



**economics**

Report to:

**New Zealand Wind Energy Association**

# **ECONOMIC BENEFITS OF WIND FARMS IN NEW ZEALAND**

**Final report**

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## Economic benefits of wind farms in New Zealand

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## 1 Summary

Wind is a growing contributor to New Zealand's energy supply mix. Wind energy generation has increased from 138GWh in 2001 to 1,930GWh in 2011, an annual increase of 28 percent. In total, wind energy's contribution to electricity supply in New Zealand was nearly five percent in 2011<sup>1</sup>. This proportion is expected to grow in the future.

The wind energy industry provides a renewable electricity source that complements the existing mix of hydro and geothermal generation. The wind energy industry also contributes to the regional and national economies in relation to economic activity.

This report has been prepared by BERL for the New Zealand Wind Energy Association (NZWEA) to determine the wind energy industry's economic contribution to New Zealand. It applies an internationally accepted method to determine the economic value of a megawatt (MW) of installed wind generation capacity with respect to employment and GDP.

### What the industry looks like

As of the end of 2011, there are 16 operating wind farms, with a combined capacity of about 623MW throughout New Zealand. These wind farms are operated by companies like Meridian Energy, Trustpower Limited, and NZ Windfarms<sup>2</sup>. Most of the current generation is in the Wairarapa-Manawatu and Wellington regions.

The New Zealand wind energy industry is composed of diverse businesses. Some offer highly specialised services and others provide general services to support wind farms. This report has identified about 100 businesses associated with activities during the planning and project development, construction and installation, and operation and maintenance (O&M) phases of wind farm activity. Most of these businesses are privately owned. They are engaged across areas such as consulting and engineering services, construction and installation, and wind energy facility development. As a result, people working in the industry are diverse, with a varied mix of skills and expertise.

### Economic benefits

#### Current - 2010-2011

The survey undertaken as part of this project shows that in terms of Full-Time Equivalents (FTEs) per MW of installed capacity, most employment is generated in the construction and installation phase (1.79 FTEs per MW). This compares to 0.81 FTEs per MW in the planning and project development phase.

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<sup>1</sup> The percent contribution of wind energy to total annual electricity generation in New Zealand is based on Ministry of Economic Development data.

<sup>2</sup> The other operators of wind farms in New Zealand are Genesis Energy, Energy<sup>3</sup> and Pioneer Generation.

Once constructed, employment requirements per MW of generation drop quite significantly, to only 0.15 FTEs required per MW of energy produced. Table 1.1 summarises FTE per MW by phase based on the survey.

**Table 1.1 FTEs per MW, NZWEA-BERL survey<sup>3</sup>**

	Planning	Construction and Installation	Operation and Maintenance
<b>Survey (110 MW)</b>	0.81	1.79	0.15

*Source: BERL-NZWEA Survey, 2012*

Table 1.2 presents the economic impact of the wind energy industry over 2010-2011, which is based on wind energy output during 2010 (1,618 GWh).

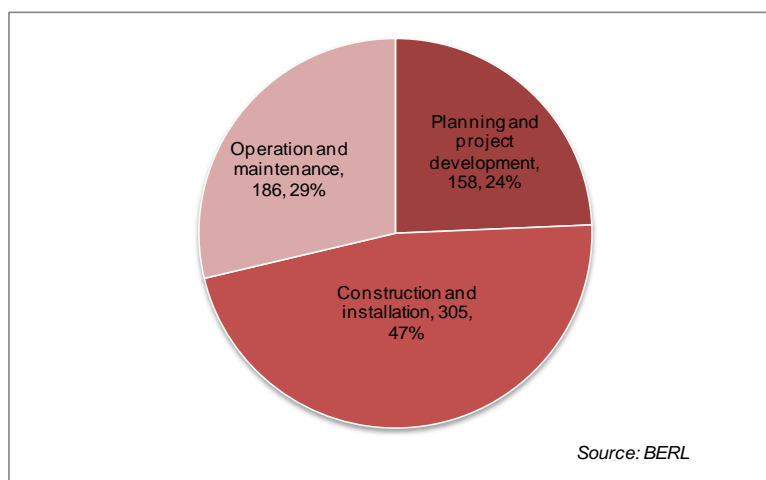
**Table 1.2 Economic contribution of wind energy industry, 2010-2011**

	Direct	Total
GDP (2011\$m)	36	65
Employment (FTEs)	380	649

*Source: BERL*

In 2011, the wind energy industry generated 649 FTE jobs. Figure 1.1 summarises the employment benefit of wind farms in 2011.

**Figure 1.1 Estimated total employment (FTEs) benefit, 2011**

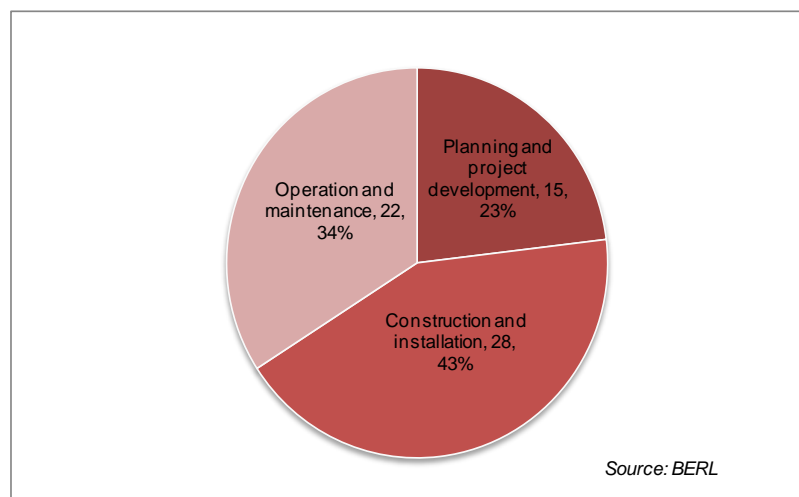


Of this total employment benefit, 305 FTEs were in construction and installation<sup>4</sup> while 186 FTEs and 158 FTEs were in O&M and planning and project development, respectively.

<sup>3</sup>Planning and construction and installation FTE per MW ratio is based on the total installed capacity of wind farms built from 2010 to 2011. About 110 MW were installed throughout New Zealand over this period.

The wind energy industry contributed \$65 million to GDP. Figure 1.2 summarises the GDP benefit of the wind energy industry in 2011.

**Figure 1.2 Estimated total GDP benefit (\$2011m), 2011**



In terms of GDP, the wind energy industry contributes about \$65 million to the national economy. Of this, \$28 million is from construction and installation activity, while \$22 million and \$15 million are from O&M activities and planning and project development of wind farms built from 2010 to 2011, respectively.

#### 2030 scenario

A larger wind energy industry in New Zealand will result in bigger economic benefits in terms of GDP and employment. Under a scenario where there is 3,500MW of installed wind capacity throughout New Zealand in 2030, the employment and GDP generated by the wind energy industry is likely to double.

Table 1.3 summarises the economic benefits of the wind energy industry under a 3,500MW scenario.

**Table 1.3 Economic contribution of 3,500MW of installed wind capacity by 2030**

	Direct	Total
GDP (\$2011m)	81	156
Employment (FTEs)	764	1,430

Source: BERL

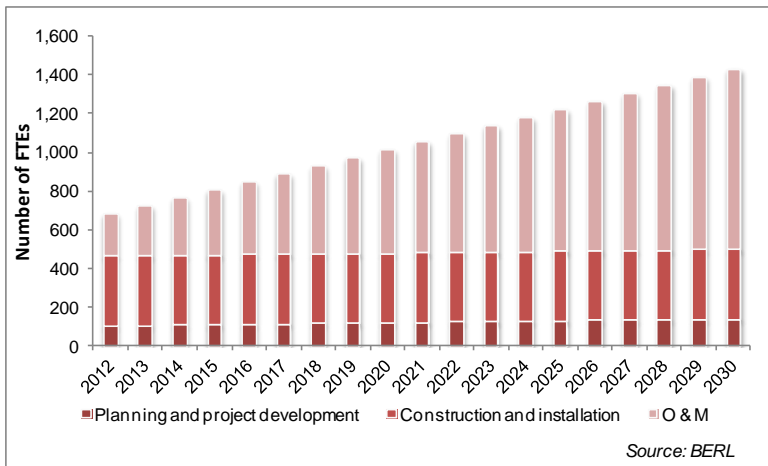
Overall, the total economic benefit associated with 3,500 MW of wind capacity will be about 1,400 FTEs and about \$156 million in GDP by 2030. The key sectors that are likely to benefit from the wind energy industry's expansion are those businesses that are involved along the lifetime of wind farms. These include those in wind farm development, consulting services, finance and other business services, retail trade, component manufacturing, industrial goods distribution, and construction.

<sup>4</sup> The combined installed capacity of wind farms completed between 2010 and 2011 is about 110 MW.

Much of the growth in employment will be in the O&M workforce as there will be a larger number of wind farms to manage.

