effective venture capital markets in Australia to attract private clean tech investment; and



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EAN ENERGY JOBS IN REGIONAL AUSTRALIA South Australia

Support the deployment of clean energy technologies by removing infrastructure and regulatory barriers (for example, smart grids supporting distributed generation, streamlined state planning policies, National Energy Market regulatory reform, CCS pipelines and storage hubs, and additional electricity network infrastructure).

ENERGY EFFICIENCY

To help households and businesses manage energy bills and to stimulate broader technical and skills development additional policies and programs are needed to overcome barriers that have ensured Australia's poor performance in energy efficiency. Key recommendations in the Prime Ministers Energy Efficiency Task Group such as the Energy Savings Initiative should be adopted.

REGIONAL TRANSITIONS, SKILLS AND INDUSTRY DEVELOPMENT

Broader experience and Ernst and Young studies prepared for NSW renewable energy precincts in this research have highlighted the need for a number of other regional and local initiatives necessary to convert the clean energy technical potential to investment and employment reality. These include:

- Raise awareness, understanding and buy-in in the local business and wider community - with local demonstrations, industry focus groups, community engagement.
- Skilling up and engaging local work forces identifying training paths, providing workshops and on-line training opportunities, education and training programs and reaching out to part time or semi-retired trainers and tradespeople.
- Skills attraction programs to attract people with extra skills not available in the region, including assessments of social infrastructure and communications strategies.
- Further understanding of clean energy opportunities - further analysis and comparison of different technologies, greater analysis of local manufacturing potential.
- National/regional industry development broader analysis of potential for, and barriers to, existing industries expansion to cleaner employment and investment opportunities and linkages to training opportunities in training programs such as the Productivity Places Program.



NERGY JOBS IN REGIONAL AUSTRALIA ii Western Australia



Western Australia has enough clean energy potential to

- power 1,500,000 homes
- remove pollution equivalent to 1,700,000 cars
- create 4.380 new jobs



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INTRODUCTION

Australia is in the early stages of a clean energy boom, with tens of billions of dollars set to be invested in renewable energy in regional areas over the coming decades. The national 20% Renewable Energy Target alone is expected to drive investments of around \$19 billion out to 2030. The introduction of stronger policies to cut pollution and make clean energy cheaper will drive even greater levels of investment.

Clean energy investments create jobs in regional Australia, where the best renewable energy resources are located. Modelling for The Climate Institute shows that with strong and decisive pollution and climate policies - including a price-tag on pollution - close to 34,000 new jobs could be created in Australia by 2030.

Where this clean energy investment and job creation occurs is up for grabs. States and regions with the best clean energy resources and the strongest policy settings will attract the lion's share.

This briefing paper - part of a larger nation-wide study - assesses Western Australia's potential to benefit from the clean energy boom, with a particular focus on the employment opportunities this will create. Both state-wide and regional employment opportunities have been assessed.

Some highlights of the Western Australian study include:

A large untapped resource: The modelling results show strong growth in WA's electricity sector, with an additional 4,900 MW of generating capacity projected to be installed by 2030. This includes renewable energy, including bioenergy, wind and solar, as well as gas.

State-wide employment: Based on the modelling results it is estimated that over 4,700 new jobs will be created in Western Australia's electricity sector by 2030, including 1,024 permanent ongoing jobs, more than 3,000 construction jobs and over 660 manufacturing jobs. The vast majority of these jobs will be in renewable energy.

Regional clean energy jobs: Thousands of new clean energy jobs are up for grabs in regional Western Australia, including over 1,460 in South West WA, including 939 ongoing jobs and 523 during the construction phase.



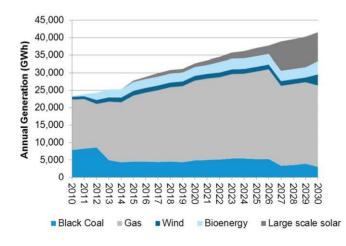
CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot Western Australia

2

Like other Australian states Western Australia currently depends on coal and gas to supply the majority of its electricity needs, with around 19 million tonnes of carbon pollution released into the atmosphere from these sources each year. Yet, Western Australia has vast and largely untapped low pollution energy sources, including solar, wind and bioenergy.

As part of this study, electricity sector modelling was undertaken by one of Australia's leading energy consultants, SKM-MMA. This modelling assessed how Western Australia's electricity generation mix might change over the coming two decades as Australia reduces its dependence on pollution. Specifically, the modelling assessed the combined effect of the 20% Renewable Energy Target and the introduction of a strong carbon price from 2012, consistent with the goal of reducing Australia's pollution by 25% below 2000 levels. Further details of the modelling have been published separately.¹

Figure 1: Western Australia's projected generation mix with strong pollution reduction policies (commercial scale technologies only)



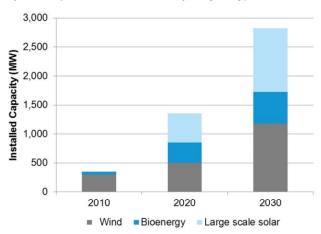
¹ The methodology can be downloaded from The Climate Institute's website.

WESTERN AUSTRALIA'S FUTURE ENERGY MIX

As illustrated in Figure 1, strong government policies to cut pollution and make clean energy cheaper will drive significant changes in Western Australia's energy mix over the coming decades. By 2030, close to 37% of Western Australia's electricity could be produced from renewable energy sources, up from around 8% today. Regional analysis shows that greater proportions of renewable electricity are attainable with extra policies and focus. The modelling also illustrates that gas is likely to play a significant, transitionary role in Western Australia.

Figure 2 illustrates the projected growth in the amount of renewable energy installed in Western Australia out to 2030. Particularly strong growth is projected for wind, bioenergy and large scale solar.

Figure 2: Projected growth in renewable energy in Western Australia with strong pollution reduction polices (commercial scale capacity only)



Consumer preferences and government policies have seen strong growth in small scale solar in recent years, including rooftop PV and solar hot water units. There are currently approximately 28,000 solar PV units and over 86,000 solar hot water units installed in WA.² Table 1 shows strong growth out to 2030.³

² Clean Energy Council (2010), Clean Energy Australia 2010.

³ Projections for these smaller scale technologies were done separately to SKM-MMA's modeling. See methodology for full documentation.



CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot Western Australia

Table 1: Projected growth in small scale solar technologies in Western Australia

Technology	Unit	2010	2020	2030
PV	MW	42	69	230
Solar hot water	MW	241	390	950
Total	MW	283	459	1,180

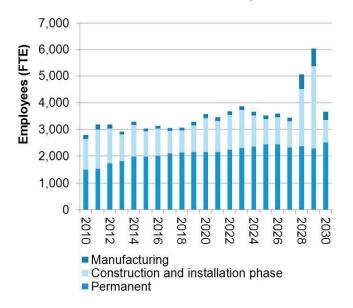
As part of this study, The Climate Institute commissioned the University of Technology, Sydney to assess the employment impacts across the sector as a whole, including both conventional and renewable technologies, as well as the number of jobs created by renewables alone. The results are summarised below.

Three key job categories were assessed: (i) permanent workers employed to operate, maintain and supply fuel to electricity generators; (ii) construction and installation workers employed to build and install a new generation plant; and (iii) manufacturing workers employed in the manufacturing sectors that supply components for new electricity installations. Details of the methodology used have been published separately.⁴

SECTOR-WIDE EMPLOYMENT

As shown in Figure 3, the total annual workforce – including all three employment categories for both conventional and renewable technologies – is projected to increase significantly between 2010 and 2030. In total an estimated 4,776 new jobs will be created over this period, including 1,024 new permanent, ongoing jobs, a peak construction and installation workforce of 3,089 people. At its peak, the number of manufacturing jobs across the state is expected to reach 663 people.

Figure 3: Projected total annual workforce in Western Australia's electricity sector



RENEWABLE ENERGY JOBS

Estimates of the number of new jobs associated with renewable energy technologies are presented in Table 2. In total, it is estimated that 4,386 new jobs could be created as a result of a shift to renewable energy in Western Australia. This includes 860 new permanent ongoing jobs, a peak construction phase workforce of 2,864 people and a peak manufacturing workforce of 662 people.

⁴ Methodology can be downloaded from The Climate Institute's website



CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot Western Australia

Table 2: Summary of renewable energy jobs estimates in Western Australia out to 2030

Renewable Technology	Ongoing jobs	Construction and Installation Phase employment	Manufacturing jobs supported	Total	
recimology	Total new jobs (FTE)	Peak workforce, 2010-2030 (FTE)	Peak workforce, 2010-2030 (FTE)		
Wind	123	772	386	1,281	
Bioenergy	419	235	2	656	
Large-scale solar	252	623	42	917	
Small-scale solar	66	995	31	1,092	
Solar hot water	0	990	245	1,235	
TOTAL	860	2,864^	662^	4,386	

[^] This is the peak annual workforce for all technologies, not the sum of individual peaks for each technology

REGIONAL CASE STUDY: SOUTH WEST WA

The South West WA region stretches from Perth down to Albany and along the south coast close to Esperance, covering over 200,000 square kilometres, and has a population of just over 1.8 million people.

REGIONAL CLEAN ENERGY POTENTIAL

As outlined in Table 3, South West WA has significant renewable energy resources, which to date remain largely untapped. While around 60 MW of renewable energy is currently installed, there is approximately 880 MW of additional capacity proposed for development. On top of this, it is estimated another 715 MW could be developed in the region.

Note, the true potential of the region's bioenergy and solar resources may be significantly higher than listed

in Table 3, but a comprehensive assessment was beyond the scope of this study.

HOW MUCH OF THE REGION'S CLEAN ENERGY RESOURCE WILL BE DEVELOPED?

South West WA has a significant renewable energy resource, which to date has yet to be fully developed. The extent to which this resource will be developed over the coming decades will depend on how attractive the region is to investors, relative to other regions across the rest of the state and Australia as a whole. Indeed, given the competitive dynamics of Australia's electricity market, not all of the renewable energy opportunities identified in South West WA will necessarily be developed over the next two decades. Other project opportunities in other regions or states may work out to be more cost effective, factoring in regional policy support and other commercial drivers.



CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot Western Australia

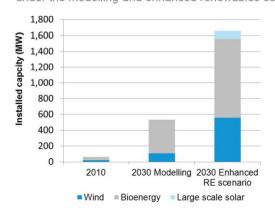
Table 3: Commercial-scale renewable energy potential in South West WA

Resource type	Existing	Additional Potential Capacity (MW)			
	Capacity (MW)	Committed and Proposed Projects	Additional Inferred Potential	Total (MW)	
Bioenergy	22	262	684	1,000	
Wind	40	521	na	561	
Large-scale solar	-	103	na	103	
TOTAL	62	886	716	1,664	

The Climate Institute commissioned modelling by leading energy sector consultants, SKM-MMA to provide an indication of how much of the South West WA renewable energy resource might be developed over the next two decades, based on the results of the state-wide modelling described above. In addition to the modelling results, The Climate Institute developed a hypothetical 'enhanced renewables' scenario, in which a much greater proportion of the region's renewable energy potential is developed over the next two decades.

The amount of renewable energy developed under each of these scenarios is shown in Figure 4. Based on the modelling results, it is projected that more than 500 MW will be developed, including around 420 MW of bioenergy and around 100 MW of wind. Under the enhanced renewables scenario, 1,000 MW of bioenergy is developed, along with over 500 MW of wind.

Figure 4: Renewable energy development in South West WA under the modelling and enhanced renewables scenarios.



In addition to commercial scale renewable energy, significant demand for small scale solar technologies is also projected. By 2030, it is estimated that approximately 57 MW of small scale solar PV will be installed in the South West WA region, along with the equivalent of 179 MW of solar hot water.

REGIONAL EMPLOYMENT IMPACTS

The expansion of renewable energy in South West WA will create new employment opportunities for local residents, including permanent operations and maintenance jobs, and supporting jobs during the construction and installation phase. There may also be potential for the region to support new manufacturing jobs in the clean energy sectors, but it is very difficult to predict the regional distribution of these jobs.

Using the same approach as for the state-wide employment estimates described above, The Climate Institute has estimated the number of jobs that could be created in South West WA between now and 2030. The results are presented in Table 4.

If the region's renewable energy resource is developed in line with the modelling results, it is predicted that more than 740 new jobs will be created in the region. This includes around 355 permanent, ongoing jobs and a peak construction phase workforce of around 384 new jobs. If the region's renewable energy resources are developed in line with the enhanced scenario, over 1,460 new jobs could be created. This includes close to 940 ongoing jobs and over 520 construction phase jobs.



Table 4: Estimate of new renewable energy jobs in South West WA (2030)

	Lower estimate (Based on Modelling)	Upper estimate (Enhanced Scenario)
New ongoing jobs (FTE)	356	939
Construction phase (FTE, peak workforce)	384	524
TOTAL	741	1,463

POLICY IMPLICATIONS

Australia has a world-class and largely untapped potential to shift to clean energy sources and reduce the economy's dependence on pollution. Through the Federal Government's 20 percent Renewable Energy Target, this transition to clean energy sources can now begin in earnest.

While the Renewable Energy Target is a key interim driver of clean energy investments, it will not do the job of shifting Australia to a clean energy economy on its own.

To unlock Australia's full clean energy potential additional policies are needed at federal, state and local levels. Key priorities are outlined below.

A LIMIT AND PRICE-TAG ON POLLUTION

The most important step Australia can take towards a low pollution economy is to introduce a limit and pricetag on carbon pollution. A credible pollution price that increases over time will level the playing field between renewable energy and conventional polluting sources, providing investors with greater long-term confidence to invest in clean energy sources.

Without long, loud and legal price signals businesses will lack the confidence to scale-up investments in clean energy from the research and development through to large-scale commercial deployment phases. As more investment flows. innovation communities. in

businesses and technology will occur. This will accelerate the cost reductions and make clean energy cheaper.

The modelling undertaken for this study also demonstrates that a strong price-tag on pollution will create a net improvement in jobs across the electricity sector in Australia, particularly in regional Australia and stimulate billions of dollars of investment in those regional areas.

