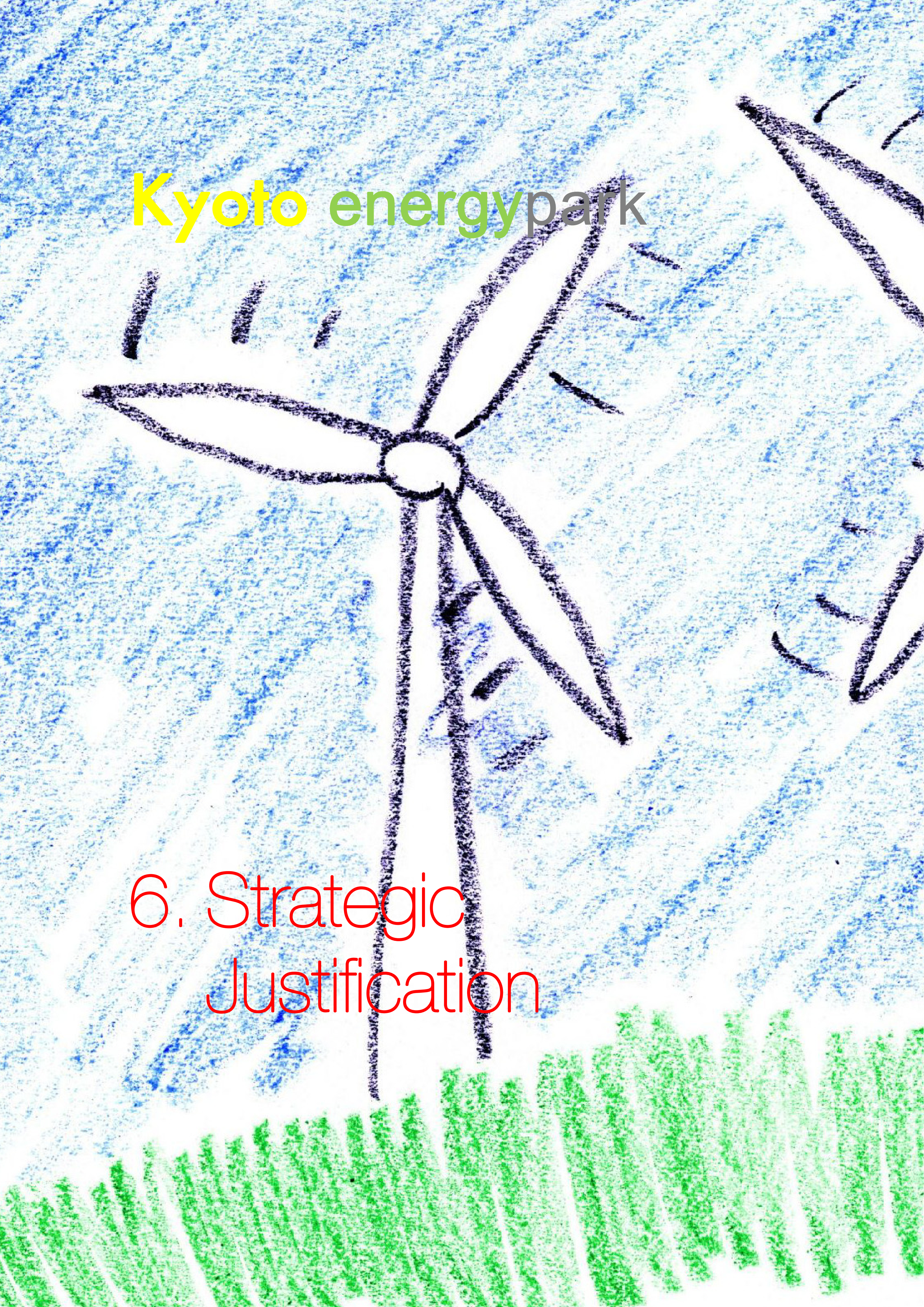
Kyoto energypark



6. Strategic Justification

6.0 STRATEGIC JUSTIFICATION

6.1 Introduction

Demand for energy rises as world economic growth increases. In particular, the emerging economic power houses of China and India are fuelling the rise in the global demand for energy. The effects of steeply rising oil prices, the growing risk of climate change impacts (now recognised as one of the world's major economic challenges) and the push to reduce carbon emissions, are all driving demand for clean, renewable energy production, to replace (or at least supplement) stationary fossil fuel generated power. At the forefront is wind power generation, currently the lowest alternative energy cost producer. Global pressures in energy prices and greenhouse gas emissions have seen most developed countries take steps to increase the contribution of renewable energy in the energy sector.

According to figures released by the International Energy Agency (IEA) in 2007 the global wind energy market has been growing at a rate of 20-30 % per annum since 1998. The IEA also predicts the annual global wind energy capacity to increase by over 20% p.a. for the next five years. In 2007 wind power generation equated to about 1.3 % of the global electricity consumption and in some countries contributes over 40 % of total energy power generation. In 2007 the global wind industry was estimated to employ 350,000 people worldwide up from 300,000 employees in 2006.

The report released by the IEA acknowledges that wind power, along with energy efficiency and fuel switching (coal and petroleum to gas) will play the major role in reducing emissions from the power sector over the next 10-20 years, the critical period in which global emissions must peak and then begin to decline to avoid the threat of dangerous climate change.

Figure 6.0 The potential for impacts from Climate Change is a global issue

6.2 Status of the Australian and NSW Renewable Energy Market

Survey results suggest that there is considerable public support for the use of renewable energy and energy efficiency in Australia. Australia's renewable energy industries cover numerous energy sources and technologies at various stages of development and commercialisation. Renewable energy technologies currently contribute about 8-9 % of Australia's electricity supply, with large scale hydro by far the largest single contributor. The recent expansion of the Mandatory Renewable Energy Target (MRET) have seen more opportunities for diversification of renewable energies such as wind power, photovoltaic, and solar thermal technologies in Australia. The deployment of these technologies provides opportunities for mitigating greenhouse gases.

Currently the biggest opportunity for mainstream renewable energy contribution is wind power. By the end of 2007, Australia had 0.8 gegawatts(GW) of installed wind power capacity, distributed nationally over 43 wind farms. By comparison in 2007, Germany had 22 GW, US 16 GW, Spain 15 GW, India 8 GW and China 6 GW. Australia currently produces less than 1% of its electricity from wind power, compared to approximately 19% of electricity production in Denmark, 9% in Spain and Portugal, and 6% in Germany.

The total wind energy capacity in 2007 was divided between South Australia (48%), Western Australia (25%), Victoria (16%), Tasmania (8%), NSW (2%) and Queensland (1%). Wind power generation has been productive in coastal regions especially in the southern states where winds are consistently stronger and air mass is colder and denser.

Also state based renewable energy targets in these states contributed to rapid development of wind power generation. In 2007 NSW drafted the New South Wales Renewable Energy Target (NRET) resulting in an increase in the number of current projects coming online. All state based renewable incentives have now been superseded by the renewed federal MRET.

Solar photovoltaic (PV) technology generates electricity from sunlight, and it can be used in grid-connected and off-grid applications. Photovoltaic applications have been successful in Australia for smaller scale applications, remote power supply and for domestic uses. The Australian government has recently introduced further rebates for PV roof top applications in an attempt to stimulate the uptake of domestic commercialisation and support the solar industry in Australia. Australia was first to develop the Sliver Cell TM technology which uses just one tenth of the costly and limited supply of silicon used in conventional solar panels while matching power, performance, and efficiency. Large scale applications (1-30MW PV plants) have been emerging overseas in Germany, Spain and the United States mainly as a result of government support in the form of rebate and feed in tariff schemes.

A commercial scale photovoltaic plant is currently being planned for Mildura in north-west Victoria. At 154 MW (A$420 million of capital investment) of rated capacity this plant would be the worlds largest and estimated to supply up to 45,000 homes with electricity needs.

6.3 Demand for electricity in NSW

Historically NSW has had a safe and secure supply of energy, which has underpinned long term economic growth. Historically energy supply has been cheap in NSW, due in part to the abundance of black coal, which is burnt to generate electricity. Electricity usage and efficiency have not been high priorities for consumers as the commodity has been relatively cheap, for all types of consumers. Over 90% of electricity is generated from fossil fuels (see Figure 6.1 below). Large scale hydro represented by the Snowy Mountains Scheme represents the largest renewable contribution in NSW.

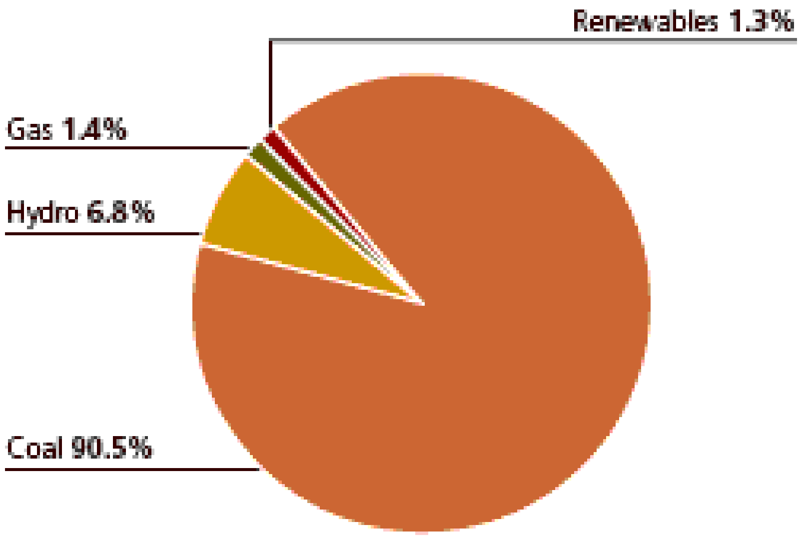


Figure 6.1 Electricity generated in NSW by fuel source (DEUS 2006)

New South Wales currently has a generator capacity deficit and consequently imports about 15-20% of its total electricity from Queensland and Victoria via the interchange networks. This adds to the cost of electricity for consumers in NSW and reduces overall efficiencies from increased transmission losses over major networks. The New South Wales Government is currently considering options for new power stations within the Hunter region including new gas fired power stations (peaking plants).

The Queensland Hunter Gas Pipeline is also currently before the NSW Department of Planning for transportation of coal seam gas from Queensland to the Hunter.

