

3 March 2011

Writers direct contact : 03 8621 6406
Email : arichards@pacifichydro.com.au

Dr T Kendall
A/g Committee Secretary
Senate Community Affairs Committee
Parliament House
Canberra ACT 2600

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 apprised 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.

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.

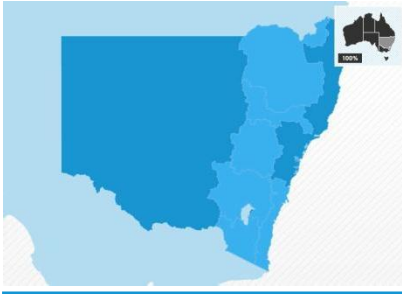
Pacific Hydro submits that the economic opportunities and benefits to regional communities from increasing renewable investment opportunities, including wind farms, are clearly demonstrated by this research. Our own experience strongly supports the conclusions and employment modelling.

Yours sincerely

Andrew Richards
Executive Manager, Government and Corporate Affairs

CLEAN ENERGY JOBS IN REGIONAL NEW SOUTH WALES

snapshot New South Wales



1 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.

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



This work was undertaken to assess the clean energy potential and employment opportunities that exist in various regions across NSW and Australia. In addition to this snapshot, The Climate Institute worked with regional and industry stakeholders to produce a clean energy jobs roadmap for six NSW regions. These roadmaps can be downloaded from The Climate

Established in late 2005, **The Climate Institute** is a non-partisan, independent research organisation that works with community, business and government to drive innovative and effective climate change solutions.



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, transitional role in NSW.

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

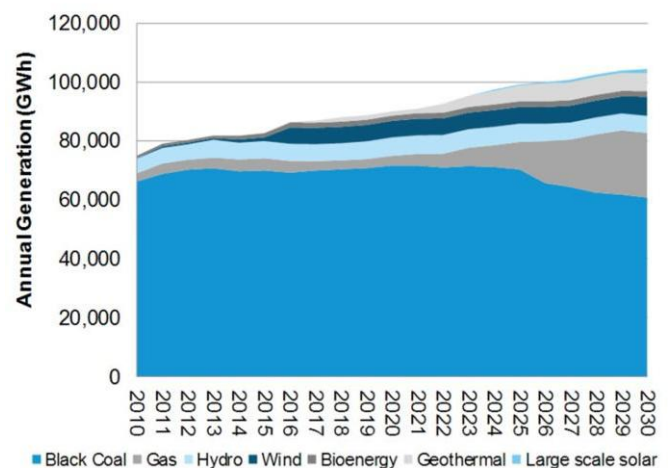
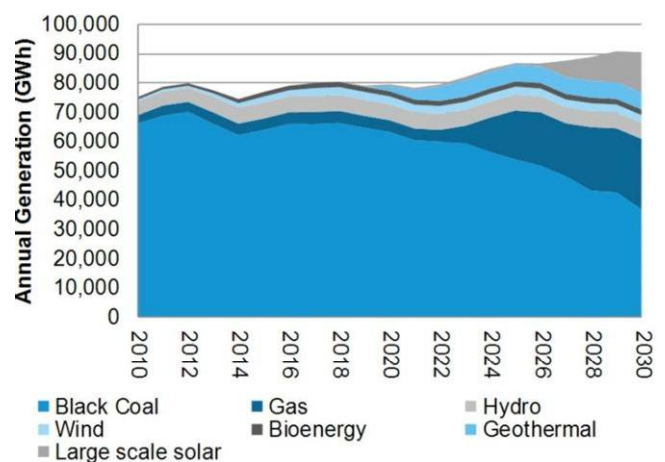


Figure 2: NSW's projected generation mix under Strong Carbon Price Scenario (commercial scale technologies only)



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



CLEAN ENERGY JOBS IN REGIONAL NEW SOUTH WALES

snapshot New South Wales

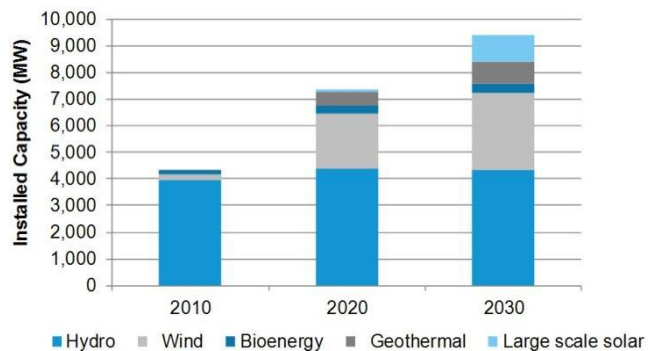
Table 1: Projected growth in small scale solar technologies in NSW

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

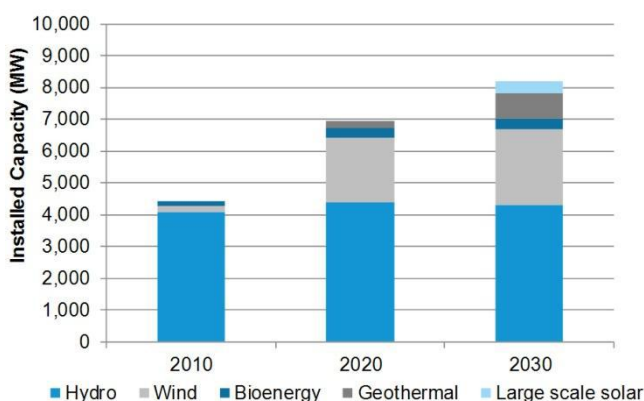


3 OUTLOOK FOR STATE-WIDE EMPLOYMENT

As part of this study The Climate Institute commissioned the University of Technology, Sydney to assess the employment impacts across the 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

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*.

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



CLEAN ENERGY JOBS IN REGIONAL NEW SOUTH WALES

snapshot 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 website

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.

4 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.



CLEAN ENERGY JOBS IN REGIONAL NEW SOUTH WALES

snapshot New South Wales

- 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.

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

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



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 price-tag 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 multi-party 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 co-investment 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



CLEAN ENERGY JOBS IN REGIONAL NEW SOUTH WALES

snapshot **New South Wales**

- 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.



CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA

snapshot **Victoria**



1 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.

Victoria has enough clean energy potential to

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



This work was undertaken to assess the clean energy potential and employment opportunities that exist in various regions across Australia. The findings for other states and regions can be downloaded from The

Established in late 2005, **The Climate Institute** is a non-partisan, independent research organisation that works with community, business and government to drive innovative and effective climate change solutions.



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, transitional 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)

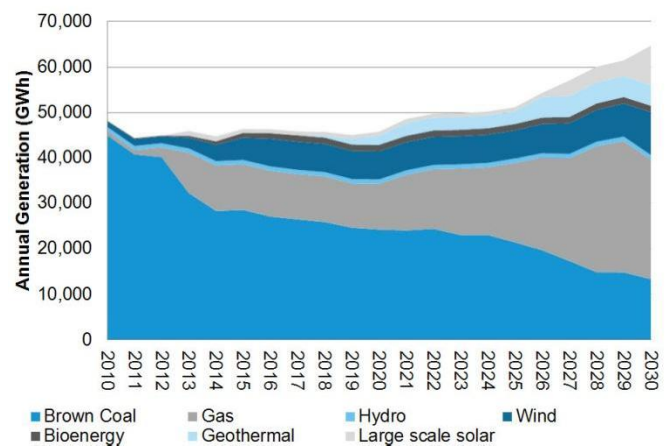
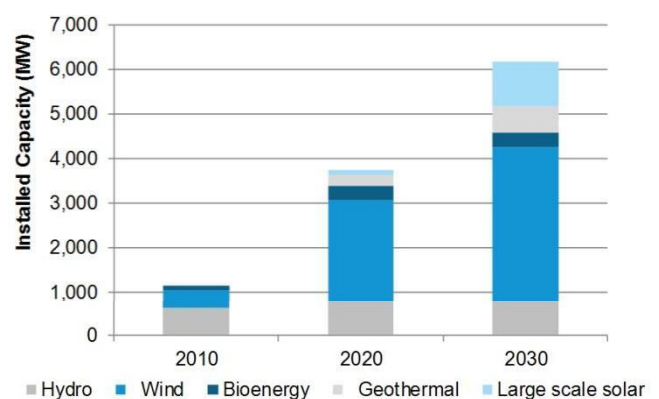


Figure 2: Projected growth in renewable energy in Victoria with strong pollution reduction policies (commercial scale capacity only)



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

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

SECTOR-WIDE EMPLOYMENT

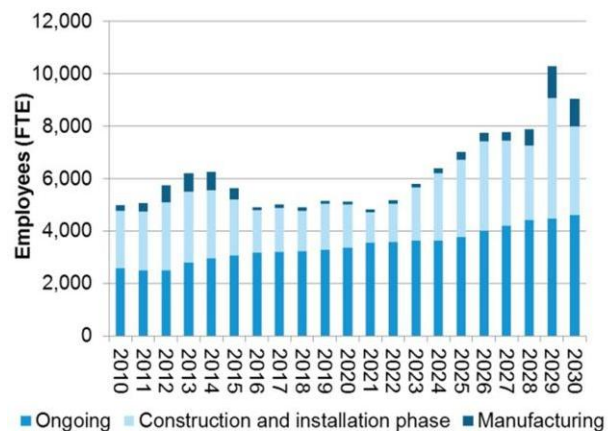
As shown in Figure 3, the total annual workforce – including all three employment categories for both conventional and renewable technologies – is projected to increase significantly between 2010 and 2030, with an estimated 7,846 new jobs created during this period. This includes 2,039 new permanent 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.

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

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.

[^] 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 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.

4 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



CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot **Victoria**

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

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

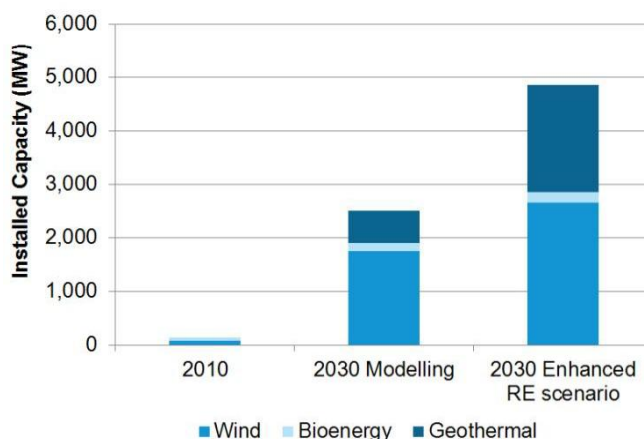
across Victoria and Australia as a whole. Indeed, given the competitive dynamics of Australia’s electricity market, not all of the renewable energy opportunities identified in the Western District will necessarily be developed over the next two decades. Other project opportunities in other regions or 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.





CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot **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.



CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot **Victoria**

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

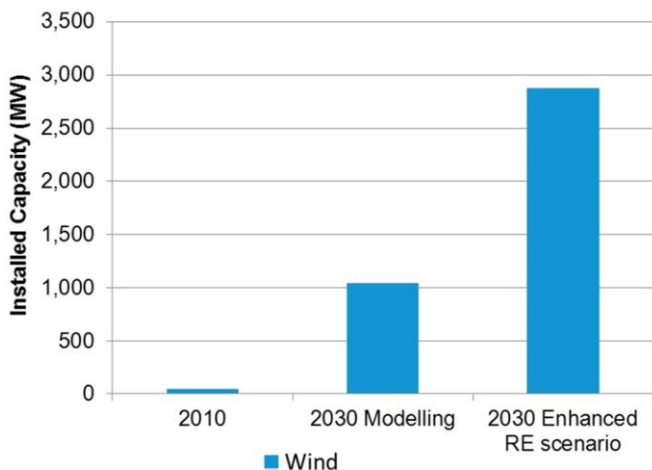
Resource type	Existing Capacity (MW)	Additional Potential Capacity (MW)		Total (MW)
		Committed & Proposed Projects	Additional Inferred Potential	
Wind	245	1427	1,202	2,874
Hydro	2	-	-	2
Solar	1	-	-	1
TOTAL	247	1,427	1,202	2,877

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

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 of 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

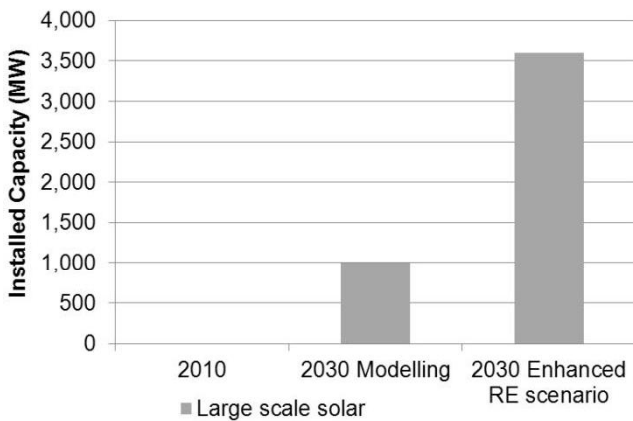
Resource type	Existing Capacity (MW)	Additional Potential Capacity (MW)		Total (MW)
		Committed & Proposed Projects	Additional Inferred Potential	
Solar		334	3,266	3,600
TOTAL	0	334	3,266	3,600



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 price-tag 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 multi-party 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 co-investment 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.

CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA

snapshot Queensland



1 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.

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



This work was undertaken to assess the clean energy potential and employment opportunities that exist in various regions across Australia. The findings for other states and regions can be downloaded from The

Established in late 2005, **The Climate Institute** is a non-partisan, independent research organisation that works with community, business and government to drive innovative and effective climate change solutions.



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, transitional role in Queensland.

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

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)

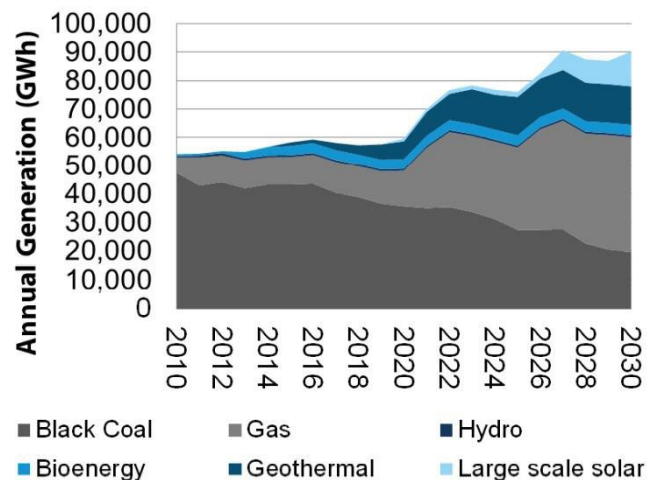
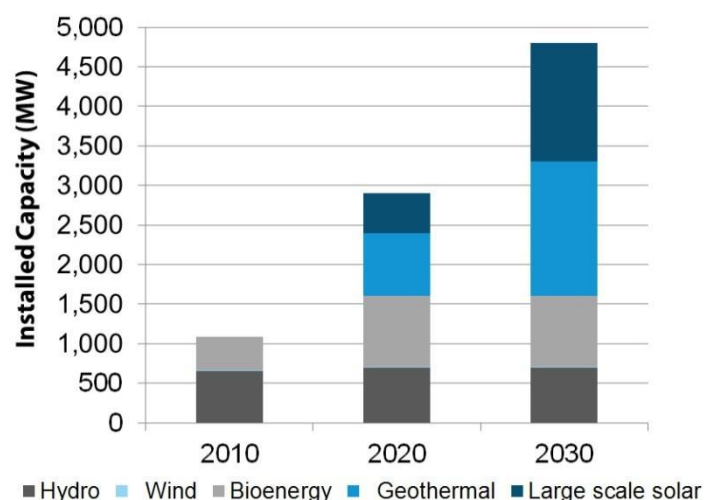


Figure 2: Projected growth in renewable energy in Queensland with strong pollution reduction policies (commercial scale capacity only)





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



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.

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



CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot 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
	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

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

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.

4 REGIONAL CASE STUDY: NORTH QUEENSLAND

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.



CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot Queensland

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

Resource type	Existing Capacity (MW)	Additional Potential Capacity (MW)		Total (MW)
		Proposed Projects	Additional Inferred Potential	
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.

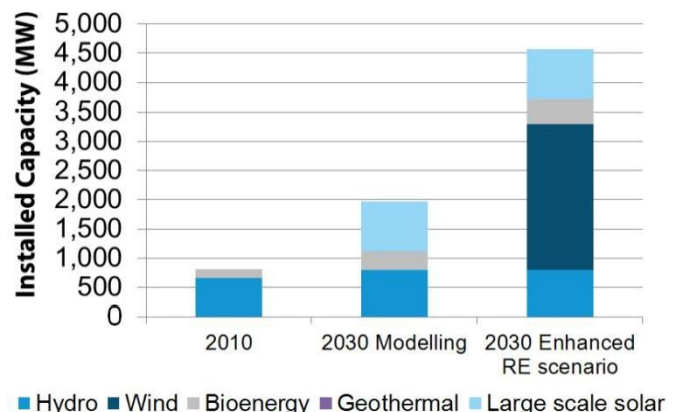
The Climate Institute commissioned modelling by leading energy sector consultants, SKM-MMA to provide an indication of how much of the North Queensland renewable energy resource might be developed over the next two decades, based on the results of the state-wide modelling described above. In addition 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.

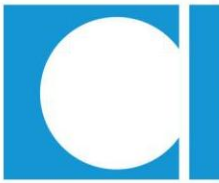
The amount of renewable energy developed under each of these scenarios is shown in Figure 4. Based on the modelling results, it is projected that more than

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.





CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot 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	683	1,234
(FTE, peak workforce)		
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.

5 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 in Queensland and Australia.



CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot Queensland

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

Resource type	Existing Capacity (MW)	Additional Potential Capacity (MW)			Total (MW)
		Committed Projects*	Proposed Projects	Additional Inferred Potential	
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

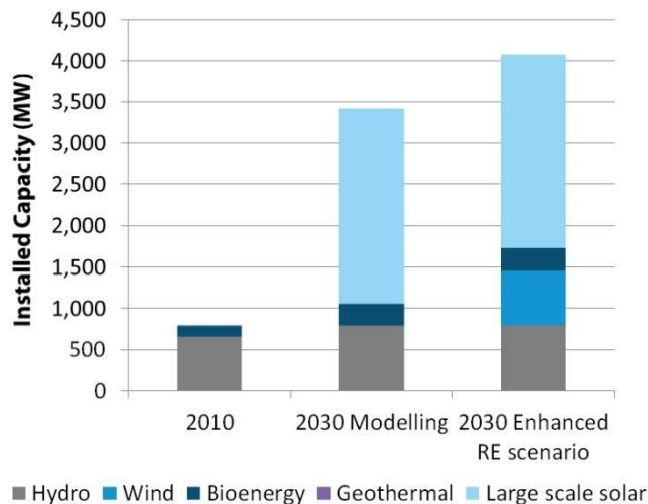
The amount of renewable energy developed under two scenarios – one based on the state-wide modelling undertaken for this project and the other based on a more extensive development of the resource – is shown in Figure 5.

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

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.

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



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 (FTE, peak workforce)	2,043	2,283
TOTAL	2,797	3,137

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 price-tag 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 multi-party 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



CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA

snapshot 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 co-investment 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.



CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA

snapshot 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



This work was undertaken to assess the clean energy potential and employment opportunities that exist in various regions across Australia. The findings for other states and regions can be downloaded from The

Established in late 2005, **The Climate Institute** is a non-partisan, independent research organisation that works with community, business and government to drive innovative and effective climate change solutions.

1 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.



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.

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

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

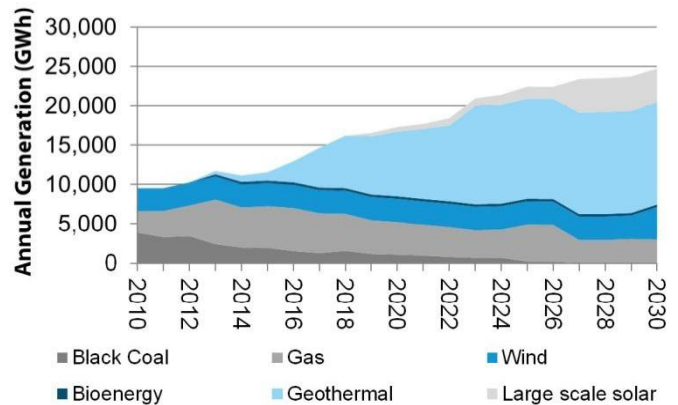
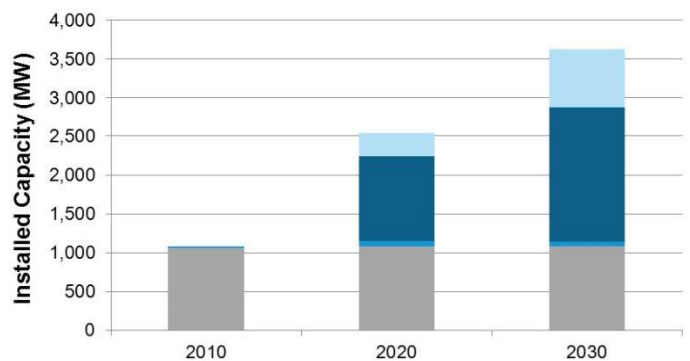


Figure 2: Projected growth in renewable energy in South Australia with strong pollution reduction policies (commercial scale capacity only)



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

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 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.