The Climate Institute welcomes the emerging multiparty commitments to have a price-tag on pollution in place in 2012. To maximise pollution savings and job creation, Parliament should ensure this carbon pricing mechanism, in conjunction with other policies, has the potential to reduce pollution by 25 percent or more below 2000 levels by 2020.

Australia has made an international commitment to reducing up to the 25% target and needs to demonstrate it has the national policies to deliver it.

A price-tag on pollution is a necessary, but not sufficient component of reforms needed.

SUPPORTING INNOVATION AND DEPLOYMENT

The 20 percent Renewable Energy Target and a carbon price are key to unlocking Australia's clean energy resources, but support for innovation will also be crucial.

A number of the technologies included in this study, particularly large-scale solar and geothermal, are at the



EAN ENERGY JOBS IN REGIONAL AUSTRALIA ot Western Australia

early stages of commercialisation in Australia. Other emerging clean energy technologies, such as wave energy, hold great potential, but are in the research and development phase. A supportive policy and investment environment will be needed to facilitate and accelerate the deployment of these technologies.

Specifically, to drive early deployment of new emerging clean energy options, above the Renewable Energy Target, governments need to:

- Put in place targeted policies to support clean technology development in each phase of the commercialisation process (for example loan guarantees, tax credits and seed funds coinvestment or grant programs, such as the Solar Flagships, revenue subsidies and accelerated depreciation). These policies remove upfront and ongoing barriers to investments in emerging technologies, such as large scale solar, marine and geothermal and:
- Support the development of effective venture capital markets in Australia to attract private clean tech investment; and
- Support the deployment of clean energy technologies by removing infrastructure and regulatory barriers (for example, smart grids supporting distributed generation, streamlined state planning policies, National Energy Market regulatory reform, CCS pipelines and storage hubs, and additional electricity network infrastructure).

ENERGY EFFICIENCY

To help households and businesses manage energy bills and to stimulate broader technical and skills development additional policies and programs are needed to overcome barriers that have ensured Australia's poor performance in energy efficiency. Key recommendations in the Prime Ministers Energy Efficiency Task Group such as the Energy Savings Initiative should be adopted.

REGIONAL TRANSITIONS, SKILLS AND INDUSTRY DEVELOPMENT

Broader experience and Ernst and Young studies prepared for NSW renewable energy precincts in this research have highlighted the need for a number of other regional and local initiatives necessary to convert the clean energy technical potential to investment and employment reality. These include:

- Raise awareness, understanding and buy-in in the local business and wider community - with local demonstrations, industry focus groups, community engagement.
- Skilling up and engaging local work forces identifying training paths, providing workshops and on-line training opportunities, education and training programs and reaching out to part time or semi-retired trainers and tradespeople.
- Skills attraction programs to attract people with extra skills not available in the region, including assessments of social infrastructure and communications strategies.
- Further understanding of clean energy opportunities - further analysis and comparison of different technologies, greater analysis of local manufacturing potential.

National/regional industry development - broader analysis of potential for, and barriers to, existing industries expansion to cleaner employment and investment opportunities and linkages to training opportunities in training programs such as the Productivity Places Program.

MR HENRY CALLS	1
+GARY ALLEN WITTERT AFFIRMED	2
PROFESSOR OF MEDICINE AND ENDOCRINOLOGIST	3
+EXAMINATION BY MR MANOS	4
Q. Looking at MFI Exhibit Y produced, is the document	5
that's just now been proposed - shown to you, is that	6
the statement of evidence that you prepared relevant to	7
this matter.	8
A. Yes, it is.	9
Q. Including a number of annexures.	10
A. Yes, it is.	11
Q. Before we tender it, at para.27 you reference, 27D, you	12
reference a paper that document is the accepted process	13
of evaluation of a public health risk. But I think	14
that the attachment, No. 11, is in fact the wrong	15
document, is that correct.	16
A. Yeah, that's correct. That refers to the additional	17
attachment that was provided and the attachment that's	18
referred to is attachment 11 relating to landfall, it	19
relates to a subsequent statement indicating that other	20
environmental developments could provide similar	21
adverse effects and that is -	22
MR HENRY: Your Honour, have I provided to the court	23
a flurry of paperwork - I'm not quite sure, 1.20 'Risk	24
Assessment'?	25
HIS HONOUR: Yes.	26
MR HENRY: Could the spare copy of that be shown to	27
Professor Wittert. I'm not sure that's been tendered.	28
CONTINUED	29
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HIS	HONOUR: No, it came to us as part of an email and	-
	to be I'm not sure.	2
MR	HENRY: A spare copy might not have been printed	
	off. Perhaps I'll just invite the court to produce	4
	this to the witness.	
XN		(
Q.	Is this the document that you had intended to reference	-
	in para.27(d).	{
Α.	Yes. The document that was there referenced relates to	9
	point 38.3 but no matter.	1(
MR	HENRY: So I tender that document. That's the	1:
	risk assessment document.	12
HIS	HONOUR: Now do you want that to be part of Exhibit	13
	Y or do you want it separate?	14
MR	HENRY: Probably best to be a separate exhibit	15
	because attachment 11 in fact serves a legitimate but	16
	different purpose within the statement.	1
EXH	IBIT #AA 1.20 RISK ASSESSMENT TENDERED BY MR HENRY.	18
ADM	ITTED.	19
		2 (
XN		2:
Q.	I wonder if you would take us briefly to those passages	22
	in that exhibit which you say demonstrates the accepted	23
	process of evaluation of a public health risk in	24
	particular.	25
A.	So the relevant material can be found on table which is	26
	labelled fig.2 and below table 3 and that's found on	27
	p.458 and there's a graphical representation of that	28
	process which precedes it which is fig.1 which is found	29
	on p.453.	3(
Q.	Again briefly are you able to describe for us in	3.
	summary form what that accepted process of evaluation	32
	of a public health risk is just in abbreviated form.	33
A.	Sure. So the paper refers to toxicology but I don't	34
	think it matters what the environmental or chemical	35
	stimulus happens to be the process would be exactly the	3 (
	same. It would require identification of a hazard and	37
	then a plausible set of exposure assessments and risk	3.0

characterisation including dose response assessments to allow some opinion to be made about cause and effect The detail of how that process may relationships. proceed might include a number of independent studies with consistent results as opposed to a single study. It may include analyses across a single site of different species or in the case of toxicology using structural analogues and again you're looking for consistency rather than inconsistency, multiple observations of different sites, different species within sectors and then severity and progression. So this is dose response relationships. administration is not relevant here because it's consistent.

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- Q. Are you saying that nothing of that nature has been done to date in respect of the asserted health impacts said to arise from wind farms.
- The asserted impacts are as described both in my Α. statement and in Dr Laurie's evidence are not disagreed That's an observation that I would dispute that there's any clear evidence of cause and effect and that there are no sufficient analyses that have provided any form of assessment as to whether alternative causes could account for those that allows an appropriate conclusion to be made. In the case control study which I don't have access to the details of and can't be evaluated and has to be considered therefore suspicious in terms of whether there are confounders or biases both in terms of the selection of the subjects as you alluded to in your cross-examination or in terms of the way the assessments were made as to whether there are any confounds. Prior psychological history may be one, attitudes to life, marital status, marital stress, financial difficulties, obesity and obstructive sleep apnoea as we've heard may all be others. So that in a case control study unless all of those factors are carefully considered then it's quite possible to make

erroneous conclusions and indeed the literature is

littered with case control studies that have misled public health in that context and it highlights the rigour that when an observation is made and no-one is doubting the nature of the symptoms experienced but I would sincerely question whether the case has been made that there are cause and effect relationships. when I've been provided with objective data and one of the ways that case control studies propose to overcome this issue of confounding and bias is to find an objective measure. Measurements of blood pressure are not perfect but they're not a bad objective measure and I was pleased to have received the work that Dr Laurie provided and the effort that was put into it by the individuals concerned of collecting their blood pressures because that formed the level of objectivity that demonstrated quite clearly to me just with a very simple spreadsheet and analytical process that in fact when the turbines were off the blood pressures were just as high if not higher than when the turbines were Now on.

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- Q. We'll come to that in a moment in more detail. But for present purposes as far as what you say in para.27(d) is concerned you've taken us to the risk assessment reference which is Exhibit AA. Effectively you're telling us that the data that's been collected and the work that's been done so far has not identified a risk which calls for further investigation.
- A. No, and there's no fundamental epidemiological signal. In countries where there are dense concentrations of wind farm like in the rest of Europe the prevalence of hypertension if anything is falling according to the most recent surveillance data which is very well kept by the EU and World Health Organisation. So there's no signal of an ecological effect.
- Q. So that deals with 27(d). Can I ask you before I tender your statement to turn to para.28 of your statement. You deal there with certain aspects of potential effects on domestic animals and livestock.

Now what aspect of your qualifications and experience 1 do you draw upon in presenting the information in para.28. 3 There's two reasons for presenting information in Α. 4 5 para.28. HIS HONOUR: Before you continue, professor. Mr Henry, 6 I think this may be a bit difficult for you might it 7 I've already said that we don't propose to draw 8 any inference one way or another about this sort of 9 evidence. I don't know where this is going but having 10 said that yesterday and even though it's not objected 11 to -12 MR HENRY: That's the reason for me asking these 13 questions prior to tendering the report is that it's 14 important for Professor Wittert to spell out the chain 15 of reasoning that he has adopted in respect to the 16 material that he's presented in para.28. 17 HIS HONOUR: Very well. 18 It's best for him to give that evidence 19 MR HENRY: rather than me summarise it I would respectfully 20 submit. 21 Α. Thank you, your Honour, I'll deal with the second point 22 Considerable amount of the work that I do 23 relates to experimentation in animals like it or not 24 and that includes a range of physiological responses 25 from reproduction to food intake and a whole bunch of 26 complex behaviours in between. The species of animals 27 include sheep, rats, mice and small native marsupials 28 and therefore I believe that I have sufficient detailed 29 knowledge of animal physiology to at least use the 30 example to assess the literature for credible evidence 31 of animal effects which one might like to see if there 32 were the levels of infrasound being described and 33 indeed the level of health effects being described and 34 also to deal with this issue of anecdotal report where 35 it depends on who you ask and what you see. 36 notion of pulling something out of a blog says well one 37

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person says and the other people say, so therefore

there's no credible evidence of an effect of animals and I believe that I'm sufficiently qualified to comment.

CONTINUED

- Q. And as far as where the material in para.28 fits into your analysis, do you say that if wind farms were causing physiological impacts on human beings, you would expect also to find some evidence of physiological impact on animals.
- A. Yes, I would. And that would include things that affected sensitive processes linked to reproduction and/or food intake. Therefore you would expect to see dairy production drop dramatically, or you would expect to see significant effects on animal reproduction. I've scoured the literature using just about every data base I can find, and I cannot find any information that primary production in Europe has been affected by the presence of wind farms and I use Europe as the example because of the densest concentration of wind farms.
- Q. Is this the case your reasoning as far as para.28 is concerned is that there's an absence in the published data of any reference to adverse effects on animals -
- A. Yes.
- Q. and that informs your reasoning about the likelihood of physiological effects on human beings.
- A. Yes, it does.

MR HENRY: I tender the statement.

HIS HONOUR: Mr Manos?

MR MANOS: There are a number of documents which we received and are not particularly relevant - and your Honour's allowed the evidence in relation to the animals - I didn't object initially because I want to ask the witness some questions about it as well.

HIS HONOUR: I understood the reason it's only marked for identification is that you wanted to object to it?

I'm not inviting you to do it, but -

MR MANOS:

No, there was a document I had some objection to and I can't remember which one it is now, but I don't think we need to waste any more time on it.

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EXHIBIT #Y MFI Y REPORT OF PROFESSOR WITTERT AND ATTACHMENTS TENDERED BY MR HENRY. ADMITTED.

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- Q. Your CV appears at tab 1 and it's 28 pages long. Can I ask you to briefly identify the aspects of your qualifications and experience which are of particular relevance to the subject matter of the material that you've presented.
- The first is apart from being a registered medical Α. practitioner and a trained physician is that I've worked in rural general practice, I did so in the rural south island area of New Zealand - that's for 12 I understand rural communities and I understand rural general practice. The second is, I have expertise in endocrinology - the issue of endocrinology and stress effects, with a subject of my MD at the University of Otago - and subsequent post doctoral work in the United States. And specifically looking at the effects of various physiological stresses and cortisol production and the mechanisms of cortisol regulation. A considerable amount of work that I do over the past several years relates to epidemiology and investigation of large cohorts. This includes an extensive analysis of biopsychosocial factors and their effects on health. I have an interest in and have published on the relationship between depression and stress and health outcomes. have an ongoing interest, right from the early days of my training, in hypertension - and have published reasonably extensively on hypertension in various contexts. And on an ongoing basis we have been conducting home sleep studies for the purposes of analysis of effects on health in the Florey Adelaide Male Aging Study.
- O. You've heard Dr Laurie's evidence.
- A. I have.
- Q. I want to ask you some questions about paras.36 and 37

of your statement. They deal with somatoform disorders and the nocebo effect. Before we come to what Dr Laurie said, can I just get you to amplify, as it were by way of explanation, what a somatoform disorder is.

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- Α. Somatoform disorder refers to a physical problem where the cause of that physical problem relates from some input into the psychological state of the central So perception of how things are for nervous system. you may lead to some disease states. Now there is no assertion in my evidence - at least I hope it's not interpreted that way, that these are not real physical problems - these are indeed, to the individuals who experience them, very real physical problems and often associated with objective measures of disorder. simply says there's a mind/body connection and that one cannot separate what happens in the mind from what happens in the body. That's the basis for a somatoform disorder.
- O. And the nocebo effect.
- A. The nocebo effect most simply is the opposite of a placebo effect. In studies, for example, of erectile dysfunction which seems to be a rather definitive state for the people so effected, up to 30% of people given a placebo tablet will report an improvement in their erectile function. The nocebo effect is the opposite and it's interesting to hear Dr Laurie acknowledge the point that if you generate anxiety in people they become unwell, that's the nocebo effect.
- Q. And you heard her evidence, she asserted that she'd seen no evidence of a nocebo effect or indeed a somatoform disorder in the people she'd seen at Waubra. Are you able to make any comment about what she said there.
- A. I can't comment on the accuracy or otherwise, but I see no evidence that such possibility is considered.
- Q. In the data that she's provided or the -
- A. It's not possible to make an assessment of my own based

on the data that's provided as the extent to which this may or may not be a somatoform. What's interesting is having been told that some of these effects are durable in terms of extending beyond the terms that the turbine is on and then to see that when someone moves away from the personal diary within hours of driving out of Waubra they seem to be cured. It seems to be inconsistent with this durability of effect and makes one wonder about the mind/body connection for some of these things. So I don't doubt that if you don't like what you fancy you feel in a particular environment and you change environments you'll feel better - and that's not uncommon.