The National Electricity Market Management Company Limited (NEMMCO) prepares an annual Statement of Opportunities which forecasts reserve capacity deficits for each state. NSW is forecast to have a reserve deficit of 283 MW of net capacity by 2014/15 (NEMMCO 2008). A large proportion of this deficit is for peak demand capacity i.e. during summer and winter months.

The installation of the Kyoto Energy Park facility would significantly contribute to the overall electrical generation capacity issues for NSW. Furthermore the installation of a Solar PV plant would directly reduce peak load capacity issues during high demand summer periods.

6.3.1 Predicted Growth in Demand for Electricity in NSW

Electricity demand is expected to grow over the next two decades mainly as a result of increased population but also indirectly through economic growth and demographic factors. Strong demand for new housing is forecast as metropolitan centres such as Wollongong-Sydney-Newcastle continue to expand with large land release subdivision and densification. In line with the forecast growth in electricity demand, transmission and distribution lines are currently insufficient to carry the higher forecast load factors and will also be required to be upgraded. According to Transgrid the growth in demand for electricity in the high population density area from Newcastle-Sydney-Wollongong is expected to grow at about 300MW p.a. Most of this electricity will continue to be sourced outside of these areas, from electricity generated from gas, coal or wind.

Increased household incomes and a stable economy have lead to greater increase in demand for electricity especially during peak demand periods as households purchase more and larger electrical appliances. The use of air conditioners in NSW homes has risen from around 31% in 1994 to 54% in 2005 and is expected to reach 75% of homes by 2014. The ownership of dishwashers also jumped from 25% to 43% over the same period (ABARE 2005)

Cheap electricity has made these changing demand patterns possible, and the underlining growth in economic activity from other sectors, such as mining, agriculture will continue to underpin demand.

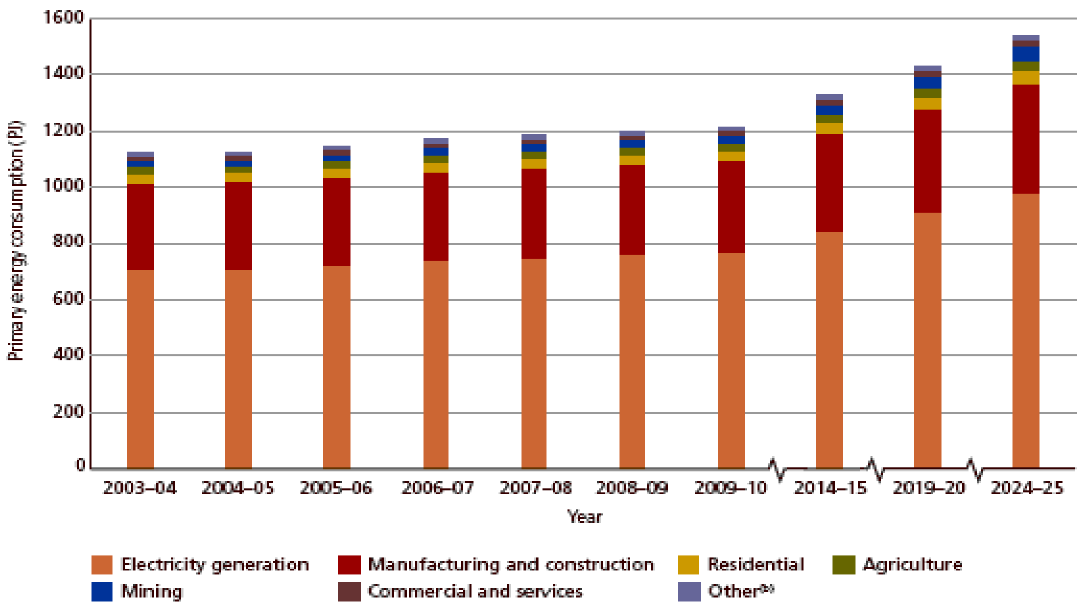


Figure 6.2- Predicted Energy consumption in NSW (ABARE 2005)

A report released by the Australian Bureau of Agricultural and Resource Economics in 2005 (ABARE 2005) predicted the energy consumption across all industry sectors up until 2025. Figure 6.2 above predicts the largest growth for the electricity generation sector, while mining is forecast to have the highest rate of growth over the period.

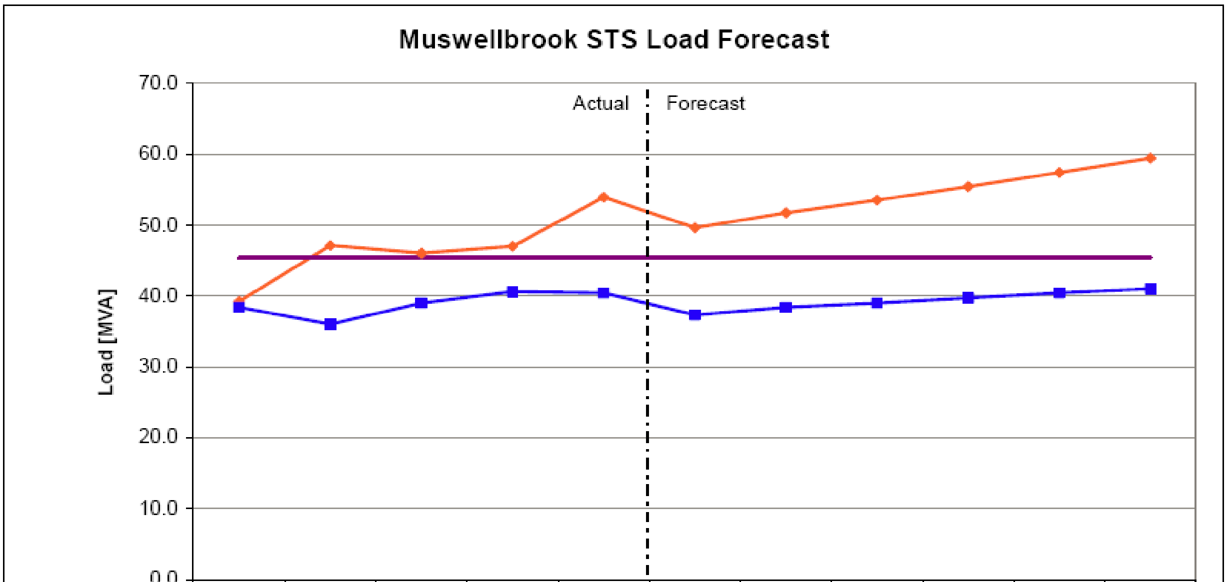
The growth in electricity generation is directly related to the rapid expected growth in demand for electricity across NSW.

6.3.2 Demand for Electricity in Muswellbrook/Scone Area

Energy Australia have identified network upgrade works in the Muswellbrook and Scone area to address supply side limitations and replace worn equipment. Energy Australia have also identified load forecasts for the Muswellbrook/Scone area which include forecasts for demand based on committed spot loads coming online (eg mines) and general load growth. Graphs showing the expected demand for load (up until 2012) for the Muswellbrook STS and the Scone substation connection options in Figure 6.3 and Figure 6.4 respectively. These are the two preferred points for connection of the Kyoto Energy Park to the grid.

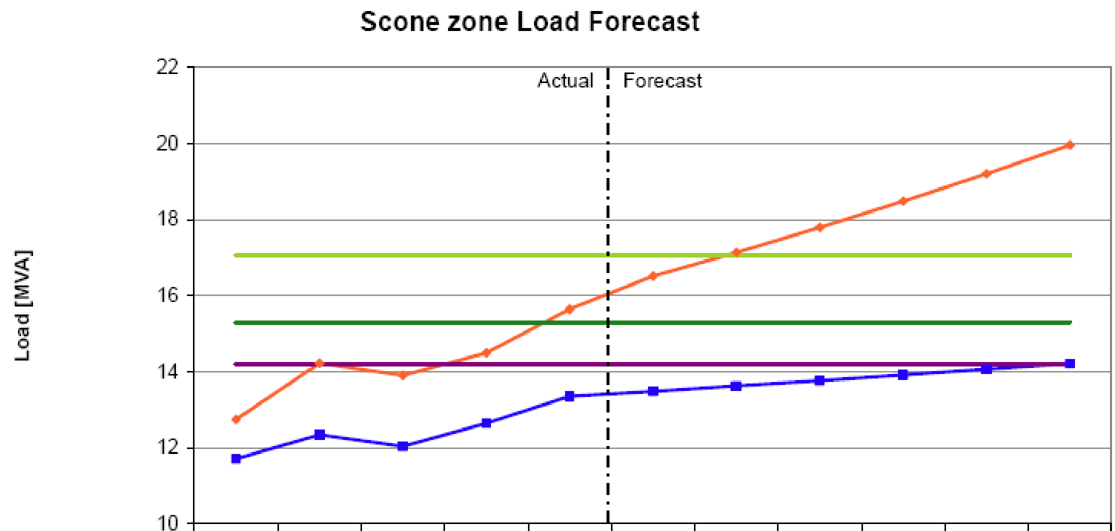
Both graphs show summer load (i.e. demand) exceeding capacity at these two substations up until 2012 and beyond. The connection of the Kyoto Energy Park to either of these points (subject to detailed fault level considerations) would reduce the overall importation of electricity from other generation sources at Muswellbrook (principally Liddell and Bayswater Power stations) thereby reducing overall transmission losses and increasing stability of the local network.

Furthermore solar photovoltaic power has a close correlation with demand in summer periods where air conditioning systems represent a large proportion of the network load. The inclusion of solar photovoltaic power is expected to provide significant stability to the network at these two points due to the current deficiency in capacity during summer periods.



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Summer Load	39.2	47.1	46.0	47.0	53.9	49.6	51.7	53.5	55.4	57.4	59.4
Winter Load	38.4	36.0	39.0	40.6	40.4	37.3	38.4	39.0	39.7	40.4	41.0
Firm Capacity	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4

Figure 6.3 – Demand forecast at the Muswellbrook STS (Energy Australia)



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Summer Load	12.74	14.22	13.9	14.49	15.64	16.51	17.13	17.79	18.48	19.2	19.96
Winter Load	11.71	12.34	12.03	12.64	13.35	13.48	13.62	13.76	13.91	14.06	14.21
Summer Firm Capacity	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2
Winter Firm Capacity	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3
Summer 1% Risk Level	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0

Figure 6.4 – Demand forecast at the Scone STS (Energy Australia)

6.4 Mitigation of Greenhouse Gases

6.4.1 International Greenhouse framework

According to figures released by the CSIRO atmospheric carbon dioxide levels have increased by 30% during the past 200 years, with the major human related sources from fossil fuel combustion and land clearing. This far reaching phenomenon has pressured governments to focus attention on reducing impacts associated with a carbon based fuels and energy generator systems.