⁴ The methodology can be downloaded from The Climate Institute’s website.

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





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

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

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



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).

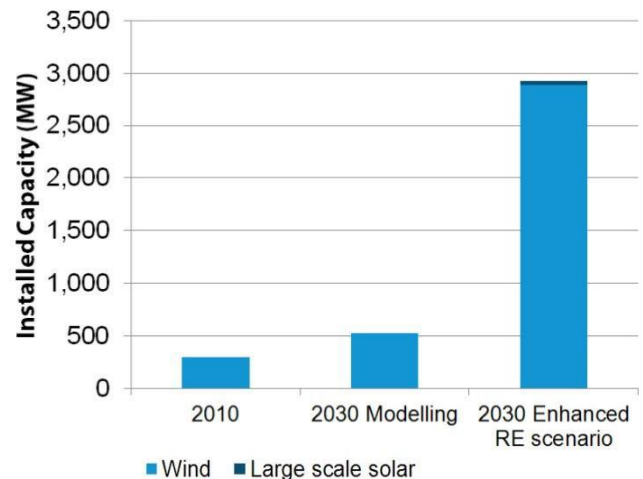
HOW MUCH OF THE REGION’S CLEAN ENERGY RESOURCE WILL BE DEVELOPED?

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.



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

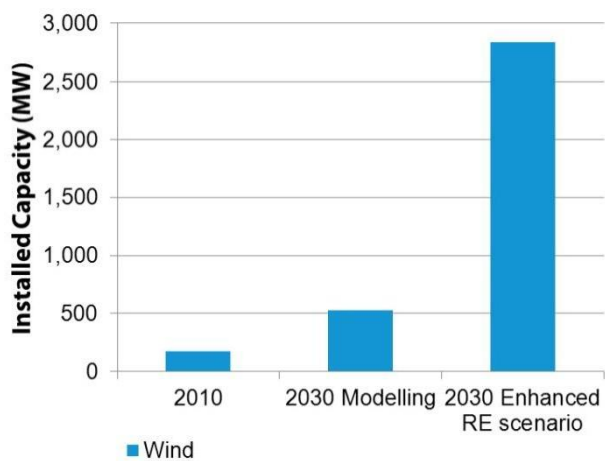
Table 5: Commercial-scale renewable energy potential in the York and Lower North Region

Resource type	Existing Capacity (MW)	Additional Potential Capacity (MW)		Total (MW)
		Committed and Proposed Projects	Additional Inferred Potential	
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 price-tag 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 multi-party 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 co-investment 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



CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA

snapshot 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

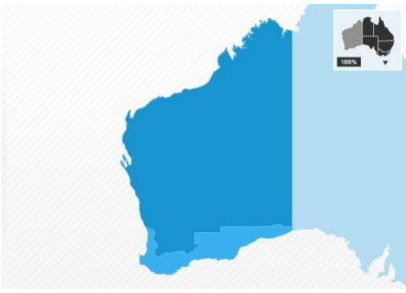
Broader experience and Ernst and Young studies prepared for NSW renewable energy precincts in this research have highlighted the need for a number of other regional and local initiatives necessary to convert the clean energy technical potential to investment and employment reality. These include:

- 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.



CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA

snapshot 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



This work was undertaken to assess the clean energy potential and employment opportunities that exist in various regions across Australia. The findings for other states and regions can be downloaded from The

Established in late 2005, **The Climate Institute** is a non-partisan, independent research organisation that works with community, business and government to drive innovative and effective climate change solutions.

1 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.



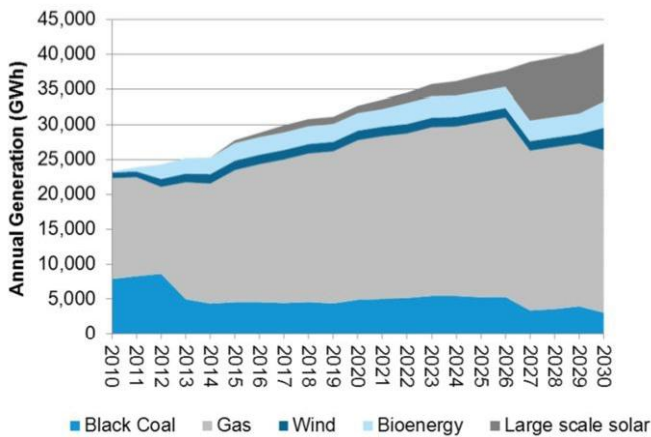
CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot Western Australia

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)



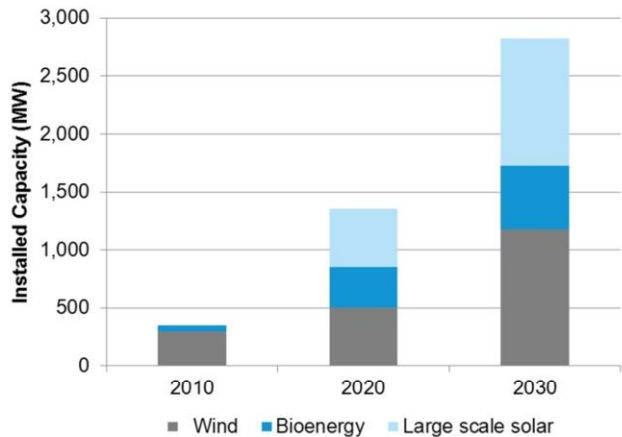
¹ The methodology can be downloaded from The Climate Institute's website.

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, transitional 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 policies (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.

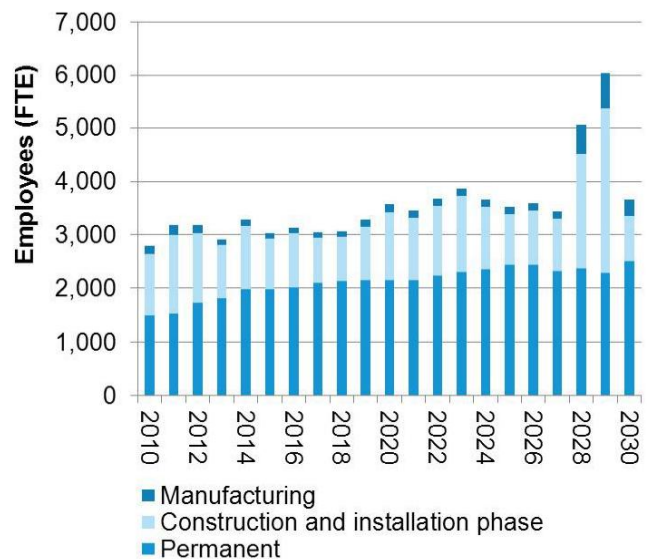
Three key job categories were assessed: (i) permanent workers employed to operate, maintain and supply fuel to electricity generators; (ii) construction and installation workers employed to build and install a new generation plant; and (iii) manufacturing workers employed in the manufacturing sectors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

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

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.



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
	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

4 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

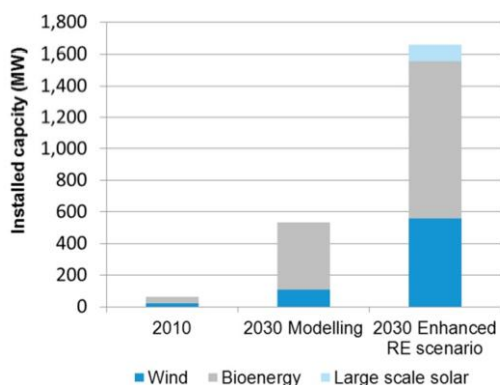
Table 3: Commercial-scale renewable energy potential in South West WA

Resource type	Existing Capacity (MW)	Additional Potential Capacity (MW)		Total (MW)
		Committed and Proposed Projects	Additional Inferred Potential	
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.



CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA snapshot Western Australia

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

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 price-tag 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 multi-party 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



CLEAN ENERGY JOBS IN REGIONAL AUSTRALIA

snapshot 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 co-investment 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

30
31
32
33
34
35
36
37
38

HIS HONOUR: No, it came to us as part of an email and to be I'm not sure. 1
2

MR HENRY: A spare copy might not have been printed off. Perhaps I'll just invite the court to produce this to the witness. 3
4
5

XN 6

Q. Is this the document that you had intended to reference in para.27(d). 7
8

A. Yes. The document that was there referenced relates to point 38.3 but no matter. 9
10

MR HENRY: So I tender that document. That's the risk assessment document. 11
12

HIS HONOUR: Now do you want that to be part of Exhibit Y or do you want it separate? 13
14

MR HENRY: Probably best to be a separate exhibit because attachment 11 in fact serves a legitimate but different purpose within the statement. 15
16
17

EXHIBIT #AA 1.20 RISK ASSESSMENT TENDERED BY MR HENRY. 18
19
20

XN 21

Q. I wonder if you would take us briefly to those passages in that exhibit which you say demonstrates the accepted process of evaluation of a public health risk in particular. 22
23
24
25

A. So the relevant material can be found on table which is labelled fig.2 and below table 3 and that's found on p.458 and there's a graphical representation of that process which precedes it which is fig.1 which is found on p.453. 26
27
28
29
30

Q. Again briefly are you able to describe for us in summary form what that accepted process of evaluation of a public health risk is just in abbreviated form. 31
32
33

A. Sure. So the paper refers to toxicology but I don't think it matters what the environmental or chemical stimulus happens to be the process would be exactly the same. It would require identification of a hazard and then a plausible set of exposure assessments and risk 34
35
36
37
38

characterisation including dose response assessments to
allow some opinion to be made about cause and effect
relationships. The detail of how that process may
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. Root of
administration is not relevant here because it's
consistent.