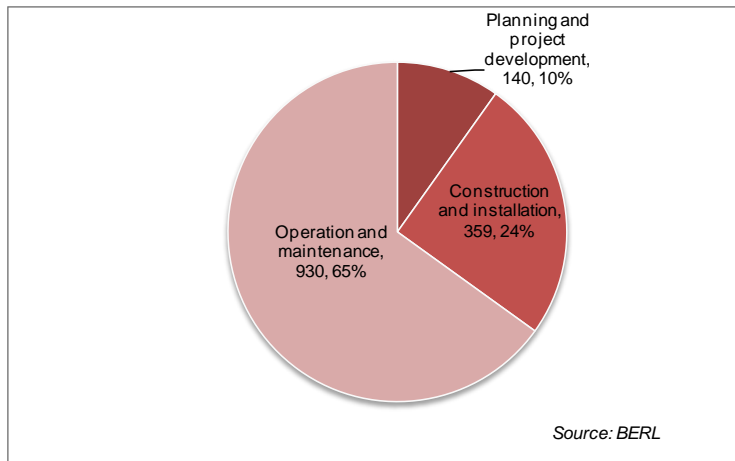
Figure 1.3 shows the total employment benefit under a scenario where the industry grows by 150MW each year from 2012 to 2030, broken down by phase of development.

**Figure 1.3 Estimated total employment benefit, 2012 to 2030**



By 2030, the potential total employment benefit of the wind energy industry is about 1,400 FTEs. Figure 1.4 shows the breakdown of the potential employment impact of the wind energy industry by 2030.

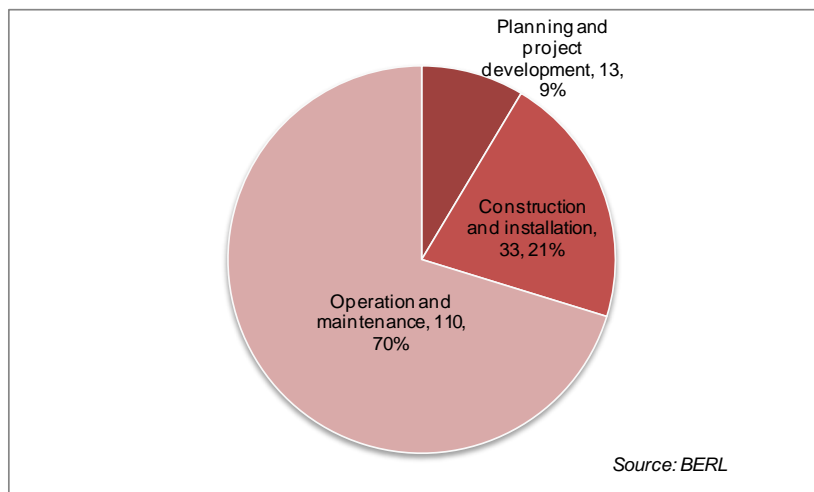
**Figure 1.4 Estimated total employment benefit, 2030**



The industry will create about 930 full-time equivalent O&M related jobs. From 29 percent of total employment benefit in 2011, O&M related employment would make up 65 percent of the total full-time equivalent jobs in the wind energy industry in 2030.

In terms of GDP benefits, the wind energy industry’s total contribution to national GDP increases from \$65 million in 2011 to \$156 million in 2030.<sup>5</sup> Figure 1.5 summarises the GDP benefit of wind energy industry in 2011.

**Figure 1.5 Estimated total GDP benefit (\$2011m), 2030**



The leading contributor to this gain in national GDP will be related to O&M activities. From about \$22 million in 2011, the potential contribution to GDP of O&M related activities increases to about \$110 million.

This is a very conservative estimate, where we have assumed that the ratio of employment to activity remains constant over time. In reality, we would expect an increasing ratio of employment to activity. This is because, as the industry develops, capability and expertise increases. This means that a greater proportion of the activity can be done within New Zealand.

To illustrate this, an analogy can be drawn with the oil and gas exploration industry in New Zealand. In the early phases of oil and gas exploration in New Zealand, most expertise and equipment in constructing oil platforms and pipelines was imported into the country. New Zealand did not have the capability, expertise, or reputation to undertake this work. New Zealand company activity was limited to site preparation, support services and general contracting.

As the industry developed, local contractors, such as Fitzroy Engineering, became increasingly active in the sector – first providing maintenance and then progressing to engineering components. A similar pattern occurred with other New Zealand businesses, especially as the industry was concentrated in the Taranaki region. Now, the local content in the construction phases of oil and gas exploration and extraction is significantly higher than what it was when the industry was in its infancy. We would expect a similar pattern to occur in the wind energy industry.

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<sup>5</sup>



### Comparison to other sectors

The wind energy industry in 2011 was a relatively small industry. However, by 2030, the wind energy industry is expected to be a relatively mature industry, generating employment and GDP on a par with other mature industries in New Zealand such as the oil and gas exploration and extraction sector, or aquaculture.

In terms of employment, the wind energy industry in 2030, with 764 FTEs, will be similar in size to the hydro-electricity generation industry (771 FTEs), oil and gas extraction (592 FTEs), and gas supply (540 FTEs).

In terms of GDP, the wind energy industry in 2030 will be comparable in economic activity to metal ore mining (\$84 million) and aquaculture (\$93 million).

The report uses a conservative approach that is based on multiplying existing employment by the amount of windfarms that will be developed (linear growth). It is likely that as the wind energy industry grows, New Zealand companies will start to develop within and around the industry.

Over time, New Zealand companies will provide services that are currently provided overseas. This pattern of growing local content occurred in the oil and gas exploration industries and there is no reason to assume that it won't happen in the wind industry. The methodology used in this report has not allowed for this "home grown" effect. Therefore, the report is likely to underestimate employment figures associated with 3,500 MW of wind generation.

## 2 Introduction

The wind energy industry is well established internationally with an installed capacity of over 230,000MW at the end of 2011. In New Zealand, it is a small but growing contributor to the supply of electricity. Over the past decade, the wind energy industry's contribution to electricity supply has been increasing.

This report presents the economic benefits of wind farms in New Zealand in terms of employment and GDP. The report identifies the economic impact in the 2011 year. It then uses an FTE per MW ratio to identify the economic impact in a scenario where the wind energy industry expands to an installed capacity of 3,500MW by 2030. The report also looks at the additional benefits of wind farms and the type of employment generated within the industry.

The report draws mainly from the responses received from companies that completed a questionnaire and participated in a phone survey, consultation with key stakeholders in the wind energy industry, and publicly available information from NZWEA member companies.

### 2.1 Methodology

The approach is based on identifying the ratio of employment to installed generation capacity, or an FTE per MW ratio, for the key activity areas of wind energy generation. This ratio is then used to determine total employment directly related to levels of wind generation activity. Input output analysis is applied to estimate GDP contribution from employment ratios. Multipliers are then used to determine indirect and induced effects of that direct employment and GDP. Throughout this report, all GDP figures are expressed in inflation-adjusted (i.e. constant price) 2011\$ values.

The FTE per MW ratio is identified through three approaches. The first is a literature review of economic impacts, which provides a method and comparators to review the survey findings. The second is a survey of New Zealand Wind Energy Association (NZWEA) members and non-NZWEA member suppliers to identify their employment related to wind generation. The third uses case studies of two recent New Zealand wind farms to estimate the level of employment generated.

The literature review of New Zealand wind farm economic impacts and international studies on economic contributions provide an initial framework and a set of ratios used to check the validity of the New Zealand calculations.

From the survey and New Zealand case studies, high and low ratios across three distinct phases of wind farm activity were identified:

1. planning and project management
2. construction and installation
3. O&M.

The forecast growth scenario to 2030 is 3,500MW. Steady output growth of 150MW per year is assumed.

The BERL-NZWEA Survey

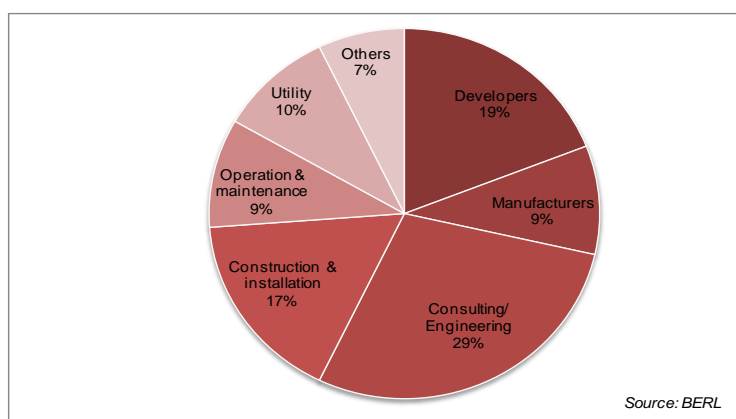
BERL, along with NZWEA, surveyed companies involved in activities related to the project development, construction and installation, and O&M of wind farms.