The Intergovernmental Panel was established in 1998 by the United Nations Environment and the World Metrological Organisation (WMO) to undertake scientific research into climate change and advise leading governments on implications. These concerns over changes to climate patterns, more erratic weather conditions and biodiversity impacts have lead to development of measures such as the Kyoto Protocol (1997) and Emissions Trading Schemes(ETS). It is within a global context that the Commonwealth Government of Australia has put in place policies and measures to reduce Australia's greenhouse gas emissions and their effect.

The Kyoto Protocol (1997) is an international treaty under which developed countries have agreed to limit net greenhouse gas emissions. Australia was one of the few nations that didn't ratify the protocol but promised to limit growth in greenhouse gas emissions to 8% above the1990 levels by 2010. In December 2007 Australia finally ratified the Kyoto protocol locking in the commitment to reduce greenhouse gas emissions by 60% on 2000 levels by 2050.

The Australian government has also put in place policy mechanisms to achieve greenhouse gas emission reduction targets including the Mandated Renewable Energy Target (MRET), the Greenhouse Gas Abatement Program (GGAP), the Greenhouse Challenge and the Emissions Trading Scheme. Of these the most important mechanisms for renewable energy implementation are the MRET. The ETS is planned to commence by no later than 2010 following recommendations from the Garnaut report to be released in September 2008.

The NSW Government has developed a number of policies, programs and initiatives aimed at reducing greenhouse gas emissions and promoting renewable energy.

6.4.2 Mandatory Renewable Energy Target (MRET)

The Mandatory Renewable Energy Target (MRET) commenced on 1 April 2001 under the Renewable Energy Electricity Act 2000.The initial MRET target required the generation of 9,500 gigawatt hours (GWh) of extra renewable electricity per year by 2010. The Federal Government's 2004 MRET Review report recommended an increase in the MRET to 20,000 GWh/year by 2020, however the recommendation was not adopted. In December 2007 the federal and state governments agreed to amalgamate the existing state based renewable energy targets into the new national MRET. The Federal Minister for the Environment has recently announced an increase in the MRET from 9,500 GWh to 45,000 GWh by 2020 (DCC 2008). This new target is expected to be legislated in early 2009.

The Mandatory Renewable Energy Target (MRET) places a legal liability on wholesale purchasers (eg electricity retailers) of electricity to proportionately contribute towards the generation of renewable energy. Purchasers are liable to buy a predetermined number of RECs each year, or pay a penalty. Purchasers may make their own contracts with renewable energy providers or trade in RECs with prices negotiated on a case by case basis.

The proposed Kyoto Energy Park will generate electricity from renewable resources which will generate Renewable Energy Certificates (RECs) under the MRET scheme. Under the scheme, the Kyoto Energy Park will be eligible for a Renewable Energy Certificate (REC) for each 1MWh of renewable energy that the park generates. This RECs can then be sold independently by the Kyoto Energy Park or traded.

The full costs of MRET have already been taken into account by electricity retail companies in power prices set by them. Therefore, the Kyoto Energy Park will not increase prices for NSW residents or businesses. In fact, it will reduce the costs of production by reducing transmission losses to the region.

6.4.3 Electricity Generation and Greenhouse Gas Emissions

Australia has the second highest greenhouse gas emissions per capita in the world, the highest belonging to the US. Fixed or stationary energy production represents a large proportion of Australia's total contribution to global warming. Figure 6.5 below shows the contribution of the respective sectors of the economy to Australia's total greenhouse gas emissions. Electricity generation contributes a large part of the emissions from stationary energy and in 2005 accounted for 70% of stationary energy and represented 35% of Australia's total GHG emissions for the country. Greenhouse Gas Emissions from electricity generation increased by 50% between 1990 and 2005 (AGO 2005).

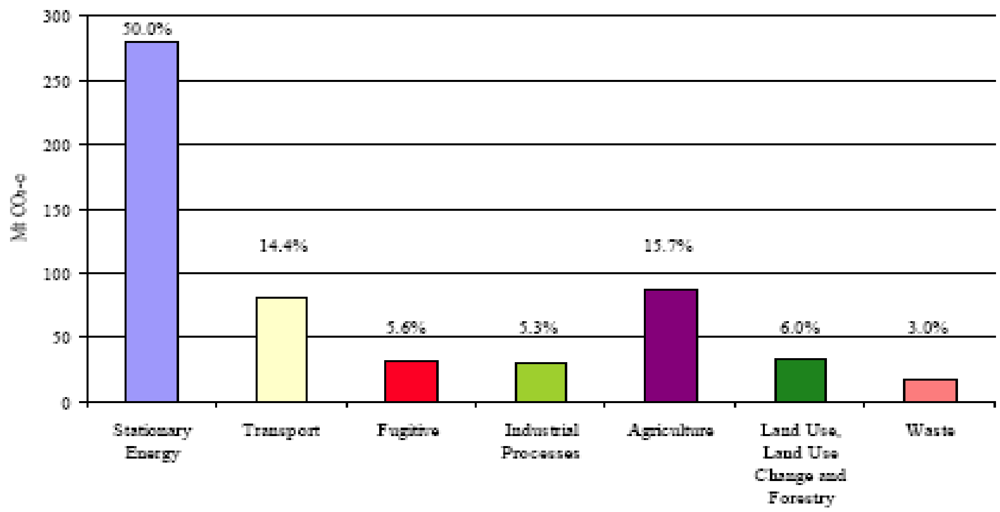


Figure 6.5 Contribution to GHG emissions in Australia by sector (AGO 2005)

Therefore over a third of Australia's GHG emissions are from the electricity supply industry. The Electricity Industry is currently dominated by fossil fuel based energy production of coal (black and brown) and gas with renewable energy production represented mainly through hydro schemes. Figure 6.6 illustrates the mix or energy resources making up the electricity supply sector across Australia.

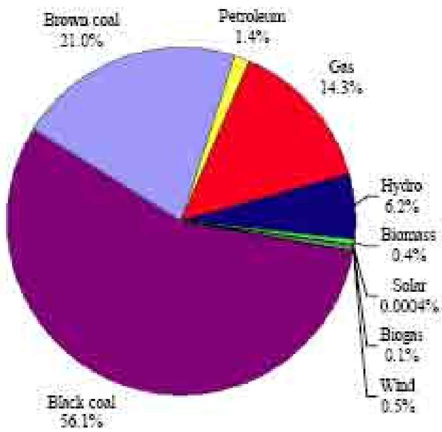


Figure 6.6 Australian Electricity generation sources (AGO 2005)

According to DEUS figures, approximately 6% of NSW's current energy usage is sourced from renewable energy. 82% of this is from hydro with 3% from wind and 1% from solar.

Renewable energy refers to electricity generated from energy sources that naturally replenish. The Kyoto Energy Park is designed to harness the energy generated through the use of solar panels, wind turbines, and hydropower. Renewable energy limits the production of greenhouse gases relative to the generation of equivalent amounts of electricity from fossil fuel. The development of the Kyoto Energy Park represents an important component to curbing greenhouse gas emissions. Both the Federal and state government's have introduced measures to support emissions reduction and increase renewable energy generation as described above.

6.4.4 Greenhouse Gas Benefits from the Kyoto Energy Park

The proposed Kyoto Energy Park project will generate electricity from green renewable resources including a solar, wind and a closed hydro system. The project will avoid generating Greenhouse Gas Emissions (GHG emissions) associated with producing electricity from fossil fuel (mainly black coal) and thermal type power stations.

Greenhouse Gas Emissions are generally expressed in terms of "CO_2-equivalent" with over 95% of the greenhouse impact of energy production a consequence of the CO_2 from fuel combustion. There is also some effect from methane (from black coal mining and natural gas production) and nitrous oxide.

A Life Cycle Assessment of the GHG emissions calculates the difference between the GHG emissions saved (or displaced by not using fossil based electricity) and the GHG emissions consumed due to the manufacture of component parts, construction activities, operations and maintenance and eventual decommissioning and disposal or materials recovery (referred to as lifecycle emissions).

The following simple formula describes the overall Life Cycle Assessment:

***GHG emissions** (net)* = ***GHG emissions** (displaced)* - ***GHG emissions** (lifecycle emissions)*

The proposed Kyoto Energy Park will have a maximum total generator capacity between 93 and 137MW as summarised in Table 2.0 (Section 2.1.3). While the Kyoto Energy Park is generating, it has the potential to displace other electricity generators that compete for supply to the National Electricity Market (NEM). Greenhouse gas emissions are saved during renewable energy production displacing fossil fuel generator demands on the NEM market. The generators supplying the NEM are predominantly large coal fired power stations, with some hydro-electric plant contribution mainly from the Snowy Mountains Hydro Scheme.

The NSW Pool Coefficient is used to calculate the average emissions intensity of electricity sourced from the electricity grid in NSW. It represents the amount of greenhouse gases emitted (expressed in tonnes of CO_2-equivalent) per megawatt hour of electricity supplied from the 'pool' of major power stations serving the NSW electricity grid. Since the electricity sourced within NSW is predominantly from coal-fired power (greenhouse gas producing), the pool coefficient is closer to 1 or 100%. The greater the contribution of hydro or other renewable sources to the electricity grid supply the lower the pool coefficient will be or the less greenhouse gas intensive the electricity supply from the grid.

The Pool Coefficient has a value of 0.954 (tonnes CO_2-e/MWh) and forecasts indicate an increase to 0.96 by 2011 by which time the Kyoto Energy Park could be operating. For the purposes of calculating Greenhouse Gas Emissions displaced by the Kyoto Energy Park (Section 6.4.6) a pool coefficient of 0.96 shall be used. This is a conservative estimation as it includes the contribution from hydro and other renewable sources in the calculation as described above.

While emissions displaced will be the same lifecycle emissions will be different for each generator component (wind, solar and hydro) of the Kyoto Energy Park and shall be analysed separately below.

6.4.5 Life Cycle Assessment (LCA)

Solar Photovoltaic Plant

The proposed Mt Moobi Solar PV Farm will generate clean and renewable energy from the sun and therefore no GHGs are emitted during production of electricity from this generator. The energy used in the manufacturing, installation and decommissioning of the Solar Farm (i.e. lifecycle assessment) can be estimated to determine net GHG emissions for this component.