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.

A. The asserted impacts are as described both in my
statement and in Dr Laurie's evidence are not disagreed
on. 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. Indeed
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
on. Now -

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
do you draw upon in presenting the information in
para.28.

A. There's two reasons for presenting information in
para.28.

HIS HONOUR: Before you continue, professor. Mr Henry,
I think this may be a bit difficult for you might it
not. I've already said that we don't propose to draw
any inference one way or another about this sort of
evidence. I don't know where this is going but having
said that yesterday and even though it's not objected
to -

MR HENRY: That's the reason for me asking these
questions prior to tendering the report is that it's
important for Professor Wittert to spell out the chain
of reasoning that he has adopted in respect to the
material that he's presented in para.28.

HIS HONOUR: Very well.

MR HENRY: It's best for him to give that evidence
rather than me summarise it I would respectfully
submit.

A. Thank you, your Honour, I'll deal with the second point
first. Considerable amount of the work that I do
relates to experimentation in animals like it or not
and that includes a range of physiological responses
from reproduction to food intake and a whole bunch of
complex behaviours in between. The species of animals
include sheep, rats, mice and small native marsupials
and therefore I believe that I have sufficient detailed
knowledge of animal physiology to at least use the
example to assess the literature for credible evidence
of animal effects which one might like to see if there
were the levels of infrasound being described and
indeed the level of health effects being described and
also to deal with this issue of anecdotal report where
it depends on who you ask and what you see. So the
notion of pulling something out of a blog says well one
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

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38

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.

XN 3
4

Q. Your CV appears at tab 1 and it's 28 pages long. Can I 5
ask you to briefly identify the aspects of your 6
qualifications and experience which are of particular 7
relevance to the subject matter of the material that 8
you've presented. 9

A. The first is - apart from being a registered medical 10
practitioner and a trained physician is that I've 11
worked in rural general practice, I did so in the rural 12
south island area of New Zealand - that's for 12 13
months. I understand rural communities and I 14
understand rural general practice. The second is, I 15
have expertise in endocrinology - the issue of 16
endocrinology and stress effects, with a subject of my 17
MD at the University of Otago - and subsequent post 18
doctoral work in the United States. And specifically 19
looking at the effects of various physiological 20
stresses and cortisol production and the mechanisms of 21
cortisol regulation. A considerable amount of work 22
that I do over the past several years relates to 23
epidemiology and investigation of large cohorts. This 24
includes an extensive analysis of biopsychosocial 25
factors and their effects on health. I have an 26
interest in and have published on the relationship 27
between depression and stress and health outcomes. I 28
have an ongoing interest, right from the early days of 29
my training, in hypertension - and have published 30
reasonably extensively on hypertension in various 31
contexts. And on an ongoing basis we have been 32
conducting home sleep studies for the purposes of 33
analysis of effects on health in the Florey Adelaide 34
Male Aging Study. 35

Q. You've heard Dr Laurie's evidence. 36

A. I have. 37

Q. I want to ask you some questions about paras.36 and 37 38

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.

A. 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 nervous system. So perception of how things are for 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. It 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.

Q. 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. 1
2

A. I do not believe so. 3

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. 4
5
6
7
8

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. 9
10
11
12
13
14
15

Q. I might turn next then to the work you did - 16

HIS HONOUR: Before you do, Mr Henry - 17

HIS HONOUR 18

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. 19
20
21
22
23

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. 24
25
26
27
28
29
30
31
32
33
34

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. 35
36
37
38

A. Well, I think it would confound the confusion, because 1
my contention is, and I believe the contention from the 2
NH&MRC, of that sort of evidence, is that it's 3
anecdotal and conclusions cannot be made, other than to 4
generate anxiety. 5

Q. So does it follow from that that were there to be a 6
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

A. That is correct. 10

Q. - as a study. 11

A. That is correct. 12

XN 13

Q. Now, I think you started to touch on this, but Exhibit 14
Z is a summary of some work that you did in analysing 15
the blood pressure data from three of the subjects that 16
Professor Laurie has referenced. I'll just get you to 17
turn to that, have you copy of it? 18

A. No. 19

Q. Now, looking now at Exhibit Z, the way in which this 20
material has been brought about, Exhibit A24 is the raw 21
data for your work in Exhibit Z, is that correct. 22

A. Yes. 23

Q. They are the journal entries for five subjects, AR, GW, 24
BMJ, RB and GB. 25

A. Correct. 26

Q. You have analysed three of them. 27

A. Correct. 28

Q. But not analysed the other two. 29

A. Correct. 30

Q. The reason why you haven't analysed the other two. 31

A. There's two reasons, the one is because it got very 32
late at night and I did it just after I got back from a 33
holiday, but I identified those two that I didn't 34
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. Elevated blood pressure, for your purposes, is 38

something over 140/90. 1

A. I took systolic at 140 and a diastolic as 90 being 2
reflective of levels that I would generally consider 3
treatment. 4

Q. The two subjects that you didn't plot graphs for in 5
fact didn't have blood pressures over those trigger 6
points. 7

A. Correct. 8

Q. Is it the case that in the data that you have presented 9
graphically in Exhibit Z, you have simply taken the 10
data from Dr Laurie's journals. 11

A. I did. The process was since Dr Laurie's instruction 12
to the people who participated in the study did try to 13
find some evidence of approval by an ethics committee 14
but was unable to locate that, but assuming that 15
informed consent had been given, there was an 16
instruction to record blood pressure first thing in the 17
morning, on waking and before eating, and therefore, 18
what I did was tabulated into a spreadsheet separately 19
the systolic and diastolic blood pressure which was the 20
first morning pressure that I could find. 21
Concurrently, and I could only do all of the 22
information for AR, I recorded when there was symptoms 23
being experienced, I could do symptoms for everybody, I 24
could do audibility of the turbines for AR, and I also 25
recorded wind direction and where it was - the 26
information was available, I recorded wind intensity, 27
and I then created a column which I could only do from 28
the dates that information was available, which was 29
mostly, I guess, November, for the most part, record 30
the average nocturnal output from the wind turbines. 31

Q. You have taken that data, as I understand it, from the 32
material at tab 6 in Exhibit A24. 33

A. That is correct. 34

Q. So time being short, I'll just see if I can take you to 35
a handful of these graphic presentations on the - will 36
you go to the data for AR and then to graph 2.2 for me. 37

A. Yes. 38

Q. That deals with the waking systolic. 1

A. That's correct. 2

Q. And mean overnight turbine power. Is this correct, 3
where you have identified that overnight turbine power 4
was zero, you found four reported waking systolic 5
values. 6

A. Correct. 7

Q. You have plotted them against the zero overnight 8
turbine power. 9

A. Correct, so the initial plotting was of the blood 10
pressure, and then when I could find overnight turbine 11
powers, I have created a last column where that was 12
included, and also a column with comments. So the 13
information was consistently documented in the 14
spreadsheet as instructed for the participants to 15
record by Dr Laurie and then I took average turbine 16
power overnight. Now, where I have recorded zero, that 17
had to be zero for the entire night, so if there were 18
any portion of the night that was zero and other 19
portions of the night that there was turbine output, 20
then it was recorded as the average, not zero. 21

Q. So what we get is a scattering of waking systolic 22
values which are arranged by reference to overnight 23
turbine power. 24

A. Correct. 25

Q. The purpose of doing that. 26

A. The purpose of doing that is what is known as a 27
correlation analysis or a dot plot in the case of a 28
graph, is to look at the relationship between two 29
variables. Since it has been asserted that there is a 30
relationship between turbine output, whether that is 31
infrasound or noise or some other phenomenon from the 32
turbine with blood pressure, I was interested to see 33
without simply eyeballing the data but actually looking 34
at it properly graphically represented, what was 35
happening when the turbines were off as opposed to when 36
the turbines were on, and when the turbines were on at 37
various intensity, this goes to the issue of dose- 38

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.

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 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.

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.

A. 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 know what that means. It's also hard to know what it 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. 1

A. Yeah, I mean I assumed, reading the case report, that 2
blood pressure was elevated during the day because 3
there had been this clear indication with symptomatic 4
elevations of blood pressure during the day. It's not 5
entirely clear to me what is meant by hypertensive 6
crises or whether these acute hypertensive crises were 7
confirmed as such or simply marked elevations of blood 8
pressure in the context of some other symptom complex 9
but let's assume that they were just that. It seems 10
reasonable that there are a number of possibilities 11
that this sort of spiking elevation in blood pressure 12
can occur. So for example, one of the possibilities 13
has been looked at and the person's general 14
practitioner appropriately looked for pheochromocytoma 15
which is a tumour of the adrenal glands. So these are 16
small glands which sit above the kidneys, they produce 17
adrenalin and noradrenalin which are stress hormones 18
and surges of these stress hormones can produce a 19
symptom complex that produces this kind of picture with 20
headache, nausea, jitteriness, palpitations and so on 21
but so can acute stress, so can panic attacks and it 22
doesn't need to be any overt stimulus for a panic 23
attack to occur. The question about obstructive sleep 24
apnoea would have been one that was appropriately 25
raised. Obstructive sleep apnoea is extremely 26
prevalent in the male population in particular; we find 27
roughly 20% of men in our cohort have a very high 28
probability of having obstructive sleep apnoea so this 29
is the age group where you'd see an effect likely to 30
occur. Clearly an astute general practitioner who's 31
thinking about these various things and doing the 32
appropriate investigations, it's not clear whether this 33
was a home sleep study or an in-lab sleep study, what 34
the quality was, it's not clear whether weight has 35
changed up or down since these things were done. And 36
again, we're living in a - we're looking at an age 37
group where there's very likely to be a hypertension 38

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. 1

Q. I want to ask you some questions about Dr Nissenbaum's 2
study which we find in Exhibit A22, attachment A; do you 3
have that. 4

A. Yes, I do. 5

Q. As I understand it Dr Nissenbaum said this was the best 6
research available on the questions that we are 7
concerned with; you would have heard her say that. 8

A. Yes. 9

Q. And I think she said that, at least in part, because it 10
is a case control study. 11

A. Yes. 12

Q. Can you tell us, firstly, what a case control study is, 13
as distinguished from other forms of research. 14

A. So there are a number of types of observational studies 15
and one type of observational study is called a case 16
control study, and this is one where people with a 17
specific disease match people who do not have the 18
disease and who then determine controls. You match 19
people with a specific exposure and those who do not 20
have an exposure, but ordinarily it is done with or 21
without disease. I think it is relevant to say that it 22
was case controlled type methodology that first led 23
Pitot to very strongly make the association between 24
smoking and lung cancer. 25

HIS HONOUR 26

Q. Who was that. 27

A. Richard Pitot in the UK. So the origins of this as a 28
rigorous methodology are quite clear but that does not 29
mean it is without problems. What is critical is that 30
data are collected from the individuals of the groups in 31
order to allow you to control for all of the 32
characteristics except the exposure in question. So if 33
you were wanting to link, for example, smoking to a 34
disease process then you would want a control for 35
everything else except the smoking: toxicity potential, 36
asbestos, environments, where they worked, how they 37
lived etc., family histories. So that there are a 38

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. So 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. So it is 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 identified. In addition in the case of control study it may be difficult to separate the chooser from the

choice. For example, studies of road accident victims 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. That may be considered a form of ascertainment bias, I guess. 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. You could conclude from that that obese people eat less and they have a different metabolic rate but that would be a wrong conclusion.