The survey, both by phone and questionnaire, covered three main areas. First, a description of the company’s main activities related to the wind energy industry. When possible, companies were asked what proportion of their total activities directly relates to the wind energy industry. Second, they were asked for the number of FTEs related to the planning and project development, construction and installation, and O&M phases of wind farms from 2010 to 2011. Finally, the survey asked participants about the role of wind farms in the growth of local and national businesses.

The survey included NZWEA member and non-NZWEA member companies that maintain offices in New Zealand. The questionnaire was sent to 30 NZWEA members and 10 non-NZWEA members. The survey was augmented with a quick phone survey to non-respondents, and a review of available annual reports. Overall, 42 companies were covered in the analysis. Of this number, 11 companies completed the questionnaire, 18 companies participated in the phone survey while employment information on the remaining 13 companies<sup>6</sup> were from annual reports and company websites.

Figure 2.1 shows the type of companies included in the analysis.

**Figure 2.1 Companies’ primary involvement in the wind energy industry, 2011<sup>7</sup>**



Most companies operate in one of three activity areas: consulting/engineering, wind farm developers, construction and installation. The consulting/engineering services (12 out of 42 companies) activity area had the largest number of businesses associated with the wind energy industry. These companies provide engineering, environmental, and legal services during the planning and project development phase of a wind farm.

<sup>6</sup> For this group of companies, we assume that about one percent of their total employment is related to wind energy activities. This proportion is based on the report of companies that participated in the phone/questionnaire survey. The respondents estimate that about a percent of their total employment is associated with activities in the wind energy industry.

<sup>7</sup> The categories are not mutually exclusive. Some companies are manufacturers and provide operation and maintenance services to the wind farms.

## Final report

Nineteen percent (eight companies) are mainly engaged in wind farm development while 17 percent (seven companies) are involved during the construction and installation phase. It should be noted that this profile of companies in the wind energy industry does not include suppliers who did not respond to the survey or who were not surveyed.

### Case studies

BERL undertook case studies to determine the economic activity for two specific wind farm developments. The first case study was of West Wind, which is operated by Meridian Energy, has an installed capacity of about 143MW. The second was Vestas, which maintains four wind farms: Tararua, Te Apiti, White Hill, and Mahinerangi. The combined capacity of these wind farms is about 346MW, which is more than half of the current total installed capacity of wind farms in New Zealand.

BERL referred to the West Wind project for FTE jobs related to the construction and installation of wind farms. The Vestas case study is used to crosscheck FTEs related to O&M against the survey of companies associated with the wind energy industry.

### **2.1 Format of the report**

Section 3 describes the context of the current analysis. The section describes electricity supply and forecasts, both of renewable and non-renewable generation. It also highlights electricity generation from wind.

Section 4 presents key findings from economic impact analyses of wind farms and the wind industry completed in New Zealand and overseas. The current study used the key findings from those studies as a benchmark for employment per unit of installed wind energy capacity. The section also discusses the methodology.

Section 5 summarises key findings from a survey of businesses involved in wind farm related activities.

Section 6 presents the economic benefits of wind farms in New Zealand. The section highlights the economic impact, in terms of GDP and employment, of 3,500MW of wind capacity in New Zealand. Section 6 also identifies other benefits from wind farms.

Conclusions of the economic impact analysis are presented in Section 7.

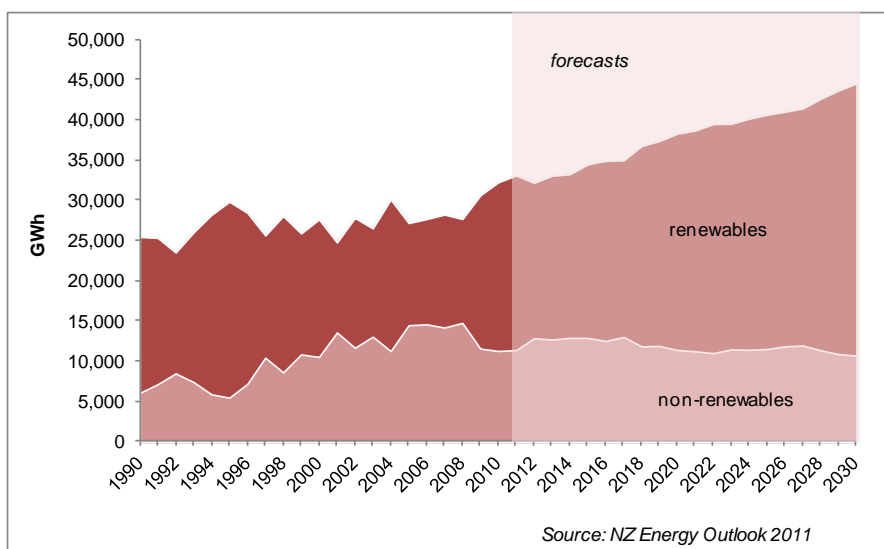
### 3 Electricity supply and forecasts

This section outlines the case for the NZWEA forecast of wind energy supply.

#### 3.1 New Zealand Energy Outlook, 2011

In 2010, 43,410 gigawatt-hours (GWh) of electricity was generated in New Zealand. Over the 20 years to 2030, growth is forecast to increase 1.2 percent per annum to around 55 GWh.

**Figure 3.1 Electricity supply by renewable and non-renewable, 1990 to 2030**

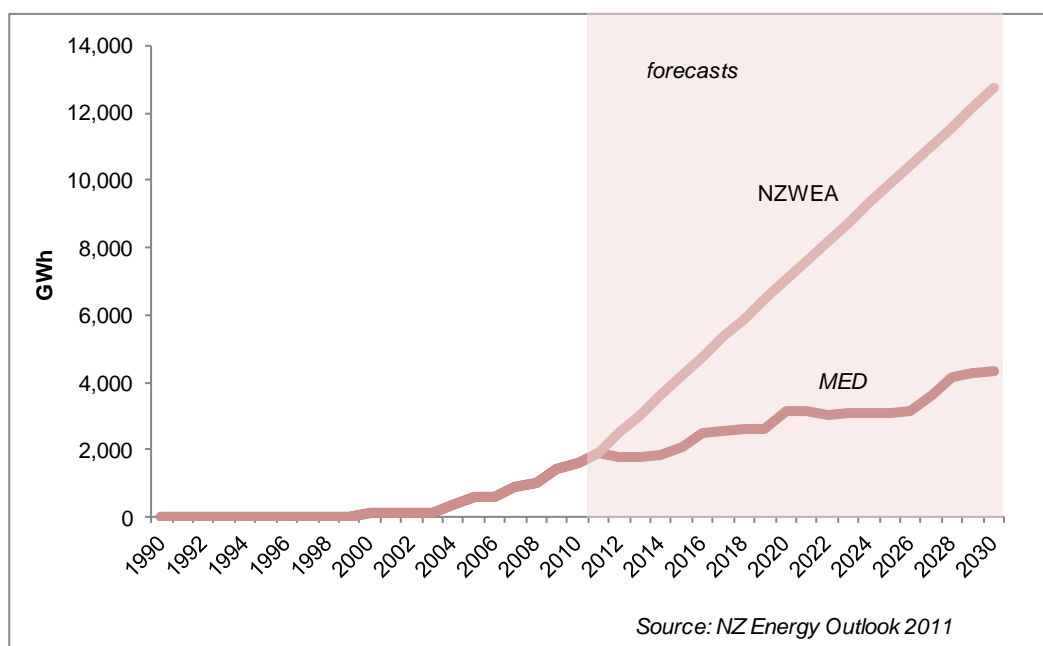


As Figure 3.1 shows, the share of electricity from renewables is increasing and in 2010 contributed 74 percent of total net electricity generation, which is the highest level over the past decade. While the contributions fluctuate depending upon weather conditions, there is a noticeable increase in renewables and a decline in non-renewable sources since 2000.<sup>8</sup>

Figure 3.2 shows the rapid growth in wind generation over the past decade.

<sup>8</sup> Renewables include hydro, geothermal, wind, solar and bioenergy. Non-renewables include coal, oil, gas and waste heat. The increase in the share of electricity generation from renewables was due to strong hydro flows and increased capacity geothermal and wind energy generation plants.

**Figure 3.2 Supply of electricity from wind, 1990 to 2030, MED and NZ forecasts**



In 2010, wind energy supplied 1,618 GWh of electricity. This is five percent of the total 32,211 GWh of electricity supply from renewable sources in that year.<sup>9</sup> Wind generation has increased at 28 percent per annum since 2001. However, looking forward to 2030, the New Zealand Energy Outlook 2011 scenario has wind energy contributing 4,361 GWh, an annual growth rate of only 5.1 percent.

### 3.2 Wind Energy Association growth target

The current growth (last 10 years) in wind generation is significantly higher than the forecast growth by the Ministry of Economic Development (MED). The difference between the MED modelling and actual growth led the wind industry, through NZWEA, to identify a plausible scenario for industry growth out to 2030. The New Zealand wind industry expects installed capacity to grow by an average of 150MW per year, increasing to 3,500MW by 2030. This capacity would be sufficient to generate an estimated 12,700 GWh, or 20 percent of New Zealand’s annual electricity demand in 2030.