It is important to note that in many cases the embodied energy in the concrete foundations, frames and inverters, including the human labour for installation can be considerable depending on primarily on the solar supporting structure or frame design. Four options for solar frame design have been included in the overall report. This Life Cycle Assessment has assumed a fixed-frame supporting structure which is representative of the worst case or the greatest embodied energy used in the design.

Therefore lifecycle emissions for this particular photovoltaic plant was largely attributed to the embodied energy used in the solar cell manufacturing process particularly the type of solar module (multicrystalline or thin film modules), materials used in frames and foundations (steel, aluminium, concrete), and energy production based on site and climatic conditions (peak daylight hours and insolation levels), energy used in the installation and maintenance and initial transport. Energy used for transportation, installation, O&M and decommissioning was found to be negligible over the life of the plant in this case.

The Energy Payback period for a thin film solar module has been conservatively estimated at approximately 2.7 years (Alsema 2004). This is for a stand alone rooftop mounted PV system. Additional energy requirements for construction and installation have to be taken into account as described above.

A study undertaken by the US department of Energy in 2004 looked into the lifecycle emissions for a 4.6 MW fixed frame photovoltaic plant in the US. The Energy Payback Period was calculated to be 0.37 years for the plant, considerably less than a rooftop mounted PV. The Energy Payback Period is the time taken to produce the amount of energy that was used in the manufacturing and installation of the plant or Embodied Energy (see Section 6.4.7).

The low Energy Payback Period was largely attributed to the design optimisation of the plant frame and foundations. The plant was a fixed frame rigid design which reduced the overall material content of the frame and concrete foundation requirements. This Environmental Assessment has assumed a simple fixed frame steel structure and thin film solar modules design. Fixed frame structures are generally rigid and require minimal concrete foundations dependent on the foundation and loads on the structure.

Four options for frames have been proposed for the Mt Moobi Solar PV farm at Kyoto Energy Park namely fixed, single axis, dual axes and CSP. Final design of the PV plant will occur subject to approval The lifecycle emissions rate and payback period of the single axes option is likely to slightly higher than the US example based on lower insolation levels, differences in frame structure and foundation preparation. The payback period for the other options would vary with frame design and tracking motor specifications but would not be considerably higher due to increased energy yields from these machines.

Green House Gas (GHG) emissions have been conservatively estimated at a rate of 0.03 tonne/MWh for the fixed frame plant. This is assuming a thin film module design with basic fixed frame and concrete foundation structure. Furthermore infrastructure requirements for high voltage systems installation and maintenance have been included in the wind turbine calculations. Therefore by combination of renewable energy generators in the park GHG emissions could be considerably reduced.

It is also noted that the environmental profiles of photovoltaic are further improving as efficiencies and material utilization rates increase and this kind of analysis needs to be updated periodically.

An LCA for the solar farm component is summarised in Table 6.0.

Wind Turbine Generator

Wind turbines generate green sustainable energy, and hence no GHGs are emitted during electricity production. However, seen from a life cycle perspective GHGs are emitted during the various processes in the life cycle of a wind turbine (i.e. lifecycle emissions). Based on data from Vestas the wind turbine manufacturer the amount of energy used in manufacturing, transportation, construction and installation (embodied energy) has been estimated at 70% with the balance of 30% during operations and decommissioning. A lifecycle analysis on the V90- 3.0 MW turbine undertaken by Vestas in 2006 estimated required consumption of 4304 MWh of electricity to produce a single V90- 3.0 MW turbine. Based on this data an estimate of 0.021 tonne GHG /MWh can be conservatively presumed for the life of the wind turbines

An LCA for the wind farm component is summarised in Table 6.0.

Mini hydro Plant

The 1MW mini hydro plant would be discharged during peak demand periods when electricity prices are higher. The water would be pumped back (recharged) during off peak periods sourcing power from wind turbine or solar components for pumping. As the energy used during recharge is from the renewable sources on site net energy would be positive. As the overall contribution to power capacity is less than 1% for the mini hydro plant lifecycle emissions would be assumed to be negligible over the life of the facility. Furthermore the plant is to be used for balancing intermittent power flows from the Kyoto Energy Park and satisfying peak demand periods on the market, which has a minor benefit on reducing infrastructure requirements for the Kyoto Energy Park and for the electricity network.

6.4.6 Greenhouse Gas Emissions Displaced by the Kyoto Energy Park

Wind Turbine Generators

Based on displacement of the equivalent generation to that produced by the wind farm component and using a forecast NSW Pool Coefficient of 0.96 (2011) as an indicator of the emissions intensity for the displaced generation then the wind turbine generators output could over a year displace electricity production that would have otherwise produced about 307,000 tonnes of greenhouse gases for the year. The actual level of emissions savings depends on a range of factors but most importantly the types and amounts of generation that are displaced relative to the wind farm contribution.

Emission savings of 307,000 tonnes of greenhouse gases each year represent about 9.2 million tonnes over an initial 30 year life compared to electricity produced by the NSW ‘pool’ of generators. At this rate, the wind farm component (42 turbines) will over a very short time achieve more emissions savings than is involved in the production of the wind farm components and their transport to the site and construction (lifecycle emissions).

Mt Moobi Solar PV Farm

A full site analysis was undertaken by Econnect in 2008 based on site conditions and plant output. The displaced GHG emissions savings for the Mt Moobi Solar PV Farm has been estimated based on a maximum generation capacity of 10MW for a fixed photovoltaic array. Based on generator production calculations the annual GHG saving for the solar farm is estimated at 17,318 tonnes GHG per year. Based on a 30 year life of the solar modules this equates to a saving of 519,500 tonnes of greenhouse gases over the life of the solar modules.

A Life Cycle Assessment of the net Greenhouse Gas (GHG) emissions estimates for the Kyoto Energy Park are summarised in Table 6.0.

Table 6.0 Kyoto Energy Park - Life Cycle Assessment (LCA)

Generator Component	Lifecycle GHG emissions (tonne/MWh)	Lifecycle GHG emissions displaced (tonne) (A)	Lifecycle GHG emissions produced (tonne) (B)	Lifecycle GHG emissions (net) (A - B)
Wind Turbine Generators	0.021	9,210,000	201,656	9,008,000
Solar photovoltaic plant	0.03	519,500	17,500	502,000
Mini hydro plant	-	-	-	-
Total	**0.054**	**9,729,500**	**219,156**	**9.5 mil tonne**

6.4.7 Energy Payback period

The embodied energy refers to the amount of energy required to manufacture and install the generator to the point of use. The Energy Payback Period is based on the period needed to generate the amount of energy equivalent to the embodied energy of each plant component which is usually quick in comparison for wind and solar generators.

The embodied energy has been estimated for each generator component based on energy used to manufacture, transport, construct and install i.e. energy used up to the point of use.

The energy payback period has been estimate as follows:

- Wind turbine generators (Vestas V90) = 5-6 months
- Solar photovoltaic plant (fixed PV array) = 12-13 months

6.4.8 Conclusion

The overall maximum rated capacity of the Kyoto Energy Park is 137 megawatts (MW) which represents a total generator capacity between wind turbines (92%), solar photovoltaic (7%) and closed loop mini-hydro (1%).

The savings in emissions of greenhouse gases (in tonnes of CO_2 equivalent) has been estimated at a maximum of 9.5 million tonnes over a 30 year lifecycle for the solar and wind farm components. This equates to an annual saving of approximately 317,000 tonnes greenhouse gases from the operation of the Kyoto Energy Park.

The Closed loop hydro plant represents a positive net energy balance as it will use renewable electricity generated from site for recharging of water storage. Lifecycle emissions for the hydro component were not calculated but are not expected to be significant as materials and labour during construction (with the exception of the mini hydro turbines) will be sourced locally.

The Kyoto Energy Park would supplement power to the grid displacing other conventional generators within the NEM market. The electricity generated by the Kyoto Energy Park would supply in the order of 62,000 households per year based on an average household electricity consumption of 5,000 kWh per year. It should be noted that average energy consumption in the Upper Hunter LGA in 2006 was 1230KWh per year per household (Key insights 2008).

The electricity produced by the proposed Kyoto Energy Park will be fed into the electricity supply grid to provide a proportion of the community's power needs. Increased generation of electricity using renewable sources from the park can result in net savings of GHG emissions for the Electricity Supply Industry. Renewable power generation will generally be taken up by the NEM displacing fossil fuel generators in off market contracts.

Conventional coal or gas fired power stations have high emissions from mining and combustion activities. In comparison renewable generators utilise zero emissions resources to produce electricity and emissions savings. Renewable energy technologies are thereby considered as having the lowest possible greenhouse gas impacts.

6.5 Principles of Ecologically Sustainable Development and Greenhouse Gas Emissions

Sustainability and sustainable development, or ecologically sustainable development (ESD), are used in relation to the need for development to readdress the association between development and its impacts on the natural environment. ESD has become central to industrial development.

The 5 principles of ESD central to the development of new energy resources are:
- Inter-species Equity – the conservation of biological diversity and ecological integrity;
- Intragenerational Equity – the provision of equity within generations;
- Intergenerational Equity – the provision of equity between generations;
- The Precautionary Principle – the assumption in decision making, that there is, or will be a serious or irreversible threat to the environment; and
- The Global Dimension – the internationalisation of environmental cost.

Inter-species Equity
This relates to the impacts a development may have on the flora and fauna sharing the environment in which it is located weighed up against the benefits. In terms of the proposed Kyoto Energy Park, the wind turbines pose the greatest risk to the surrounding fauna. In particular, bird strike associated with the Wedge-tail Eagle (*Aquila audax*) and the Nankeen Kestrel (*Falco cenchroides*). An EMP will be prepared for the site which will include measures for monitoring these species and actions to address any impacts arising.

In relation to the impact on the flora, it is considered that given the highly disturbed nature of the site that the Kyoto Energy Park will have a negligible impact on regional biodiversity. Additionally, the DEWHA have deemed the proposal was not a 'Controlled Action' under the EPBC Act 1999.

In this respect, it is considered that the impacts associated with the proposal are minimal in relation to the benefits gained by implementing a renewable energy based electricity supply which contributes to a reduction in greenhouse gas emissions associated with fossil fuel based energy production.

Intragenerational Equity
This relates to the access of electricity to all generations at an affordable cost. The Proposed Kyoto Energy Park will achieve this as it relies on free sources of electricity generation – i.e., the sun and wind. The electricity produced will be fed back into the main grid and available for all to access at a reasonable cost.