- 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 1
studied. So that is the concept of power, where you are 2
talking about a small effect size and large variances 3
then you may need many more people. A classic example 4
that has been in the media of a fluid case control 5
study, whatever the motivation may be for that, was the 6
MMR vaccination issue that has been in the media lately. 7
That is an example of the case controlled study fluid in 8
its design and execution, which for whatever reason 9
happened to motivate that process. 10

XN 11

Q. Bearing in mind what you have said about case control 12
studies so far. If we go to the material which is now 13
attributed to Dr Nissenbaum at tab 8 of Exhibit A22, you 14
will see there, firstly, an abstract, secondly a bio, 15
and then you will see a table, which we now know is 16
Dr Lawrie's work, and there is then a paper headed 'Wind 17
turbines ... and Value List'. And as I understand 18
Dr Lawrie's evidence it's that paper which she says 19
comprises the best evidence about health effects and 20
wind turbines. Do you have any comment to make about 21
the reliability of the paper and the rigour with which 22
the research was undertaken. 23

A. It's almost impossible to evaluate the data for accuracy 24
because the methodology is not sufficiently - not 25
presented with any clarity or at all for that matter. 26
The most clarity you can get out of the this was 22 of 27
about 30 adults. I have never seen any kind of 28
scientific documentation that would document 'about', 29
it's either a certain number of subjects or it isn't. 30
Why is it 22? How are your cases and control selected 31
etc. etc. other than, say, similar age and occupation 32
and living about three miles away and then defined as 33
not exposed? What we don't know is intensity of 34
exposure. There is no corroboration of the various 35
issues; there are a lot of suppositions, there is a lot 36
of reference back to a paper that will soon be completed 37
and the fact that this is a preliminary study. I think 38

this is unassessable and unless you ring up your mates 1
and ask them to review it as peer review you will not 2
pass muster in a journal. I edited the Journal of 3
Obesity Research and Clinical Practice, we receive a 4
large number of papers each week and I would have to say 5
that I wouldn't even send a paper of this sort out for 6
review, it isn't sufficient information. 7

Q. Do you believe then that the material which is 8
attributed to Dr Nissenbaum at tab 8 is a basis for a 9
moratorium on further wind farm developments pending 10
further research. 11

A. The issue as I'm hearing it put says, we need more 12
research. In order to justify research you need a 13
rationale that is of sufficiently convincing magnitude 14
to argue with funding agencies that they should part 15
with dollars that someone else thinks are more important 16
to have. I can't see and, as stated in my witness 17
statement a rationale in the evidence that I have 18
available to me for further study to be done. Now that 19
doesn't mean there isn't an effect, it simply means that 20
I can't see, based on the data, that there is sufficient 21
evidence to attribute cause and effect. 22

Q. And to justify the allocation of funding to further 23
research. 24

A. Funding is always good for research, I'm always a fan of 25
research, and I would be delighted personally to get 26
more funding for research but I would have a hard time 27
writing a business plan if you like, which is what a 28
grant application is, and saying that this is the basis 29
for wanting to do further study, I don't think I would 30
get the money to do so. 31

Q. The next issue I want you to comment on very quickly. 32
Dr Lawrie yesterday made comment about one of the 33
subjects had elevated cortisol levels. I may have 34
pronounced that incorrectly. 35

A. That's correct. 36

Q. But is that an issue which falls within one of your 37
specialised fields. 38

- A. Yes, cortisol is produced by the adrenal glands, which I 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 rhythmicity 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. certain 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.
- 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.

A. No, it's not correct. I have spoken to people living 1
and working in the vicinity of a wind farm, admittedly 2
not huge numbers, small numbers. I have also visited a 3
wind farm, I toured, in fact, the Waubra wind farm quite 4
extensively, was taken wherever I chose to go on the map 5
and speak to whoever I wished to speak to. I have not 6
presented any of this in evidence because I don't think, 7
on the one hand, you can criticise anecdotes and, on the 8
other hand, use them, but I will offer the court 9
anecdotes seeing an anecdotes are being sprinkled around 10
deliberately. That is that I was told - hearsay but 11
unfortunately this is what occurred - that someone 12
working very close in the vicinity of a wind farm and 13
whose property was very close to turbines, had a friend 14
who had a bipolar disorder who liked to come up and stay 15
when she was getting out of control because she found 16
that her psychiatric state improved when she was at the 17
wind farm. Hearsay and anecdotal. 18

Q. And not something on which you would place any or much 19
reliance. 20

A. None whatsoever. 21

Q. Is it essentially for that reason that you haven't 22
documented your personal experiences in the vicinity of 23
the Waubra wind farm. 24

A. Only to say that I have visited, correct. 25

Q. The final topic is this. Dr Lawrie suggested that of 26
the symptoms that she has documented in para.25 of her 27
statement, there was then an additional symptom which 28
she said is not to be found elsewhere or is not caused 29
by any other known agent, and she made reference to I 30
think vibration of the lips and the chest and stomach I 31
think she might have mentioned as well. Did you hear 32
her evidence about that. 33

A. Yes, I did. 34

Q. What do you say about those sorts of symptoms and 35
whether they are associated with illness in the 36
community. 37

A. If I heard Dr Lawrie correctly, and I'm happy to be 38

corrected if I did not, I also heard a qualifying statement that the description of this vibrating feeling was sort of like pins and needles.

HIS HONOUR

Q. Tingling.

A. Tingling, thank you. That sensation is what we would call perioral paraesthesia, and it's commonly seen in people who are hyperventilating or anxious. The extent to which that is the same as the sensation of the lip vibration is difficult to say without having talked to the individuals myself, but having heard Dr Lawrie's qualification of what may be meant by lip vibration I would suggest that both nausea and lip vibration may be symptoms of anxiety and may be compatible with an anxious state as maybe acute elevations of blood pressure consistent with a panic attack which may look just like a mycetoma.

Q. So do you accept the proposition that there are symptoms being manifested in and around the Waubra wind farm which are not found anywhere else or caused by any known medical condition.

A. No, I do not accept that proposition.

+NO CROSS EXAMINATION BY MR PSALTIS

~~+CROSS-EXAMINATION BY MR MANOS~~

Q. Would I understand your evidence to this effect: if one person visits a wind farm and reports an adverse effect, that would not cause you any concern.

A. I visited the wind farm and about halfway into my visit was sneezing uncontrollably and spent the next day in bed. I would not ascribe either my hayfever attack or my cold directly to being caused by the turbines.

Q. I have provided your instructing solicitor with a copy of a written statement of Patricia Godfrey which I ask you to read, did you read that.

A. I unfortunately have not had time to read that, I apologise. Happy to look at it now.

Q. I will just read to you a paragraph. This is from Patricia Godfrey, who will give evidence next week.

- Q. 'Shortly after I could hear the noise from the turbines I started suffering from disrupted sleep patterns. As I suffered from periods of broken sleep I found that the noise from the turbines seemed to affect me more. It was incessant. To drown out the turbine noise I tried 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 too tight. The pain started in the back of my head and radiated over the top. At times it would throb and the throbbing seemed to coincide with my heartbeat. At 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. So if that is reported to you would say 'Thank you for that, next, please'.
- A. 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. It is also 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. That does not 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.
- 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 1
and I would wonder very much whether the deaf ears that 2
the issue is falling on apparently worldwide relates to 3
similar perceptions that I have about the quality of 4
evidence. 5

Q. Just on that, you've read Dr Laurie's reports and you 6
are aware of the Federal Government's inquiry. 7

A. Yes. 8

Q. Are you aware the Victorian government is also 9
conducting an inquiry. 10

A. I was aware they were planning an inquiry, I'm not aware 11
they are going ahead. 12

Q. Have you heard other Governments around the world are 13
pursuing the matter at the moment. 14

A. New South Wales Government has already held an inquiry 15
and reported and I'm aware there are various activities 16
taking place in various countries and that is a 17
perfectly reasonable approach from politicians and 18
government agencies charged with population health, is 19
to address the concerns that are brought to them and to 20
determine whether the basis for those assertions are 21
reasonable to make a recommendation. That's the public 22
health process at work and pleased for it. 23

Q. Isn't that exactly what Dr Laurie is simply advocating; 24
that there's some information that's available, as a 25
result of that information she's formed the opinion that 26
we need to research and she kept on repeating that, 'We 27
need the further research'. Don't we add all the 28
information together, the 40-odd people that transcripts 29
we've seen - did you read the affidavits that were filed 30
in relation to the other matter before the court in the 31
Quinn matter. 32

A. Yes, I did. 33

Q. There's a dozen or so there, and you've heard the 34
evidence of Dr Laurie speaking to some additional people 35
out at Waubra and in Canada, we've got three or four 36
governments making these inquiries, isn't that a fair 37
basis to say we need some further research. 38

- A. It relates to the quality of the evidence presented and 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.
- 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.

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.