The industry is well positioned to meet this potential as wind energy is becoming economic with improvements in technology and as the price of energy increases. Wind energy will become an important part of the current mix of renewable and non-renewable energy sources.

<sup>9</sup> This includes electricity from hydro (24,470 GWh), geothermal (5,551 GWh), wind (1,618 GWh), wood (346 GWh) and biogas (226 GWh). Electricity generated from wind is 3.7 percent of the total generation (renewable and non-renewable) in 2010.

## 4 Analysis

This section identifies the FTE per MW ratio used to determine direct employment over the three phases of a life of a wind farm in New Zealand. The analysis covers a scan of local and overseas studies of the economic benefits of wind farms; the findings of the BERL-NZWEA survey; employment required during the construction and installation stage of the West Wind wind farm; and the number of full-time jobs Vestas employs for O&M activities.

### 4.1 Local and overseas studies

This section summarises the economic benefits of wind farms and the wind energy industry from analyses completed in New Zealand and overseas. The FTE per MW identified from these studies are used to benchmark findings from the New Zealand analysis.

#### 4.1.1 Local studies

##### Turitea Wind Farm

A 2008 analysis by New Zealand Institute of Economic Research (NZIER, 2008) of the economic impact of the construction of Turitea Wind Farm in Palmerston North suggests that the direct spend of constructing a wind farm with an installed capacity of 300MW to 360MW is between \$750 million to \$900 million. Of this total construction expenditure, about 20 percent or approximately \$150 million to \$180 million is spent in the local economy. The construction of the wind farm is likely to employ about 100 FTEs on site. The study also reports that the direct impact during the O&M phase is between \$0.8 to \$1.2 million per year and a further 10 to 15 FTEs in terms of local employment (depending on the final size of the wind farm).

##### West Wind

Based on an interview conducted for the current study, West Wind, with a total installed capacity of about 143MW, required about 150 FTEs during the construction and installation phase. Most people employed were from the Greater Wellington and Manawatu-Wairarapa regions.

##### Castle Hill Wind Farm

A BERL report in relation to the Castle Hill Wind Farm project suggests that a wind farm with a generation capacity of up to 860MW could directly create 147 FTEs, \$51.3 million in expenditure and contribute \$15.6 million during its construction phase over the first five years.<sup>10</sup> The study cites that the construction phase is estimated to have a total cost of \$1.7 billion over the five years, of which \$246 million will be spent in the development area (Masterton-Tararua Districts). During the operational phase, Castle Hill Wind Farm is expected to generate \$9.4 million in expenditure, \$3.9 million in GDP and 37 FTEs in local employment.

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<sup>10</sup> BERL (2011). The wind farm will be constructed in stages, with any first stage in the order of 300 MW installed capacity.

#### 4.1.2 Overseas studies

Studies completed in Canada, the United States, and Europe show that the wind energy industry contributes significantly to local and national employment.

##### Europe

A study completed by the European Wind Energy Association (EWEA, 2009), shows that the wind energy sector directly employed 108,600 people in the European Union (EU). Of this direct employment, 59 percent are in the wind turbine and component manufacturing industries. Including indirect<sup>11</sup> employment, the sector employed 154,000 people throughout the EU in 2007. Turbine and component manufacturing account for the largest share of wind energy industry's employment in Europe.

Other key areas of employment are wind farm development (16 percent), and installation and O&M (11 percent). Utilities and power providers support an extra 9 percent, while consultants, and research and development make up three percent and one percent, respectively.

The study also reports that countries with developed industries like Denmark, Germany and Spain, who are exporting technologies, turbines, and other components, are likely to experience the highest benefits in terms of employment in the future.

##### United States

A 2008 study in the US suggests that every 100MW of installed wind power capacity provides 310 FTEs in the manufacturing sector, 67 contracting and installation jobs, and 9.5 FTEs in O&M every year.<sup>12</sup>

According to the American Wind Energy Association (AWEA), increasing the nation's total wind power generating capacity by 50 percent in 2008 has increased total employment in the sector in the US to 85,000 from 50,000 in 2007. The share of domestically manufactured wind turbine components has also grown from under 30 percent in 2005 to about 50 percent in 2008 due to new facilities opened from 2007 to 2008. Of the 85,000 jobs in the sector, AWEA estimates that about 8,000 of these are construction jobs. Other jobs include those in turbine component manufacturing, construction and installation of wind turbines, O&M, and legal and marketing services.

Another study by the American Solar Energy Society and Management Information Services, Inc., published at the end of 2008, looked at the typical employee profile of a 250-person wind turbine manufacturing company and identified 126 occupations. The study suggests that the workforce within the wind energy industry is varied and diverse.

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<sup>11</sup> Those employed indirectly as component manufacturers, consultants, legal professionals, financial services providers and so on.

<sup>12</sup> Methipara, J., Sauer, A., Elles, C., and Beck, F. (2009).



Canada

A 2006 survey of businesses associated with the wind energy industry estimated that the wind energy industry directly employed 1,200 FTEs in 2006<sup>13</sup>. Of this employment, about 70 percent were in non-support functions including managers, consultants, engineers and scientists, and trades people. Support staff (including labourers and assistants) contributed a further 360 FTEs.

Including indirect employment, total employment in the Canadian wind energy industry was estimated at 2,280 FTEs. This employment was expected to grow to 5,300 FTEs by 2011. Employment among trades people and labourers was expected to increase from 270 FTEs in 2006 to 1,800 FTEs by 2011. In 2010, wind farms in Canada had an installed capacity of 3,400MW.

Other international comparisons

In terms of the average employment over the life of an energy facility, wind power generates more jobs per MW during the manufacturing, construction and installation phase than biomass, coal-fired and natural gas facilities. This suggests that wind farms can potentially generate more employment than coal and gas plants during the construction and installation phase.

The FTE per MW ratios in Table 4.1 imply that most employment in the wind energy industry and in the other renewable energy types is in manufacturing and construction while most employment in coal and gas plants is in fuel processing and O&M.

**Table 4.1 Estimated employment per megawatt, renewable and fossil power plants<sup>14</sup>**

	Manufacturing, construction, installation	Operation & Maintenance/Fuel processing	Total
Solar PV	5.76 to 6.21	1.2 to 4.80	6.96 to 11.01
Wind power	0.43 to 2.51	0.27	0.70 to 2.78
Biomass	0.40	0.38 to 2.44	0.78 to 2.84
Coal-fired	0.27	0.74	1.01
Natural gas fired	0.25	0.70	0.95

*Source: UNEP/ILO/IOE/ITUC (2008)*

Note: Based on findings from a range of studies in the United States and Europe published in 2001–04. Assumed capacity factor is 21 percent for solar PV 35 percent for wind, 80 percent for coal, and 85 percent for biomass and natural gas.

In summary, the findings presented in local and overseas studies reveal that the wind energy industry is an international industry offering diverse employment opportunities. Overseas evidence suggests that most employment is in turbine and component manufacturing. However, in most cases this evidence was from countries that were early adopters of wind energy and were involved in turbine and component manufacture.

<sup>13</sup> Canadian Wind Energy Association (2006).

<sup>14</sup> The table presents average employment over the life of the facility. See [UNEP/ILO/IOE/ITUC \(2008\)](#). [Green jobs: towards decent work in a sustainable, low carbon world](#).

## 4.2 Survey

Table 4.2 summarises the FTE per MW ratio by phase based on the BERL-NZWEA survey. The survey reveals that the largest proportion of employment in the New Zealand wind energy industry is related to construction and installation activities (about 190 FTEs), followed by planning and project development activities (81 FTEs). For O&M, the survey reveals that there were 93 FTE jobs associated with about 623MW generation of operating wind farms over the same period.

**Table 4.2 FTEs per MW, BERL-NZWEA survey<sup>15</sup>**

	Planning	Construction and Installation	Operation and Maintenance
<b>Survey (110 MW)</b>	0.81	1.79	0.15

*Source: BERL-NZWEA Survey, 2012*

## 4.3 Case studies

BERL undertook two case studies to determine the economic activity related to wind farm development and O&M. The first was with West Wind, operated by Meridian Energy, which has an installed capacity of about 143MW. Construction and installation of the wind farm directly required 150 FTEs. This means that the construction and installation of the 62 turbine-wind farm employed about 1.05 FTEs per MW.

The second was Vestas, one of the world's leading turbine manufacturers. Vestas maintains four wind farms in New Zealand: Tararua, Te Apiti, White Hill, and Mahinerangi. The combined capacity of these wind farms is about 346MW, which is more than half of the current total installed capacity of wind farms in New Zealand. Vestas employs 43 technicians to provide repair and maintenance services to these wind farms. This suggests that the Vestas-managed wind farms required about 0.12 FTE per MW for O&M services across the four wind farms. This FTE per MW ratio was compared with the FTE per MW ratio estimated from employment reported in the survey.