- Q. Can I ask you to turn to p.8 of your statement. In para.33 you reference a publication by the National Health and Medical Research Council.
- A. Yes.
- Q. Can you explain for us the role and the function of that body.
- A. The National Health and Medical Research Council is the peak body in Australia constituted by the Federal Government and reporting to the minister, that is charged with the conduct of health and medical research as well as providing advice that would help form the basis of health policy and evidence based practice guidelines.
- Q. And the document at attachment 14 is referred to as a rapid review. Can you tell us what term means in respect of the document.
- A. Yes, it means that a review has been commissioned and the terms of reference require it to be completed within six months.
- Q. As opposed to a lengthier period, which other references might call for.
- A. Correct, and I believe this may have been done given the urgency that the NH&MRC felt in providing some advice.

Q. Does the rapidity of the response call into question the quality of the response.

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- A. I do not believe so.
- Q. At the end of the day then, is it the position that peak Federal body concerned with medical research has concluded that there is insufficient basis for further research into the questions that we are concerned with here.
- A. Well, they have certainly concluded that there is insufficient evidence to be concerned about a significant health effect on wind farms, and I can't see that, based on the information that I have had access to, that a case can be made for any kind of research that can be done in a rapid form as Dr Laurie asserts.
- Q. I might turn next then to the work you did HIS HONOUR: Before you do, Mr Henry -

Q. As I understood the criticism by Dr Laurie of that review, it was that there wasn't the personal input from those who complained of problems living next to or

nearby to wind farms. Do you have any comment to make about that.

- A. The way that an evidence-based review would be conducted is based on published literature, so the reliance would be almost entirely on that, as opposed to the inquiry that is currently being run by the Federal government, which would take submissions from members of the public that felt affected. So if someone had done a case control study or a epidemiological or ecological study of some sort and published it, then the NH&MRC would have considered that document, but not invited individuals or spoken to individuals.
- Q. Well, I appreciate that, but that's Dr Laurie's criticism. Do you agree with that, that the absence of that sort of material detracts from the force of the conclusions or not.

HIS HONOUR

Well, I think it would confound the confusion, because Α. 1 2 my contention is, and I believe the contention from the 3 NH&MRC, of that sort of evidence, is that it's anecdotal and conclusions cannot be made, other than to 4 5 generate anxiety. 6 So does it follow from that that were there to be a Q. significant epidemiological study, that would find its 7 way into, or in all likelihood, the review and would 8 have been considered as a -9 10 That is correct. Α. - as a study. 11 Ο. 12 Α. That is correct. 13 ΧN Now, I think you started to touch on this, but Exhibit 14 Ο. Z is a summary of some work that you did in analysing 15 16 the blood pressure data from three of the subjects that 17 Professor Laurie has referenced. I'll just get you to 18 turn to that, have you copy of it? 19 Α. No. Now, looking now at Exhibit Z, the way in which this 20 ο. 21 material has been brought about, Exhibit A24 is the raw data for your work in Exhibit Z, is that correct. 22 23 Α. Yes. 24 They are the journal entries for five subjects, AR, GW, Q. 25 BMJ, RB and GB. 26 Correct. Α. 27 Q. You have analysed three of them. Α. Correct. 28 29 Ο. But not analysed the other two. 30 Α. Correct. 31 The reason why you haven't analysed the other two. Ο. There's two reasons, the one is because it got very 32 Α. late at night and I did it just after I got back from a 33 34 holiday, but I identified those two that I didn't analyse as being normotensive. Therefore, the issue 35 was moot and I was interested in the three where there 36 was clear evidence of elevated blood pressure. 37

Q.

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Elevated blood pressure, for your purposes, is

- something over 140/90.
- A. I took systolic at 140 and a diastolic as 90 being reflective of levels that I would generally consider treatment.

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- Q. The two subjects that you didn't plot graphs for in fact didn't have blood pressures over those trigger points.
- A. Correct.
- Q. Is it the case that in the data that you have presented graphically in Exhibit Z, you have simply taken the data from Dr Laurie's journals.
- The process was since Dr Laurie's instruction to the people who participated in the study did try to find some evidence of approval by an ethics committee but was unable to locate that, but assuming that informed consent had been given, there was an instruction to record blood pressure first thing in the morning, on waking and before eating, and therefore, what I did was tabulated into a spreadsheet separately the systolic and diastolic blood pressure which was the first morning pressure that I could find. Concurrently, and I could only do all of the information for AR, I recorded when there was symptoms being experienced, I could do symptoms for everybody, I could do audibility of the turbines for AR, and I also recorded wind direction and where it was - the information was available, I recorded wind intensity, and I then created a column which I could only do from the dates that information was available, which was mostly, I guess, November, for the most part, record the average nocturnal output from the wind turbines.
- Q. You have taken that data, as I understand it, from the material at tab 6 in Exhibit A24.
- A. That is correct.
- Q. So time being short, I'll just see if I can take you to a handful of these graphic presentations on the will you go to the data for AR and then to graph 2.2 for me.
- A. Yes.

- Q. That deals with the waking systolic.
- A. That's correct.
- Q. And mean overnight turbine power. Is this correct, where you have identified that overnight turbine power was zero, you found four reported waking systolic values.
- A. Correct.

- Q. You have plotted them against the zero overnight turbine power.
- A. Correct, so the initial plotting was of the blood pressure, and then when I could find overnight turbine powers, I have created a last column where that was included, and also a column with comments. So the information was consistently documented in the spreadsheet as instructed for the participants to record by Dr Laurie and then I took average turbine power overnight. Now, where I have recorded zero, that had to be zero for the entire night, so if there were any portion of the night that was zero and other portions of the night that there was turbine output, then it was recorded as the average, not zero.
- Q. So what we get is a scattering of waking systolic values which are arranged by reference to overnight turbine power.
- A. Correct.
- Q. The purpose of doing that.
- A. The purpose of doing that is what is known as a correlation analysis or a dot plot in the case of a graph, is to look at the relationship between two variables. Since it has been asserted that there is a relationship between turbine output, whether that is infrasound or noise or some other phenomenon from the turbine with blood pressure, I was interested to see without simply eyeballing the data but actually looking at it properly graphically represented, what was happening when the turbines were off as opposed to when the turbines were on, and when the turbines were on at various intensity, this goes to the issue of dose-

- response relationships, and what I find is, if anything, blood pressure tends to be a little bit higher when the turbines are off. What is interesting about this is the consistency of effect across the individuals.
- Q. Just looking at graph 2.2, were you able to find any consistency in the relationship between turbine power and waking systolic.
- A. No, I was not. There were random effects other than the fact that there was this tail up when the turbines were off. The cynic would interpret this as being that having turbines running is good for your blood pressure as an alternative explanation. The interesting thing with AR in the journal is that the highest blood pressures were recorded on the last two days of recording, which reached quite extraordinarily high levels, and they resulted from an altercation at a polling booth with a proponent from a wind farm, indicating just how strongly just stress and interpersonal interaction can affect blood pressure.

CONTINUED

Q. We'll deal quickly then with chart 2.3, that's the same as 2.2 but it deals with diastolic rather than systolic.

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- A. Correct. And that's essentially a horizontal line.
- Q. You've included as part of that graph an R-squared linear of 0.003, what does that mean.
- A. That means it's approximately a horizontal line. So the R-squared value will increase as the slope increases.
- Q. Essentially do we see the same presentation of data for ${\sf GW}$.
- A. Yes.
- Q. And BMJ/BJ.
- A. Yes.
- Q. In other words, no relationship between output and blood pressure.
- A. No. And in fact, again the trend in fig.4.2, the systolic blood pressure for BMJ is the similar trend for the blood pressure to be higher when the turbines are off.
- Q. Yes.
- A. And lowest when the output is maximum; again, suggesting to the cynic that having turbines on may be good for your blood pressure.
- Q. You draw no such conclusion though.
- A. I draw no such conclusion. I would also add that in fig.2.4 that does not look at the relationship with mean turbine power but it looks at the relationship to audibility of the turbine. And because of the scale it's difficult to see but the little blips up on the line at the bottom, that's represented as a zero, one or two, two being when the turbines are said to be very loud, one is loud and zero when they're inaudible. So where you see those blips up it's turbine audibility and again there's no consistent relationship between turbine audibility and blood pressure. Or indeed, might I say, symptoms or anything else.
- Q. The next issue, Exhibit A21 was tendered, that's a

document comprising an email from Dr Laurie to Mr Manos with some particulars, a summary of process, I think, and transcript taken by Dr Laurie; you've seen that.

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- A. I have.
- Q. And my question is what do you say about the utility of those case histories in forming opinions about cause and effect.
- Α. So the - not all of the details requested were provided and I guess that's probably because they could not all be provided. Dr Laurie's acknowledged that they were not full case histories, they were not complete documents but I guess rapid assessment of phenomena from individuals who were either contacting her therefore specifically complaining of. So therefore they're anecdotal evidence and it's hard to know, other than the fact that these people quite obviously are having significant problems which I acknowledge and there's no question about the accuracy of the information elicited, what's in question is cause and effect relationships and it cannot be used to ascribe any assertion that these are necessarily due to the wind farm even if they abate when moving away. Because if you're anxious about the wind farm or your neighbour's been complaining about the wind farm and generates your anxiety and so on, then it's hard to It's also hard to know what it know what that means. means in a context of other things going on in your life as has been clearly demonstrated from those studies looking at road traffic noise and other forms of ecological effects. Much the same has been documented with EMF or with mobile phone towers, with landfill and so on you see exactly the same phenomena.
- Q. Did you hear the evidence of Dr Laurie when she first gave evidence about certain changes to the data in Exhibit 21, perhaps the most significant of it was that subject 20 seems to have elevated nocturnal blood pressure but not elevated day time blood pressure. You would have heard that for the first time I think when

Dr Laurie gave her evidence.

Yeah, I mean I assumed, reading the case report, that Α. blood pressure was elevated during the day because there had been this clear indication with symptomatic elevations of blood pressure during the day. It's not entirely clear to me what is meant by hypertensive crises or whether these acute hypertensive crises were confirmed as such or simply marked elevations of blood pressure in the context of some other symptom complex but let's assume that they were just that. It seems reasonable that there are a number of possibilities that this sort of spiking elevation in blood pressure can occur. So for example, one of the possibilities has been looked at and the person's general practitioner appropriately looked for pheochromocytoma which is a tumour of the adrenal glands. So these are small glands which sit above the kidneys, they produce adrenalin and noradrenalin which are stress hormones and surges of these stress hormones can produce a symptom complex that produces this kind of picture with headache, nausea, jitteriness, palpitations and so on but so can acute stress, so can panic attacks and it doesn't need to be any overt stimulus for a panic attack to occur. The question about obstructive sleep apnoea would have been one that was appropriately Obstructive sleep apnoea is extremely prevalent in the male population in particular; we find roughly 20% of men in our cohort have a very high probability of having obstructive sleep apnoea so this is the age group where you'd see an effect likely to occur. Clearly an astute general practitioner who's thinking about these various things and doing the appropriate investigations, it's not clear whether this was a home sleep study or an in-lab sleep study, what the quality was, it's not clear whether weight has changed up or down since these things were done. again, we're living in a - we're looking at an age group where there's very likely to be a hypertension

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occurring, we just don't know enough to say that it's
not hypertension during the day either on an
intermittent basis associated with anxiety or panic
attacks and I'm not even sure that I know enough about
the exclusion of the pheochromocytoma to be sure that
that's excluded or any other significant disease
process although I assume that the cardiologist has
been involved, this has been adequately looked at.

- Q. Do you agree, in effect, with what Dr Laurie said about subject 20, that there might be plausible medical explanations for elevated nocturnal blood pressure but not elevated day time blood pressure which have nothing to do with the wind farm.
- A. Correct.

ADJOURNED 1.03 P.M.

TRANSCRIPT CONTINUED BY REPORTER

RESUMING 2.18 P.M. Q. I want to ask you some questions about Dr Nissenbaum's study which we find in Exhibit A22, attachment A; do you have that. A. Yes, I do. Q. As I understand it Dr Nissenbaum said this was the best

- Q. As I understand it Dr Nissenbaum said this was the best research available on the questions that we are concerned with; you would have heard her say that.
- A. Yes.
- Q. And I think she said that, at least in part, because it is a case control study.
- A. Yes.
- Q. Can you tell us, firstly, what a case control study is, as distinguished from other forms of research.
- A. So there are a number of types of observational studies and one type of observational study is called a case control study, and this is one where people with a specific disease match people who do not have the disease and who then determine controls. You match people with a specific exposure and those who do not have an exposure, but ordinarily it is done with or without disease. I think it is relevant to say that it was case controlled type methodology that first led Pitot to very strongly make the association between smoking and lung cancer.