A. 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 question. I'm not sure that it's a case of, 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. 1
2

Q. But would you agree that those who, from what your basic 3
understanding of it is, those involved in this society 4
or the Waubra Foundation, all they want to do is make 5
sure there's a safe setback distance so human health is 6
not affected; isn't that the overriding objective of 7
those groups. 8

A. I don't know what the overriding objective is, I've not 9
been briefed by the foundation on their objectives. 10

Q. Is there any other benefit that could flow from what you 11
have learned today to members of the society who are 12
advocating an increased setback in populated areas. 13

A. I understand your question and I'm not sure that's what 14
I'm here to answer is the answer to your question. 15

HIS HONOUR: I agree with the witness, I'm not sure 16
that his speculation on the motives for these groups 17
will assist us. 18

MR MANOS: The witness introduced the pharmaceutical 19
benefit example where there's obviously, clearly, as we 20
understand it, connection between sponsorship and drugs 21
being prescribed. It must be fair for me to test that 22
view in relation to this society. There's no suggestion 23
other than a question by Mr Henry, that some of these 24
people may get some research, that there's going to be a 25
benefit. The objective must be public health. This is 26
a witness who is put forward as a public health expert. 27

HIS HONOUR: You talk about, in somewhat amorphous 28
terms 'these groups'. In order for the witness to be 29
able to give a meaningful response he would have to know 30
about the aims and objectives of these groups. He can 31
only speculate and his speculation is not going to 32
assist us. 33

MR MANOS: He heard about the aims from Dr Laurie's 34
evidence. 35

HIS HONOUR: One group. 36

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.

MR MANOS: I'll move on.

XXN

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.

A. 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
need. 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.

A. Yes. 1

Q. Do you say that accurately reflects the text that 2
appears at the foot of the following page, save for the 3
use of maybe a different word here or there. 4

A. Yes, that's assuming without actually going through it 5
word-by-word that it's close enough. 6

Q. Looking at the first page of the report in the middle of 7
the page 'In my investigation of Mars Hill, Maine 22 out 8
of 30 adults exposed live within about 3,500 feet' 9
you're critical of that statement in terms of it being a 10
case control study. 11

A. I'm critical of any scientific investigation that uses 12
the word 'about'. 13

Q. It matters whether it's 31 people or 29 people. 22 14
people I would respectfully suggest have been prepared 15
to participate in this study, that's what it says, 16
that's what it says, '22 out of about 30 people have 17
agreed to participate'. You can't read any more into 18
that statement can you. 19

A. '22 out of about 30 adults exposed who lived, were 20
evaluated'. It didn't say 'were prepared to 21
participate'. I have to say I'm a little surprised that 22
someone who is so precise with language should choose to 23
nitpick with me over the wording that's clearly stated 24
here when the issue at hand is scientific integrity. 25

Q. Is your understanding that with these case control 26
studies you need people to voluntarily participate, you 27
cannot compulsorily force them to do something. 28

A. Participation is always voluntary. 29

Q. So my question is a fair question, isn't it; that the 30
only way to interpret this statement is that 22 out of 31
about 30 people agreed to participate, or if you want to 32
use the term used, to be evaluated, that's all that that 33
statement says, isn't it. 34

A. Well it says 'were evaluated'. The interpretation that 35
they agreed to be evaluated or the basis by which they 36
were selected and invited to be evaluated is an 37
inference that you are making that I'm not prepared to 38

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

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38

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

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.

Q. You don't know that. 1

A. Well, it's not stated to me that it's properly collected 2
data, therefore I cannot know that because it's not been 3
declared. 4

Q. It could possibly be properly collected data using your 5
test. 6

A. It could be but it's not declared and it would seem very 7
odd not to declare the methodology in a scientific 8
presentation. 9

Q. Let's assume the data was collected to your 10
satisfaction - 11

A. If this were done to my satisfaction, yes. 12

HIS HONOUR 13

Q. Would that include knowing the nature of the questions 14
that were asked. 15

A. I would have to know the nature of the questions asked. 16
I would have to know by ascertainment - all of the 17
issues that I raised during my preliminary comments on 18
case controlled studies would need to have been 19
sufficient in order to be able to comment on that data 20
as a source of concern. 21

XXN 22

Q. I moved on to this topic because you were commenting on 23
Dr Laurie's evidence about doing some research quite 24
quickly. If you have a group of people who live within 25
a certain distance of a wind farm and a group of people 26
living outside, say 10 kilometres or 20 kilometres away 27
from a wind farm, you could quite quickly undertake a 28
case control study of those two groups, couldn't you. 29

A. Could I? What are you asking me? 30

Q. You or an appropriate qualified researcher, someone 31
else. That can be done quite rapidly. 32

A. What are you suggesting could be done quite rapidly? 33

Q. The survey that would need to be done. Obviously you 34
would need to spend some time identifying the people and 35
matching them but, if you're dealing with a series of 36
questions, that can be a research test that can be done 37
fairly quickly. 38

A. Can I refer to my statement. 1

Q. Yes, but that is a fairly simple question. 2

A. It is a simple question, and I would like to answer 3
precisely being an advocate of precise language. Point 4
41, which is p.9 of my evidence statement, I would 5
suggest that for any research to be made as to an 6
adverse health effect from sounds that arise from wind 7
turbines, a direct measurement of actual sound exposure 8
as well as perceived sound exposure over a reasonable 9
period of time, together with an objective evaluation of 10
potential confounders and an objective assessment of the 11
health effects is required, in accordance with the 12
standards of public health risk assessment. I cannot 13
see a compelling reason to recommend that this be done 14
on the basis of the available data. 15

Q. Yes, my question to you is can that research be done 16
reasonably quickly. 17

A. It would depend on the resources that were available to 18
do it. It would be dependent upon adequacy of design 19
and the appropriate power calculations to determine the 20
number of people that were required to participate. 21
There would be a process of protocol development, 22
protocols then need to be peer reviewed. The peer 23
review process would then also require that there was 24
reference to an appropriate ethics committee, 25
irrespective of the nature of the survey and how 26
invasive or uninvasive we may perceive it to be. Could 27
that be done reasonably quickly? I believe it could but 28
that is a matter of definition; what is the definition 29
of 'reasonably quickly'? Are we talking weeks, months, 30
years, half a decade? What's your definition of 31
'reasonably quickly' Mr Manos. 32

Q. I would suggest to you a period of months. 33

A. No, I don't believe it could be done in a period of 34
months. 35

Q. All those steps are necessary in your opinion to have a 36
proper case control study. 37

A. Yes, I do. 38

Q. Even if you're not seeking to peer review it. 1

A. Yes, I do. If you're not seeking peer review then, you 2
know, one would have to question the purpose of doing it 3
because you just get back into the cyclical argument 4
we've been having all day. 5

Q. Let me put to you this proposition. Let's say you live 6
near a wind farm with your family and, after the wind 7
farm started operating, you and the other members of 8
your family started to suffer from headaches, and 9
previously hadn't suffered that. Given your background 10
and experience, do you believe that you could quickly 11
prepare a research approach which has characteristics of 12
the case control study that you've just mentioned, and 13
get that out in the community in a very short period of 14
time. 15

HIS HONOUR: What does 'a very short period of time' 16
mean? It's not going to assist us because you've put to 17
the witness this can be done in months and he's 18
disagreed with that. 19

MR MANOS: That was on his formal case control 20
study. I'm asking if he found himself in this 21
situation, on that assumption, could he be do it. 22

XXN 23

Q. You could do that within a couple of weeks to a month, 24
couldn't you. 25

A. You're asking me to speculate on a set of personal 26
circumstances where emotional context would override 27
objective judgment. Is that what you're asking me to 28
do? Or are you asking me as a witness on scientific - 29

Q. I'm suggesting you and your family are exposed to 30
headaches that you previously hadn't been exposed to. 31
You would say in that situation you would lose your 32
objectivity in carrying out proper research. 33

A. When my family are sick I take them to a medical 34
practitioner other than myself. I seek outside opinion. 35
I can have no objective opinion at all when it comes to 36
my family. I reserve the right to veto but that's a 37
different matter. 38

Q. I'm not asking you to treat these people. I'm simply saying myself and my family have suffered headaches, I'm suggesting you could rapidly prepare a series of questions and identify a group of people who might be asked those questions to do a bit of a case control study.

A. If I did, what validity would it have?

HIS HONOUR: You might get further if you asked him whether he was retained to conduct research because you are going to continually founder on this question of his personal -

MR MANOS: The problem with that is he has indicated that, if that were the case, he would have to go through the processes he's described, which is a lengthier process. I'm seeking to ascertain if there could be a more rapid response if the Professor was personally involved.

A. I'm delighted to debate this with Mr Manos but I think this debate would waste the court's time.

HIS HONOUR

Q. Let the court deal with that.

HIS HONOUR: I don't know that you're going to get anywhere because you're going to continually founder on the rocks with his personal involvement -

MR MANOS: I don't know whether he has answered my question about losing personal objectivity -

HIS HONOUR: He may not have said in so many words but everything is indicated to suggest to me that he couldn't approach it objectively because he's subjectively involved. I don't believe this line of inquiry is going to assist.

MR MANOS: The witness has criticised Dr Laurie saying they could get a fairly rapid response.

HIS HONOUR: There are many ways of testing that. I don't know whether the way you're doing it at the moment is going to assist.

XXN

Q. In the material you've presented to the court there are

some documents and reports about infrasound. 1

A. Yes. 2

Q. And prior to being involved in this matter, did you have 3
any real understanding or knowledge of infrasound. 4

A. I did not. 5

Q. Have you learnt something about that since being engaged 6
in this matter. 7

A. 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

A. 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

A. 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
health, not as an expert in infrasound. 36

Q. With respect you didn't answer my question. 37

A. I didn't answer your question because the information 38

that I presented in the report, which as I started off
answering your question saying, was that based on the
information that I was provided with on the measurements
of infrasound, and based on the information in those
reports, I could only conclude that there was no risk of
infrasound to human health in the development of
Waubra - or the proposed development.

Q. I'll ask the question again: one of the articles that
you produced that you attached to your statement deals
with infrasound. Do you agree that article provides
some information to say that infrasound has an effect on
human health.

HIS HONOUR: There are lots of arguments -

MR MANOS: We could be here until the cows come
home -

HIS HONOUR: It would be a lot easier if you put
specific articles -

MR MANOS: Well, I can but I would have thought the
professor could answer that particular question. If we
want to finish the witness, the witness could answer my
question -

HIS HONOUR: If you are precise with your questions I
think -

MR MANOS: How more precise can I be to say 'with
respect to the article -'

HIS HONOUR: Get the article and put it to him.

MR MANOS: I would have thought he knew the answer.

XXN

Q. Do you have your Exhibit Y in front of you.

A. Yes I have.

Q. Have you considered the reference of the various
articles on p.11 of that report, starting with the
heading 'General Toxicology', starting at p.11 of that
article.