## 4.4 Summary

Table 4.3 summarises the employment requirement by phase of wind farm development and operation.

<sup>15</sup> Planning and construction and installation FTE per MW ratio is based on the total installed capacity of wind farms built from 2010 to 2011. About 110 MW were installed throughout New Zealand over this period.

Table 4.3 Comparison of employment per megawatt

	FTE per MW		
	Planning and project development	Construction and installation	Operation and Maintenance
<b>Survey (110MW)</b>	0.81	1.79	0.15
<b>Vestas (345.8MW)</b>			0.12
<b>New Zealand case study</b>			
<i>West Wind (142.6MW)</i>	0.08	1.05	
<i>Tararua 3 (93MW)</i>		1.08	
<i>Te Uku (64.4MW)</i>	0.08		
<b>International case study</b>			
<i>European Wind Energy Association</i>			
<i>Annual MW</i>	1.3 <sup>a</sup>	1.2	0.07
<i>Cumulative MW</i>	0.07 <sup>a</sup>		0.33
<i>UNEP/ILO/IOE/ITUC<sup>b</sup></i>		0.43 to 2.51	0.38 to 2.44

Sources: BERL-NZWEA (2012), EWEA (2009), UNEP/ILO/IOE/ITUC (2008)

<sup>a</sup> Other direct employment in IPP/utilities, consultants, research institutions, universities, financial services and others. This estimate is based on annual MW.

<sup>b</sup> Based on findings from a range of studies in the United States and Europe published in 2001 to 2004. Assumed capacity factor is 35 percent for wind.

In New Zealand, the construction and installation phase has more impact on employment compared to the planning and project development, and O&M phases.

Overseas evidence suggests that most employment is in turbine and component manufacturing, while New Zealand case studies indicate that the construction and installation phase has more impact on employment than the planning and project development and O&M phases. This is because there is currently no major manufacturing base or capability within New Zealand. We would expect that as the industry develops, the share and level of activity captured during the construction and installation phase increases.

The large difference in employment ratios during the planning and product development phase is likely due to the fact that, in the case studies, much of the planning and project development related activities such as feasibility analysis, scientific studies and obtaining consents and permits had already been done. The low ratio identified from the case studies is likely to be the ongoing planning and project development as part of the construction and operation of the wind farm.

## 5 The wind energy industry in New Zealand

This section highlights the type of companies covered in the analysis and the current size of the New Zealand wind energy industry.

### 5.1 Composition

The wind energy industry is composed of companies providing diverse services at various phases, from wind project development to O&M. The nature of those services, as well as the scale and scope of their operation, varies according to three phases.

#### 5.1.1 *Planning and project development*

Companies that are involved in this phase are responsible for site selection, wind power feasibility analysis and other scientific studies<sup>16</sup>, wind farm design layout, wind turbine selection and acquisition, obtaining consents and permits, construction contracting, acquiring leases, energy production estimates, and project financing. Legal and financing companies are also involved in this phase.

#### 5.1.2 *Construction and installation*

The companies providing engineering, procurement, and construction services such as civil work, laying cables for electrical infrastructures and installing wind turbines are involved in this phase. Companies that deliver technical assessments (e.g. geotechnical assessments) and those who are engaged in wind turbine, industrial heavy equipment and components/materials transport are involved in this phase.

#### 5.1.3 *Operations and maintenance*<sup>17</sup>

Operations include scheduling site personnel, observing turbine operation, dealing with equipment failure, and coordinating with the utility to respond to curtailments or outages. Maintenance includes both scheduled (preventative) services, such as periodic equipment inspections, oil and filter changes, calibration of electronic sensors, blade cleaning, and unscheduled services to repair component malfunctions. For this analysis, we included wind turbine and component manufacturers under this category.

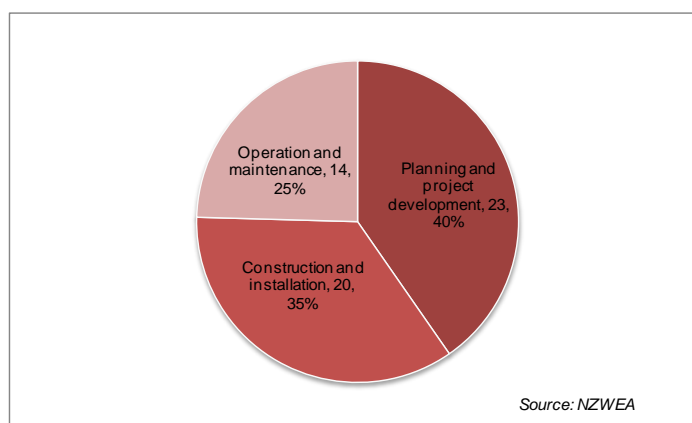
NZWEA membership suggests that there are at least 57 New Zealand based-companies involved in the wind energy industry. Figure 5.1 presents the composition of these companies by the three phases.

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<sup>16</sup> Apart from individual companies, universities, government, and crown entities are involved in research and development related to wind energy.

<sup>17</sup> This also covers the routine maintenance of wind turbines after the manufacturer warranty has expired. Wind farm operators may perform maintenance on their own, or sub-contract the service to independent service companies.

**Figure 5.1 Composition of the New Zealand wind energy industry, 2011**



Of the 57 companies, 23 (40 percent) are involved in activities related to planning and project development, 20 companies in the construction and installation, and 14 companies provide O&M related services. Including other suppliers and non-NZWEA members, we estimate that the industry has about 100<sup>18</sup> companies engaged in the various phases of wind farm development.

Table 5.1 shows the type of companies under each phase of a life of a wind farm.

**Table 5.1 Type of companies in the New Zealand wind energy industry**

Planning and project development	Construction and installation	Operation and maintenance
Consulting services	Wind turbine manufacturer	Power transmission and distribution
Wind energy facility developer	Lines company	Electricity generator
Design and build	Components manufacturer	Broadcast and telecommunication services
Electricity generator	Engineering and services	System operator
	Transport	Trading, retailing and metering
	Generator/Supply company/ Lines company/ Retailer	Personal protection equipment
	Electrical equipment manufacturer	Gearbox repair
	Cable manufacturer	Wind turbine manufacturer
	Earthing accessories supplier	
	Other suppliers	

Source: NZWEA

Table 5.1 suggests the wind energy industry is composed of diverse businesses ranging from those offering highly specialised products and services, to those providing general services such as consulting and telecommunication services. With this diversity in the composition of businesses, we

<sup>18</sup> The estimate of the number of companies whose main activities relates to the planning, construction and installation, and O&M phases of wind farms is based on NZWEA membership. Key companies such as Vestas, TruPower Limited and TRH Services identified the suppliers.

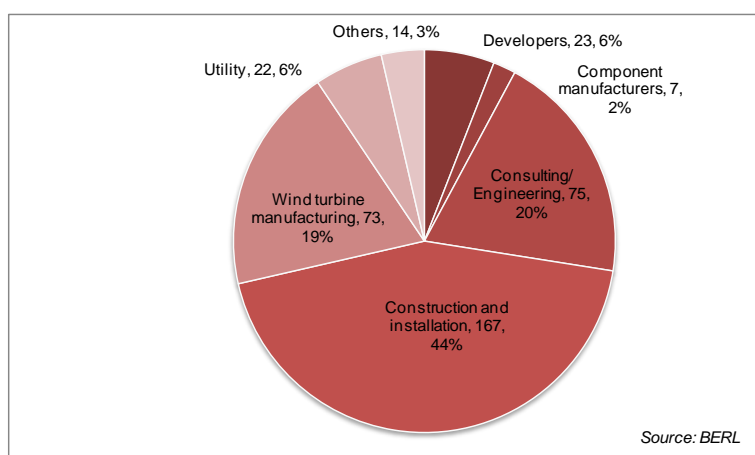
expect that the job profile in the industry would also be as diverse as the type of companies associated with the wind energy industry.

## 5.2 Current size

The New Zealand wind energy industry is largely a private sector-based industry. Of the 100 companies associated with the wind energy industry in New Zealand, 42 companies are covered in the analysis. These companies employ about 7,900<sup>19</sup> people throughout New Zealand. Of this total employment, the survey indicates that about 380 FTEs relate directly to wind energy activities.

Figure 5.2 presents the composition of direct employment in the industry.

**Figure 5.2 Composition of the direct employment in the wind energy industry, 2011**



Most employment from 2010 to 2011 was in companies related to construction and installation (167 FTEs), followed by consulting and engineering services (75 FTEs), and wind turbine manufacturing (73 FTEs). Components manufacturers (7 FTEs) and energy facility developers<sup>20</sup> (23 FTEs) were also engaged in wind energy related activities over the same period.

There were about 22 FTEs directly related to the wind energy activities in utility companies. This employment is in planning and project development, and O&M phases.<sup>21</sup>

<sup>19</sup>The estimate was based from data compiled from annual reports and publicly available information (such as company websites) on the number of people employed in the company. This estimate of total people employed in companies involved in wind related activities is likely to be underestimated, as some suppliers do not report employment in their annual report nor in their websites. The list of companies included in the analysis is reported in the Appendices.