In this respect, these benefits out weigh the potential negative impacts.

Intergenerational Equity

The proposed Kyoto Energy Park offers intergenerational equity primarily through the very nature of the methods of electricity production. As clean, renewable resources, rather than fossil fuels are used in the process, there are zero emissions adding to the greenhouse effect. This, in effect, will aid the move toward a 'cleaner' more sustainable environment which will be available for future generations.

The Precautionary Principle

It must be acknowledged that it is not possible to eliminate all risk involved in a proposed development or technology. However, the use of renewable sources of electricity production are considered a safer method of production when global warming appears to be a certainty in using other more traditional forms of electricity generation.. With the use of renewable resources there is no risk of the production of air and water pollutants such as CO_2, NOx, SOx, Mercury and Selenium associated with fossil fuelled powered stations, or exposure to radiation associated with nuclear power plants. For those risks involved, such as bird strike, and aesthetic and noise impacts, management and mitigation measures can be implemented. Such measures are proposed to be implemented for those risks associated with the proposed Kyoto Energy Park. There are no unknown or unquantifiable threats to the environment associated with the proposed Kyoto Energy Park that will require a precautionary approach to be adopted.

The Global Dimension

The proposed Kyoto Energy Park will not produce any off-site impacts. In fact, the development will contribute to Australia's targeted reductions in greenhouse gas emissions under the Kyoto Protocol.

6.6 Socio-Economic Impacts

Key Insights Pty Ltd were engaged by Pamada to undertake the Socio-Economic Study for the Kyoto Energy Park proposal. The assessment evaluates the likely socio-economic impacts associated with the proposal as is contained within *Appendix K – Socio Economic Impact Assessment (Key Insights 5th September 2008)*.

With regard to Social Impact Assessment, one of the most important components is that of community consultation. While considerable consultation has already been carried out, a Community Information Day aimed at informing community members and enable to their input was conducted on Saturday 16th February, 2008. This Information Day allowed Key Insights Pty Ltd to independently assess current community issues, aspirations and concerns about the development of the site through the documentation of discussions undertaken during the session and the analysis of findings emerging from feedback.

6.6.1 Scone demographics

The Kyoto Energy Park proposal contributes to meeting environmental and social needs as outlined in local and regional policy and planning documents including environmental health, eco-generating works, tourism, climate change, economic development, and cultural and heritage recognition. The proposed development has the potential to further enhance Scone's social infrastructure, with minimal risk or adverse impacts.

Scone has a population of 5,080 people and falls within the Upper Hunter Shire Council, which was formed in 2004 when the shires of Scone, Merriwa and Murrurundi were amalgamated. The socio-economic profile of Scone and the Upper Hunter reveals a strong labour market, with low unemployment and high workforce participation.

The male workforce, in particular, appears to be well-placed to provide input into various aspects associated with the project. The dominant industries of employment are manufacturing and construction. The dominant occupations for Scone males are "technical and trade", "machinery drivers and operators" and labourers. Input across these industries and occupations will be central to the establishment of the Kyoto Energy Park. Furthermore large construction contractors, haulage contractors and industrial suppliers are located within the Newcastle and Hunter areas.

6.6.2 Socio-economic Impacts

The Kyoto Energy Park proposal creates the opportunity to establish a sustainable energy market and provide renewable energy to regional electricity markets. Furthermore, it creates the opportunity to contribute to state-wide greenhouse reduction and renewable energy targets, whilst promoting long-term environmental benefits and increased economic activity within the region.

The investment of considerable funds during the construction and establishment of the Kyoto Energy Park will contribute to the creation of employment across a range of industries including construction, transport and manufacturing sectors.

The most significant economic component of the project will be during the manufacturing and construction phase. The total expected capital expenditure for the project is between 140 and 190 million dollars depending on the final Kyoto Energy Park overall capacity. It is estimated that the proportion of expenditure that may be captured domestically is in the order of 82 to 122 million dollars, representing a proportion of approximately 60% of total expenditure. The domestic proportion of capture of this expenditure may grow by the time the project is commenced if a higher proportion of components can be sourced within Australia.

With regard to employment generation, the manufacturing and construction phase represents the largest employment provider for the project. Table 6.1 estimates the total direct job years generated for the construction of 42 wind turbines and associated infrastructure.

Table 6.1 – Kyoto Energy Park - Total direct job-years created

Capacity	Total direct job-years (7.5 per MW)	Total direct Australian Job-years (3.7 per MW)
89MW	**668**	**329**
126MW	**945**	**466**

The solar and hydro components operate at high efficiencies with low maintenance relative to the wind farm component. Accordingly, additional employment for the solar and mini hydro components is not expected as resources would be pooled into the wind farm component.

Scone has a low unemployment rate (currently around 4% or close to full employment), which combined with a high participation rate of 62.2% may indicate a labour market operating at, or near capacity. It may therefore be the case that additional specialists may need to relocate to Scone for a time to fulfil some positions related to this project. Additional workers to the area will positively impact on local businesses, through an increase in customers and clients.

The creation of on-going employment for the Kyoto Energy Park is in the order or 10 to 15 fulltime equivalent jobs.

6.6.3 Multiplier Economic Impacts

Multiplier impacts refer to the indirect flow-on, or benefits related to economic activity. The dispersed nature of the supply chain for renewable energy components will mean that a considerable proportion of indirect employment will be captured by firms beyond the immediate area. However, some components of the initial activity, such as construction, are likely to be sourced locally. Quantifying the employment effects resulting from multipliers is difficult due to the complex and emerging nature of the renewable energy sector.

Estimates based upon the expected output from the Kyoto Energy Park for indirect jobs associated with the project are estimated between 1351 and 1,911 Australian job years. These multipliers are very broad and give no indication as to the geographic breakdown of indirect employment.

The economic impact of construction of buildings (Managers, residence, Maintenance shed and Visitor's and Education Centre) is expected to create a further 14 direct jobs and a further 43 indirect jobs.

There will also be considerable multiplier effects on local employment opportunities in particular, as a result of the project. The indirect employment flowing from these locally based industries is more likely to be captured locally, providing increased economic activity for Scone and the Upper Hunter Shire. These multipliers will be also felt throughout the region and further field as firms supply inputs for manufacture and construction, and corresponding wages are expended.

With regard to the operational phase of the project, the economic flows associated with the selling of power onto the power grid are difficult to ascertain but would also represent an economic benefit.

6.6.4 Regional benefits

Other regional benefits of the Kyoto Energy Park proposal have been summarised below.

Other Climate change threats

Climate change impacts are also projected to have an impact on electricity generation and supply particularly coal fired electricity generation. These risks can include:

- increased threats from storm, lightening and bush fire damage which may increase damage related to electrical infrastructure transmission over long distances associated with centralised power generation;
- reduced water availability for cooling of thermal and coal fired power stations;
- increased costs for wholesale electricity as the cost of process cooling water increases and water supply decreases;
- reduced operational capacity of main network feeders during periods of very high temperatures
- increased peak demand from air conditioners due to periods of above average temperatures
- Impacts on existing hydro projects such as the Snowy Scheme (6% of NSW's total electricity supply) through drought affected water shortages

Less reliance of fossil fuel prices

Domestic and industrial consumers have become use to cheap and efficient supply of electricity with little barriers to supply. However changing environmental and geo-political circumstances means the risks to energy supply and associated costs are changing. The rising cost of oil and gas due to strong global demand means Australia is vulnerable to the fluctuations of world prices for these commodities. With the projected introduction of the Emission Trading Scheme (ETS) in 2010, the cost of electricity from conventional coal fired power stations is predicted to increase mainly as a requirement to balance carbon emissions from these sources. The Kyoto Energy Park will generate carbon offsets under the ETS which would be taken up by carbon intensive emitters such as coal fired power stations.

Decentralised power generators

A single coal fired power station in NSW can generate up to 2640 MW or approximately 20% of the total NSW capacity. Centralised power generation increases the potential risk attached to the loss of supply,

Figure 6.7 Bayswater Coal-fired Power Station

be it from potential terrorist attacks, major network damage and faults, storm or fire damage resulting from changing climatic conditions. Renewable energy technologies are generally considered ‘embedded generation’ as they are decentralised and distributed throughout the network. By decentralising power sources the losses from large scale transmission of power is minimised. The Kyoto Energy Park will contribute towards capacity deficiencies identified at connection points.

Public Opinion about Wind Farms

Opinion polling conducted in October 2006 by AC Neilson on behalf of Australian Wind Association (Auswind) showed an overwhelming acceptance of wind power by the broader community.
Key findings included:

- Nine out if ten Australians are aware of climate change and concerned about environmental issues.
- Seventy eight percent say Australia should be a leader in greenhouse gas reduction
- Nearly three out of four Australians recognize coal fired red power stations as a major contributor to climate change.
- Three out of four believe the federal government should do more to support wind energy and reduce carbon emissions.
- 68% are willing to pay more for environmentally friendly energy sources.

In general, people are very supportive of renewable energy, but not in their backyard.

6.6.5 Local Benefits of the Kyoto Energy Park

Approximately 70% of the local Scone area is based on rural type agricultural pursuits. The negative economic impacts of climate change are likely to be felt much more considerably in the local area than in urban areas of NSW, therefore the benefits of this project are also likely to be significantly weighted in favour of the local community.

Diversification of industry and skills sector

Australia is recognised as one of the driest continents in the world and will be one of the most affected by climate change. The rural and regional communities will be particularly affected. The development of renewable energy has the potential to diversify communities away from traditional industries, such as farming that will be heavily impacted by climate change and furthering drought conditions. During the early stages of the project Pamada were contacted by the Muswellbrook TAFE who are commencing a Renewable Energy Certificate Course and are interested in utilising the site for educational purposes and training.

Contribution to the Rural and Regional Communities

In July 2008 a report was released by the Bureau of Meteorology and the CSIRO that predicted the impacts on rural communities and particularly drought affected regions from climate change. According to the report droughts could occur twice as often, cover twice the area and be more severe in key agriculture production areas within the next 20-30 years, commencing by 2010. These climate forecasts are causing both governments and farmers to reassess land usage and diversify their earnings away from being totally reliant on farming incomes. Hosting a renewable energy park can be another income source for rural communities operating and benefiting from adverse climate conditions.

In recent years many local rural communities have realised the potential for adding new pollution free industries into communities. Many wind farms have developed in regional areas and these are looking to the renewable energy sector as a source of future prosperity. As an example the rural town of Ararat City in western Victoria, already the home to the Challicum Hills Wind Farm, is now looking to establish a renewable energy business precinct, with the potential as a manufacturing and transport hub for southeast Australia.