A. Is this the infrasound report dated November 2001?

Q. Yes.

A. So that's exhibit 8.

Q. 7.

A. So there is two - this is tab 7 is the Colby paper which is 'Wind Turbine Sound and Health Effects'. Tab 8 is 'Infrasound'. Which one am I directed to?

Q. I am looking at tab 7.

MR HENRY: Behind tab 7.

A. Okay, behind tab 7.

XXN

Q. Looking at the document entitled 'Infrasound - Brief Review of Toxicological Literature', with the heading 'General Toxicology', there are a hole lot of articles commented on and a brief summary in some instances provided - a brief summary is then provided under the heading of the paper.

A. Yes.

Q. Do you agree that some of those articles summarise that there is an effect on human health caused by infrasound; for example - this is qualified - but on p.12, for example, under the heading of 'Radneva'.

A. What page are we on?

Q. P.12.

A. Yes.

Q. On p.14 under the name 'Karpova'; read that summary.

A. Yes.

Q. And at the foot of p.15, for example, under the author's name 'Slarve'.

A. Yes. The commonality of those studies, if I might comment at this point, was the intensity of the infrasound and -

Q. I understand the qualification.

HIS HONOUR: Let the witness finish the answer.

A. The intensity of the infrasound on each of those occasions is above the levels that I've been indicated occurred in Waubra and are therefore unlikely to occur at Allendale. I did hear Dr Laurie's testimony that there may be infrasound levels at a higher intensity. If levels are present, indeed, at a higher intensity, the evidence has to be looked at differently, but my 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

A. Yes. 5

Q. Did you read that very short summary. 6

A. Indeed, a very short summary. 7

Q. Had you read that prior to - 8

A. I hadn't read the paper, no. 9

Q. Had you read the summary. 10

A. I had read the summary. 11

Q. You say that, in your workings, you do work with animals 12
for experimentation purposes. 13

A. 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

A. 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

A. Yes. 22

Q. Do you accept that at certain infrasound levels that 23
human health can be affected. 24

A. 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

A. 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

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38

A. Based on the data that exists, if people were consistently exposed to 90 decibels of infrasound then yes, it is quite possible there would be a physiological effect. 1
2
3
4

Q. You have quoted in your report Exhibit Y, from the New South Wales Legislative Council written by Dr Diesendorf. Do you know him at all. 5
6
7

A. I do not. 8

Q. Do you know if he's a medical practitioner. 9

A. I do not. 10

Q. In your report you have provided extracts of that order. This is at tab 5, behind tab 5 in your statement. 11
12

A. Yes, which page are you referring to? 13

Q. That document you will see from your extracts goes up to at least p.123. Do you recall the document is in excess of 200 pages. 14
15
16

A. Yes, it's a long document. What is here is the decision primarily. It's the executive summary, which starts and summarises from chapter 4 onwards, talking about various aspects, but includes the environment and economical impacts etc. The relevant statement I think you are referring to appears on p.160. 17
18
19
20
21
22

Q. Yes, that is the one that you have quoted from. 23

A. Yes. That is 7.30. 24

Q. I would like to produce to you the entire chapter 7. 25

A. Thank you. 26

Q. Do you recognise that document. 27

A. Yes, I do. 28

Q. So, p.116, at 7.28. 29

A. Yes. 30

Q. 7.28, 7.29 and 730, until we get to this issue. 31

A. 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 visitor to the Waubra wind farm. Did you notice any 37
38

impacts on yourself at the time that you went there, 1
apart from the hayfever. 2

A. Hay fever and a cold, yes. No. 3

Q. And you commented that you didn't find the farm or the 4
turbines particularly audible. 5

A. No, they were audible, I videoed them extensively from 6
multiple locations. I wore a hardhat because I was 7
required to do so. The wind through my hardhat and my 8
cap on subsequent occasions made a little more noise 9
than the turbine, except in one location, where I could 10
clearly hear the turbine. 11

Q. Para.7.21 'Further research by Vandenburg. 12

A. Can I clarify something please? Have we moved from 13
infrasound to noise. We are still on infrasound because 14
these paragraphs refer to audible noise. So 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

Q. Dealing with sound, I agree this is dealing with sound 19
generally, then there is a section more specifically 20
about infrasound. 21

A. Yes. 22

Q. But you didn't put forward all of the document. 23

A. No, I put forward the section of the document that dealt 24
with infrasound, because I, as you say, was needing to 25
find data related to infrasound and tried to view as 26
much evidence as I could possibly find relating to 27
infrasound. So while I could find considerable 28
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
Then I had to rely on as much evidence as I could find 33
to form an opinion. 34

Q. I am conscious of the time. Can I take you to p.117. 35
You have set out in your report at p.116 and the next 36
page to 119, p.117 is 'Committee comment'. 37

A. Yes. 38

Q. I take it you don't claim to be an acoustician. You see 1
in 7.37 'The committee acknowledge the evidence that 2
demonstrates that atmospheric conditions impact on noise 3
levels'. They are just talking about noise levels 4
there, not a particular type of noise. Then there is a 5
recommendation at p.117. Is there any reason why you 6
excluded that page from your paper. 7

A. Which is the recommendation? Recommendation 17 at the 8
foot of p.117. Because the question I was asked was to 9
comment on the health effects and that statement had 10
nothing to do with the health effects. 11

Q. Didn't some of Dr Laurie's material suggest this - some 12
people were having their sleep affected. 13

A. I haven't disputed the fact that some people have their 14
sleep affected. It's in my statement. 15

Q. Is it not relevant that this committee is dealing with 16
the issue or has made certain recommendations about 17
noise modelling, needs to be undertaken at night-time as 18
well. 19

A. Are you wanting me to be an acoustician? 20

Q. No, we can reasonably assume most people sleep at night. 21
That is a fair assumption, is it not. 22

A. That is a fair assumption, a small part of the 23
community, shift-workers, but the general population 24
will sleep at night. This committee suggests further 25
modelling needs to take place for nighttime activity. I 26
don't think we are in any disagreement with this court 27
that turbines can be heard and that they are heard more 28
by some people than others. This information is in my 29
statement. I am not entirely sure what I am being asked 30
to comment on. Are you asking me to specifically 31
indicate why that statement was omitted from my 32
testimony? 33

Q. In effect, I am asking why you didn't put forward that 34
page. You put forward the preceding page and a couple 35
of pages thereafter. 36

A. I was dealing with health effects, and the issue of 37
noise was not in contention, since I had already 38

acknowledged that some people may have disturbed sleep 1
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

A. Yes, I do. 9

Q. Again that page has not been included in your paper. 10

A. 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

A. 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 brought 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

A. 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

A. 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

A. 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

A. 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.
- A. We are hearing different bits of information, so let's 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 effects. 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. 1
2

A. I am saying and I will refer back to my testimony if I may. 3
4

COMSR MOSEL: 24 and 25? 5

A. No, it was a statement around health effects and sleep which I had before and now I can't find it. I apologise. 6
7
8

HIS HONOUR: Para.14. 9

A. Thank you. 'The issue of sleep disturbance is complex 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. I believe 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 10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38

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.

CONTINUED

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38

The extent to which sleep may be disrupted because of noise for any one individual on a persistent basis is unclear to me. So, on the one hand I am acknowledging this issue, on the other hand I am indicating that careful studies of the relationship between these various factors have been done in the context of audible sound, and what we haven't got clear is this murky business of infrasound, because there now seems to be some dispute about the measured level of infrasound.

Q. But there is a difference between road traffic noise or aircraft noise or -

A. Aircraft noise is much louder.

Q. But one of the other studies talks about aircraft, road transport and rail noise.

A. Aircraft noise is very loud.

Q. But it's not continuous 24/7, is it.

A. Well, I'm not sure there is an assertion that necessarily for all people turbine noise is continuous 24/7.

Q. But you understand that if the wind is blowing, a turbine might operate 24/7.

A. It might be, and I've also heard testimony that it depends on the direction.

Q. But let's assume it's operating 24/7. You've heard the sound, you hear a whoosh every less than a second. You've experienced it yourself, haven't you.

A. Yes. I find it quite relaxing.

Q. That wasn't my question. You've experienced it.

A. I've experienced it.

Q. So it is a continuous cycle, potentially 24/7.

A. Again, I can't answer the question, because I'm not an acoustician, about where you can hear it, but I will make the point that, for the most part, I couldn't hear it, other than standing under the turbine in one other location.

Q. But the committee here, on p.123, acknowledges that noise annoyance is an adverse health effect that can result from wind farms. You acknowledge that as well.

A. Yes. 1

Q. That can lead to sleep disturbance and sleep disturbance
can have an adverse effect on one's wellbeing. 2
3

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. 4
5
6
7

Q. For three people. 8

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. 9
10
11

Q. With respect, there was never such an assertion. You, I
suggest, have read that into the information. 12
13

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. 14
15
16

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. 17
18
19
20
21
22
23

A. Well, you are asking me to comment on the objectivity of
one set of data and not the other. 24
25

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. 26
27
28
29

A. I was provided with data that I could objectively
evaluate. I objectively evaluated the data I was
provided. 30
31
32

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. 33
34
35
36
37

A. Yes. 38

- Q. You didn't think it was important to include that in your attachment. 1
2
- A. I have already included that in my attachment. I have 3
indicated at point 12 'The anecdotal evidence that some 4
people living in the vicinity of wind farms', etc., that 5
is quite clearly stated. I've talked again about the 6
issue in point 14 which addresses it. I'm not sure how 7
more explicit you would wish me to be. 8
- Q. You would agree that if someone suffers depression from 9
whatever cause, as a result of living near or adjacent 10
to a wind farm, that that is an issue that needs to be 11
addressed. 12
- A. If you're attributing cause and effect and you're saying 13
that the depression is due to loss of amenity, or are 14
you saying that the depression is due to infrasound, or 15
are you saying the depression is due to audible sound? 16
You know, there are many, many issues that colour this, 17
and I think we've been through all of that with the 18
evidence from the paper from Dr Peterson, which is not 19
in dispute, with the evidence relating to other 20
developments of a similar type that have environmental 21
impact, that's not in dispute. These are phenomenon 22
that are broadly associated with many different things. 23
I'm not sure they can be directly ascribed in a cause 24
and effect basis to sound from a wind turbine. So there 25
are some things that, although I wish I could comment on 26
with better clarity, I can't, because the information 27
that I have been provided with is vague, in the sense 28
that there is no sufficient dissection of cause and 29
effect relationships. Does that constitute a need for 30
additional research? I don't think so, because I think 31
there is sufficient clarity around what already exists, 32
and the issue then comes down to public health risk 33
assessment, and that's a matter for the court to decide 34
in the planning context. 35
- Q. What I am putting to you at the moment in relation to 36
this passage is that the emotional response is a factor 37
that needs to be considered and, if that leads to 38

depression, that is an adverse health effect. 1

A. 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

A. I did not. 8

Q. How many people did you speak to in Waubra. 9

A. Probably half a dozen. 10

Q. Who live near or adjacent to the wind farm. 11

A. Yes. 12

Q. Did any of them report any adverse effects to you. 13

A. No. 14

Q. Any adverse health effects. 15

A. 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

A. 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

A. 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 38

discredited form of treatment for cardiovascular 1
disease. It is based on running a chemical called EDTA 2
through a drip into the veins and it's meant to leach 3
out all the plaque and cholesterol, and of course it 4
leaches out a whole lot of other stuff, so they run that 5
in through another drip. There was this very firm 6
belief, because he had seen two or three people improve, 7
that this must be a good treatment, but subjected to 8
proper study, it is not a good treatment and, in fact, 9
it is associated with significant harm in a number of 10
circumstances. The point is that you can believe your 11
own publicity if you're not maintaining a high level of 12
scepticism and objectivity in your evaluation of data. 13