HIS HONOUR

- Q. Who was that.
- A. Richard Pitot in the UK. So the origins of this as a rigorous methodology are quite clear but that does not mean it is without problems. What is critical is that data are collected from the individuals of the groups in order to allow you to control for all of the characteristics except the exposure in question. So if you were wanting to link, for example, smoking to a disease process then you would want a control for everything else except the smoking: toxicity potential, asbestos, environments, where they worked, how they lived etc., family histories. So that there are a

number of errors that may creep into a case control study. Bias is one of the big problems and this has been defined as any systematic error in the design, conduct or analysis of a study that results in a mistaken estimate of the exposure's effect on the risk of disease, and there are a number of sources of bias. So one type of bias is recall bias. So that is the propensity of diseased subjects, or cases, or individuals as they may be termed, depending on circumstances when interviewed to scrutinise their memory and report more accurately than a non-exposed and non-diseased group. So recall bias may be acuity bias, in other words you may highlight one set of symptoms more than another. So it's bias in reporting. Bias may also occur in the selection of cases and controls. that how you select individuals to a particular group or case is appropriately selected, or are your controls appropriately selected or are they cases that volunteer themselves to you, and so on. And there are also issues where strong personal feelings may be involved may lead to a source of bias because of the specific nature of the questions that are used or the way they are framed. Confounding refers to an extraneous variable that satisfies both of two conditions. So it's risk factor for the disease being studied but it is associated with exposure being studied. So in the case we have been talking about anxiety may be a risk factor for stress related disease but it may also be a consequence of exposure to a wind farm for whatever reason. not a consequence of the exposure but it's an effect, ameliorating effect within the study. And it's the major potential problem with any observational study where the factors are not fully described in the data in which case they cannot be accounted for in the analyses. And there are a variety of types of confounding that can be controlled for provided they are adequately In addition in the case of control study it identified. may be difficult to separate the chooser from the

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For example, studies of road accident victims choice. find that those wearing seatbelts were 80% less likely to suffer serious injury or death in a collision, but data comparing rates for those collisions involving two front seat occupants of a vehicle, one belted and one unbelted, showed a measured efficacy of only around half That may be considered a form of ascertainment bias, I quess. A further problem is you have to depend on correct and honest reporting of the risk factor which may be many years in the past or, in the case of long-term prior exposure, as maybe asbestos, or the exposure may be seen as socially undesirable, epidemiological studies or observational studies of sexually transmitted diseases and certain behaviours. And case control studies can be by assessed if the risk factor is incorrectly reported for whatever reason, intentionally or unintentionally. For example, when we maintain diet diaries and appetite studies it is well known that obese people don't report their intake. That is part of the disease process whatever it happens to be, but it is a well-known and documented offence. could conclude from that that obese people eat less and they have a different metabolic rate but that would be a wrong conclusion.

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- Q. Are case controls studies therefore a useful tool.
- A. They are and that's why I began with the example of smoke and lung cancer. So providing all of these methodological difficulties are accounted for and this is where peer review comes in to ensure that that is the case and I would have to say that over the years the rigour with which case controlled studies are done and evaluated has increased significantly. And unless these things are adequately attended to most major journals will not accept them for publication.

HIS HONOUR

- Q. And is the numbers in the study important.
- A. The numbers in the study may or may not be important. So where the intensity of the exposure or the effect

size is large, then you would need fewer people to be studied. So that is the concept of power, where you are talking about a small effect size and large variances then you may need many more people. A classic example that has been in the media of a fluid case control study, whatever the motivation may be for that, was the MMR vaccination issue that has been in the media lately. That is an example of the case controlled study fluid in its design and execution, which for whatever reason happened to motivate that process.

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- Q. Bearing in mind what you have said about case control studies so far. If we go to the material which is now attributed to Dr Nissenbaum at tab 8 of Exhibit A22, you will see there, firstly, an abstract, secondly a bio, and then you will see a table, which we now know is Dr Lawrie's work, and there is then a paper headed 'Wind turbines ... and Value List'. And as I understand Dr Lawrie's evidence it's that paper which she says comprises the best evidence about health effects and wind turbines. Do you have any comment to make about the reliability of the paper and the rigour with which the research was undertaken.
- It's almost impossible to evaluate the data for accuracy Α. because the methodology is not sufficiently - not presented with any clarity or at all for that matter. The most clarity you can get out of the this was 22 of about 30 adults. I have never seen any kind of scientific documentation that would document 'about', it's either a certain number of subjects or it isn't. Why is it 22? How are your cases and control selected etc. etc. other than, say, similar age and occupation and living about three miles away and then defined as not exposed? What we don't know is intensity of There is no corroboration of the various exposure. issues; there are a lot of suppositions, there is a lot of reference back to a paper that will soon be completed and the fact that this is a preliminary study. I think

this is unassessable and unless you ring up your mates and ask them to review it as peer review you will not pass muster in a journal. I edited the Journal of Obesity Research and Clinical Practice, we receive a large number of papers each week and I would have to say that I wouldn't even send a paper of this sort out for review, it isn't sufficient information.

- Q. Do you believe then that the material which is attributed to Dr Nissenbaum at tab 8 is a basis for a moratorium on further wind farm developments pending further research.
- A. The issue as I'm hearing it put says, we need more research. In order to justify research you need a rationale that is of sufficiently convincing magnitude to argue with funding agencies that they should part with dollars that someone else thinks are more important to have. I can't see and, as stated in my witness statement a rationale in the evidence that I have available to me for further study to be done. Now that doesn't mean there isn't an effect, it simply means that I can't see, based on the data, that there is sufficient evidence to attribute cause and effect.
- Q. And to justify the allocation of funding to further research.
- A. Funding is always good for research, I'm always a fan of research, and I would be delighted personally to get more funding for research but I would have a hard time writing a business plan if you like, which is what a grant application is, and saying that this is the basis for wanting to do further study, I don't think I would get the money to do so.
- Q. The next issue I want you to comment on very quickly.

 Dr Lawrie yesterday made comment about one of the subjects had elevated cortisol levels. I may have pronounced that incorrectly.
- A. That's correct.
- Q. But is that an issue which falls within one of your specialised fields.

Yes, cortisol is produced by the adrenal glands, which I Α. referred to previously as producing the hormones adrenaline and noradrenaline, which are the fight and flight hormones. Cortisol is very important in linking circadian rhythm to intermediary metabolism, which is the way that cells in the body use energy and regulate themselves. It is also important in regulating body composition and dispersing of fats and body mass. It is secreted in the cortisol itself in a pulsator manner. The pulsatility is increased in its amplitude, beginning in the early hours of the morning, and it trains itself to the normal circadian rhythm and then later in the day the pulses are smaller and the mean levels are lower, so you get this peak in the early hours of the morning which drop off late in the day. And that normal rhythm in the morning, the rhythmisticity of activity is important for health. There are many things that can disrupt that: stress, sleep disturbance, obstructive sleep apnea or if you put a broad package around disorders of sleep and sleep disorder breathing is just one of those but there are other factors. medications, excess alcohol consumption and many other things can affect cortisol but it is difficult to use single cortisol measures to make any kind of assessment of what is going on with a stress axis.

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- Q. Is there anything in what Dr Lawrie said yesterday about cortisol that would lead you to review the conclusion or the opinions or your process of reasoning as disclosed in your statement.
- A. I haven't seen any data that would lead me to form any conclusion whatsoever about cortisol. I am not sure why it is mentioned.
- Q. The next point, which is a brief one, I think Dr Lawrie suggested that you'd never spoken to anyone perhaps it might not have been Dr Lawrie it might have been Mr Manos suggesting that you'd never spoken to anyone living in the vicinity of a wind farm. Is that in fact correct.

No, it's not correct. I have spoken to people living Α. and working in the vicinity of a wind farm, admittedly not huge numbers, small numbers. I have also visited a wind farm, I toured, in fact, the Waubra wind farm quite extensively, was taken wherever I chose to go on the map and speak to whoever I wished to speak to. I have not presented any of this in evidence because I don't think, on the one hand, you can criticise anecdotes and, on the other hand, use them, but I will offer the court anecdotes seeing an anecdotes are being sprinkled around That is that I was told - hearsay but deliberately. unfortunately this is what occurred - that someone working very close in the vicinity of a wind farm and whose property was very close to turbines, had a friend who had a bipolar disorder who liked to come up and stay when she was getting out of control because she found that her psychiatric state improved when she was at the wind farm. Hearsay and anecdotal.

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- Q. And not something on which you would place any or much reliance.
- A. None whatsoever.
- Q. Is it essentially for that reason that you haven't documented your personal experiences in the vicinity of the Waubra wind farm.
- A. Only to say that I have visited, correct.
- Q. The final topic is this. Dr Lawrie suggested that of the symptoms that she has documented in para.25 of her statement, there was then an additional symptom which she said is not to be found elsewhere or is not caused by any other known agent, and she made reference to I think vibration of the lips and the chest and stomach I think she might have mentioned as well. Did you hear her evidence about that.
- A. Yes, I did.
- Q. What do you say about those sorts of symptoms and whether they are associated with illness in the community.
- A. If I heard Dr Lawrie correctly, and I'm happy to be

	corrected if I did not, I also heard a qualifying	1
	statement that the description of this vibrating feeling	2
	was sort of like pins and needles.	3
HIS	HONOUR	4
Q.	Tingling.	5
Α.	Tingling, thank you. That sensation is what we would	6
	call perioral paraesthesia, and it's commonly seen in	7
	people who are hyperventilating or anxious. The extent	8
	to which that is the same as the sensation of the lip	9
	vibration is difficult to say without having talked to	10
	the individuals myself, but having heard Dr Lawrie's	11
	qualification of what may be meant by lip vibration I	12
	would suggest that both nausea and lip vibration may be	13
	symptoms of anxiety and may be compatible with an	14
	anxious state as maybe acute elevations of blood	15
	pressure consistent with a panic attack which may look	16
	just like a mycetoma.	17
Q.	So do you accept the proposition that there are symptoms	18
	being manifested in and around the Waubra wind farm	19
	which are not found anywhere else or caused by any known	20
	medical condition.	21
Α.	No, I do not accept that proposition.	22
+NO	CROSS EXAMINATION BY MR PSALTIS	23
+CRO	OSS-EXAMINATION BY MR MANOS	24
Q.	Would I understand your evidence to this effect: if one	25
	person visits a wind farm and reports an adverse effect,	26
	that would not cause you any concern.	27
Α.	I visited the wind farm and about halfway into my visit	28
	was sneezing uncontrollably and spent the next day in	29
	bed. I would not ascribe either my hayfever attack or	30
	my cold directly to being caused by the turbines.	31
Q.	I have provided your instructing solicitor with a copy	32
	of a written statement of Patricia Godfrey which I ask	33
	you to read, did you read that.	34
Α.	I unfortunately have not had time to read that, I	35
	apologise. Happy to look at it now.	36
Q.	I will just read to you a paragraph. This is from	37
	Patricia Godfrey, who will give evidence next week.	38

'Shortly after I could hear the noise from the turbines Ο. I started suffering from disrupted sleep patterns. suffered from periods of broken sleep I found that the noise from the turbines seemed to affect me more. To drown out the turbine noise I tried was incessant. sleeping with headphones on and listening to tapes but that didn't work. The nearest turbines were about 750 m away from our dwelling.' And then she comes to 'I also started to experience head pain. The pain is extremely hard to describe, it is like having a hat on and it's The pain started in the back of my head and too tight. radiated over the top. At times it would throb and the throbbing seemed to coincide with my heartbeat. times I could feel every heartbeat pulsating in my head'. Accept that that is - again this will come from Mrs Godfrey next week - and she says elsewhere that the only change is that wind turbines were turned on. that is reported to you would say 'Thank you for that, next, please'.

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Α. In my statement, item 14, I have commented on the issue of sleep disturbance and just to remind you of what I have said 'The issue of sleep disturbance is complex since it may be a consequence of stress and anxiety and of itself and/or noise perception'. So the notion that there are some people and Mrs Godfrey quite clearly is one of them, that may be inconvenienced, distressed by noise that disrupts sleep is indisputable and at no time have I attempted to dispute that and have indeed addressed it directly within my evidence. addressed directly by the papers to which I have referred as indicating that there are a certain percentage of people who will be annoyed by the noise and I think that is without doubt true. stray into many of the other issues that we have studied.

Q. Perhaps I'll be more specific. Mrs Godfrey presents to you and describes those symptoms. You say 'Thank you for that'; you'll store that information in the back of your mind but you're not going to immediately ring up the NHMRC and say 'We need to do some research on this'. Would that be a fair comment.

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- A. If Mrs Godfrey presented to me with sleep disturbance I would want a very thorough evaluation of Mrs Godfrey and I always ask the question 'What kind of disease does this person have or complaint does this person have and what kind of person has this complaint?'. So my initial approach would be to find out firstly about Ms Godfrey, evaluate her health status in the whole as well as the environmental exposures to which she may be exposed and I would then deal with the matter as I felt appropriate. I have, as needed in the past, rung regulatory agencies about issues I felt relevant to patients. I cannot tell you how I may respond in the clinical situation with someone whom I have not had the opportunity to talk to. Would I dismiss it as trivial? I would not.
- Q. I wasn't suggesting you would dismiss it as trivial I was suggesting that would be insufficient to you to initiate some research.
- A. It would be insufficient for me to initiate research, it would be sufficient for me to acknowledge that she presents with a significant concern and that it may indeed relate to wind, correct.
- Q. What if a second person presents similar symptoms or identical symptoms to that; that they didn't suffer the symptoms that suddenly present after a wind farm has been turned on.
- A. If there was consistency of effect and that consistency of effect was commensurate with an appropriate response and with exposures that were asserted to have occurred and history had been taken and the information had been collected with sufficient scepticism and documented in an appropriate way then yes, I would be very interested in pursuing it further but it would depend on the rigor

with which the information is collected and presented and I would wonder very much whether the deaf ears that the issue is falling on apparently worldwide relates to similar perceptions that I have about the quality of evidence.

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- Q. Just on that, you've read Dr Laurie's reports and you are aware of the Federal Government's inquiry.
- A. Yes.
- Q. Are you aware the Victorian government is also conducting an inquiry.
- A. I was aware they were planning an inquiry, I'm not aware they are going ahead.
- Q. Have you heard other Governments around the world are pursuing the matter at the moment.
- A. New South Wales Government has already held an inquiry and reported and I'm aware there are various activities taking place in various countries and that is a perfectly reasonable approach from politicians and government agencies charged with population health, is to address the concerns that are brought to them and to determine whether the basis for those assertions are reasonable to make a recommendation. That's the public health process at work and pleased for it.
- Q. Isn't that exactly what Dr Laurie is simply advocating; that there's some information that's available, as a result of that information she's formed the opinion that we need to research and she kept on repeating that, 'We need the further research'. Don't we add all the information together, the 40-odd people that transcripts we've seen did you read the affidavits that were filed in relation to the other matter before the court in the Quinn matter.
- A. Yes, I did.
- Q. There's a dozen or so there, and you've heard the evidence of Dr Laurie speaking to some additional people out at Waubra and in Canada, we've got three or four governments making these inquiries, isn't that a fair basis to say we need some further research.