<sup>20</sup> These are wind turbine manufacturing companies providing O&M services to wind farms.

<sup>21</sup> Based on the proportion reported by a company engaged in electricity transmission and distribution, about 20 percent of their wind energy related employment goes to planning a wind project, while about 80 percent of wind energy related employment of those in the electricity generation also goes to planning and wind project development.

## 6 Economic benefits

This section presents the economic impact assessment of wind farms in New Zealand. Using employment as a measure of activity in the wind energy industry, direct and total economic benefits in terms of GDP and employment were estimated. The section focuses on the economic benefits of increasing the generation capacity of wind farms in New Zealand to 3,500MW.

### 6.1 Approach

The approach used to estimate the economic benefits from wind farms in New Zealand is to identify the level of activity of businesses directly involved in wind farms during the planning and project development, construction and installation, and O&M phases. National multipliers<sup>22</sup> are then applied to determine the indirect and induced effects of the direct activities of companies related to the wind energy industry. To avoid double counting, where the company might be included in the indirect multiplier as well, we have excluded the first round effect when calculating the indirect and induced impacts for the industry.

For this analysis, employment is used as the base measure of activity. Employment was identified through a variety of sources, including survey, interviews of business in the wind energy industry, and public information (such as websites and annual reports)<sup>23</sup>. A survey and interviews were also used to determine how wind farms impact local and national employment in New Zealand. Websites and annual reports of 13 companies identified that supply goods and services to the wind energy industry were reviewed. This allowed non-respondents to the survey and non-NZWEA member businesses to be included in the analysis. Combining the information from all sources (survey, interviews and public information), the analysis covered 42 businesses.<sup>24</sup>

The findings from the survey, interviews and secondary materials served as basis for describing the base employment as well as the potential employment and GDP contribution of the wind energy industry if its installed capacity increases from 623MW in 2011 to 3,500MW in 2030.

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<sup>22</sup> At the national level, we use 2005-2006 New Zealand multipliers that have been revised by BERL/Infometrics. These are multipliers broken down into 59 industries. We used GDP deflators that take into account inflation to provide real prices.

<sup>23</sup> The method of data collection is presented in the Appendices.

<sup>24</sup> The companies included in the analysis are listed in the Appendices. Four of the 42 companies are identified suppliers of Vestas and TRH Services while the rest are NZWEA members.

## 6.2 Economic benefits of activities between 2010 and 2011

The economic benefits of activities between 2010 and 2011 is summarised in Table 6.1.

**Table 6.1 Summary of economic benefits, 2011**

	Direct	Total
GDP (2011\$m)	36	65
Employment (FTEs)	380	649

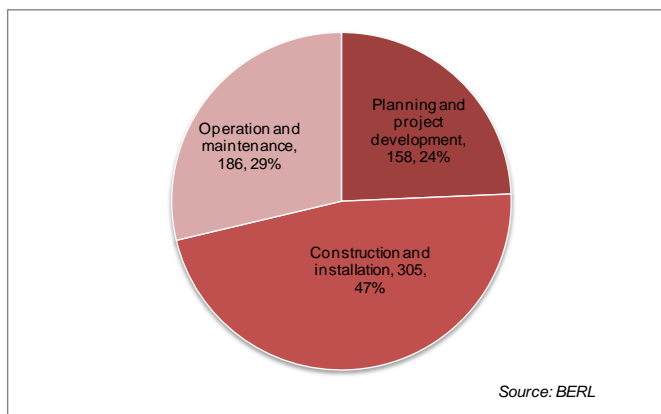
Source: BERL

From 2010 to 2011, 58 wind turbines with a combined installed capacity of about 110MW were installed throughout New Zealand. Over this period, the industry has directly contributed 380 FTEs to national employment and added \$36 million to the national GDP. A further 140 FTEs and \$52 million in GDP were generated from indirect activities. The total benefit from the wind energy industry is 649 FTEs in employment and \$65 million in GDP, with induced effects from consumption spending of those working in the wind energy industry.

### 6.2.1 Employment by phase of activity

Figure 6.1 summarises the total employment benefits at each phase of wind farm development and operation.

**Figure 6.1 Estimated total employment benefit by phase, 2011**



Most of the employment benefit was in construction and installation activities. Of the 649 FTEs, 305 FTEs were in construction and installation<sup>25</sup> jobs while 186 FTEs were in O&M jobs.

Overall, the wind energy industry has directly contributed 380 FTEs and about \$36 million to New Zealand's GDP in 2011. These economic benefits to New Zealand imply that each full-time job generated by the industry contributed about \$94,000 to GDP in 2011.

<sup>25</sup> The combined installed capacity of wind farms completed between 2010 and 2011 is about 110MW.



### 6.3 Economic benefits of a steady output growth to 2030

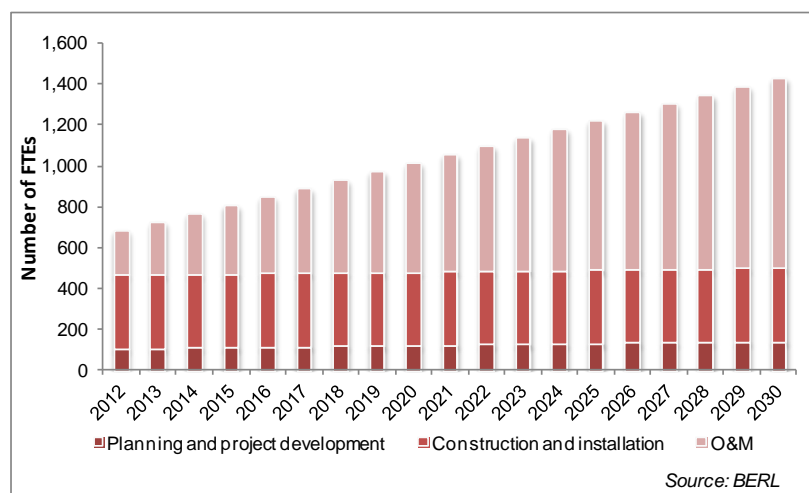
For this analysis, we present the quantum of economic benefits of increasing the generation capacity of the wind farms in New Zealand in the future. We assume that the wind energy industry has a steady annual growth of about 150MW over the next 18 years. Thus by 2030, wind farms in New Zealand will have a total installed capacity of 3,500MW. This future capacity of wind farms is about 2,880MW more than the operating capacity of wind farms in the country in 2011.

The employment calculations are based on a scaling up (straight multiplication) of existing activities. A plausible scenario is that the NZ industry develops to support the wind industry, as has occurred in the oil and gas exploration industry. The methodology used in this report does not allow for this kind of effect. Thus, the report takes a conservative approach to employment associated with the wind industry in 2030.

#### 6.3.1 Employment benefits at 2030

Figure 6.2 shows the total employment trends from a steady output growth of 150MW per year, from 2012 to 2030. A 150MW per year output expansion is expected to result in an annual increase of about 20 permanent full-time O&M jobs each year over the next 18 years. By 2030, the total employment benefit of wind farms in New Zealand is about 1,400 FTEs. Of this employment, the wind industry directly creates 764 FTEs.

**Figure 6.2 Estimated total employment benefit by phase, 2012 to 2030**



Of the direct employment benefit, about 215 FTEs will be in construction and installation activities while about 100 FTEs will be in planning and wind farm development activities. The operational workforce will rise from 89 FTEs in 2011 to 450 FTEs by 2030, making up about 65 percent of the total employment benefit. This implies that the industry will require roles such as site technicians, lines men, health and safety experts, qualified operators and support staff in the future.

### 6.3.2 GDP contribution at 2030<sup>26</sup>

In 2030, the wind energy industry is expected to directly contribute about \$81 million in GDP. This is more than double its estimated total impact on GDP in 2011. About \$54 million of this contribution comes from O&M while the rest is split between planning and development (\$9 million) and construction and installation activities (\$18 million).

Increasing the generation capacity of the wind energy industry is likely to stimulate activities in other non-wind energy industry related sectors such as accommodation and retail trade. These indirect effects add a further \$45 million to New Zealand's GDP in 2030. Including induced effects, the wind energy industry can potentially contribute a further \$30 million to national GDP.<sup>27</sup>

Table 6.2 presents the contribution to national GDP by phase of wind farm development and operation.

**Table 6.2 Contribution to national GDP (\$2011m) by 2030**

	Direct	Total
Planning and project development	9	13
Construction and installation	18	33
Operation and maintenance	54	110
<b>Total GDP</b>	<b>81</b>	<b>156</b>

Source: BERL

By 2030, the wind energy industry will have a total impact of about \$156 million in GDP. The largest contribution to GDP will be in O&M activities, followed by construction and installation activities. Thus, businesses in the electricity transmission and distribution, electricity generation, and turbine and component manufacturing are likely to benefit from a larger wind energy industry in the future.