Local network integrity and reduced risk of faults

The connection of the Kyoto Energy Park will involve upgrading the existing lines in the area and associated electrical infrastructure. This will contribute to network infrastructure development in the area improving the network integrity, distribution and security for all stakeholders including local community.

Major Environmental Benefits

The Kyoto Energy Park will displace the uptake of conventional coal fired electricity in the local area and contribute towards meeting demand for future development in the area. The Kyoto Energy Park offers significant environmental benefits over fossil fuel power stations:

- the development footprint of the Kyoto Energy Park proposal is less than 1% of the total area of the combined sites thereby minimising destruction and disturbance of vegetation and habitat, landscape, biodiversity corridors, soils, and associated impacts;
- the project components would be fully decommissioned following the design life and are fully recyclable leaving minimal impacts on the landscape;
- no greenhouse gas emissions during operation of wind, solar and hydro generators;
- no air pollutants such as nitrous oxides, sulphur oxides, heavy metals or particulates are emitted as a by product;
- no production of wastewater to pollute natural waterways including temperature increases, siltation and sedimentation of receiving waters;
- no requirement for storage of water in large man made water reservoirs;
- no excess water use for project generator components;
- no long term heavy vehicle traffic movements and associated impacts on local amenity and rural roads;
- no waste products (nuclear or otherwise) which require long term disposal.

Water Consumption of Coal fired Power Stations

Fossil fuel fired power stations use large amounts of potable water in their operations, primarily for cooling water (in cooling towers) and for boiler make-up water. Any reduction in the use of fossil fuel fired power stations will lead to a reduced demand on NSWs finite sources of water. This in turn will free up water for more productive uses, and is also likely to have longer term benefits to creek quality and thereby water quality.

Macquarie Generation own and operate two of the countries largest coal fired power stations just south of Muswellbrook in the Upper Hunter Valley. Water for these stations are sourced from the Hunter River and Lake Liddell. Annual water consumption figures are represented below:

Table 6.2 – Water Consumption in Hunter Coal-fired Power Stations

Company	Power Facility	Coal Consumption (Tonne/year)*	Water Consumption (ML/year)*	Power Production (GWh/year)*
Macquarie Generation	Liddell (Hunter River / Lake Liddell)	5 million	25,000	10,000
Macquarie Generation	Bayswater (Hunter River / Lake Liddell)	8 million	36,000	17,000
TOTAL		13 million	61,000	27,000

**Source: www.macgen.com.au*

Water usage for these two power stations equates to approximately 12% of Sydney's water consumption per year (Sydney Water 2008).

Based on an annual energy generation from these two power stations of 27,000 GWh/year, this equates to a total annual water consumption of 2200 Litres per MWh of electricity produced. Therefore the Kyoto Energy Park is likely to reduce water consumption in the Hunter Area by approximately 536 to 792 million litres of potable water per annum.

The Kyoto Energy Park will contribute towards the development of Scone as clean and sustainable region of the Upper Hunter. The Kyoto Energy Park is a clean, non-polluting, renewable, replenishable resource for the area in direct contrast to the Muswellbrook region which is dominated by the coal fired power stations and associated open cut mines.

Kyoto Energy Park - Operational Water Consumption
Conventional plants generating power from fossil and nuclear fuels use large amounts of water for cooling. Wind turbines do not use water for cooling purposes. In some arid countries small amounts of water is required for cleaning of blades (dust and insect build up) where rainfall is insufficient.

The Solar PV Plant would have negligible water requirements. Cleaning of PV panels would be undertaken manually approximately twice per year, or during rainfall periods.

The Mini-Hydro Plant would be charged prior to operations. Water losses to the system would be minimal as the system would be sealed. Some minor losses would be expected from evaporation and small leakages. During maintenance water would be stored in tanks. Additional water would be required to replenish levels, estimated to be an additional water cart per month.

Fresh water would be required for drinking, maintenance works and for the Managers Residence.

Table 6.3 –Kyoto Energy Park – Operational Water Consumption (ML/p.a.)

Component	Water Consumption (ML/p.a.)
Wind Turbines	-
10MW Solar PV Plant	-
Mini-Hydro Plant (Closed Loop)	0.07
Emergency Fire-fighting (Storage)	0.02
Amenities (Manager's residence, Visitor's & Education Centre, Maintenance Shed, Site Substation)	0.49
Total Operational Water Consumption (ML/year)	0.58
Annual Water Consumption per MWh (L/MWh)	1.6

The total water consumption for the Kyoto Energy Park has been estimated at 0.58 ML (580,000 Litres) per annum, as illustrated in Table 6.3 above. Based on an annual energy generation from the Kyoto Energy Park, estimated at 354,600 MWh per annum (see Section 2.1.2), this equates to a total annual water consumption of 1.6 Litres per MWh of electricity produced.

This is the equivalent of less than 0.07% of the annual water consumption of Bayswater and Liddell (Macquarie Generation) power stations combined.

Approximately 30% of operational water consumption requirements would be sourced from rainfall falling on rooftops of proposed buildings and stored in tanks adjacent to site facilities. This water shall be used mainly for amenities on site at buildings and facilities.

Approximately 90% of the estimated water consumed on site would be for amenities (e.g. toilets, hand washing facilities and drinking water), in the order of 490,000 Litres per annum. Grey water recycling facilities for amenities shall be used to considerably reduce the need for external water supply on site. It is expected that up to 60% of grey water can be recycled on site. Composting toilet facilities will also be considered on site during the final design of facilities.

Additional water would be trucked to site from a registered bore located within the Scone town. No water shall be sourced from registered bores within the sites or from farm dams for operational water consumption.

Increased tourism to the area

The addition of a tourism component in the form of the Visitor Education Centre would provide further economic benefit to the local area. It would provide employment on the site and additional income from visitors. As a consequence other businesses in the area may benefit; especially those equipped to supply the tourist trade such as accommodation and food providers. Other tourism drawcards for the Upper Hunter (such as the equine industry) may also benefit from the increased profile that Scone and the Upper Hunter would receive as a supplier of renewable energy.

The presence of the Kyoto Energy Park will also provide an additional source of revenue, in terms of leases, to the landowners where the park will be located. The expenditure of this income by the owners in the local area will further benefit the economy.

Moobi Foundation Charter

During the operation of the Kyoto Energy Park, the proponent (Pamada) would facilitate the formation of the Moobi Foundation managed by non politically-aligned community representatives selected from the community including a representative from the Kyoto Energy Park Company. Other groups may include the Upper Hunter Council, Scone Chamber of Commerce, Country Women's Association and others as nominated.

The Moobi Foundation would be set up to oversee the foundation and determine eligible programmes for support in the community. The allocation for funding and relevant programs would be decided by the representatives of the Moobi Foundation. It is likely that the funds will support local education and community programs, however the decision for where funding is allocated would be decided by the representatives of the Foundation.

Through the Moobi Foundation it is proposed The Kyoto Energy Park Company would provide seed funding for on-going community and education programs on a yearly basis. The Foundation will also assist with the raising of further funds to enable and support local good living and thriving enterprise.

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6.6.6 Social and Economic Impacts Conclusions

The development of the Kyoto Energy Park has estimated economic benefits at a number of phases, depicted below as manufacturing and construction, construction and installation, ongoing maintenance, the associated multiplier effects, and the construction of on-site buildings. Main economic benefits include the following:

- The manufacturing and construction phase represents that largest economic injection into the local and regional economy.
- The proposed Kyoto Energy Park will include up to 42 wind turbine generators on two sites. Typically 60% of total expenditure for wind turbine construction and installation is captured domestically, and it creates an estimated 3.7 total direct Australian job years per MW. Total job years are estimated to be 329 to 466, depending on installed MW capacity.
- The wind farm component of the park will provide estimated ongoing 10 – 15 fulltime equivalent jobs over the operating life of the project.
- The Estimates based on the expected output from the wind power at the Kyoto Energy Park and the multiplier estimates from the literature for indirect jobs associated with the project range between 914 and 1595 job years.
- Based on the expected expenditure of $15m on the buildings will create 14 direct jobs and a further 42 indirect jobs.
- The proposed Visitor Education Centre would provide further benefits to the region through tourism and the associated income derived both directly and indirectly from that, as will the lease income generated for the land owners from the where the park is located.

The Kyoto Energy Park proposal creates the opportunity to establish a sustainable energy market and provide renewable energy to regional markets. Furthermore, it creates the opportunity to contribute to state-wide greenhouse reduction and renewable energy targets, whilst promoting long-term environmental benefits.

In analysing and assessing the potential social and economic impacts of the proposed Kyoto Energy Park, it can be concluded that while there is the potential for some negative impacts to occur, these are localized and are able to be mitigated.

Potential positive socio-economic impacts:
- Creation of employment opportunities for local residents during the construction and operational phases
- Significant environmental benefits through the promotion of renewable resources, its contribution to meeting regional, state and national greenhouse gas and climate change targets and due to the proposed development generating no new emissions or pollution from its operation.
- Contribution to the local and regional economies via the potential use of local and regional resources during construction and through the generation of increased tourism
- Potential to promote local culture and heritage (Indigenous and non-Indigenous), education programs and tourism to the region.

Potential negative socio-economic impacts associated with the proposed development include:
- The visual amenity of selective near and adjoining neighbours may be adversely impacted, however these impacts can be mitigated through mitigation and planning, design and visual screening.
- With regard to the impact of the development on land values, the Land Value Impact Assessment concluded that there may be some potential for short term land devaluation, which has a high potential of being influenced by community perceptions, however, this impact may moderate itself over due course and become a neutral or positive impact (see Section 6.7.7).

Potential for negative social and community impacts have been identified, however these are manageable and need to be viewed in context of wider regional benefits, shifts in common thinking towards climate change and greenhouse emissions and policy and planning contexts.

6.7 Strategic Planning considerations

6.7.1 Site History

The Upper Hunter was occupied by the Wannaruah Aboriginal People prior to European settlement and comprised two family groups or clans - the Tullawong and Murrawin. The Tullawong inhabited the Dart Brook area and the Murrawin occupied the Junction of the Pages and Isis Rivers near Gundy. Employment was sought on surrounding farms. The first European settler to the area was Henry Danger whose assessment of the area led to pastoral settlement.