EXHIBIT #A25 CHAPTER 7 OF THE GENERAL PURPOSE STANDING 14
COMMITTEE NO.5 TENDERED BY MR MANOS. ADMITTED. 15

Q. As I understood your evidence-in-chief, you have an 17
interest and expertise in relation to sleep disturbance. 18

A. We are conducting a study at present which involves home 19
sleep studies. 20

Q. Without breaching your client confidentiality, do you 21
have any patients who are exposed to noise 24/7, if I 22
can use that term again. 23

A. Yes. The interesting question, to which I don't know 24
the answer as yet: in the study, we have a series of 25
questionnaires that deal with the issue of noise. We 26
also have the capacity in the agreement to do 27
geographical mapping, which would give us an idea of 28
traffic density at any particular locality. We also ask 29
people about shiftwork, which of course is important in 30
circadian rhythm, day/night shifts. The sort of issues 31
are: what time do people go to bed at night; what time 32
do they wake up in the morning; how much coffee do they 33
drink before they go to sleep; how much alcohol do they 34
drink; have they had a fight with their wife or partner 35
or kids or neighbour or so on. They will all have an 36
effect. A bad day at work, and the many other 37
vicissitudes of life will affect sleep, including 38

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. 1

A. It's not a good analogy. It's an analogy. I don't 2
comment on the quality of it. 3

Q. Do you agree, from your knowledge and understanding of 4
sleep disturbance, that continuous noise may have less 5
impact and disturbance than a noise which is cyclical, 6
like the whoosh of a wind turbine. 7

A. I think that that is an interesting question, and the 8
question to which people may or may not accommodate to a 9
specific type of noise - and I've raised that issue in 10
my statement - which is about sensory integration, is an 11
open question, and I've acknowledged and mentioned that 12
sensory integration may be one of the mechanisms. So 13
I've not ignored that at all. 14

Q. You haven't ignored it, but you haven't also answered my 15
question. 16

A. Perhaps because I didn't follow it clearly enough. 17
Maybe I should have asked again. 18

Q. What I was putting to you was that, with your experience 19
and background and understanding of sleep disturbance, 20
continuous noise may have less interruption on your 21
sleep patterns than a cyclical noise of a whoosh of a 22
wind turbine every second or whatever period of time it 23
takes. 24

A. And what I answered was that the notion that that may be 25
the case was presented in my evidence, that the 26
inability to accommodate the intermittent noise may be 27
more difficult than continuous noise, that's the sensory 28
integration. That was in my statement, Mr Manos. I'm 29
pleased for the opportunity to clarify that for you. 30

Q. You've also attached behind tag 4 a report from the 31
English Wind Energy Association, and the first page of 32
that is a chart, which I think is prepared by others, 33
and that just gives some indicative noise levels. Would 34
you agree that generally the noises that have been 35
generated by the types of activities are likely to be 36
intermittent noises, not 24/7 noises. 37

A. I think that would probably be true for everything 38

- there. 1
- Q. A busy general office, I mean, people don't work 24 2
hours a day, but that could be a continuous noise. 3
- A. I'll make the statement again: I think that would be 4
true for everything on the list. 5
- Q. It's not really fair to therefore compare the wind 6
turbine noise which might operate 24/7 with those sorts 7
of activity/noise sources. 8
- A. I believe I'm hearing an assertion that I haven't been 9
able to verify in the diaries, for example, that I was 10
given that the wind is audible 24/7, and also I was 11
under the impression that, depending on the wind 12
direction - I heard this from Dr Laurie - that there was 13
some intermittency and some remission from the sound of 14
the turbines depending on environmental circumstances. 15
So I believe that intermittency, as in periodic let's 16
say, may well be a characteristic of all of these. 17
- Q. Say you're at home for an entire week, you live on your 18
farm, and the wind farm adjacent, 500 m away or 800 m 19
away, is operating 24/7 for that entire week. The 20
circumstances of that are going to be different to the 21
examples that are set out of the various noise levels at 22
tab 4. Would you agree with that. 23
- A. What is the assumption I am to be making: that I can 24
hear it; that at a distance I can hear it; that I am not 25
at work during the day? I am not sure what you are 26
asking me to assume. 27

CONTINUED 28

Q. I said you are there 7 days, the entire time you work on the farm. 1
2

A. Okay. 3

Q. And you can hear the wind farm. 4

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. 5
6
7
8
9
10
11
12
13
14
15
16

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. 17
18
19

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. 20
21
22
23

Q. How long did you spend near or adjacent to the Waubra wind farm. 24
25

A. I was there for a day. 26

Q. I don't assume you were there for 24 hours. 27

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. 28
29
30
31
32
33
34
35
36
37

Q. During the time that you were at Waubra do you 38

understand that the wind turbines were turning. 1

A. 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

A. On that particular date? 8

Q. Yes. 9

A. Yes. 10

Q. If we go to 24 November, they are obviously off for a 11
substantial period of the day. 12

A. Yes, may I ask you a question? 13

Q. No. With his Honour's permission you might. 14

A. 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

A. 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

A. 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

A. 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 patterns and result in sleep disturbance. Sleep disturbance can have a negative health impact on a human.

A. That's correct and this is what I've acknowledged. So that I will refer you back to statement 14.

Q. I understand that. If, in addition to the audible noise from the turbines that are operating 24 hours, in the example you used and the assumption you are making, there is also infrasound, say at 90 decibels, would you agree that that also could potentially affect one's sleep.

A. You are asking me to speculate on the conformance of infrasound and audible sound. I can speculate on infrasound at 75 decibels when it comes from the intermittent crash of waves on the beach doesn't appear to have an adverse effect, if we talk about a variance of 15 decibels of infrasound I honestly do not know. I can't even begin to speculate on that matter.

Q. But you acknowledged earlier that at 90 decibels infrasound could have an adverse effect on the human body.

A. Yes, and the question did not relate to sleep. The question related to the adverse effects that were among those listed and the statement I believe at the time were physiological effects or effects on physiology, and it's an open question as to what those are.

Q. So you can't assist the court as to whether or not if we got audible sound in addition to, say, infrasound at 90, that that may also be another factor that affects one's sleep pattern.

A. If you have audible sound and infrasound at 75, which is the intermittent crashing of waves, which is the closest I can get to this, it appears not to have any adverse effect. Now that's the only way I can conceptualise this because that's the only term of reference I have.

Q. In your experience with waves do they come in as frequently as the whoosh say - I'm talking about

different concepts here - with a wave is the audible 1
part, you hear the crashing of the wave every few 2
seconds, whatever, it is not as frequent - 3
A. It depends a bit on the rides and the weather, I 4
suppose. 5
Q. But have you ever experienced waves that come in every 6
one second. 7
A. I think I have certainly been at the beach where the 8
waves have come in quite frequently. 9
Q. Not every second. 10
A. I can't tell you because usually I'm asleep. 11
Q. Early in your evidence - I didn't fully understand it 12
and that's a failing of myself - you made some comments 13
about a person who is coming and going, that the 14
symptoms seem to go when they leave. You recall that 15
evidence. 16
A. Yes, it's based on the information in the journal which 17
Dr Lawrie has referred to. 18
Q. AR, for example, was at Philip Island and there was some 19
changes in the cognition. But you have heard it 20
reported that people who are affected by wind turbines 21
their symptoms can dissipate or disappear if they move 22
away from the wind turbines. You understand that that 23
is what people are reporting. 24
A. People are moving away from their lives there, whether 25
it's specifically - I mean we get back to cause and 26
effect relationships. You know, you are wanting me to 27
speculate that - implying that it is cause and effect 28
from the turbines, insofar as the turbines are the 29
source of their distress and whether that's because they 30
are there and everything that's associated with their 31
lives there and the conflict and the entire issue. 32
Frankly, when I get away from work and everywhere my 33
blood pressure goes down quite significantly, I'm sure 34
yours is much lower at the cricket other than when 35
Australia is losing and I'm sorry about that, but I 36
think that there are many, many, many factors that 37
affect blood pressure and to assert that when you move 38

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.

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.

A. 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.

CONTINUED

A. You tell me. 1

Q. You read the article. 2

A. 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

A. Absolutely. 9

Q. And chest vibrations. 10

A. 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

A. 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

A. 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

A. 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

A. 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

A. 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 infrasound 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 8

Q. The ear picks up audible sounds, sounds are vibrations 9
are they not. 10

A. Sounds are vibrations, yes. 11

Q. And the infrasound is at frequencies from 0-20 Hz which 12
the ear doesn't detect as an audible sound. 13

A. Correct. 14

Q. When I say 'the ear', the brain doesn't pick up the 15
audibility of that sound. 16

A. Correct. 17

Q. But any noise that has been generated results in a 18
vibration which is then picked up by the ear. Could it 19
be that infrasound, being present the whole time, is 20
causing a continuous vibration which then can affect - 21
creates a vibration in the head which then causes the 22
brain to vibrate giving rise to the headaches. 23

OBJECTION: MR HENRY OBJECTS 24

MR HENRY: That's just an invitation for speculation 25
and it doesn't seem to be - 26

OBJECTION 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 interchange; 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 going to help us. 35

MR MANOS: I would have thought it might be a key to 36
the whole matter. 37

HIS HONOUR: I've ruled on the question and it's not 38