It relates to the quality of the evidence presented and Α. at the risk of being flippant, and only because I've written it in my statement, I think there are more than 60 people that would describe consistent stories of alien abduction and indeed there are some governments that have held inquiries about the matter but I don't think we would for one minute believe in aliens on the basis of that. I'm not wishing to trivialise the issue, I'm simply wanting to highlight the problem with the anecdotes and hearsay as opposed to the way evidence should and could be documented, and reports and investigators like Dr Nissenbaum do the case no favour. Where there are assertions about turbines and blood pressure and dare I say, considerable reports in the media warning residents that they should be monitoring their blood pressure, creating what I consider to be significant anxiety among the public, only to find that when you put a careful and considered and objective evaluation to the data collected you find quite the opposite, if anything, but certainly nothing, then one has to be very sceptical about the quality of the remainder of the data.

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- Q. Just on the blood pressure information, Dr Laurie didn't assert there was correlation between the wind farm and the blood pressure numbers, did she.
- A. I must have misunderstood; that was my impression.

 Perhaps I've misunderstood but that was the impression I came away with.
- Q. It would be fair to say the information was presented, you inferred that there must be a relationship between the blood pressure and the output, that's why the information was put forward.
- A. There was a large amount of information about wind farms causing hypertension. The postulate that appeared to be most favoured, if I recall the testimony correctly, related variably to infrasound, variably to an association with symptoms and variably to sleep disturbance. I've looked at Dr Laurie's data very

carefully and since I tabulated everything for AR, I believe was the first of the subjects who kept the most thorough and complete diaries, I can find no relevant associations between any of those things.

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- Q. My question is, is there any piece of information you can point to where it was asserted there was a relationship between the two.
- A. I have to say that my recollection of the testimony is exactly that.
- Q. Coming back to this issue, you're concerned about the quality of the research I use that term loosely that's insufficient basis for which funding should be available to carry out proper research. It's the chicken and the egg situation, isn't it; where do we start? You gather some information, some anecdotal evidence has been collected, to use your phrase; doesn't that prick the ears up so further investigation is warranted, isn't that the approach Dr Laurie has taken.
- A. Are we suggesting the entire scientific community, take me out of the picture for a minute, because just a drop in the bucket of what's going on internationally, are we suggesting the entire world of academics is blind to the evidence, to the state that they will not or cannot embark on appropriate investigations? This is like the EMF story all over again as far as I can see.
- Q. But there are symposiums being held around the world, more than one, dealing with this issue of wind turbine syndrome.
- A. Symposia no, if I may indulge the court just for a minute to take a slight left step, I work in an industry that's severely criticised for its relationship with the pharmaceutical industry who have been variably accused of many things; disease lobbying, to the effect industry-sponsored conferences are being highly regulated and support of activity by lobby groups who are active, or activists in any specific context, is viewed with some degree of scepticism. I don't say that's true for any particular lobby group, but I'm

saying lobby groups exist for a particular purpose and will hold conferences and get-togethers for a particular purpose. If the quality of the evidence that comes out of that is robust and if the debate is open and even-handed, great, but I've just spent some time reviewing Dr Nissenbaum's evidence with Mr Henry and consistent with my initial impression I've come away rather concerned with what I see and if that's the basis for which we should pursue legitimate scientific investigation using public money I'm again concerned with that assertion.

- Q. What benefit is going to flow as a result of an increase in setback of wind turbines from populated areas.
- A. I'm not sure that I'm on top of the reason for the question.
- Q. The question was put poorly. Let me put it to you again. You used the example of pharmaceutical companies. There's a benefit that could flow if their drugs were prescribed by medical practitioners to patients. Those people who are involved in the Society For Wind Vigilance will not benefit if there is an increase in the setback distance of a wind farm from a populated area, will they.
- Α. That's true in the sense, if they could come up with some consensus about setback. What I've heard is 'We did our investigation at - ' was it Dr Nissenbaum did it I think at a distance which we've heard is around 5 km and that was deemed to be associated with a very low incidence of effect, assuming his case control study is accurate, and that's in question. Then I'm presented with evidence that suggests that 10 km is proposed to be reasonable and now I'm hearing that it's an open-ended I'm not sure that it's a case of, question. notwithstanding Dr Laurie's assertions, and I find Dr Laurie to have incredible passion and integrity without doubt, but the question of 'We don't actually know how far we want it back', leads to me to question do we want this at all. That may not be Dr Laurie's

view but I suspect it's very much the view of many other people.

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- Q. But would you agree that those who, from what your basic understanding of it is, those involved in this society or the Waubra Foundation, all they want to do is make sure there's a safe setback distance so human health is not affected; isn't that the overriding objective of those groups.
- A. I don't know what the overriding objective is, I've not been briefed by the foundation on their objectives.
- Q. Is there any other benefit that could flow from what you have learned today to members of the society who are advocating an increased setback in populated areas.
- A. I understand your question and I'm not sure that's what I'm here to answer is the answer to your question.
- HIS HONOUR: I agree with the witness, I'm not sure that his speculation on the motives for these groups will assist us.
- MR MANOS: The witness introduced the pharmaceutical benefit example where there's obviously, clearly, as we understand it, connection between sponsorship and drugs being prescribed. It must be fair for me to test that view in relation to this society. There's no suggestion other than a question by Mr Henry, that some of these people may get some research, that there's going to be a benefit. The objective must be public health. This is a witness who is put forward as a public health expert.
- HIS HONOUR: You talk about, in somewhat amorphous terms 'these groups'. In order for the witness to be able to give a meaningful response he would have to know about the aims and objectives of these groups. He can only speculate and his speculation is not going to assist us.
- MR MANOS: He heard about the aims from Dr Laurie's evidence.
- HIS HONOUR: One group.
- MR MANOS: And the Waubra Foundation. 37
- HIS HONOUR: He's spoken of those objectives but it's 38

an open-ended inquiry you are putting to him and he doesn't know.

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MR MANOS: I'll move on.

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- Q. How do we get funding then for the research that

 Dr Laurie speaks about if you can't get to the case

 control study level that you're seeking. You've got to

 start somewhere.
- Α. Perhaps I need a point of clarification. I heard on many occasions an impassioned plea for research and I heard on many occasions, as we all did, a plea for independent research, but I also heard an extensive discussion about our research and my collaborators and our funding. I was left a little confused about the objective of a foundation that purports to lobby and gather funds for independent research but persists in activity that does not generate what I've seen of a good research and at various times it's called research and at various times it's called not research, and at various times it's asserted I'm a researcher, at various times it's asserted that I'm not, at other times I'm just gathering some evidence for preliminary investigation to determine what kind of research we Without any clarity being brought to that question I was informed yesterday by the testimony that this could be done simply and quickly but was not clear on what simply and quickly meant and anything that I've seen so far that's been done simply and quickly has been highly questionable.
- Q. You criticised Dr Nissenbaum's report.
- A. I did.
- Q. Do you have Exhibit A22 in front of you, at Tab 8.
- A. Yes, I do.
- Q. You've studied the chart on the second page of that document.
- A. I believe this is the one you're referring to (INDICATES).
- Q. Yes. 38

A. Yes.

- Q. Do you say that accurately reflects the text that appears at the foot of the following page, save for the use of maybe a different word here or there.
- A. Yes, that's assuming without actually going through it word-by-word that it's close enough.
- Q. Looking at the first page of the report in the middle of the page 'In my investigation of Mars Hill, Maine 22 out of 30 adults exposed live within about 3,500 feet' you're critical of that statement in terms of it being a case control study.
- A. I'm critical of any scientific investigation that uses the word 'about'.
- Q. It matters whether it's 31 people or 29 people. 22 people I would respectfully suggest have been prepared to participate in this study, that's what it says, that's what it says, '22 out of about 30 people have agreed to participate'. You can't read any more into that statement can you.
- A. '22 out of about 30 adults exposed who lived, were evaluated'. It didn't say 'were prepared to participate'. I have to say I'm a little surprised that someone who is so precise with language should choose to nitpick with me over the wording that's clearly stated here when the issue at hand is scientific integrity.
- Q. Is your understanding that with these case control studies you need people to voluntarily participate, you cannot compulsorily force them to do something.
- A. Participation is always voluntary.
- Q. So my question is a fair question, isn't it; that the only way to interpret this statement is that 22 out of about 30 people agreed to participate, or if you want to use the term used, to be evaluated, that's all that that statement says, isn't it.
- A. Well it says 'were evaluated'. The interpretation that they agreed to be evaluated or the basis by which they were selected and invited to be evaluated is an inference that you are making that I'm not prepared to

make because the methodology of the study is not declared. I don't know whether the study was referred to and evaluated by an ethics committee who would have insisted that the recruitment of the subjects were done by those sorts of principles -CONTINUED

There is no information here that allows me to infer what you're wishing me to infer from this data.

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- Q. What about the use of the words 'were evaluated to date'. Does that mean anything to you.
- A. 'To date' says this is something I'm continuing to do.
- Q. Or it means only 22 out of the 30 people have agreed to be evaluated at this point in time.
- A. That's open to interpretation. When one does science one requires a level of precision that does not leave things open to interpretation.
- Q. So you say, 'Well, there is insufficient information presented at the moment for me to make a proper analysis or to rely on this report'.
- A. Correct.
- Q. Assume for the moment, for the present purposes if you can, there were about 30 people in Maine, 22 of those people agreed to participate in a case controlled study. They lived within 3,500 feet of a wind farm. They were asked a series of questions and the same series of questions were then asked of another group of people who lived about 3 miles away. Make those assumptions. Those people then respond in a tabulated form that appears on the previous page. You say, when you read that information, making those assumptions, that that is not any basis to be alarmed that exposure to a wind farm could have an effect on a person's sleep habits or their stress or headaches. Is that what you say.
- A. Mr Manos I refer you back to my let me answer the question directly first. The answer is I don't know because I can't evaluate the evidence. Let me refer you back to the statement I made about the very recently discredited mumps, measles, Rubella study. There were a number of people who stopped vaccinating their children on the basis of that study. I am unwilling to be concerned or let me say to be very concerned about anything where I can not evaluate the evidence. I would want to see properly collected data. This is not properly collected data.

- O. You don't know that.
- A. Well, it's not stated to me that it's properly collected data, therefore I cannot know that because it's not been declared.

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- Q. It could possibly be properly collected data using your test.
- A. It could be but it's not declared and it would seem very odd not to declare the methodology in a scientific presentation.
- Q. Let's assume the data was collected to your satisfaction -
- A. If this were done to my satisfaction, yes.

HIS HONOUR

- Q. Would that include knowing the nature of the questions that were asked.
- A. I would have to know the nature of the questions asked.

 I would have to know by ascertainment all of the issues that I raised during my preliminary comments on case controlled studies would need to have been sufficient in order to be able to comment on that data as a source of concern.

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- Q. I moved on to this topic because you were commenting on Dr Laurie's evidence about doing some research quite quickly. If you have a group of people who live within a certain distance of a wind farm and a group of people living outside, say 10 kilometres or 20 kilometres away from a wind farm, you could quite quickly undertake a case control study of those two groups, couldn't you.
- A. Could I? What are you asking me?
- Q. You or an appropriate qualified researcher, someone else. That can be done quite rapidly.
- A. What are you suggesting could be done quite rapidly?
- Q. The survey that would need to be done. Obviously you would need to spend some time identifying the people and matching them but, if you're dealing with a series of questions, that can be a research test that can be done fairly quickly.

- A. Can I refer to my statement.
- Q. Yes, but that is a fairly simple question.
- A. It is a simple question, and I would like to answer precisely being an advocate of precise language. Point 41, which is p.9 of my evidence statement, I would suggest that for any research to be made as to an adverse health effect from sounds that arise from wind turbines, a direct measurement of actual sound exposure as well as perceived sound exposure over a reasonable period of time, together with an objective evaluation of potential confounders and an objective assessment of the health effects is required, in accordance with the standards of public health risk assessment. I cannot see a compelling reason to recommend that this be done on the basis of the available data.

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- Q. Yes, my question to you is can that research be done reasonably quickly.
- It would depend on the resources that were available to Α. It would be dependent upon adequacy of design and the appropriate power calculations to determine the number of people that were required to participate. There would be a process of protocol development, protocols then need to be peer reviewed. The peer review process would then also require that there was reference to an appropriate ethics committee, irrespective of the nature of the survey and how invasive or uninvasive we may perceive it to be. that be done reasonably quickly? I believe it could but that is a matter of definition; what is the definition of 'reasonably quickly'? Are we talking weeks, months, years, half a decade? What's your definition of 'reasonably quickly' Mr Manos.
- Q. I would suggest to you a period of months.
- A. No, I don't believe it could be done in a period of months.
- Q. All those steps are necessary in your opinion to have a proper case control study.
- A. Yes, I do. 38

- Q. Even if you're not seeking to peer review it.
- A. Yes, I do. If you're not seeking peer review then, you know, one would have to question the purpose of doing it because you just get back into the cyclical argument we've been having all day.

- Q. Let me put to you this proposition. Let's say you live near a wind farm with your family and, after the wind farm started operating, you and the other members of your family started to suffer from headaches, and previously hadn't suffered that. Given your background and experience, do you believe that you could quickly prepare a research approach which has characteristics of the case control study that you've just mentioned, and get that out in the community in a very short period of time.
- HIS HONOUR: What does 'a very short period of time' mean? It's not going to assist us because you've put to the witness this can be done in months and he's disagreed with that.
- MR MANOS: That was on his formal case control study. I'm asking if he found himself in this situation, on that assumption, could he be do it.

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- Q. You could do that within a couple of weeks to a month, couldn't you.
- A. You're asking me to speculate on a set of personal circumstances where emotional context would override objective judgment. Is that what you're asking me to do? Or are you asking me as a witness on scientific -
- Q. I'm suggesting you and your family are exposed to headaches that you previously hadn't been exposed to. You would say in that situation you would lose your objectivity in carrying out proper research.
- A. When my family are sick I take them to a medical practitioner other than myself. I seek outside opinion. I can have no objective opinion at all when it comes to my family. I reserve the right to veto but that's a different matter.