## 6.4 Other benefits

### 6.4.1 Export of expert services

New Zealand's wind energy industry also exports its expertise. Some companies (e.g. Aurecon, Windflow Technology and Vestas) are developing skills and expertise in New Zealand and exporting it to markets in Australia, Europe and Asia. New Zealand can expect to grow its share of service exports as the industry expands.

### 6.4.2 Research and development

Some businesses in the wind energy industry are establishments that construct individual components and systems that make up the wind turbine. These businesses are localising production to take advantage of a growing market, reduce transportation costs, and minimise the risks associated with

<sup>26</sup> GDP figures are expressed in inflation-adjusted (i.e. constant price) 2011\$ values.

<sup>27</sup> The sum of the direct (\$81 million), indirect (\$45 million) and induced (\$30 million) effects gives the total economic impact (\$156 million) of the wind energy industry to national GDP.

exchange rates. They conduct research and development that leads to innovation. One example is Windflow Technology, a turbine manufacturer based in Christchurch. In 2012, Windflow signed an agreement with General Dynamics SATCOM for joint development, manufacture and sales of the Windflow 500 technology.

Suppliers of components are also expected to localise their assembly line. The growth of the wind energy industry will provide new opportunities for New Zealand workers. More jobs are likely to be created as suppliers and component manufacturers innovate and localise their businesses and assembly lines.

#### **6.4.3 Regional development**

Wind energy projects are anchored to a geographic area. As a result, they have significant impact on local communities and economies during construction and operation by creating jobs and supporting local businesses.

Wind farms can also create stable incomes. Landowners receive rental for the turbine sites, roadways, and power line easements. This rental can help preserve and protect traditional uses of rural lands. In most cases, this provides substantial new income. For those owners who rely primarily on agriculture or forestry, where incomes can vary depending on weather patterns and commodity prices, regular lease payments create more stability in incomes and diversify income sources.

#### **6.4.4 Electric power supply portfolios**

Compared with fossil fuel generation wind energy has low risk associated with fuel costs (the fuel – wind – is free) and cost of greenhouse gas emissions. Hence, rising fossil fuel prices or the introduction of the cost of greenhouse gas emission is unlikely to affect the cost of wind energy. Electricity generators and retailers such as Meridian Energy, Contact Energy, Genesis Energy and Mighty River Power have wind energy options. As these options are realised, New Zealand will have a more diversified energy mix with more wind farms. Moreover, the addition of wind energy to the resource portfolio spreads energy-related risks in New Zealand.

#### **6.4.5 Tourism**

Communities that host wind farms benefit not only in terms of additional income for property owners but also in terms of increased activity flows related to tourism. Although there is no published study on the tourism impact of wind farms in New Zealand, wind farms are used as an icon that promotes tourism in local areas in the Tararua-Manawatu and Wellington regions.

The construction and maintenance of roads to service wind farms also improves access for local residents and tourists who would enjoy hiking, biking and other outdoor related activities. For example, the West Wind Recreation Area has been open to the public since December 2011. The recreation area boasts of platforms where views of the wind farm and the coast can be enjoyed, as well as access

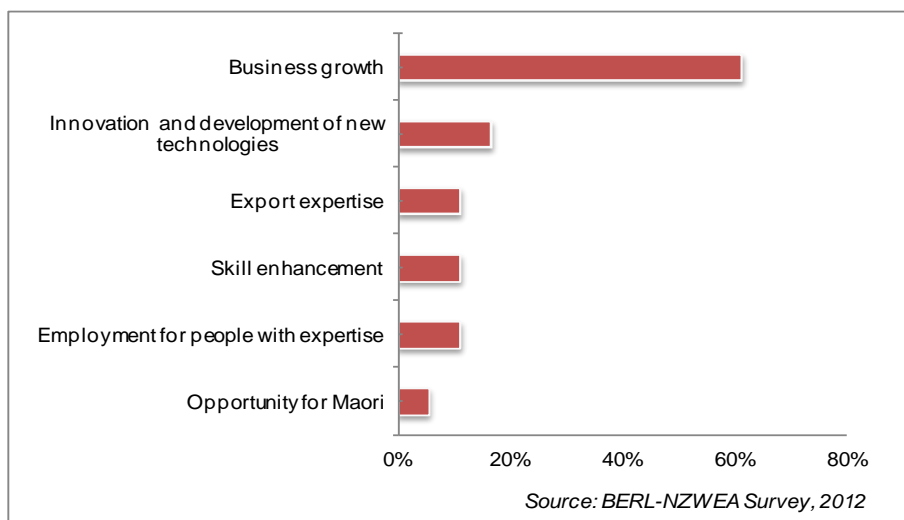
to the Makara beach and two mountain biking tracks.<sup>28</sup> Te Apiti and Hau Nui wind farms also have viewing and information area that are open to the public.

**6.4.6 Future growth of businesses**

The participants in the study report that the wind energy industry is important in the future growth of their business. Participants perceive that increasing the installed capacity of the wind farms over the next five to ten years is beneficial in sustaining business operation and generating opportunities.

Figure 6.3 presents the opportunities from the expansion of the wind energy industry.

**Figure 6.3 Opportunities from the expansion of the wind energy industry<sup>29</sup>**



The survey reports that the expansion of the industry offers opportunities for businesses to grow and for the people in the industry to enhance their skill and export their expertise. Participants in the survey identified opportunities to increase revenues and profits with a sustained increase in megawatt output of the industry.

Eight out of 11 businesses that completed the questionnaire consider that expansion of the wind energy industry will have moderate to strong influence in promoting technology, innovation and productivity of businesses within the industry. The participants also report that financial benefits are likely to flow during the consenting and construction phases.

The sustained increase in business profits could also have flow on effects on employment. One in ten respondents stated that skill enhancement and export of New Zealand expertise were among the opportunities that come with a larger wind energy industry. The other opportunities cited by

<sup>28</sup> <http://www.meridianenergy.co.nz/assets/PDF/What-we-do/Our-power-stations/1-0-1550-MER-West-Wind-Recreation-PDFAW.pdf>

<sup>29</sup> Based on 21 responses from 18 participants in the phone survey.

participants were increased employment of people with expertise in civil and earth works, electrical engineering and project management, and real business opportunity for Māori.

#### 6.4.7 Skills and qualification required to support growth

To support its future growth, the wind energy industry will require a diverse and technically skilled workforce. Table 6.3 summarises what the survey participants report as skills and qualifications required to support the future growth of the wind energy industry.

**Table 6.3 Skill and qualification required to support growth of the wind energy industry**

Type of skills	Specialisation
Engineering	geodetic, structural, civil, electrical, mechanical, design, environmental engineers
Project management	wind project development, commissioning, planners environmental engineers, wind specialist, consultants to assess the feasibility of the project, ecologist, meteorologist financial and legal consultants health and safety experts human resource management
Technical	design and development, IT, GIS and other visualisation skills
Trade	electrical, mechanical, builders, lines men, turbine technicians, qualified operators
Administrative	human resource management, finance, support
Others	consumer/marketing, site assessment, insurance and risk assessment, power transmission, transport specialist, policy experts

Source: BERL-NZWEA Survey 2012

#### 6.5 Comparison within the Energy sector

The wind energy industry's estimated direct contribution (\$36 million) to national GDP is about two percent of the GDP contribution of the electricity supply industry (\$1,968 million) in 2011. The estimated direct employment from the wind energy industry is comparable to the employment of oil and gas extraction (592 FTEs), and gas supply (540 FTEs) industries.

Table 6.4 presents the GDP and employment contribution of the wind energy industry, gas supply and electricity supply industries in 2011.

**Table 6.4 Comparison within the Energy sector**

	Wind energy	Electricity supply	Gas supply
GDP (2011\$m)	36	1,968	148
Employment (FTEs)	380	7,167	540

Source: BERL

Compared to other energy related sectors, the wind energy industry's contribution is about three percent and 44 percent of the 2011 GDP of the electricity supply (\$1,968 million) and gas supply (\$148 million) industries.

## 7 Conclusion

The wind energy industry is a growing industry. Forecast growth suggesting 3,500MW of installed wind capacity would directly support 764 FTEs and contribute \$81 million in GDP. The wind energy industry employs people with technical, business, and relationship management skills. The economic impact analysis suggests that, on average, each full-time job generated by the industry contributes about \$94,000 to GDP.

The expansion of the wind energy industry will also result in changes in the size and composition of its workforce. The greater number of working wind farms means that the operational workforce will make up more than half of the industry's workforce by 2030. This implies that the industry will require roles such as site technicians, lines men, health and safety experts, qualified operators, and support staff in the future.

The expansion of the wind energy industry will have a positive impact on the labour market. The planning and wind farm project development phase will directly support business services and electricity generation sectors. This phase potentially creates about 100 full-time equivalent jobs by 2030.

The construction and installation phase supports the construction and retail industries. The expansion of the wind energy industry will directly create about 215 construction and installation related full-time jobs.