The proposed site consists of two separate rural properties of several hundred hectares containing high ridgelines. The current property was part of the original land grant in 1825 of Invermien and Satur. The properties underwent various changes and subdivisions and amalgamations until in 1924 when it was under the ownership of WC Barnes. In 1939 Mrs Grace Munro bought the property. The proposed sites are now owned by a single landholder and are completely within the Upper Hunter Shire. There are several buildings /sheds on the property are not of heritage significance.

Land-based production and activities form the foundations of the Scone economy. It is predominantly based on the equine and agricultural industries. A retail sector has developed in support of these industries.

Local Government support for renewable energy production began in 2005 when the Upper Hunter Shire, Scone Local Environmental Plan 1986 was amended to allow Eco-generating devices in the Shire.

Additionally, in 2005, the Upper Hunter Shire Council approved the proposed installation of additional Wind Monitoring towers on both the Middlebrook Station and Mountain Station sites.

6.7.2 Suitability of the Kyoto Energy Park location

The current site was identified by the former NSW Sustainable Energy and Development Authority (SEDA) in 1995 as one of eleven sites in NSW suitable for generation of electricity from wind. SEDA installed a wind monitoring mast on the Mountain Station site in 1999. The CSIRO has been continuously monitoring and modelling wind conditions on site since the year 2000 (over 8 years of data), confirming the locations suitability for wind generation (see Section 2.2.5).

In 2004 EHN (Oceania) Pty Ltd initially commenced discussions with the landowner to seek approval for a 'wind farm' on the Mountain Station site. No formal agreements were reached with the landowner and discussions were dismissed. The NSW Wind Atlas also recognised the importance of the Scone area for wind generation in the document published in 2006.

Pamada Pty Ltd recognised the importance of the site and the suitability for a renewable energy park including solar and mini hydro technologies. In November 2006 Pamada engaged Garrad Hassan to undertake an assessment of the wind viability of the site. The assessment has demonstrated that there is sufficient wind resource to develop a medium scale wind farm at the proposed site. Pamada also engaged Econnect in December 2005 to undertake a high level electrical connection feasibility study to determine likely connection costs to the grid. Econnect also completed an analysis of the site for a commercial scale photovoltaic plant up to 10MW in total capacity in 2007 following consideration of other alternatives to design.

Other characteristics of the site which have considered the initial strategic planning alternatives were:

- moderate wind speeds over the two sites (6.5-7.5m/s @105m agl - Mountain; 6.5-7.5m/s @105m agl – Middlebrook)
- dominant and uniform wind patterns from the W and SE over both sites.
- sparse vegetation on predominantly cleared landholdings and largely modified vegetation communities;
- relatively low concentrated population in immediate area with nearest residencies greater than 1 km away from proposed turbines;
- good local road access to site to allow transportation of oversize and overmass vehicles;
- strong connection options in close proximity to the subject sites;
- a single landowner

A second wind mast was installed on the Mountain Station site in 2006 monitored by the CSIRO to confirm viable conditions for wind power generation and to generate wind shear coefficients.

The use of grazing land for development of the wind turbines will not significantly affect its potential for grazing. Once developed, the area of land required by the development will be minimal in comparison to the overall size of the properties (<1%). During construction, there may be a greater impact due to the increased numbers of personnel onsite, movement of large equipment and materials, earthworks and temporary storage of equipment on the ground. The areas affected during construction will be managed through EMPs prepared prior to construction with arrangements made for the landowner and staging of the development phases.

6.7.3 Access and Transport

Scone has significant transportation advantages being situated along the New England Highway and main Northern Railway line. While the major road and rail links are advantageous Scone has relatively poor public transport facilities between major towns and rural villages. Local bus services exist within the Scone area and neighbouring towns such as Wingen, Bunnan and Parkville and Murrurundi.

The region is well serviced with education facilities. Educational facilities include nine primary schools and three secondary schools. There are two TAFE colleges in the area (Scone and Muswellbrook), with the closest universities being the University of Newcastle and University of New England (Armidale).

The Muswellbrook TAFE is conducting a new course in renewable and sustainable energy, one of the first TAFE campuses in NSW to offer this course. The Muswellbrook TAFE coordinated has contacted Pamada Pty Ltd early in the project to discuss the new course and possible interaction with the Kyoto Energy Park and educational facilities for students.

6.7.4 Native Title Claimants

The Wonnarua People have been recognised by the Native Title process and are the registered Native Title Claimants in the Wonnarua area. Federal Native Title Legislation recognises the traditional rights of the Indigenous Native Landholders under Australian Law.

In 1993, the Commonwealth passed the Native Title Act to recognise and protect traditional rights of Native Title Holders over their land. New South Wales introduced legislation to reflect the laws administered by the Act. A more recent High Court decision confirmed that freehold title completely extinguished native title.

The proposed site is in the Wannarua Local Aboriginal Land Council area. As the Wonnarua People are the registered Native Title Claimants they have particular rights under Native Title legislation however Native Title rights can only exist over land where it is not private freehold land. The native landholders were consultated extensively during the planning stages of the development and have no objections to the proposal.

6.7.5 Surrounding Landuses

Scone is primarily a large service town for the surrounding rural areas. The Upper Hunter region has significant equine and agricultural industries combined with a rapidly expanding coal mining interest to the north and south. Development within Scone includes a main street shopping centre with stand alone individual retailers, commercial, medical, educational facilities and residential development. Development surrounding Scone includes a sealed airport, a number of large horse studs and an equine centre consisting of a race track, training facilities, TAFE college, vet centre, and conference/reception area.

The Upper Hunter has a significant agricultural sector occupying around 82% of the land in the LGA. The dominant non-agricultural land uses include urban, rural residential and coal mining. The main landuse activities within the area are summarised as follows:

- Grazing (mainly sheep but some cattle)
- Horse studs
- Dairy and piggeries
- Cereal cropping
- Intensive agriculture (vineyards and olives)
- National Parks and reserves
- Rural properties and homesteads
- Rural residential subdivisions
- Underground coal mining

The nearest coal mine to the site is the Dartbrook mine which is located just west of Aberdeen and approximately 14km south east of the Mountain Station site boundary. The Dartbrook mine was an underground mine and has now been closed with the longterm planning of this mine not known. There is currently a proposal for the Bickham Hill coal mine which his located approximately 18km directly north west of Middlebrook Station site boundary. The Bickham Hill mine currently has a bulk sample pit and is planning to submit a development application for an open cut mine in the near future.

The Scone Aerodrome is located 5km east of Mountain Station and approximately 4 km southeast of Middlebrook Station.

6.7.6 Impacts on future surrounding landuse

Future changes to land use could include different types of pastoral activities, increased rural residential development, possible sub-division of land and increasing rural industrial development.

Population growth in the Upper Hunter LGA is mainly concentrated around the Scone and Aberdeen areas. The population of Scone was estimated at 5085 in 2006, with population growth expected to increase by between 0.25% to 0.5% over the next 25 years, mainly from 'lifestyle changes' coming into the area.

The Upper Hunter Council approvals data shows that between 1996 and 2005 there was an average of 15 subdivisions per year over the whole LGA. This includes subdivisions for both urban and rural areas. This is very low considering the large proportion of rural lots in the LGA. The Upper Hunter Land Use Strategy 2007 estimates that to accommodate future growth approximately 70% of new dwellings will be located in urban areas and 30% of new dwellings in rural areas, mostly within the Scone area. This equates to a maximum of 15 to 20 new dwellings or subdivisions each year in rural areas predicted up to the year 2032. The current demand for subdivision is primarily from existing individual landowners on rural properties.

The dominant landuse activities in the vicinity of the Kyoto Energy Park sites are illustrated in Figure 6.8. There are currently some areas around Scone zoned for rural residential which are currently only 60-70% developed, and likely to be further developed, prior to new rezonings being released. Some potential future areas were identified in the UHLS as having potential for long term rural residential areas and are shown in Figure 6.9 below. The blue circles indicate potential future residential zones that could be considered in the next 25 years.

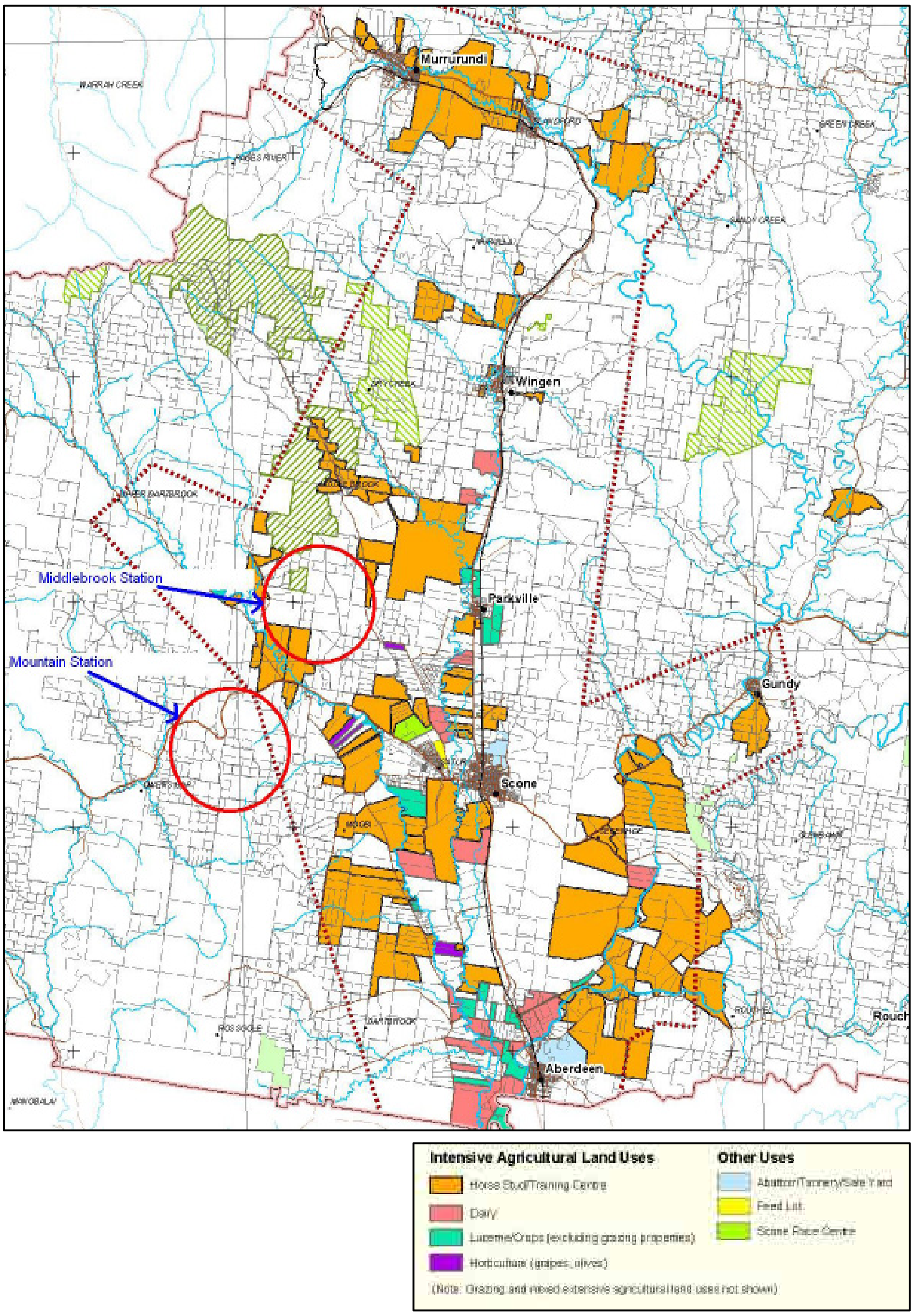

Figure 6.8 Kyoto Energy Park Existing Surrounding Land-uses (Department of Planning