Q.	I'm not asking you to treat these people. I'm simply	1
	saying myself and my family have suffered headaches, I'm	2
	suggesting you could rapidly prepare a series of	3
	questions and identify a group of people who might be	4
	asked those questions to do a bit of a case control	5
	study.	6
Α.	If I did, what validity would it have?	7
HIS	HONOUR: You might get further if you asked him	8
	whether he was retained to conduct research because you	9
	are going to continually founder on this question of his	10
	personal -	11
MR I	MANOS: The problem with that is he has indicated	12
	that, if that were the case, he would have to go through	13
	the processes he's described, which is a lengthier	14
	process. I'm seeking to ascertain if there could be a	15
	more rapid response if the Professor was personally	16
	involved.	17
Α.	I'm delighted to debate this with Mr Manos but I think	18
	this debate would waste the court's time.	19
HIS	HONOUR	20
Q.	Let the court deal with that.	21
HIS	HONOUR: I don't know that you're going to get	22
	anywhere because you're going to continually founder on	23
	the rocks with his personal involvement -	24
MR I	MANOS: I don't know whether he has answered my	25
	question about losing personal objectivity -	26
HIS	HONOUR: He may not have said in so many words but	27
	everything is indicated to suggest to me that he	28
	couldn't approach it objectively because he's	29
	subjectively involved. I don't believe this line of	30
	inquiry is going to assist.	31
MR I	MANOS: The witness has criticised Dr Laurie	32
	saying they could get a fairly rapid response.	33
HIS	HONOUR: There are many ways of testing that. I	34
	don't know whether the way you're doing it at the moment	35
	is going to assist.	36
XXN		37
Q.	In the material you've presented to the court there are	38

	some documents and reports about infrasound.	1
Α.	Yes.	2
Q.	And prior to being involved in this matter, did you have	3
	any real understanding or knowledge of infrasound.	4
Α.	I did not.	5
Q.	Have you learnt something about that since being engaged	6
	in this matter.	7
Α.	I've learnt a great deal. Does it mean that I know	8
	anything? Probably not.	9
Q.	It's all relative. But you acknowledge that infrasound,	10
	according to one of the papers you've presented, can	11
	have an impact on human health, on human activity.	12
A.	I saw lots of information in those papers and there was	13
	no information that led me to the conclusion that	14
	infrasound of the levels that were being monitored in	15
	Dr Laurie's own witness statement would have an effect	16
	on human health. What I was interested in is some	17
	information I came across suggesting that infrasound, if	18
	you live near the beach, is of the order of 75 decibels.	19
	That would suggest that sleeping on the cliffs with the	20
	waves crashing below you would be devastating for your	21
	health. Anecdotally - and I can't confirm this - it's	22
	rather good for you.	23
Q.	Do you know what frequencies that 75 decibel measurement	24
	is.	25
Α.	Under 20 hertz I gather. I can't be more precise than	26
	that but it's infrasound.	27
Q.	To come back to my question: one of the arguments that	28
	you have attached to your statement sets out reports,	29
	does it not, of infrasound having an effect on human	30
	health.	31
Α.	I evaluated wavelengths I could find that was collected	32
	with as much objectivity as I believe the authors of	33
	those reports could generate them with, and commented on	34
	that only in the context of an evaluation of human	35

- Q. With respect you didn't answer my question.
- I didn't answer your question because the information Α.

	that I present	ed in the report, which as I started off	1
	answering your	question saying, was that based on the	2
	information tha	at I was provided with on the measurements	3
	of infrasound,	and based on the information in those	4
	reports, I coul	ld only conclude that there was no risk of	5
	infrasound to 1	human health in the development of	6
	Waubra - or the	e proposed development.	7
Q.	I'll ask the qu	uestion again: one of the articles that	8
	you produced th	hat you attached to your statement deals	9
	with infrasound	d. Do you agree that article provides	10
	some information	on to say that infrasound has an effect on	11
	human health.		12
HIS	HONOUR:	There are lots of arguments -	13
MR I	MANOS:	We could be here until the cows come	14
	home -		15
HIS	HONOUR:	It would be a lot easier if you put	16
	specific artic	les -	17
MR I	MANOS:	Well, I can but I would have thought the	18
	professor could	d answer that particular question. If we	19
	want to finish	the witness, the witness could answer my	20
	question -		21
HIS	HONOUR:	If you are precise with your questions I	22
	think -		23
MR I	MANOS:	How more precise can I be to say 'with	24
	respect to the	article -'	25
HIS	HONOUR:	Get the article and put it to him.	26
MR I	MANOS:	I would have thought he knew the answer.	27
XXN			28
Q.	Do you have you	ır Exhibit Y in front of you.	29
Α.	Yes I have.		30
Q.	Have you consid	dered the reference of the various	31
	articles on p.1	ll of that report, starting with the	32
	heading 'Genera	al Toxicology', starting at p.11 of that	33
	article.		34
Α.	Is this the inf	frasound report dated November 2001?	35
Q.	Yes.		36
Α.	So that's exhib	oit 8.	37
Q.	7.		38

Α.	So there is two - this is tab 7 is the Colby paper which	1
	is 'Wind Turbine Sound and Health Effects'. Tab 8 is	2
	'Infrasound'. Which one am I directed to?	3
Q.	I am looking at tab 7.	4
MR .	HENRY: Behind tab 7.	5
Α.	Okay, behind tab 7.	6
XXN		7
Q.	Looking at the document entitled 'Infrasound - Brief	8
	Review of Toxicological Literature', with the heading	9
	'General Toxicology', there are a hole lot of articles	10
	commented on and a brief summary in some instances	11
	provided - a brief summary is then provided under the	12
	heading of the paper.	13
Α.	Yes.	14
Q.	Do you agree that some of those articles summarise that	15
	there is an effect on human health caused by infrasound;	16
	for example - this is qualified - but on p.12, for	17
	example, under the heading of 'Radneva'.	18
Α.	What page are we on?	19
Q.	P.12.	2 (
A.	Yes.	21
Q.	On p.14 under the name 'Karpova'; read that summary.	22
A.	Yes.	23
Q.	And at the foot of p.15, for example, under the author's	2 4
	name 'Slarve'.	25
Α.	Yes. The commonality of those studies, if I might	26
	comment at this point, was the intensity of the	27
	infrasound and -	28
Q.	I understand the qualification.	2 9
HIS	HONOUR: Let the witness finish the answer.	3 (
Α.	The intensity of the infrasound on each of those	31
	occasions is above the levels that I've been indicated	32
	occurred in Waubra and are therefore unlikely to occur	33
	at Allendale. I did hear Dr Laurie's testimony that	34
	there may be infrasound levels at a higher intensity.	35
	If levels are present, indeed, at a higher intensity,	3 (
	the evidence has to be looked at differently, but my	37

statement was prepared with the evidence that I was

	presented with.	1
XXN		2
Q.	I understand that. Can I take you to p.23, heading of	3
	'Studies in Monkeys', and the author 'Swanson'.	4
Α.	Yes.	5
Q.	Did you read that very short summary.	6
Α.	Indeed, a very short summary.	7
Q.	Had you read that prior to -	8
Α.	I hadn't read the paper, no.	9
Q.	Had you read the summary.	10
Α.	I had read the summary.	11
Q.	You say that, in your workings, you do work with animals	12
	for experimentation purposes.	13
Α.	Yes, I do.	14
Q.	And monkeys are known to be used or have been used in	15
	the past for the purpose of assisting with human health.	16
Α.	Not by me, but I know some.	17
Q.	Taking you back to p.15, you heard the evidence about	18
	the vibrations and the tingling. There is, in a sense,	19
	a reference to that issue there at the foot of p.15,	20
	isn't there, that some people experience body vibration.	21
Α.	Yes.	22
Q.	Do you accept that at certain infrasound levels that	23
	human health can be affected.	24
Α.	Yes, I accept that at certain sound levels there are	25
	physiological effects that have been well documented and	26
	are documented in this discussion.	27
Q.	If Mr James who we've spoken of has measured 90 decibels	28
	of infrasound at 1500 feet which is about 450 m, could	29
	that level possibly, from what you understand, affect	30
	the human body.	31
Α.	The passage that you've just directed me to says '120 to	32
	144'.	33
Q.	I understand that but I'm not just asking about that	34
	particular article. I don't know how many there are.	35
	There are 20 or 30 articles summarised in this paper.	36
	What I'm putting to you is, from what you learnt in	37
	relation to infrasound in this paper and other papers,	38

if you had a level of 90 decibels measured at 450 m from a wind turbine, do you believe that that could have an effect on the human body.

CONTINUED

A.	Based on the data that exists, if people were	1
	consistently exposed to 90 decibels of infrasound then	2
	yes, it is quite possible there would be a physiological	3
	effect.	4
Q.	You have quoted in your report Exhibit Y, from the New	5
	South Wales Legislative Council written by	6
	Dr Diesendorf. Do you know him at all.	7
Α.	I do not.	8
Q.	Do you know if he's a medical practitioner.	9
Α.	I do not.	10
Q.	In your report you have provided extracts of that order.	11
	This is at tab 5, behind tab 5 in your statement.	12
Α.	Yes, which page are you referring to?	13
Q.	That document you will see from your extracts goes up to	14
	at least p.123. Do you recall the document is in excess	15
	of 200 pages.	16
Α.	Yes, it's a long document. What is here is the decision	17
	primarily. It's the executive summary, which starts and	18
	summarises from chapter 4 onwards, talking about various	19
	aspects, but includes the environment and economical	20
	impacts etc. The relevant statement I think you are	21
	referring to appears on p.160.	22
Q.	Yes, that is the one that you have quoted from.	23
Α.	Yes. That is 7.30.	24
Q.	I would like to produce to you the entire chapter 7.	25
Α.	Thank you.	26
Q.	Do you recognise that document.	27
Α.	Yes, I do.	28
Q.	So, p.116,at 7.28.	29
Α.	Yes.	30
Q.	7.28, 7.29 and 730, until we get to this issue.	31
Α.	Yes.	32
Q.	Dr Diesendorf is then quoted in para.7.30.	33
A.	Correct.	34
Q.	I take you back to p.114 para.7.17.	35
A.	Yes.	36
Q.	You are in a situation in a sense, where you were a	37

visitor to the Waubra wind farm. Did you notice any

- impacts on yourself at the time that you went there, 1 apart from the hayfever. Α. Hay fever and a cold, yes. No. 3 And you commented that you didn't find the farm or the 4 Q. turbines particularly audible. No, they were audible, I videoed them extensively from 6 Α. 7 multiple locations. I wore a hardhat because I was 8 required to do so. The wind through my hardhat and my cap on subsequent occasions made a little more noise 9 than the turbine, except in one location, where I could 10 11 clearly hear the turbine. Para.7.21 'Further research by Vandenburg. 12 Q. Can I clarify something please? Have we moved from 13 Α. We are still on infrasound because 14 infrasound to noise. these paragraphs refer to audible noise. 15 Dr Diesendorf's statement at 7.7.30 on p.116 refers to 16 infrasound. We appear now to be talking about audible 17 sound. 18 19 Q. Dealing with sound, I agree this is dealing with sound generally, then there is a section more specifically 20 21 about infrasound. 22 Yes. Α. 23 But you didn't put forward all of the document. ο. No, I put forward the section of the document that dealt 24 Α. 25 with infrasound, because I, as you say, was needing to 26 find data related to infrasound and tried to view as much evidence as I could possibly find relating to 27 28 infrasound. So while I could find considerable information relating to sound, might I say it's not in 29 dispute by myself or anyone else, that wind turbines can 30 be audible, that is not in dispute. What is unclear is 31 the health effect from something that can't be heard. 32 33 Then I had to rely on as much evidence as I could find 34 to form an opinion. 35 I am conscious of the time. Can I take you to p.117. Q.
- You have set out in your report at p.116 and the next page to 119, p.117 is 'Committee comment'.
- A. Yes.

Q. I take it you don't claim to be an acoustician. You see in 7.37 'The committee acknowledge the evidence that demonstrates that atmospheric conditions impact on noise levels'. They are just talking about noise levels there, not a particular type of noise. Then there is a recommendation at p.117. Is there any reason why you excluded that page from your paper.

- A. Which is the recommendation? Recommendation 17 at the foot of p.117. Because the question I was asked was to comment on the health effects and that statement had nothing to do with the health effects.
- Q. Didn't some of Dr Laurie's material suggest this some people were having their sleep affected.
- A. I haven't disputed the fact that some people have their sleep affected. It's in my statement.
- Q. Is it not relevant that this committee is dealing with the issue or has made certain recommendations about noise modelling, needs to be undertaken at night-time as well.
- A. Are you wanting me to be an acoustician?
- Q. No, we can reasonably assume most people sleep at night. That is a fair assumption, is it not.
- A. That is a fair assumption, a small part of the community, shift-workers, but the general population will sleep at night. This committee suggests further modelling needs to take place for nighttime activity. I don't think we are in any disagreement with this court that turbines can be heard and that they are heard more by some people than others. This information is in my statement. I am not entirely sure what I am being asked to comment on. Are you asking me to specifically indicate why that statement was omitted from my testimony?
- Q. In effect, I am asking why you didn't put forward that page. You put forward the preceding page and a couple of pages thereafter.
- A. I was dealing with health effects, and the issue of noise was not in contention, since I had already

	acknowledged that some people may have disturbed sleep	
	than others. I see no additional benefit when I have	2
	acknowledged something, in mulling over the point. I am	3
	at a loss to understand the point you are making.	4
HIS	HONOUR: That recommendation 17 is included in the	5
	summary of recommendations.	6
XXN		7
Q.	P.118 'Vibroacoustic Disease'. See that heading.	8
Α.	Yes, I do.	9
Q.	Again that page has not been included in your paper.	10
Α.	Yes, because I am not clear what vibroacoustic disease	11
	is or what the relevance of vibroacoustic disease is to	12
	wind farms.	13
Q.	Even though this council committee is considering wind	14
	farms specifically.	15
Α.	The statement, if I can refer you to .7.43.	16
	Vibroacoustics is used, something that appears with very	17
	high vibration for people who were working with special	18
	machinery, like really heavy industrial machinery and	19
	the vibrations will be so heavy their cells will be	20
	disturbed. There is no way this could be the case with	21
	wind turbines, so I did not know why this is bought up	22
	as an issue. It does not have anything to do with wind	23
	turbines, that is 7.43 and it's reference is 497.	24
Q.	You have included in your statement at p.123 'Committee	25
	Comment' 7.67.	26
Α.	Committee comments. Yes.	27
Q.	You are not disputing the committee's comment that there	28
	is unique sound characteristic from wind farm noise.	29
Α.	No, I have made that statement on a number of occasions.	30
Q.	The next part of it, that there are difference	31
	influences on the perception of this noise.	32
Α.	Correct and I have made that statement.	33
Q.	Do you also acknowledge the first part of the next	34
	sentence. 'The committee further notes noise annoyance	35
	is an adverse health effect that can result from wind	36
	farms'.	37
Α.	Correct.	38

Q. You say that in itself is not enough basis for you to be alarmed in conjunction with the other material that has been presented and considered by you.