The O&M phase is likely to sustain more permanent full-time equivalent jobs over the lifetime of wind farms. The operational workforce of the wind energy industry will be about 450 FTEs in 2030. These new employment opportunities will be throughout New Zealand. Other employment opportunities will result from linkages in the economy and the rest will be from induced effects of spending of workers and their families. Applying indirect and induced multipliers, the wind energy industry can potentially sustain about 1,400 FTEs, contributing about \$156 million in GDP, in 2030.

Table 7.1 summarises the economic benefits of a 3,500MW wind farm industry in New Zealand.

**Table 7.1 Summary of economic benefits of a 3,500MW generation**

	Direct	Total
GDP (\$2011m)	81	156
Employment (FTEs)	764	1,430

*Source: BERL*

The report takes a conservative approach to the number of jobs created in the wind industry in the future. As the industry grows, New Zealand companies could supply a greater proportion of the goods and services than they currently supply. This has occurred in other industries such as the oil and gas sector in Taranaki. As there are similarities between the two industries in terms of specialist technical requirements and the concentration of activity, this could plausibly happen in the wind industry. The

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methodology used in this report to calculate employment and GDP is conservative because it does not consider this effect.

Looking ahead, the wind energy industry will continue to be multi-faceted and interdisciplinary. As more wind farms are installed across New Zealand, employment opportunities within the industry are expected to increase.

The economic contribution of the wind energy industry to New Zealand goes beyond employment and contribution to GDP. The wind energy industry also encourages exports and tourism, promotes R&D and skill development, supports regional economic development, improves the security of energy supply and provides a renewable source of energy.

## 8 Appendices

### 8.1 Data collection

The analysis used primary and secondary data. Primary data was collected through a survey of businesses involved in the wind farm industry. Secondary data was collected from the annual reports and websites of companies whose businesses are directly related to wind farm development and operation in New Zealand.

The written survey turnout was low. The results were augmented with a phone survey to non-respondents and a review of available annual reports and websites of companies involved in the wind energy industry. Two interviews were conducted for the case study on employment in the industry. The interviews focused on business and career opportunities in the wind energy industry, as well as the skills and expertise required to support the growth of the wind energy industry in New Zealand.

Secondary data were also gathered from existing economic impact assessment of wind farms in New Zealand and overseas. Information from secondary materials were used to identify FTE to MW ratios related to the planning and project development, construction, and O&M phases of wind farms and to check the order of magnitude of employment.

### 8.2 Data analysis

Standard multiplier analysis was used to estimate the economic impact of wind farms in New Zealand. In a multiplier analysis, wind farms can have three impacts on the local and national economy:

- Direct effects: these are expenditures during the wind project development, construction and installation, and O&M phases (i.e. on-site jobs of contractors and crews, jobs at the turbine).
- Indirect effects: this refers to the increase in economic activity that occurs when a contractor, vendor, or manufacturer receives payment for goods or services and in turn is able to pay others who support their business.
- Induced effects: these are the change in wealth and income that is induced by the spending of those persons directly and indirectly employed by the project (i.e., spending on food, clothes, utilities, transportation, insurance, medical, etc.).

The results of the input-output analysis estimate these effects on the employment and GDP. The estimates the economic impact on GDP and employment using survey data were compared to similar studies overseas.

#### 8.2.1 *Direct employment by 2030*

The FTEs per MW ratio was used to estimate the employment required to achieve a total installed capacity of 3,500MW by 2030. The analysis assumes that there will be a steady growth of 150MW rolled out between 2011 and 2030. A steady and sustainable increase in installed capacity over the



next 18 years will allow companies to have sufficient time to adapt and build up their businesses in order to cope with increasing number of MW being added every year.

To estimate the potential employment benefit from annually increasing the wind energy industry's output by 150MW, FTE per MW related to each phase of a wind farm was determined. Table 8.1 shows the FTE per MW ratios considered in the analysis.

**Table 8.1 FTE per MW by phase, New Zealand, 2010 to 2011**

	<b>Planning and project development</b>	<b>Construction and installation</b>	<b>Operation and Maintenance</b>
Low	0.08	1.05	0.12
Average	0.45	1.42	0.14
High	0.81	1.79	0.15

*Source: BERL-NZWEA Survey, 2012*

The ratios were estimated based on the employment information collected during the survey and interviews with key persons in the wind energy industry. FTEs per MW at each phase are the:

- number of FTEs associated with planning a wind farm
- number of FTEs employed to run 623MW output of wind farms in New Zealand in 2011
- FTE employment to MW output ratio that is specific to the construction and installation of a wind farm project.

The average ratios (from the low and high FTE per MW range) were used to determine the number of FTEs at each phase, which can be directly generated from a 150MW per year expansion to a 3,500MW capacity by 2030.

Indirect employment was determined using standard multiplier analysis<sup>30</sup>. The employment multiplier will vary depending on the main activity of the companies included in the analysis. National multipliers for other business services and other construction industries were used for the planning and project development, and construction and installation phases, respectively. For the O&M phase, national multipliers for electricity generation, electricity transmission and distribution and wholesale trade (industrial goods) were applied. The latter were used for businesses in wind turbine and component manufacturing, which are providing repair and maintenance services to the wind farms throughout the country.

<sup>30</sup> Based on a 59-industry composition of the New Zealand economy.

## 8.3 List of companies in the New Zealand wind energy industry

Table 8.2 List of companies included in the analysis

Company	Main Activity	Affiliation	Total number of people employed
GL Garrad Hassan	Wind energy consulting	NZWEA member	2
Vestas New Zealand	Manufacture, installation and maintenance of wind turbines	NZWEA member	45
URS New Zealand Ltd	Engineering and environmental services	NZWEA member	285
Blackley Construction Ltd	Pipe and cable installation using open excavation and trenchless methods	NZWEA member	6
Trustpower Ltd	Wind farm identification, development and operation, NZ electricity Gentaileer	NZWEA member	428
Weld cone Wind Farm, Ludworth Wind Farm and Energy Limited	Distribution, wind farm development	NZWEA member	1
Ashurst Engineering and Construction Co. (198)	Fabrication, installation & maintenance to the electricity industry	NZWEA member	40
Energy3 Services	Wind energy facility developer; Small unit farm devt; monitoring & assessment	NZWEA member	6
Mainpower	Electricity distribution	NZWEA member	200
Seimens	Wind turbine manufacturer	NZWEA member	120
TRM	Wind farm operation and maintenance	NZWEA member	13
Beca Carter Hollings and Ferner	Engineering consultancy services	NZWEA member	1900
Meridian	Electricity Generation	NZWEA member	765
Meteorological Service of New Zealand	Forecasting weather; tailor customed forecasts	NZWEA member	220
Pioneer Generation	Renewable generating company; core business is hydro but new buisness is on wind energy; electricity supply company	NZWEA member	24
Boffa Miskell	Environmental planning; ecological assessment; urban design consulting services	NZWEA member	140
Ergo Consulting	Electrical engineering; industrial and power related sevices	NZWEA member	25
Ventus Energy	Wind project development	NZWEA member	1
Enercon	Turbine manufacturer; intall and maintain	NZWEA member	4
Higgins construction	Construction services; infrastructure; roading	NZWEA member	200
Powerco	Lines company/ gas	NZWEA member	
Aurecon	Consultant to the wind energy market; implementation	NZWEA member	500
Oisoft	Data collection and analysis; provides softwares	NZWEA member	
Marsh Limited	Consulting; insurance and risk implications of the wind farm projects; placement cover during the development and construction phase	NZWEA member	2
Wind Farms Development	Wind farm project development	NZWEA member	5
The Proprietor of Taranua, C Block	Wind farm project development	NZWEA member	3
OPUS International Ltd	Consulting services	NZWEA member	6
Downer	Engineering and infrastructure project services; overall management services	Vestas supplier	25
Windflow Technology	Wind turbine design and assembly company based in Christchurch; engineering design and R & D; production; and O & M engineering	TRM supplier	12
ABB New Zealand	Power and transmission distribution	NZWEA member	650
Bremca	Design and manufacture of switchboards, switchgears and automation solutions	TRM supplier	125
Hyspecs	Fluid power engineering; installation; maintenance and fault finding services	TRM supplier	33
Daniel Smith Industries Ltd.	Civil engineering contractor; crane rental and civil engineering/ construction	Vestas supplier	60
MainPower New Zealand	Lines Company	NZWEA member	214
Mighty River Power	New Zealand-owned integrated energy generation, trading, retailing and metering business.	NZWEA member	800
Buddle Findlay	Consulting Services	NZWEA member	92
Transpower	Transmission / System Operator	NZWEA member	520
Ergo Consulting Ltd	Consulting Services	NZWEA member	22
Kenex Ltd	Consulting Services	NZWEA member	14
Unison Networks	Lines Company/ Wind Farm Developer	NZWEA member	160
WEL Networks	Lines Company/ Wind Farm Developer	NZWEA member	192
Wind Farm Group	Wind Energy Facility Developer	NZWEA member	6

Source: Various annual reports and company websites

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## Final report

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