The Scone West Rural Residential zone includes a provision for approximately 30 rural lots at an average area of 10ha per lot. This area is purely an investigation area and has not been rezoned to allow for development. A transmission line route option (Option 2 or 4) is proposed to transect the area however the line would be confined to the existing road reserve and not impact upon any future rural lots should they be rezoned.

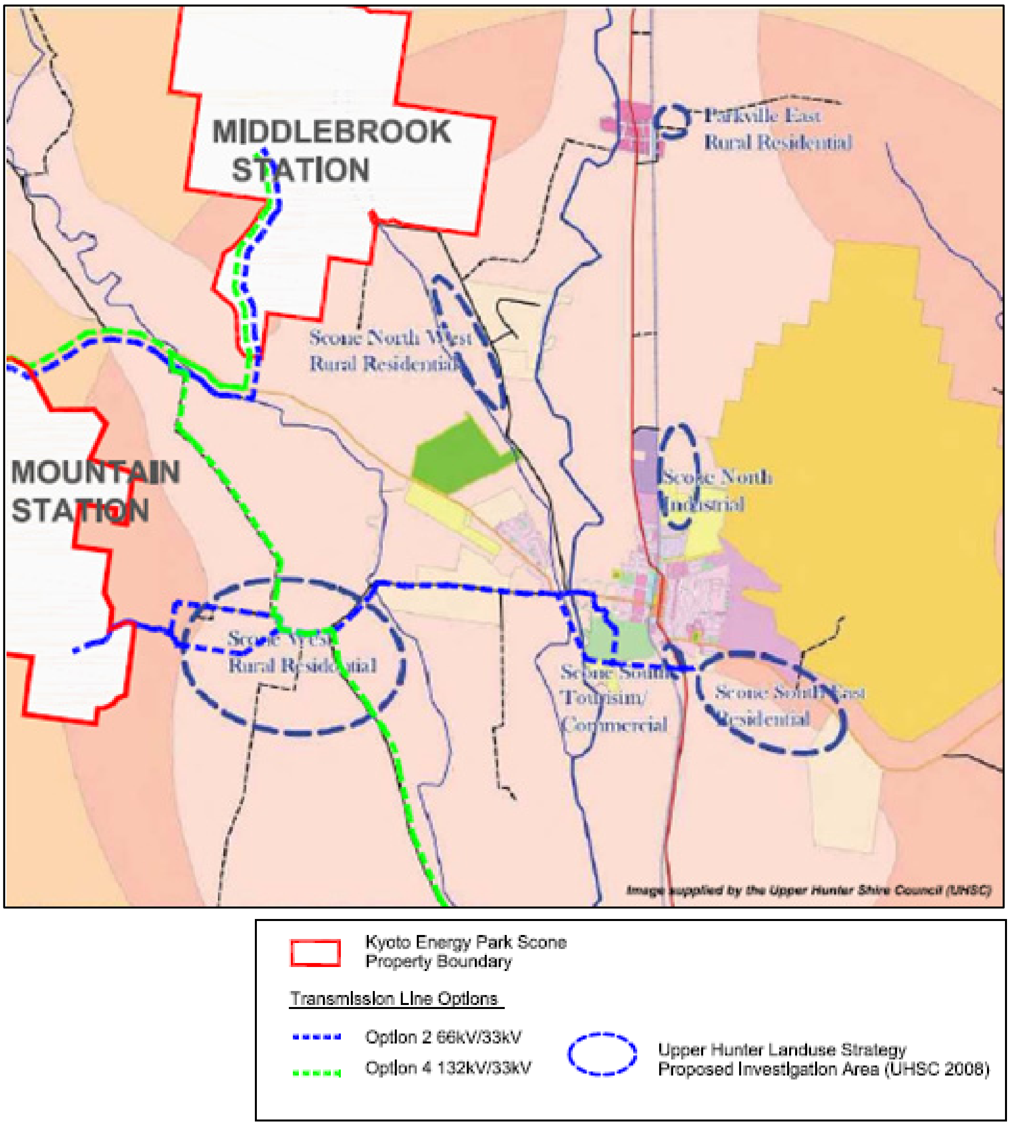

Figure 6.9 Existing and potential rural residential land use zonings (Draft Upper Hunter Land Use Strategy 2007)

The Scone area is generally considered as potential future coal mining area based on resource alone (see Section 14.0). Restrictions with respect to depth and complexity of resource, social and environmental impacts such as community acceptance, sterilization of agricultural land, impacts associated with road and rail traffic, environmental impacts on the Scone surrounds, transport access and buffers to urban and rural and zones, would need to be resolved prior to mining occupation in close proximity to Scone township.

The installation of the Kyoto Energy Park will not limit the future use of the subject properties for grazing or other intermittent landuses on the subject sites.

6.7.7 Potential Devaluation of Property

Key Insights Pty Ltd have undertaken a socio-economic impact assessment which has included an assessment of possible land devaluation from effects of wind turbines on surrounding properties. Bob Dupont Land Valuations Pty Ltd were engaged by Key Insights to provide advice on the potential for land devaluation as a result of the Kyoto Energy Park project specifically from wind turbines (see attached report in Appendix K(i). The background review was based on an assessment of existing evidence in the market both in Australia and internationally, information of the development, an inspection of the local area, knowledge of land values in the Scone region and the impact developments of this nature have on land values.

A major study was conducted in the USA by the Renewable Energy Policy Project (REPP) which examined 24,300 property transactions from 10 locations, over a six year period prior to the siting of wind turbines and three years following installation (see Appendix Q(i). The study concluded that there was no evidence to suggest that wind turbines sited within a five mile radius of property had a negative impact on value. Property values appeared to exceed the regional average within the case study locations, actually having a positive impact. In other words, property in view of the wind farm rose more than properties that were not in view.

Valuation evidence within Australia to date has been limited to a single study prepared on the effect of the Crookwell Wind Farm in NSW Australia on local property values. In this valuation a total of 78 property sales surrounding the Crookwell Wind Farm were evaluated over a period of 15 years from 1990 to January 2006. Sales of properties in the view shed of the wind farm (within a 6km radius) were compared with sales of those not in the view shed. No reductions in property values for those properties in the view shed of the wind farm were found.

In 2004 a Panel inquiry was held into the Bald Hills Wind Farm in Victoria. A range of submissions from property professionals on the panel concluded that:

“the effect of wind energy facilities on surrounding property values is inconclusive, beyond the position that the agricultural land component of value would remain unchanged. On this there appeared to be general agreement. It therefore follows that it has not been demonstrated to the satisfaction of this Panel that significant value changes, transfers or inequities would result from the project proceeding.”

Therefore there appeared to be a general consensus from the Panel inquiry that wind farm developments have no impact on the agricultural viability of land (Bald Hills Panel Report, 2004 and RICS, 2004). In their final conclusion on property values the panel commented that valuation effects from the wind farm development may occur, specifically devaluation of the amenity, lifestyle and non-agricultural development component of the surrounding land.

It is difficult to use the findings and research from previous wind farms as a clear indication as to what will occur at a potential site, such as the Kyoto Energy Park, however it does assist in providing a better understanding of the potential outcomes.

Overall there is no reliable consensus in international research that indicates wind turbines add a positive or negative value to property prices and agricultural land. The land surrounding the proposed Kyoto Energy Park is dominated by agricultural land, prominent horse studs, rural homesteads and lifestyle blocks, and some rural residential subdivisional developments. Given the nature of the land and the prominence of the wind farm component of the development on top of ridge lines, there may be a potential initial effect on the amenity, lifestyle and non-agricultural development component of land values in the area. As a worst case scenario there is some potential that properties with a highly impacted view of the Kyoto Energy Park may suffer a temporary reduction in value predicted to occur within the first 1-2 years of operation of the wind turbines. This suggests that the impact is perceived and not substantially related to adverse environmental factors experienced at the residence.

Bob Dupont Pty Ltd went on to summarise as follows:

> *"However, our experience and enquiries has shown that this reduction is more a consequence of the perception of negative effect than actual outcomes and once developments of this nature are in place, after a period of time (generally 1 to 2 years) the effect generally reduces to zero."*

In conclusion the report undertaken by Dupont's provides several examples of impacts on prices of properties, primarily in the US and UK, however, concludes that overall there is no reliable consensus in international research that indicates that wind turbines add a positive or negative value to property prices and agricultural land.

The results of the research has identified factors that may contribute to the impacts of wind farms have on property prices particularly within Australia. These impacts are likely to be noise and visual aspects. It also needs to be acknowledged that variables such as distance from the wind turbine, its visibility and local public perception are relevant and need to be considered in the proposal.

The Kyoto Energy Park proposal will achieve compliance with strict noise criteria in accordance with current prescribed regulations to ensure that the existing noise amenity of the area is conserved. Pamada will introduce measures identified in this report to reduce the overall visual impact of the proposal on properties most highly affected. Based on research and the summations of the Socio-Impact study the effects of property devaluation in the vicinity of the development should they occur would be expected to be temporary and recoverable within a short timeframe.

Kyoto Energy Park Scone is wholly an Australian Enterprise. The Management is 100% Australian.
The funding of this proposal and report is 100% Australian.
An Australian Project