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- We are hearing different bits of information, so let's Α. keep some things separate. Let's talk about noise very separately from the issue of infrasound, because if you blur them, then it becomes very difficult to provide a concise and cogent answer to your question. What I have stated in my testimony very clearly is an acknowledgement that under certain circumstances, there will be a perception of noise by people, and that may lead to sleep disturbance, and that with or without the presence of anxiety, may lead to an adverse health effect. Whether that is annoying, doesn't matter how you operationalise that. That is true, what the data says that is true for a small percentage of people. How you link that to the sort of data I have been provided and the assertions that have been made, is to me completely unclear, because if you accept that there are certain percentage of people who will have sleep disturbances, you already have information of the health You know that information has been available before the Peterson paper and has never been in any dispute. So I am not entirely clear what you are asking me because I have acknowledged where I believe there is an issue, and I have questioned where I believe the evidence is unclear and I believe I have been quite consistent with that.
- Q. Well you have been. What I am putting to you is when you read that committee comment in conjunction with the other information that has been presented to you, that that doesn't cause you to form an opinion that we need to further research this issue and try to work out what is causing -
- A. The issue is clear, the statement is clear, the issue is clear, it has been stated by others, it has been asserted in my testimony, it's not something I am going to state in any other way, sir.

- Q. Perhaps I am not clear. When you say 'the issue is clear', what do you mean by that.
- A. I am saying and I will refer back to my testimony if I may.

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COMSR MOSEL: 24 and 25?

A. No, it was a statement around health effects and sleep which I had before and now I can't find it. I apologise.

HIS HONOUR: Para.14.

'The issue of sleep disturbance is complex Thank you. since it may be a consequence of stress and anxiety in and of itself and/or noise perception'. At that point it's perhaps relevant for me to comment that I have no testimony today, I can't recall if it's something you read out or something I heard from Dr Laurie. it was the statement from Mrs Godfrey that you read out or alluded to indicating the sleep disturbance got progressively worse. So this may well be, this interplay between sleep and anxiety, is just speculating on that. A similar circumstances may be seen in other circumstances etc. If you then refer to the paper I presented on road traffic noise, which is the attachment at the back of 10, no sleep and poor health might end the relationship between road traffic noise and cardiovascular problems, and in that analysis, which I included partly to highlight the issue, but also because I consider it to be an extremely well done study and wanted to illustrate to the court what I consider to be good science, the conclusion was that the analysis showed no relationship between noise exposure nor response to noise and cardiovascular problems. Now it's acknowledged some people would hear noise, it's acknowledged that on some occasions the noise will disrupt sleep, it's unclear to me for any one individual to be consistent, the noise is at a particular location, whether it's like a car that goes past or whether it's any different to if you sleep close to a busy motorway and there are constantly cars going past, which is often the case obviously, there is a change of amenity which may be a consideration as far as I can see from at least the journal from AR, the comments about noise being audible in the minority at the time, so if it's noise disrupting sleep it only occurred occasionally on that case.

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	The extent to which sleep may be disrupted because of	1
	noise for any one individual on a persistent basis is	2
	unclear to me. So, on the one hand I am acknowledging	3
	this issue, on the other hand I am indicating that	4
	careful studies of the relationship between these	5
	various factors have been done in the context of audible	6
	sound, and what we haven't got clear is this murky	7
	business of infrasound, because there now seems to be	8
	some dispute about the measured level of infrasound.	9
Q.	But there is a difference between road traffic noise or	10
	aircraft noise or -	11
Α.	Aircraft noise is much louder.	12
Q.	But one of the other studies talks about aircraft, road	13
	transport and rail noise.	14
Α.	Aircraft noise is very loud.	15
Q.	But it's not continuous 24/7, is it.	16
Α.	Well, I'm not sure there is an assertion that	17
	necessarily for all people turbine noise is continuous	18
	24/7.	19
Q.	But you understand that if the wind is blowing, a	20
	turbine might operate 24/7.	21
Α.	It might be, and I've also heard testimony that it	22
	depends on the direction.	23
Q.	But let's assume it's operating 24/7. You've heard the	24
	sound, you hear a whoosh every less than a second.	25
	You've experienced it yourself, haven't you.	26
Α.	Yes. I find it quite relaxing.	27
Q.	That wasn't my question. You've experienced it.	28
Α.	I've experienced it.	29
Q.	So it is a continuous cycle, potentially 24/7.	30
Α.	Again, I can't answer the question, because I'm not an	31
	acoustician, about where you can hear it, but I will	32
	make the point that, for the most part, I couldn't hear	33
	it, other than standing under the turbine in one other	34
	location.	35
Q.	But the committee here, on p.123, acknowledges that	36
	noise annoyance is an adverse health effect that can	37

result from wind farms. You acknowledge that as well. 38

A. Yes.

- Q. That can lead to sleep disturbance and sleep disturbance can have an adverse effect on one's wellbeing.
- A. That's correct, although it is interesting to see the evidence tendered to the court about the relationship between adverse effects on blood pressure and turbine output and I've found none.
- Q. For three people.
- A. Well, I didn't produce the data. I was given the data, with an assertion that this was demonstrable evidence of how terrible this is.
- Q. With respect, there was never such an assertion. You, I suggest, have read that into the information.
- A. I did read it into the information from about three or four different news reports, including on ABC. I found it hard to escape that information.
- Q. But your position is that you've read the affidavits in the Quinn matter, you've read the transcripts Dr Laurie has provided, let's say 50 to 60-odd people. You are not prepared to rely on those but you are prepared to rely on three blood pressure analyses to say positively that there is no correlation between wind turbine output and blood pressure.
- A. Well, you are asking me to comment on the objectivity of one set of data and not the other.
- Q. I'm just asking you, in bare numbers, it seems odd that you are seeking to rely on three numbers, but when there's 50 samples provided, you don't want to rely on those.
- A. I was provided with data that I could objectively evaluate. I objectively evaluated the data I was provided.
- Q. Turning to the last page of the document that I provided to you, p.125, you see a heading 'Committee Comment', para.7.79. In your statement you've touched on the issue of emotional effects. Have you read that paragraph 7.79 prior to today.
- A. Yes. 38

Q. You didn't think it was important to include that in your attachment.

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- A. I have already included that in my attachment. I have indicated at point 12 'The anecdotal evidence that some people living in the vicinity of wind farms', etc., that is quite clearly stated. I've talked again about the issue in point 14 which addresses it. I'm not sure how more explicit you would wish me to be.
- Q. You would agree that if someone suffers depression from whatever cause, as a result of living near or adjacent to a wind farm, that that is an issue that needs to be addressed.
- If you're attributing cause and effect and you're saying Α. that the depression is due to loss of amenity, or are you saying that the depression is due to infrasound, or are you saying the depression is due to audible sound? You know, there are many, many issues that colour this, and I think we've been through all of that with the evidence from the paper from Dr Peterson, which is not in dispute, with the evidence relating to other developments of a similar type that have environmental impact, that's not in dispute. These are phenomenon that are broadly associated with many different things. I'm not sure they can be directly ascribed in a cause and effect basis to sound from a wind turbine. So there are some things that, although I wish I could comment on with better clarity, I can't, because the information that I have been provided with is vague, in the sense that there is no sufficient dissection of cause and effect relationships. Does that constitute a need for additional research? I don't think so, because I think there is sufficient clarity around what already exists, and the issue then comes down to public health risk assessment, and that's a matter for the court to decide in the planning context.
- Q. What I am putting to you at the moment in relation to this passage is that the emotional response is a factor that needs to be considered and, if that leads to

	depression, that is an adverse health effect.	1
Α.	The emotional response to anything needs to be	2
	considered and is always in the context of many other	3
	factors that occur in people's lives.	4
Q.	You touched on the nocebo effect in your statement. In	5
	your discussions with people in Waubra, did you form any	6
	opinion that anyone was suffering from that effect.	7
Α.	I did not.	8
Q.	How many people did you speak to in Waubra.	9
Α.	Probably half a dozen.	10
Q.	Who live near or adjacent to the wind farm.	11
Α.	Yes.	12
Q.	Did any of them report any adverse effects to you.	13
Α.	No.	14
Q.	Any adverse health effects.	15
Α.	No. The only anecdote that was reported to me was of	16
	someone's relative, or friend, I should correct myself,	17
	who had bipolar disorder and, when feeling particularly	18
	fragile, found that being on the wind farm improved that	19
	situation.	20
Q.	What if 10 people reported that to you.	21
Α.	That they felt better?	22
Q.	Yes, if they had bipolar and they went near a wind farm.	23
A.	To be honest, it is an anecdote, and I wouldn't know	24
	whether it is the country air, the removal of	25
	city-related stress, seeing a friend. It is an anecdote	26
	and it doesn't appear in my testimony because it is an	27
	anecdote and I highlight it only to say I am not willing	28
	to rely on anecdotes.	29
Q.	My question is: say you had reports of 10 people who	30
	experienced those phenomenon, undertook that	31
	self-treatment, that when they are on the edge of their	32
	psychological condition, they go to the wind farm for	33
	self-treatment, would you report that back to your	34
	colleagues in that relevant area.	35
Α.	I would be very sceptical and let me tell you why. When	36
	I worked in general practice in New Zealand, my	37

colleague was doing chelation therapy. It is a

discredited form of treatment for cardiovascular disease. It is based on running a chemical called EDTA through a drip into the veins and it's meant to leach out all the plague and cholesterol, and of course it leaches out a whole lot of other stuff, so they run that in through another drip. There was this very firm belief, because he had seen two or three people improve, that this must be a good treatment, but subjected to proper study, it is not a good treatment and, in fact, it is associated with significant harm in a number of circumstances. The point is that you can believe your own publicity if you're not maintaining a high level of scepticism and objectivity in your evaluation of data.

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EXHIBIT #A25 CHAPTER 7 OF THE GENERAL PURPOSE STANDING COMMITTEE NO.5 TENDERED BY MR MANOS. ADMITTED.

- As I understood your evidence-in-chief, you have an 0. interest and expertise in relation to sleep disturbance.
- We are conducting a study at present which involves home Α. sleep studies.
- Without breaching your client confidentiality, do you Q. have any patients who are exposed to noise 24/7, if I can use that term again.
- The interesting question, to which I don't know Α. the answer as yet: in the study, we have a series of questionnaires that deal with the issue of noise. also have the capacity in the agreement to do geographical mapping, which would give us an idea of traffic density at any particular locality. We also ask people about shiftwork, which of course is important in circadian rhythm, day/night shifts. The sort of issues are: what time do people go to bed at night; what time do they wake up in the morning; how much coffee do they drink before they go to sleep; how much alcohol do they drink; have they had a fight with their wife or partner or kids or neighbour or so on. They will all have an A bad day at work, and the many other vicissitudes of life will affect sleep, including

medication use and a multitude of factors. We try and ask about all of these, including, as I say, the issue of shiftwork, and in the most recent version we are trying to incorporate some issues of noise exposure, although it's very difficult, unless you've got an objective measure of noise, as well as a perceived measure of noise - and this is a debate that now goes backwards and forwards - but in as much as we can objectify by GIS mapping, we will have that data. I don't know that I can tell you any more than that yet.

- Q. But your report at least is considering road traffic noise, and that, I would suggest, is unlikely to be operating 24/7.
- A. Well, I can't tell you which of these people have airconditioners running in their house at night, who can hear the refrigerator, the neighbour's airconditioning unit running, I can't tell you who's got ceiling fans going, I can't tell you who's got those fancy rotary watering thingies going out in a paddock that can make a noise. I can't tell you all of the sources. There are many sources of noise, like dogs bark, birds, crickets. Some of these noises are appealing, some of them are unappealing, and I guess the definition of noise is 'I don't like what I hear'.
- Q. You mentioned airconditioning. Do you recall that in the affidavits in the Quinn matter, a number of people said they turned on their airconditioners to drown out the sound of the wind turbines.
- A. I can't give you a number.

- Q. But you recall reading that some people said that.
- A. Yes.
- Q. Did you read into that that they were seeking to get a continuous sound, rather than hearing the whoosh every one or two seconds.
- A. I interpreted that as people who are very annoyed with the sound of the wind turbine and preferred one form of noise over another. I sometimes prefer listening to music to hearing the dog bark.

- Q. Do you say that's a good analogy, do you.
- A. It's not a good analogy. It's an analogy. I don't comment on the quality of it.

- Q. Do you agree, from your knowledge and understanding of sleep disturbance, that continuous noise may have less impact and disturbance than a noise which is cyclical, like the whoosh of a wind turbine.
- A. I think that that is an interesting question, and the question to which people may or may not accommodate to a specific type of noise and I've raised that issue in my statement which is about sensory integration, is an open question, and I've acknowledged and mentioned that sensory integration may be one of the mechanisms. So I've not ignored that at all.
- Q. You haven't ignored it, but you haven't also answered my question.
- A. Perhaps because I didn't follow it clearly enough.

 Maybe I should have asked again.
- Q. What I was putting to you was that, with your experience and background and understanding of sleep disturbance, continuous noise may have less interruption on your sleep patterns than a cyclical noise of a whoosh of a wind turbine every second or whatever period of time it takes.
- A. And what I answered was that the notion that that may be the case was presented in my evidence, that the inability to accommodate the intermittent noise may be more difficult than continuous noise, that's the sensory integration. That was in my statement, Mr Manos. I'm pleased for the opportunity to clarify that for you.
- Q. You've also attached behind tag 4 a report from the English Wind Energy Association, and the first page of that is a chart, which I think is prepared by others, and that just gives some indicative noise levels. Would you agree that generally the noises that have been generated by the types of activities are likely to be intermittent noises, not 24/7 noises.
- A. I think that would probably be true for everything

	there.
Q.	A busy general office, I mean, people don't work 24
	hours a day, but that could be a continuous noise.
Α.	I'll make the statement again: I think that would be
	true for everything on the list.
Q.	It's not really fair to therefore compare the wind
	turbine noise which might operate 24/7 with those sorts
	of activity/noise sources.
Α.	I believe I'm hearing an assertion that I haven't been
	able to verify in the diaries, for example, that I was
	given that the wind is audible $24/7$, and also I was
	under the impression that, depending on the wind
	direction - I heard this from Dr Laurie - that there was
	some intermittency and some remission from the sound of
	the turbines depending on environmental circumstances.
	So I believe that intermittency, as in periodic let's
	say, may well be a characteristic of all of these.
Q.	Say you're at home for an entire week, you live on your
	farm, and the wind farm adjacent, 500 m away or 800 m
	away, is operating 24/7 for that entire week. The
	circumstances of that are going to be different to the
	examples that are set out of the various noise levels at
	tab 4. Would you agree with that.
Α.	What is the assumption I am to be making: that I can
	hoar it. that at a distance T can hoar it. that T am not

at work during the day? I am not sure what you are

CONTINUED

asking me to assume.

Q. I said you are there 7 days, the entire time you work on the farm.

- A. Okay.
- Q. And you can hear the wind farm.
- A. Okay. Look, I know what you are getting at and it's a contributory negligence question. I don't know the answer to the question because when you work on the farm there are many other sources of noise, including the things that go touk, touk, touk round and round watering, which to my mind makes as much noise and as a irritating as a turbine. The extent to which someone might be irritated and annoyed and therefore upset and affected by the noise of the turbines as opposed to the myriad of other noises you get on the farm, the harvester, the tractor, the birds the crickets, the wind, I am sorry I can't answer that question.
- Q. But none of those other noises, again, are ever going to be intermittent, they are not there 24/7 and whoosh every one second.
- A. I believe I have indicated I am also uncertain that your assertion that the turbine noise is there 24/7 is capable of being substantiated because that is not what I have taken away from the evidence to date.
- Q. How long did you spend near or adjacent to the Waubra wind farm.
- A. I was there for a day.
- Q. I don't assume you were there for 24 hours.
- A. I'm talking about the evidence in court, not my experiences at Waubra. The assertion has been made that it will depend on environmental conditions and quite clearly in many of the statements it says the wind, the noise is not always present. So, you know, on the one hand I'm perfectly willing to acknowledge all of the issues you raise but you are trying to push me into a corner to acknowledge something here which I think is not consistent with the evidence I have heard to date and I am finding this distinctly uncomfortable.
- Q. During the time that you were at Waubra do you

	understand that the wind turbines were turning.	1
Ã.	The wind turbines were turning, I could see it.	2
Q.	Looking at Exhibit A24, which is the document which is	3
	the personal journals of Dr Lawrie, behind the last tab	4
	of the power outputs. Just turn to 13 November 2010.	5
	Do you read that graph to indicate that the wind	6
	turbines were operating 24/7 or, I should say, 24 hours.	7
Α.	On that particular date?	8
Q.	Yes.	9
Α.	Yes.	10
Q.	If we go to 24 November, they are obviously off for a	11
	substantial period of the day.	12
Α.	Yes, may I ask you a question?	13
Q.	No. With his Honour's permission you might.	14
Α.	May I ask a question?	15
HIS	HONOUR	16
Q.	If you are not sure of what he is getting at that's fine	17
	but if you don't understand the question -	18
Α.	I'm not sure what he is getting at in the context of the	19
	relationship between the graph which demonstrates power	20
	output and audibility, which is what the question	21
	relates to, and therefore I'm unsure as to what I'm	22
	answering.	23
Q.	I think you can say you are unsure as to what you are	24
	answering and if Mr Manos wants to pursue it he can	25
	pursue it.	26
XXN		27
Q.	Do you understand that an operating wind turbine	28
	generates noise.	29
Α.	I understand that an operating wind turbine generates	30
	noise, I also understand that the noise and the	31
	intensity of the noise varies according to climatic and	32
	environmental conditions and also the position in which	33
	the noise is measured.	34
Q.	On 13 November 2010 the turbines seem to have been	35
	turning the entire 24 hours.	36
Α.	Yes.	37
Q.	I suggest to you there is every possibility that at	38

least one property would have been exposed to continuous
noise during that period of time, and that property
would have heard the noise and would have heard the
whoosh every second or so

A. On 13 November there is no record of individual AR in diary having heard the noise. Which individual are you referring to?

HIS HONOUR

- Q. Maybe we can short-circuit this. If you were invited to arrive at an assumption contrary to your understanding of the evidence, that assumption being that unlike road traffic noise, unlike some of the other noises, the wind turbine noise was constant for every hour of every day over lengthy periods of time, would that situation, if you were asked to assume that, and the quality of the wind turbine noise cause you to see that that noise would be different from road traffic noise and other noises in terms of its annoyance.
- A. The short answer is I can only speculate on that, I can't give you an answer with any degree of certainty or knowledge, but I can say that if you had to think it through from first principles, a noise that was constant that didn't have any intermittency about it that was highly predictable in its constancy may well cognate to better than if the noise came and went. So one can speculate on these things in different directions, it is quite clear that the presence of the noise, and the acceptability of the noise are going to be variables which will impact on any individual's experience and if that individual's experience is adverse then it is adverse for them, there is no debating that.

XXN

- Q. And we at least in relation to some of the people in the Howard area that that noise impact is averse and hence they turn on their air-conditioner.
- A. That is clearly stated in some of the testimonials, that is correct.
- Q. And what I'm putting to you and his Honour's question,

- what that all means is, that can really impact on sleep 1 patterns and result in sleep disturbance. disturbance can have a negative health impact on a 3 Α. That's correct and this is what I've acknowledged. 5 So that I will refer you back to statement 14. 7 Ο. I understand that. If, in addition to the audible noise from the turbines that are operating 24 hours, in the 8 example you used and the assumption you are making, 9 there is also infrasound, say at 90 decibels, would you 10 agree that that also could potentially affect one's 11 12 sleep. Α. You are asking me to speculate on the conformance of 13 infrasound and audible sound. I can speculate on 14 infrasound at 75 decibels when it comes from the 15 intermittent crash of waves on the beach doesn't appear 16 to have an adverse effect, if we talk about a variance 17 of 15 decibels of infrasound I honestly do not know. 18 can't even begin to speculate on that matter. 19 Q. But you acknowledged earlier that at 90 decibels 20 infrasound could have an adverse effect on the human 21 22 body. 23 Yes, and the question did not relate to sleep. Α. question related to the adverse effects that were among 24 25 those listed and the statement I believe at the time were physiological effects or effects on physiology, and 26 27 it's an open question as to what those are. 28 So you can't assist the court as to whether or not if we Q. got audible sound in addition to, say, infrasound at 90, 29 that that may also be another factor that affects one's 30 31 sleep pattern. If you have audible sound and infrasound at 75, which is 32 Α. the intermittent crashing of waves, which is the closest 33 I can get to this, it appears not to have any adverse 34 effect. Now that's the only way I can conceptualise 35
- Q. In your experience with waves do they come in as frequently as the whoosh say I'm talking about

this because that's the only term of reference I have.

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different concepts here - with a wave is the audible part, you hear the crashing of the wave every few seconds, whatever, it is not as frequent -

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- A. It depends a bit on the rides and the weather, I suppose.
- Q. But have you ever experienced waves that come in every one second.
- A. I think I have certainly been at the beach where the waves have come in quite frequently.
- Q. Not every second.
- A. I can't tell you because usually I'm asleep.
- Q. Early in your evidence I didn't fully understand it and that's a failing of myself you made some comments about a person who is coming and going, that the symptoms seem to go when they leave. You recall that evidence.
- A. Yes, it's based on the information in the journal which Dr Lawrie has referred to.
- Q. AR, for example, was at Philip Island and there was some changes in the cognition. But you have heard it reported that people who are affected by wind turbines their symptoms can dissipate or disappear if they move away from the wind turbines. You understand that that is what people are reporting.
- A. People are moving away from their lives there, whether it's specifically I mean we get back to cause and effect relationships. You know, you are wanting me to speculate that implying that it is cause and effect from the turbines, insofar as the turbines are the source of their distress and whether that's because they are there and everything that's associated with their lives there and the conflict and the entire issue. Frankly, when I get away from work and everywhere my blood pressure goes down quite significantly, I'm sure yours is much lower at the cricket other than when Australia is losing and I'm sorry about that, but I think that there are many, many, many factors that affect blood pressure and to assert that when you move

environment that it can be directly attributed to the turbine is a bit of a stretch. Now that's not to say it is or it's not to say it isn't, it's just to say one can't be sure.

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- Q. If you have an adverse reaction to something, moving away from the source can benefit you can't it. I give you a simple example, there is a putrid smell, if you are nauseous your response is to move away and hopefully that nausea will pass quickly. Why is that different to, let's say, let's assume that some people suffer headache when turbines are operating, when they move away from the vicinity of the wind turbines their headaches disappear, why is that different.
- A. So the issue is cause and effect relationship. So do I have a headache because I'm stressed by the turbine or do I have a headache because I've got sleep disturbance from the turbine?
- Q. Or the turbine, for whatever reason, has caused the headache.
- Α. You know, if it's 'for whatever reason' then you get into the murky territory of is it because of the sound, is it because of the infrasound, or is it because I don't like what I see and hear? Other than that is it because I've been involved in some community action order or are there other aspects of my life that are made difficult by this, because of this or in association with this? I think if the evidence was bringing out the consistency of the issues and they were dissected through in that manner, I think you would find people around the world would be far more convinced about the matter than what I have presented in my testimony, which is to say that I find the anecdotal reports to be difficult to hang my hat on as meaning anything specific other than the fact that there are a group of people who feel unwell, but I cannot ascribe cause and effect to that with any degree of certainty.
- Q. If, say, a person was suffering vibrations when wind turbines were operating, they move away and the

- vibrations go; do you imagine vibrations can be, for want of a better word, started by the human mind.
- A. Yes, I do. In fact just recently in one of the medical journals, and I can't remember which one but it was one of the kind of premier ones in the top tier, reported a syndrome which is phantom vibrator syndrome where you artificially feel your telephone or your pager vibrating in your pocket. Now I get that.
- Q. I get that too, what does that mean. $\label{eq:continued}$

A.	You tell me.	1
Q.	You read the article.	2
Α.	It means that there's this mind/body connection and you	3
	can fantasise things that aren't really there; you get	4
	that, I get that. Does it mean the vibrator was in the	5
	pocket at the time?	6
Q.	You're saying that you think there is a possibility that	7
	the human mind can cause one's lips to vibrate.	8
Α.	Absolutely.	9
Q.	And chest vibrations.	10
Α.	Absolutely. When I get anxious before exams I get	11
	twitching of my eyelid.	12
Q.	But if these symptoms are only occurring when the wind	13
	turbines are operating is there any cause and effect	14
	relationship there.	15
Α.	We don't know. We've just been through an agonising	16
	analysis of the blood pressure trying to point out	17
	whether the turbines are on or off the blood pressure	18
	can be equally high.	19
Q.	That's a different issue.	20
Α.	Why is it a different issue?	21
Q.	You have pointed to an article about road traffic noise	22
	not having any impact on the cardiovascular system in	23
	general terms is the summary.	24
Α.	The point is the same, the point is there is a mind/body	25
	connection and when you account for that you don't find	26
	the effect of the road traffic noise.	27
Q.	And there's anecdotal evidence to say when wind turbines	28
	are operating people suffer headaches or vibrations or	29
	chest tightness.	30
Α.	I don't think the anecdotal evidence that's the case has	31
	been presented with sufficient clarity or rigor that	32
	satisfies at least my analysis of it that that's the	33
	case.	34
Q.	Could it be that the infrasound is the root cause of	35
	these problems.	36
Α.	You're asking me to speculate on infrasound.	37
HIS	HONOUR: The professor has been at pains to tell	38

	us he's not an	expert in intra sound.	1			
MR	MANOS:	He's learned a lot but learned nothing I	2			
	think he said.		3			
HIS	HONOUR:	I'm not sure that asking him to speculate	4			
	that infrasoun	d can be the root of the cause is really	5			
	going to help	us.	6			
MR	MANOS:	Let me ask a different question.	7			
XXN			٤			
Q.	The ear picks	up audible sounds, sounds are vibrations	9			
	are they not.		10			
Α.	Sounds are vib	rations, yes.	11			
Q.	And the infras	ound is at frequencies from 0-20 Hz which	12			
	the ear doesn'	t detect as an audible sound.	13			
Α.	Correct.		14			
Q.	When I say 'th	e ear', the brain doesn't pick up the	15			
	audibility of	that sound.	16			
Α.	Correct.		17			
Q.	But any noise	that has been generated results in a	18			
	vibration whic	h is then picked up by the ear. Could it	19			
	be that infras	ound, being present the whole time, is	20			
	causing a cont	inuous vibration which then can affect -	21			
	creates a vibr	ation in the head which then causes the	22			
	brain to vibra	te giving rise to the headaches.	23			
OBJ	OBJECTION: MR HENRY OBJECTS					
MR	HENRY:	That's just an invitation for speculation	25			
	and it doesn't	seem to be -	26			
OBJ	ECTION UPHELD		27			
MR	MANOS:	Because it's beyond the witness's	28			
	expertise?		29			
HIS	HONOUR:	For the very reasons that I said in the	30			
	previous inter	change; that this witness has taken us as	31			
	far as he can	with respect to his knowledge of	32			
	infrasound and	asking him to speculate, from a medical	33			
	point of view,	based upon what infrasound may or may not	34			
	do is not goin	g to help us.	35			
MR	MANOS:	I would have thought it might be a key to	36			
	the whole matt	er.	37			
HIS	HONOUR:	I've ruled on the question and it's not	3 8			